Neither of us have any disclosures. We’d like some extra cash flow. But we don’t have it. If anyone wants to pay us a lot of money, we’d be happy to disclose it.
AKA “What the bleep do they do over there in team 4?”
Sports Medicine Updates

- AHO:
  - Thanks to everyone who came out for AHO Mass PPE Day!

- Team 4 providers:
  - Christine starting at 833 for sports starting mid July!

- Phila U merger
  - Providing coverage for their athletics
  - Telehealth
Sports Medicine Updates

• Lower extremity complaints:
  • Please get weightbearing films.

• Low back pain
  • If already failed PT, send to physiatry, not us. Patients don’t like being told to do PT…again.

• Ultrasound
  • Dr. Valko has promised us a new ultrasound machine.
  • Update on procedure capabilities
Agenda

• Pediatric Sports Med Potpourri
  • Concussion
  • Preparticipation cardiac screening
  • Growth plate injuries/issues
  • Hip pain
Case: 15 year old female falls from top of cheerleading pyramid

- Hits head on ground, does NOT lose consciousness
- Develops headache later that night
- Parents brought her to ER/UC and CT head was done, normal
- Feels “off”
- Follows up with you next day
- Normal vitals
- HA, eyes hurt, feels “cloudy”
- Is an honor roll student
Concussion - Differential Dx

- Heat Exhaustion/Stroke
- Dehydration
- Medications or drugs of abuse
- Hypoglycemia
- Migraine
- Altitude sickness
- Depression
- Overtraining
- Intracranial lesion
Concussion

• Guidelines
  • 4th International Conference on Concussion in Sport, 2012 - Zurich
  • 5th International Conference on Concussion in Sport, 2016 - Berlin
• “Complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces”
• Most common head injury in athletics
• Most occur when unexpected by athlete
Concussion - Pathophysiology

• Altered cellular metabolism causes decreased blood flow to the brain at a time the brain needs it most
• Protective mechanism to prevent cerebral edema
• This “mismatch” causes symptoms and increases the vulnerability of the brain to further injury
Potential Role of PCP

- Make correct diagnosis
  - Know the symptoms
  - Know the differential
- Manage typical concussions
  - Guide academic, physical, and emotional rest
  - Prevent academic and neurologic disasters
  - Consider medications and therapies
  - Guide return to activities and clear for full return
- Refer atypical or prolonged concussions
Concussion Symptoms

- **Physical**
  - Headache
  - Fatigue
  - Visual disturbances (photophobia, flashing)
  - Auditory disturbances (phonophobia, tinnitus)
- **Cognitive**
  - LOC
  - Amnesia
  -Difficulty concentrating
  - Slurred speech
  - Personality changes
  - Inappropriate behavior
  - Feeling “dinged”, “foggy,” or “dazed”
- **Emotional**
  - Depression
  - Irritability
  - Nervousness
  - Emotional lability
  - Inappropriate emotions
- **Coordination and balance disturbances**
Concussion - Exam

• Review injury history
  • Initial symptoms
    • Amnesia or dizziness
  • Initial evaluation
  • Initial management
• Review concussion history
  • Previous concussions
  • ADD, migraines, depression, anxiety, sleep disorder
• Review current symptoms
  • Physical, cognitive, and emotional
  • Consider symptom scale at every visit

“Hi, Mrs. Caves! Can Jeffy come out and get a concussion?”
Concussion - Exam

• 4 C’s
  • Cervical
  • CNS (full neurologic exam)
  • Cognition (serial 7s, 3 object recall)
  • Coordination (walk the line backwards with eyes closed, finger-to-nose, eye tracking, single leg stance, tandem stance)
• Eye exam
Neurologic and Academic Disasters

• Second Impact Syndrome
  • Second concussion while still symptomatic
  • Immediate and massive cerebral edema

• Post-Concussion Syndrome
  • Symptoms beyond standard for age
  • Increased incidence without immediate rest
  • Increased incidence when initial presentation of dizziness
  • Repeat injury while still symptomatic

• Suicide

• Underperformance at school
Academic, Social, and Physical Rest

- PREVENT ACADEMIC AND NEUROLOGIC DISASTER
- Initiate academic, physical, social rest
- As patients start to feel better, let symptoms be their guide for progression of ADLs
- Pearls
  - Naproxen
  - Melatonin
  - Sunglasses inside
  - Selective TV
  - Frequent breaks
Return to Play/School

- Initiate Return-to-School Protocol
  - Coordinate with guidance counselor
  - Abbreviated or modified schedule
  - Breaks at nurses office
  - Ability to leave school early or arrive late
  - Extended deadlines
  - Defer testing
  - Set of notes***
  - Limited gym

- Initiate Return-to-Friends Protocol
  - Start with small events and limited phone and computer
  - Events with “outs” only
Interventions

- Medications
  - Headache
  - Sleep
  - Cognition and concentration
  - Fatigue and fogginess
  - Nausea
  - Dizziness
  - Depression and anxiety
- Neuroimaging
- Counseling
- Neuropsychological testing
- 504 evaluation
- Physical therapy
When to Refer

- If symptoms last longer than normal for age
  - Professional athlete: 1-3 days
  - College athlete: 5-7 days
  - High school athlete: 2-3 weeks
  - Middle school athlete: ???
- Medications
- High level athlete
- Headache
- Disqualification from sports
Clear for Full Return to School/Play

• Complete return to school and social activities
• Initiate Return-to-Sports Protocol
  • After symptoms free with school and social activities
  • After physical exam is completely normal!
  • Lengthen return depending on length of symptoms
• Consider computerized neuropsychologic testing
• Consider permanent restriction from high risk activity
  • More than 3 concussions
  • Easy provocation
  • Severe symptoms
  • Prolonged recovery
  • Comorbid modifiers
Graduated RTP Protocol

1. Rest until asymptomatic with ADL and school
2. Light aerobic exercise (walking on a treadmill, stationary bike)
3. Sport specific exercise (skating in hockey, running drills in soccer)
4. Non-contact training drills (passing drills, light resistance training)
5. Full contact training
6. Return to competition
Concussion

• Questions?
Pre-participation Exam

• Case: 14yo male presents for “sports physical.” What do you do?
  • a. General Well Child visit
  • b. Update vaccines, sign paperwork, use the extra time to catch up during already busy schedule
  • c. Review vital signs, patient history, and completed PIAA form, focusing on cardiac, concussion, disqualifying medical conditions sections and perform targeted exam.
**PPE - purpose**

- Maximize safe participation in sport
  - Determine clearance for sport participation
    - 95% of children cleared
- Identify:
  - Life threatening conditions
    - e.g. HCM, ARVC
  - Conditions that require treatment prior to participation
    - e.g. HTN
  - MSK conditions, requiring rehab
  - Concussion history and risk
  - Conditions that can interfere with performance and req tx.
    - e.g. EIB
PPE - Cardiac Screening

- Review causes of SCD in athletes
- Discuss current guidelines
- Look at research about screening modalities
- Review what we are doing in Philadelphia
PPE - Cardiac Screening

• Sudden Cardiac Arrest (SCA) is the most common medical cause of death in young athletes (12-25yo).
• Rate: 1 in 50,000 athlete-years
• Highest risk:
  • Male
  • African-American
  • ”Burst” exertion activities - basketball, soccer, football
    • DI NCAA Men’s Basketball - risk is 1 in 3100
Cardiac Screening - Causes of SCA in US

Maron – 2009
N = 690

- HCM 37%
- Possible HCM/LVH 8%
- Coronary Artery Abnormality 17%
- Dilated CM 6%
- ARVC 4%
- SUD 6%
- MI 3%
- Myocarditis 6%
- Aortic dissection 3%
- Other 14%

Maron, Circ, 2009
Cardiac Screening - Causes of SCA in US

Etiology of SCD in NCAA Athletes 2003 - 2013

- SUD 25%
- Anomalous coronary 11%
- Myocarditis 9%
- CAD 9%
- Myocarditis 9%
- Idiopathic LVH/possible SCT 1%
- Idiopathic LVH/possible cardiomyopathy 8%
- HCM 8%
- ARVC 5%
- Aortic dissection 5%
- DCM 3%
- Long QT 1%
- Kawasaki’s Disease 2%
- Commotio 2%
- WPW 3%

Harmon, Circulation, 2015
Cardiac Screening - Current Guidelines

• AHA-ACC Guidelines
  • Recommend AHA 14-point screening as part of H&P (Class I; Level of Evidence C)
  • Targeted use of ECGs (Class I; Level of Evidence C)
  • Recommend against mass screening with ECG (Class III; Level of Evidence C)
The 14-Element AHA Cardiovascular Screening Checklist for Congenital and Genetic Heart Disease

**Personal history**

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**Family history**

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**Physical Examination**

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*Judged not to be of neurocardiogenic (vasovagal) origin; of particular concern when occurring during or after physical exertion.

**Refers to heart murmurs judged likely to be organic and unlikely to be innocent; auscultation should be performed with the patient in both the supine and standing positions (or with Valsalva maneuver), specifically to identify murmurs of dynamic left ventricular outflow tract obstruction.

***Preferably taken in both arms.
PIAA forms
Cardiac Screening - Current Guidelines

• AMSSM Consensus Statement 2016
  • “The absence of definitive outcome-based evidence at this time precludes AMSSM from endorsing any single or universal cardiovascular screening strategy for all athletes, including legislative mandates.”
  • “The decision to implement a cardiovascular screening programme, with or without the addition of ECG, necessitates careful consideration of the risk of SCA/D in the targeted population and the availability of cardiology resources and infrastructure.”
Cardiac Screening - Current Debate

• To ECG or not to ECG...
Cardiac Screening - Pros & Concerns of Universal ECGs

- Save lives

- Sport disqualification
- False positives
  - Must be correctly interpreted
- Anxiety regarding diagnosis
- Cost
  - Individual
  - Society
- Resources availability
- Pre-existing conditions
Cardiac Screening - Interpretation of ECGs in Athletes

Cardiac Screening - Eligibility for Play

BETHESDA CONFERENCE REPORT

36th Bethesda Conference: Eligibility Recommendations for Competitive Athletes With Cardiovascular Abnormalities

Barry J. Maron, MD, FACC, Conference Co-Chair
Douglas P. Zipes, MD, MACC, Conference Co-Chair
AHA 14 Point + H&P vs. Universal ECG

- Price et al, 2013
  - H&P + ECG + limited echo in 2017 high school athletes
  - 5 cardiac disorders associated with SCD detected
    - 2 (40%) detected by H&P
      - False positive 14.5%
    - 5 (100%) detected by ECG
      - False positive 2.8%
AHA 14 Point + H&P vs. Universal ECG

• Drezner et al, 2016
  • H&P + ECG in 5258 NCAA athletes (35 institutions)
  • 13 cardiac disorders associated with SCD detected
    • 2 (15%) detected by H&P
      • False positive rate 33.3%
    • 13 (100%) detected by ECG
      • False positive rate 3.4%
Cardiac Screening - What we’re doing at St Joe’s

• History and Physical Exam for all athletes
• AHA 14 point screening
• Targeted ECG, cardiac w/u for +screens on H&P
• Universal ECG + echo for Men’s Basketball
Cardiac Screening - Athlete Health Organization

- History & PE
- Universal ECGs for all students
Where is this headed?
Preparticipation Cardiac Screening - Summary and Recommendations

- Utilize the PIAA forms to your advantage.
- Beware of “all no” line-drawers
- Specifically go over the cardiac questions
- Universal ECGs not recommended at this point
  - Targeted based on risk is reasonable
  - Need correct interpretation
  - Will insurance cover? Discuss with family.
Preparticipation Cardiac Screening

• Question?
Growth Plate Injuries

- Terminology
- Apophysitis
  - Osgood-Schlatter
  - Sinding-Larson-Johansson
  - Severs
  - Iselin
- Review of growth plate fractures - Salter Harris 1 and 2
Terminology

- Physis
- Tendon
- Body
- Epiphysis
- Apophysis
- Metaphysis
- Diaphysis
Terminology - Physis (Growth Plate)

- Source of longitudinal growth
- Physeal fractures through the hypertrophiic zone
- Growth disturbance related to disruption of vascularity
Terminology - Apophysis

- Does not contribute to longitudinal growth
- Insertion point for tendon or ligament
- Acts as a “release valve” and “warning bell”
- Usually fuses to bone as skeletal maturity progresses
- Can persist and become symptomatic
Case: 12 y/o with anterior knee pain

- No injury/inciting event
- Pain with athletic activity
- TTP at tibial tuberosity
- Pain does not awaken from sleep
- Ice/motrin helps
- Recently had a growth spurt
Differential Dx

- Infection
- Osteochondritis Dissecans
- Stress Fracture
- Tumor
Aphophysitis - Definitions

• Apophysis: Cartilaginous prominence adjacent to the physis (growth plate)
• Site of tendon attachment prior to skeletal maturity
• Use/overuse can result in a traction apophysitis: repetitive microtrauma caused by the forces pulling on the attached tendons resulting in inflammation and/or partial avulsions
• Excessive force may result in an avulsion fracture
Apophysitis - Causes

• During a time of rapid growth, bone growth exceeds the ability of the muscle-tendon unit to stretch sufficiently to maintain its previous level of flexibility, causing increased tension at the attachment site
• Training and competition increase force generation of the attached muscle and amplify traction forces
• Underlying biomechanical factors such as foot pronation or genu valgum may exacerbate abnormal forces at the apophysis
• Improper technique
Apophysitis - Presentation

• Gradual/insidious onset of pain
• May present as persistent or worsening symptoms after a single event
• Pain with exercise/athletic activities
• SHOULD NOT HAVE night time pain, fevers, weight loss, pain persisting after skeletal maturity
Apophysitis - Treatment

- Rest from activities that cause pain
  - Inadequate protection/stress can result in avulsion fx
- Ok to modify activity as long as activity is painless
  - General rule - no participation in gym or sport is child is limping
- Rehab/PT to address underlying flexibility and strength deficits
Osgood-Schlatter Disease

- Traction apophysitis at the tibial tuberosity
- Often seen during rapid growth
  - Ages 8-13 in girls
  - Ages 12-15 in boys
- More common in active individuals
- Often insidious, can be initiated by traumatic event
- Pain exacerbated by running/jumping/kneeling
- Tenderness/swelling over tibial tuberosity
- Risk factors include quad and hamstring tightness
Osgood-Schlatter - Treatment

- Self limiting - Can take up to 24 months
- Ok to play through pain as long as not limping
- Ice, NSAIDs, patellar tendon strap, PT/HEP
- If limping - activity modification with rest, gradual reintroduction of physical activities
- Immobilization/surgery rarely needed
Sinding-Larsen-Johannsson Disease

- Traction apophysitis which develops because of the pull of the patella tendon at the inferior pole of the patella.
- SLJD appears to affect males over females and is seen in active adolescents between the ages of 10 and 13 years.
- Pain inferior patella, especially with running and jumping activities.
- Bony tenderness over the inferior patellar pole with or without swelling.
- Radiographs may demonstrate irregular calcification at the inferior pole of the patella or may be normal.
Sinding-Larsen-Johansson - Treatment

- Self limited with resolution usually occurring with apophyseal closure at inferior pole of patella
- Shorter in duration than OSD - 3-18 months
- Most children respond to ice, NSAIDs and PT
- Severe cases - consider knee immobilizer, sleeve, strap
Sever’s Disease

- Most common overuse injury in pediatric/adolescent population
- Affects children between ages 8-12
  - Females earlier, males 2-3x females
- 60% bilateral
- Significant force from direct impact, or opposing tension from plantar fascia and gastroc-soleus complex
- Pain post heel, worse with running, jumping
- TTP at achilles insertion, TTP w calcaneal squeeze test
- Cord tightness, weak ankle dorsiflexors
- X-ray may show apophyisis that appears thick, sclerotic, fragmented
Sever’s - Treatment

- Relative rest, NSAIDs, ice, achilles tendon stretching and ankle strengthening
- Role for heel cups, pads, or orthotics?
- Severe cases may require crutches or walking boot, cast for 2-4 weeks
- Recurrence is common
Iselin’s Disease

- Traction apophysitis involving tuberosity of 5th metatarsal
- Females ages 8-12, males ages 10-14
- Pain worse with running, jumping, cutting
- Typically insidious onset, may start after inversion injury
- PE reveals TTP base of 5th met, soft tissue edema, enlargement of tuberosity
- Pain with resisted eversion, extreme dorsiflexion and plantar flexion with inversion
- Xray - best seen on oblique view
Iselin’s - Treatment

- Limitation of activity based on severity of symptoms
- Ice, NSAIDs, PT
- Consider immobilization/walking boot 2-4 weeks
- Benign and self limiting
- Rarely non-union may occur with symptoms later in life - consider surgical excision in these cases
Growth Plate Fracture

- Salter Harris Classifications
- SH 1
- SH 2
Salter-Harris Fracture Classification

- Type 1: Through growth plate
- Type 2: Through growth plate and metaphysis
- Type 3: Through growth plate and epiphysis
- Type 4: Through all three elements
- Type 5: Crush injury of growth plate
Salter-Harris I

- Fracture through hypertrophic zone of physis
- Injury and tenderness
- X-ray
  - Normal
  - Soft tissue swelling
  - Effusion
  - Subtle displacement or widening
Salter-Harris I

- Almost zero chance of growth disturbance
- Risk of chronic pain
- 3-4 weeks of relative immobilization
- RTP after 1-3 weeks of stretching, strengthening, and functional training
Salter-Harris II

- Physeal fracture line extends through metaphysis
- Rotation and angulation
- X-ray
  - Thurston Holland fragment
  - Assess for angulation and displacement
Salter-Harris II

- Reduction to functional position
- 3-6 weeks of immobilization
- Growth disturbance in distal femur

Seymour Fracture
- SH II fracture of distal phalanx
- Associated nail bed injury
- Can treat initially with antibiotics and immobilization
- Often needs surgical I&D
Growth Plate Injuries

- Questions?
SORE KNEE, HUH? HAVE YOU TRIED ICING IT?
Hip pain in children
Pediatric hip pain

- **Inflammatory/infections**
  - Transient synovitis
  - Septic arthritis
  - Osteomyelitis
  - Pyomyositis
  - Reactive arthritis
  - JIA

- **Injuries/overuse injuries**
  - Apophysitis
  - Apophyseal avulsion fractures
  - Stress fracture
  - Muscle strains
  - Referred pain

- **Developmental**
  - Legg-Calve-Perthes Disease
  - Slipped capital femoral epiphysis
Pediatric Painful Hip

- Sick or not sick
- Age
# Pediatric Painful Hip

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<th>Typical Age</th>
<th>M:F ratio</th>
<th>Other</th>
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<td>1.2-2:1</td>
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<td>Transient synovitis</td>
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<td>2:1</td>
<td>Fall/winter</td>
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<td>Perthes disease</td>
<td>4-10yrs, peak 5-7yrs</td>
<td>4:1</td>
<td>Rare in blacks</td>
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<tr>
<td>Slipped capital femoral epiphysis</td>
<td>Early adolescence</td>
<td>1.5:1</td>
<td>Obese children</td>
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<td>Mean 12 years, girls</td>
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<td>Endocrinopathies</td>
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<td></td>
<td>Mean 13.5 years, boys</td>
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<td>Blacks &gt; whites, hispanics</td>
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<td>Apophysitis, avulsion fractures</td>
<td>Prior to growth plate closure</td>
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<td>Growth plates in hips close later than most</td>
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Case 1: 11yo obese, black male presents with 3 weeks of right thigh discomfort and pain with walking. There was no trauma. Pain has been gradually worsening in severity and mom reports he is now limping.
Slipped Capital Femoral Epiphysis - SCFE

- Displacement of femoral epiphysis from the femoral neck through the physeal plate
  - Often no trauma
- Epidem:
  - 1 in 1,000 to 1 in 10,000
  - Obese male > female (1.5:1)
  - Ages 8-15 (mean 12-13)
- Obesity = significant risk factor
SCFE

- **Presentation:**
  - Obese males > females
  - Bilateral in 20-30% on presentation
    - Of unilateral cases, 30-60% become bilateral
    - More in underlying endocrine disorders
- **Pain:**
  - Hip (anterior hip/groin)
  - Thigh or knee
SCFE - Exam

- Well appearing
- Obese, limp
- Resting external rotation
- Pain with passive ROM
- Decreased IR and forced ER with hip flexion
SCFE - X-ray findings

- Klein’s Line
SCFE - Classification

- Stable - able to ambulate (90% cases)
- Unstable - unable to ambulate
SCFE - Management

• If suspect SCFE in office
  • Non weight bearing (crutches or wheel chair)
  • Stable and reliable - urgently to Peds Ortho
  • Unstable and unreliable - send to ED

• Surgical fixation:
  • Stable - screw fixation
  • Unstable - more complicated
    • Higher rates of long term complications
Obese preteen with groin/thigh/knee pain and a limp
If very reliable - crutches and send to ortho
If unreliable - ED
Case 2: 7yo male presents with complaints of left thigh pain for 4 weeks, worsening and now causing a limp.
Legg-Calve-Perthes Disease

- Idiopathic avascular necrosis/osteonecrosis of the femoral epiphysis
- Epidem:
  - Age 4-10 years, peak 5-7
  - Male:female = 4:1
  - Caucasian more common than black
- Not obesity related
Perthes Disease - Exam

- Well appearing child
- Limp or pain in hip (anterior hip/groin)
- Limited and painful ROM
  - Rotation
  - Abduction
- Trendelenburg gait
Perthes Disease - X-ray

- AP and frog leg lateral
- Decreased size or density of femoral epiphysis
- Crescent sign on lateral view
  - Subchondral fracture correlates with extent of necrosis
Perthes Disease - Management

• Referral to Pediatric Orthopedics
• Treatment:
  • Non weight bearing, rest
  • Braces/orthotics occasionally
• Prognosis dependent on amount of femoral head involved
Pediatric hip pain Case 3

14yo female soccer player comes in with 2w of left anterior hip pain. She points to her ASIS when indicating the site of pain. She does not have any pain with walking, but starts to feeling it with any running. There was no trauma or injury; she never experienced a “pop.”
Apophysitis
Apophysitis

- Apophysis:
  - Growth plate at site of tendon attachment prior to skeletal maturity
- Traction apophysitis
  - Excessive activity and muscular tightness
  - Repetitive microtrauma to the growth plate
  - Inflammation and pain
- Presentation:
  - Gradual pain at site of apophysis without trauma
Apophysitis

- Well appearing
- Normal, painless hip ROM
- TTP to palpation at site of apophysitis
- Muscular tightness corresponding to apophysis

**THOMAS TEST**

Test the rectus femoris muscle which may be restricted, preventing flattening of leg.

1: normal condition
2: restricted condition

**Popliteal angle**
Apophysitis - Management

- Rest from aggravating activities
  - Sports OK if not causing pain/limp
- Correction of underlying factors
  - Muscular tightness
- PT
- 3-4 weeks till resolution
Avulsion fracture

• Similar pain and exam to apophysitis but acute onset of pain with “pop”
Avulsion Fracture - Management

- Rest from aggravating activities
- If < 3 cm displaced
  - Conservative (rest, PT)
- If > 3 cm displaced
  - Ortho referral for ORIF
Pediatric Hip Pain Summary

- Sick or not sick
- Have high index of suspicion for:
  - Obese preteen with limp
  - Late school aged (5-7) with limp
- When in doubt, if having pain with ambulation, make non-weight bearing with crutches and send to ortho
Pediatric hip pain

- Questions?
References


References

• Wilson JC. Apophysitis of the lower extremities. Contemporary Pediatrics. 6/1/11.