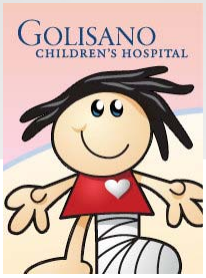
Common Pediatric Orthopaedics Issues



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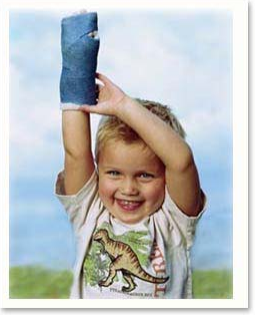
Objectives

- Identify the common types of injuries and fractures in children
- Evaluate hip complaints and identify the most common disorders
- Discuss types of scoliosis and when to refer
- Verbalize key physical findings, radiographic evidence and symptoms which should prompt an expeditious referral to pediatric orthopaedics

Overall Secrets of Orthopaedics

1. The musculoskeletal exam is based on point tenderness.
2. If you really want to examine an injured child appropriately, you must know the anatomy – e.g., where the physis is located.
3. Most children's injuries are benign.
4. If you can splint, you can treat almost anything temporarily.
5. Children rarely have significant sprains – most major injuries are fractures.
6. Fever and redness usually mean infection.
7. Always worry about the hip.



Pediatric Injuries

When doing a musculoskeletal physical examination:

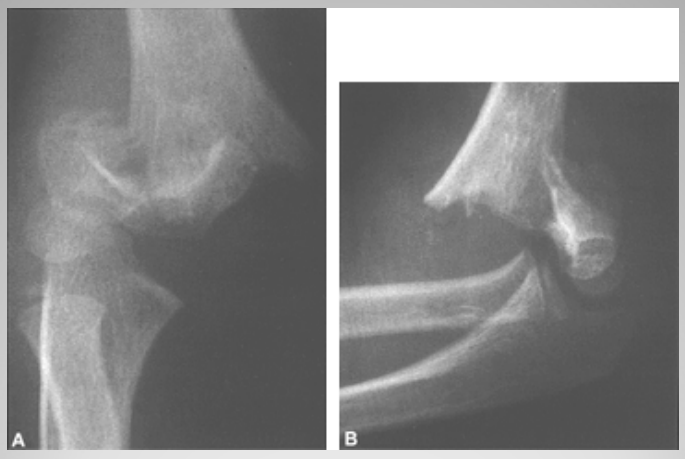
- You have two extremities- for best exam, look at both and compare.
- Swelling & deformity can be subtle, but comparing one side to the other can detect it.
- The back of the hand is good for temperature differences.
- Evaluate point tenderness, ROM, strength, sensation

Point Tenderness

- "Point tenderness": If you can push in one spot and make it hurt, you have probably found the site of injury
- Fracture is much more likely if the child can identify a very pinpoint area of pain, even with a negative x-ay
- Always think of what structures are underneath the site of pain (you have to know the local anatomy – esp. muscle, ligament, tendon, bone, nerve)

Muscle Strength

- Weakness can be easily overlooked during an exam in a child
- Simple muscle grading is 1-5
  1. No Activity
  2. Trace Activity
  3. Antigravity
  4. Weak
  5. Normal



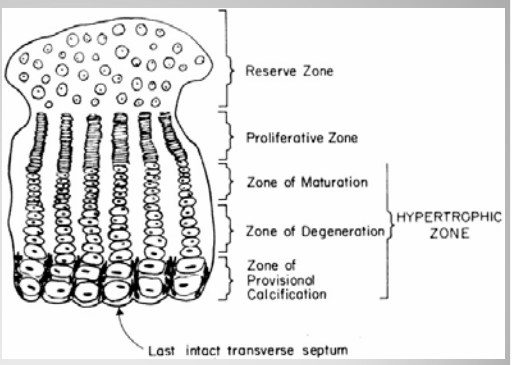
Children's Bone Injuries

Physeal Fractures

- Injury to the growth plate of a bone (physis)
- Growth plate is made of cartilage and therefore more vulnerable than the adjacent bone
- Common injury in a growing child – cannot occur in a skeletally mature person once the growth plates have closed
- Same mechanism of injury which causes ligament injuries in adults (“closed” growth plates) often causes physeal injuries in children (“open” growth plates)

Physeal Strength

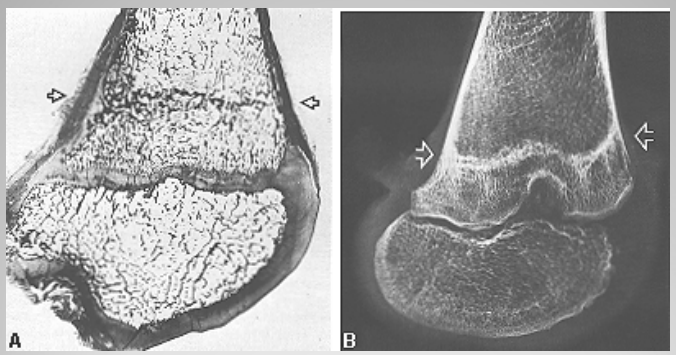
- The weakest part of the physis is the hypertrophic zone.
- Generally, the proliferative zone is not disrupted
- Most physeal injuries do not result in physeal arrest



Salter Harris Classification

Salter I	S: **S**traight across physis
Salter II	A: extends **A**bove physis
Salter III	L: extends **L**ower than physis
Salter IV	T: extends **T**hrough the physis
Salter V	R: Rammed or c**R**ushed physis

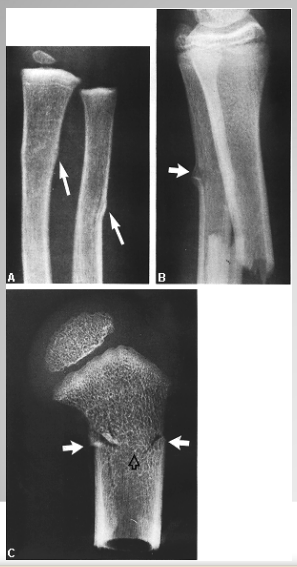
Harris-Park Growth Arrest Lines



Traverse lines of increased density visible on xrays during growth after an injury or acute illness – asymmetric line would increase concern for physeal growth arrest or abnormal growth

Physeal Arrest from a Transphyseal Fracture

Buckle (Torus) Fractures



- Due to softer bones
- One side of the bone may buckle upon itself without disrupting the other side
- This is also known as an incomplete fracture.

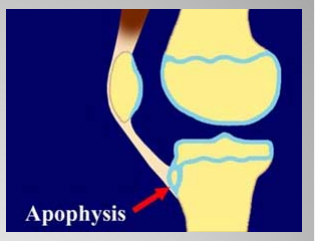
Children remodel well after fractures - the younger the child & the closer the injury is to physis = more apt to remodel without intervention, even with angulation

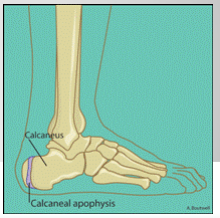
Examples of treatment

- Most distal radius fractures can be reduced and casted.
- Many elbow injuries (ex. supracondylar fracture) require reduction and pinning to protect the nerves and vessels.
- Salter Harris III and IV fractures usually require reduction and internal fixation.

Apophyseal Injuries

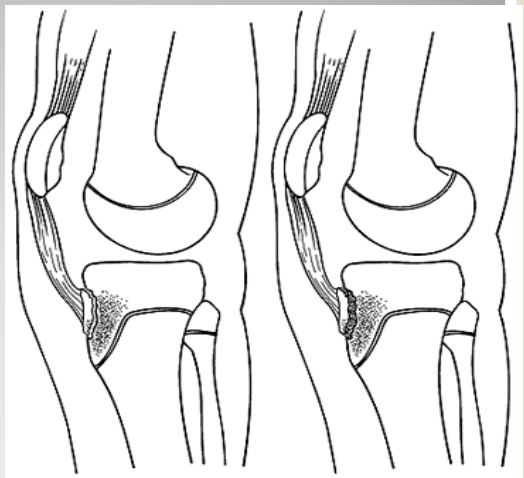
- Apophysis = natural bony projection attached to bone with cartilage; a region of muscle/tendon or ligament insertions
- Examples: Iliac crest, Tibial tubercle, calcaneus
- Growing children are subject to stress or "apophysitis" - e.g. Osgood Schlaters (tibial tubercle) or Sever's disease (heel)
- Usually respond to activity modification

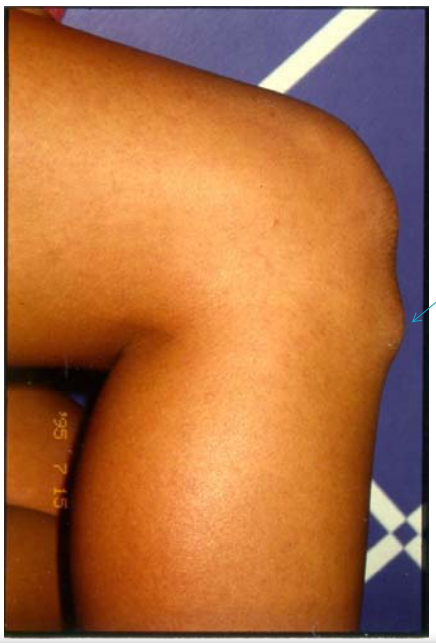




Osgood Schlatters

- The quadriceps generates considerable force
- In growing children &adolescents, the proximal tibial apophysis is weak and susceptible to overuse injuries - e.g. microfractures with elevation of the tubercle and a bursitis.
- Creates a painful, tender bump

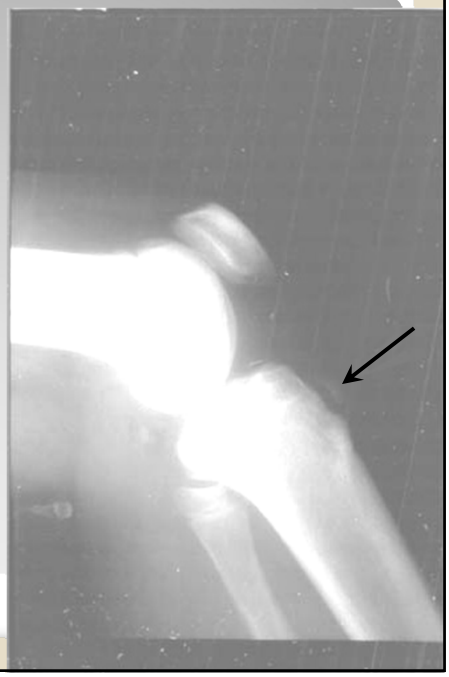




"Bump" seen with Osgood Schlatters

Osgood Schlatters - treatment

- Treat with ice, NSAID, activity modification and occasionally immobilization
- May get gradual resolution of the symptoms, but have persistence of the bump
- A few patients develop a loose ossicle which can remain painful and responds to surgical excision.



Compartment Syndrome

- Occurs when there is too much swelling in a muscle compartment causes further vascular flow problems
- May occur after fracture, surgery, burn or any acute injury
- This can quickly lead to the point of muscle death.
- Signs are **pain out of proportion to the injury** and particularly pain with passive stretch
- **A SURGICAL EMERGENCY**

The Hip

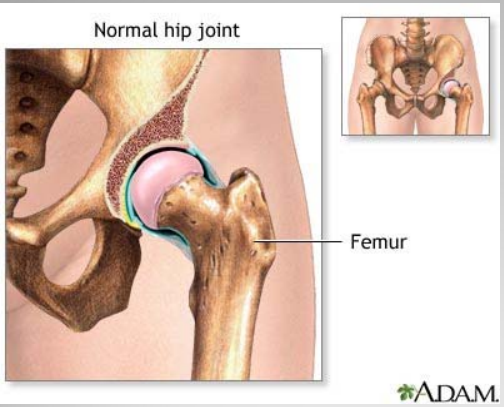


Table 1. Differential Diagnosis For The Limping Child

- Septic arthritis
- Osteomyelitis
- Toxic synovitis
- Juvenile rheumatoid arthritis (JRA)
- Rheumatic fever
- Fracture
- Tumor
- Legg calve perthes (LCP)
- Slipped capital femoral epiphysis (SCFE)

Why Should We Worry So Much About the Hip?

1. It has a unique blood supply which makes it more vulnerable to a disruption in blood flow to the femoral head
2. When it goes bad, it goes really bad
3. Early diagnosis is important for several disorders – septic hip, SCFE

When you are examining a child for complaints of the knee, always think of the hip – may be referred pain

Diagnosing the Hip

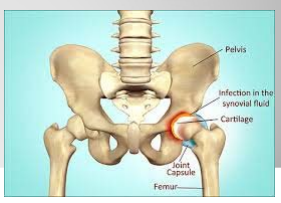
- History
  - Recent injury?
  - Onset of symptoms
  - Fever or recent illness
  - Pain
  - Weight bearing
- Evaluate weight bearing and gait
- PE
  - Warmth, erythema
  - ROM – always compare to contralateral side
    - Abduction/adduction
    - Flexion/extension
    - Internal rotation/External rotation
  - Pain with ROM

Age Based Clues – may help in DD

- Septic Arthritis
  - Any age, but usually 5 yrs or less
- Developmental Dysplasia of the Hip
  - Neonate to Walking Age
- Legg-Calve-Perthes Disease
  - Walking to 10, most commonly 6-10 yrs
- Slipped Capital Femoral Epiphysis
  - 9 yrs through Adolescence

Septic Hip

- Surgical emergency because joint destruction begins early – by 72 hours, some changes may be irreversible
- Hip is susceptible to necrosis (AVN) from damage to vessels
- Early diagnosis can be difficult
- Differential diagnosis is "Transient Synovitis" – important to differentiate



What is Transient Synovitis?

- Inflammation of the hip joint
- Thought to be usually a viral synovitis of the hip – there may be a hx of recent URI
- Can be related to trauma
- Generally, painful hip for a few days and then improves
- Usually, the child can still walk, but may limp
- Nontoxic child

How do you distinguish the two?

- Exam:
  - More pain with septic arthritis
- Fever:
  - Rarely have much with transient synovitis
- Loss of Motion:
  - More restricted with septic arthritis
- Imaging Studies:
  - Septic arthritis has more fluid on ultrasound and MRI
- Labs: WBC, ESR, CRP
- If unclear, ultimate diagnosis is made w aspiration of the joint

Algorithm for hip DD – Kocher, et al

- **Kocher criteria:** (for child with painful hip)
  - includes:

1) non-weight-bearing on affected side
2) ESR greater than 40 mm/hr
3) Fever
4) WBC count of >12,000 mm3

- when 4/4 criteria are met, there is a 99% chance that the child has septic arthritis
- when 3/4 criteria are met, there is a 93% chance of septic arthritis
- when 2/4 criteria are met, there is a 40% chance of septic arthritis
- when 1/4 criteria are met, there is a 3% chance of septic arthritis

Algorithm was 97% predictive at Boston Children's where it was developed. Not quite as predictive from other centers – but still identifies the factors to consider for septic hip

Treatments are very different

- Transient Synovitis
  - Treat symptoms
  - NSAID's, crutches, rest, time
- Septic Arthritis
  - Surgical Drainage and antibiotics
- Failure to treat a septic hip can lead to severe sequeli – so if in doubt, REFER!

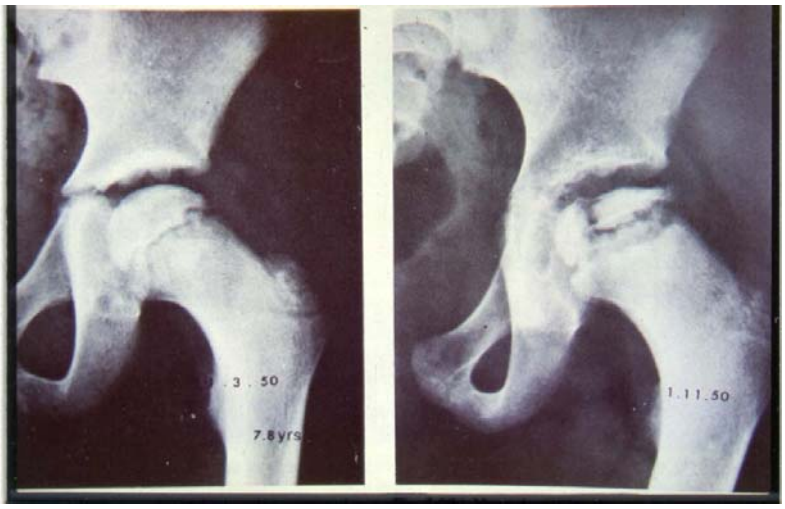
Recommendations

- If fever, non-weight bearing, elevated ESR, leukocytosis & elevated CRP - patient needs a hip aspiration.
- If any two of these are present with hip discomfort, obtain an orthopaedic consultation
- Remember to get blood cultures

LCP - Legg-Calve-Perthes Disease

- Idiopathic osteonecrosis of the hip in children
- Cause is unknown in most cases
- Hypercoagulable state may increase risk – i.e.Protein S, Protein C, Antithrombin III deficiencies
- Incidence is higher with exposure to passive smoke – reason?

LCP: Avascular necrosis of the femoral head which leads to subsequent collapse of the femoral head



LCP Treatments

- Treatments remain controversial
- The basic principle is to maintain motion of the hip
- The younger the age at diagnosis, the better prognosis for a functional hip
- Children ages 8-9 generally benefit from surgery to redirect the hip into the acetabulum
- Bracing, casting, traction, and extreme activity limitation are often used to preserve motion and help symptoms

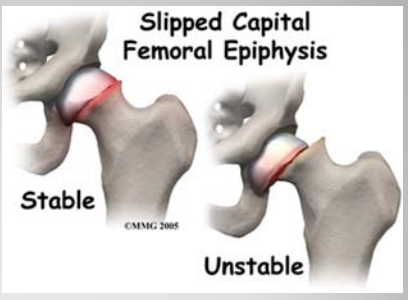
Surgical Treatments

Femoral osteotomy

Pelvic osteotomy

SCFE - Slipped Capital Femoral Epiphysis

- A separation or “slip” of the femoral head from the femoral neck
- May be subtle or severe



SCFE - Slipped Capital Femoral Epiphysis

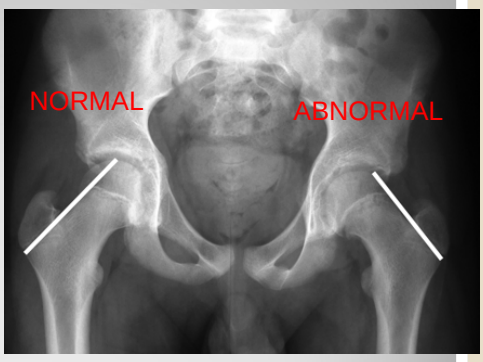
- May have hip pain, but patients often presents with **KNEE** pain
- Commonly male, overweight
- Think about endocrinopathies such as hypothroid, especially in a younger child
- Delayed skeletal maturation increases the risk because the slip occurs through the growth plate – SCFE cannot happen once the growth plates are closed

SCFE – PE findings

- Limp or unable to WB
- Hip and/or knee pain
- Increased external rotation of hip
- Limited or no internal rotation of hip
- Obligatory hip abduction with hip flexion

Klein's Line

- May see on AP view but most often on lateral view
- Line drawn along superior border of femoral neck should cross at least a portion of the femoral epiphysis
- Helpful especially for a subtle or early slip



Treatment

- If untreated, it leads to progressive slippage and early arthritis
- The onset of osteoarthritis is directly related to the degree of slippage
- Early treatment with screw fixation is reliable
- This makes early diagnosis VERY important
- Immediate referral is essential – make child NONweightbearing while awaiting evaluation
- If the slip becomes unstable, avascular necrosis is much more likely

Scoliosis

- A curvature and rotation of the spine
- Can occur in cervical, thoracic and/or lumbar spine
- By definition, cobb angle measurement must be >=10 degrees to be a scoliosis

Scoliosis Terms

Age of Onset

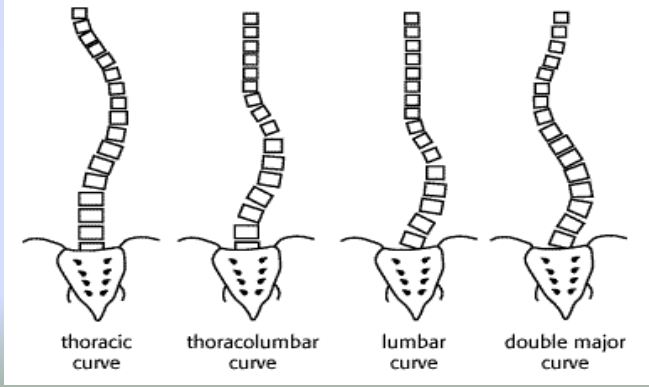
- Infantile Scoliosis - Diagnosed age 3 or less
- Early Onset Scoliosis – age 5 or younger at the time of diagnosis
- Late Onset Scoliosis – Above age 5 at diagnosis
- Juvenile Scoliosis – Below age 10 at diagnosis
- Adolescent Scoliosis – Age 10 and above at diagnosis

Types

- Congenital – due to malformed vertebrae
- Neuromuscular – secondary to neuromuscular diseases such as cerebral palsy and muscular dystrophies
- Syndromic – as part of other disorders such as Marfan's syndrome or Ehler's Danlos
- Soft Bone Disease – due to rickets (rare) or OI
- Idiopathic – No underlying cause can be identified

Curve Location - based upon **apex** of curve

- Cervical - apex C1-C6
- Cervical thoracic - C7-T1
- Thoracic - T2-T11
- Thoracolumbar - T12-L1
- Lumbar - L2-L4
- Lumbosacral - L5-S1



Scoliosis – Adams Forward Bend

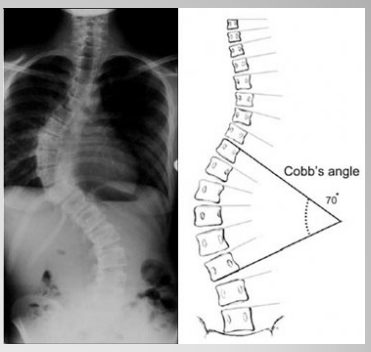
Measures the rotation of the spine

Useful for screening in idiopathic scoliosis - though the threshold to refer is controversial.

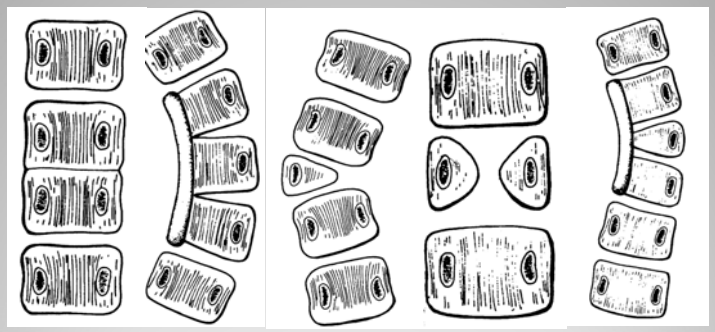
Generally refer to Pediatric Orthopaedics with a scoliometer reading of at least 5-7 degrees

Scoliosis – Cobb angle

- Cobb angle measures the magnitude of the curvature
- Angle formed between the intersection of lines that are drawn parallel to the ‘end vertebrae” of the curve
- Scoliosis = curve measuring 10 degrees or more



Scoliosis – Congenital



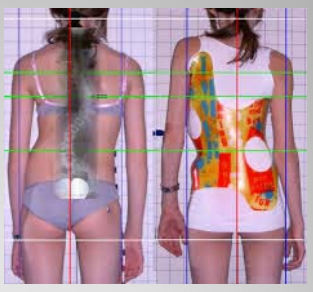
- Curves progress because of asymmetric growth
- They can become very severe.
- Two basic types of congenital malformation – failure of formation and failure of segmentation (can be both)

Scoliosis – Neuromuscular

- Caused by abnormal muscles and nerve signals from underlying disorder
- Most children should already have an Orthopaedist, but if not, refer when curve is noticed
- Brace may be used for support, but rarely prevents progression
- May progress and need surgical intervention – growing rods in younger child or spine fusion in older child

Scoliosis – Idiopathic

- Scoliosis with no apparent cause
- Research is suggesting a strong genetic link
- MUST do a careful examination for a cause – thorough neuro exam, assess for S&S syndrome, CP or muscular dystrophy, Nf1 – before calling it idiopathic
- LEFT thoracic curve or abnormal looking curve is likely to NOT be idiopathic (NF1, intraspinal cause, etc.)
- May be treated with observation, PT, bracing, surgery depending upon the curve size, skeletal maturity, cause & age of child



- General recommendation to refer when scoliometer reading is >= 5-7 degrees. Also ALWAYS refer a young child with scoliosis

Pearls – When to Refer Expeditiously

- Any child with concern for septic joint, especially septic hip**
- Slipped Capital Femoral Epiphysis
- Open fracture **
- Concern for compartment Syndrome **
- Young child with scoliosis

- ** May need to be sent to ED rather than office for Peds Ortho evaluation