

# Sports Medicine Update for the Primary Care Physician

Joshua V. Okon, MD

Clinical Instructor

Assistant Director- Primary Care Sports Medicine Fellowship

Department of Family and Community Medicine

Christine Marschilok, MD

Clinical Assistant Professor

Department of Family and Community Medicine

## Disclosures

- 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

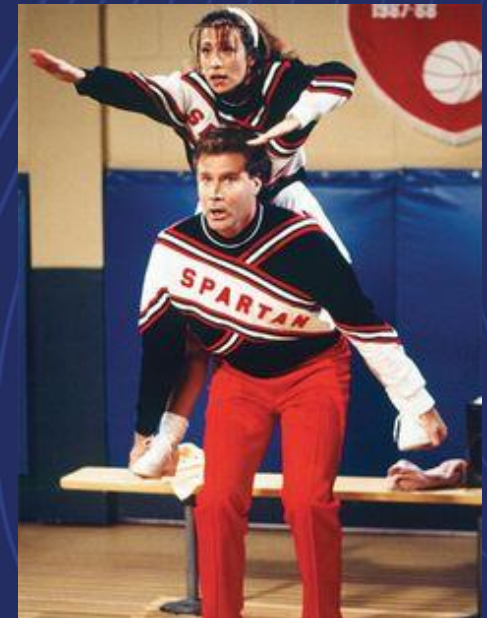
- Lower extremity complaints:
  - Please get weightbearing films.
- Low back pain
  - If already failed PT, send to physiatry, not us. Patients don't like being told to do PT...again.
- Ultrasound
  - Dr. Valko has promised us a new ultrasound machine.
  - Update on procedure capabilities

# 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
  - 4<sup>th</sup> International Conference on Concussion in Sport, 2012 - Zurich
  - 5<sup>th</sup> 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)
  - Nausea and/or vomiting
  - Sleeping abnormalities
  - Coordination and balance disturbances
- Cognitive
  - LOC
  - Amnesia
  - Difficulty concentrating
  - Slurred speech
  - Personality changes
  - Inappropriate behavior
  - Feeling “dinged”, “foggy,” or “dazed”
- Emotional
  - Depression
  - Irritability
  - Nervousness
  - Emotional lability
  - Inappropriate emotions



## 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



## 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 foginess
  - 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

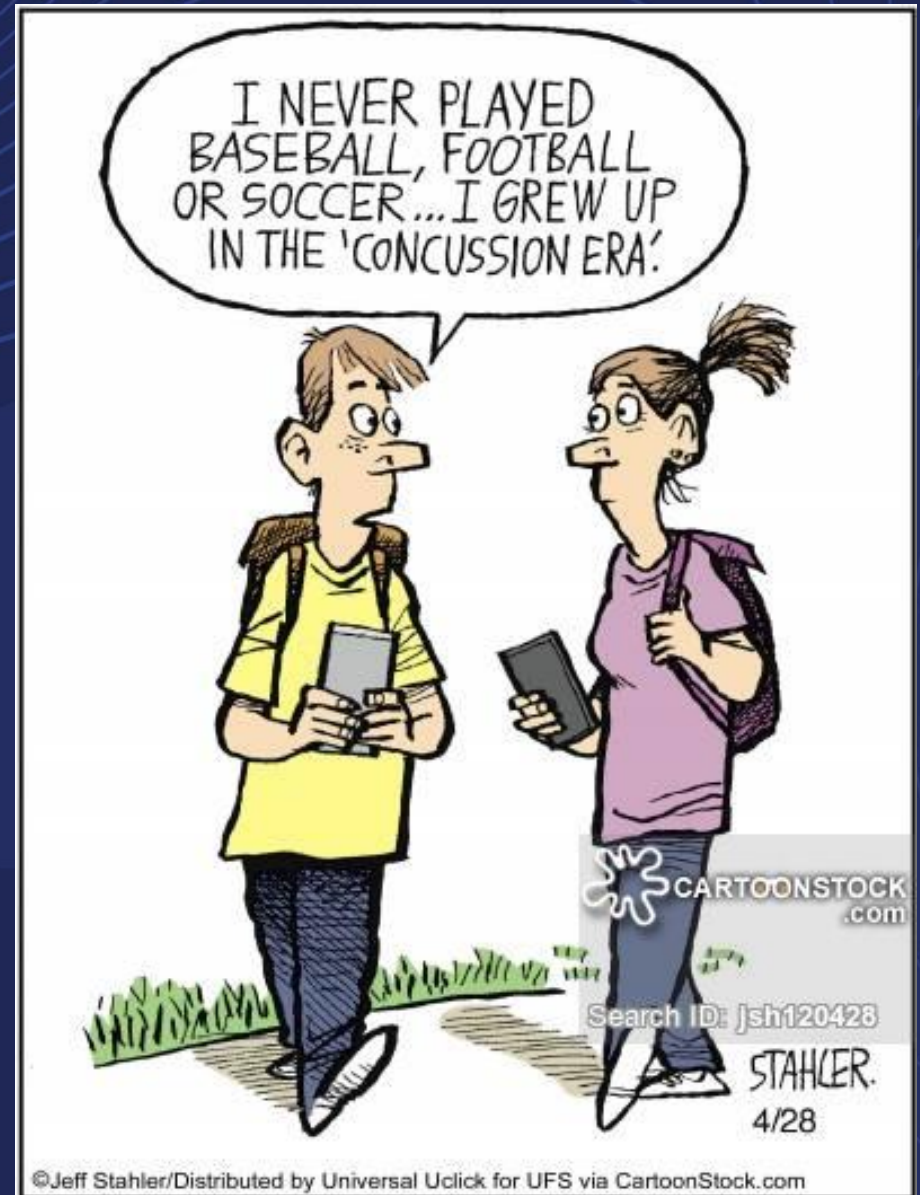


## Graduated RTP Protocol

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?





**Jefferson™**

HEALTH IS ALL WE DO



## 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

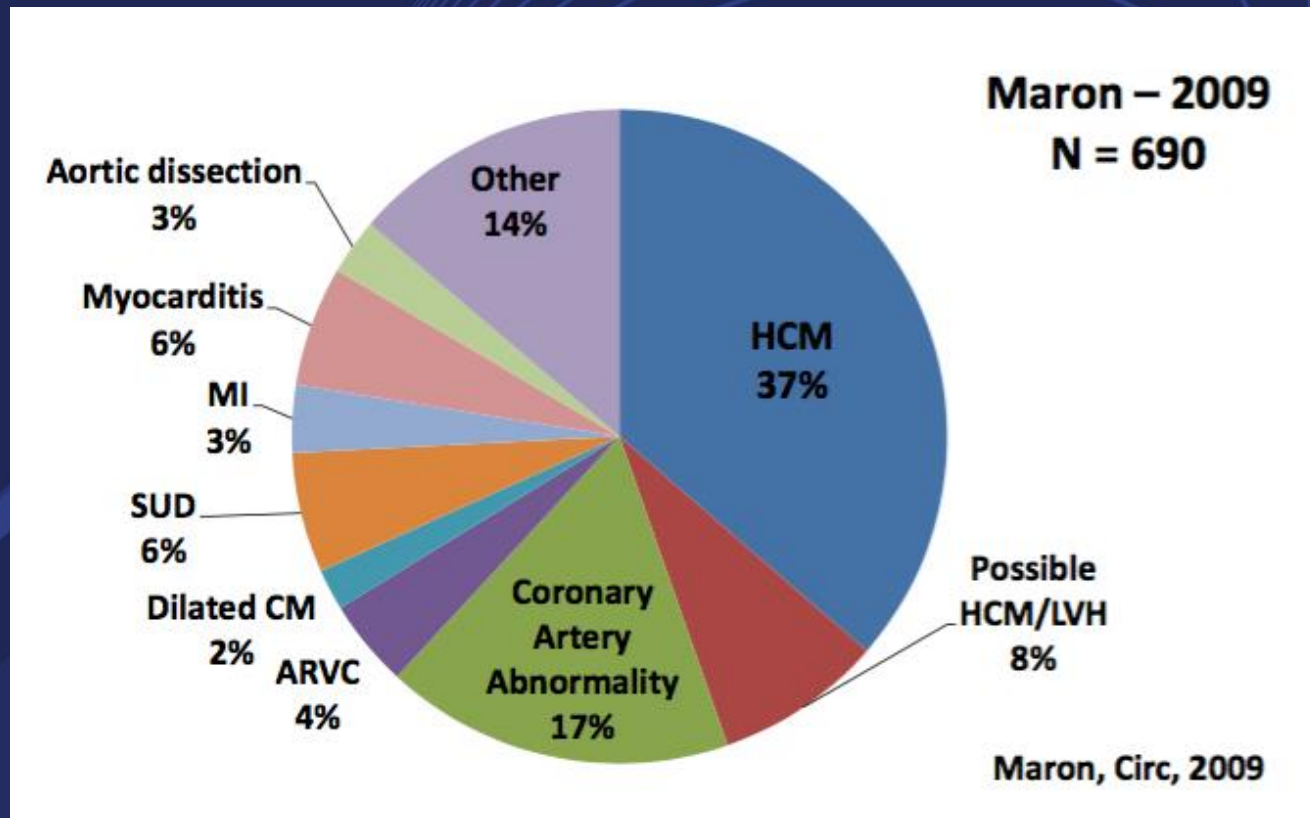
- Review causes of SCD in athletes
- Discuss current guidelines
- Look at research about screening modalities
- Review what we are doing in Philadelphia



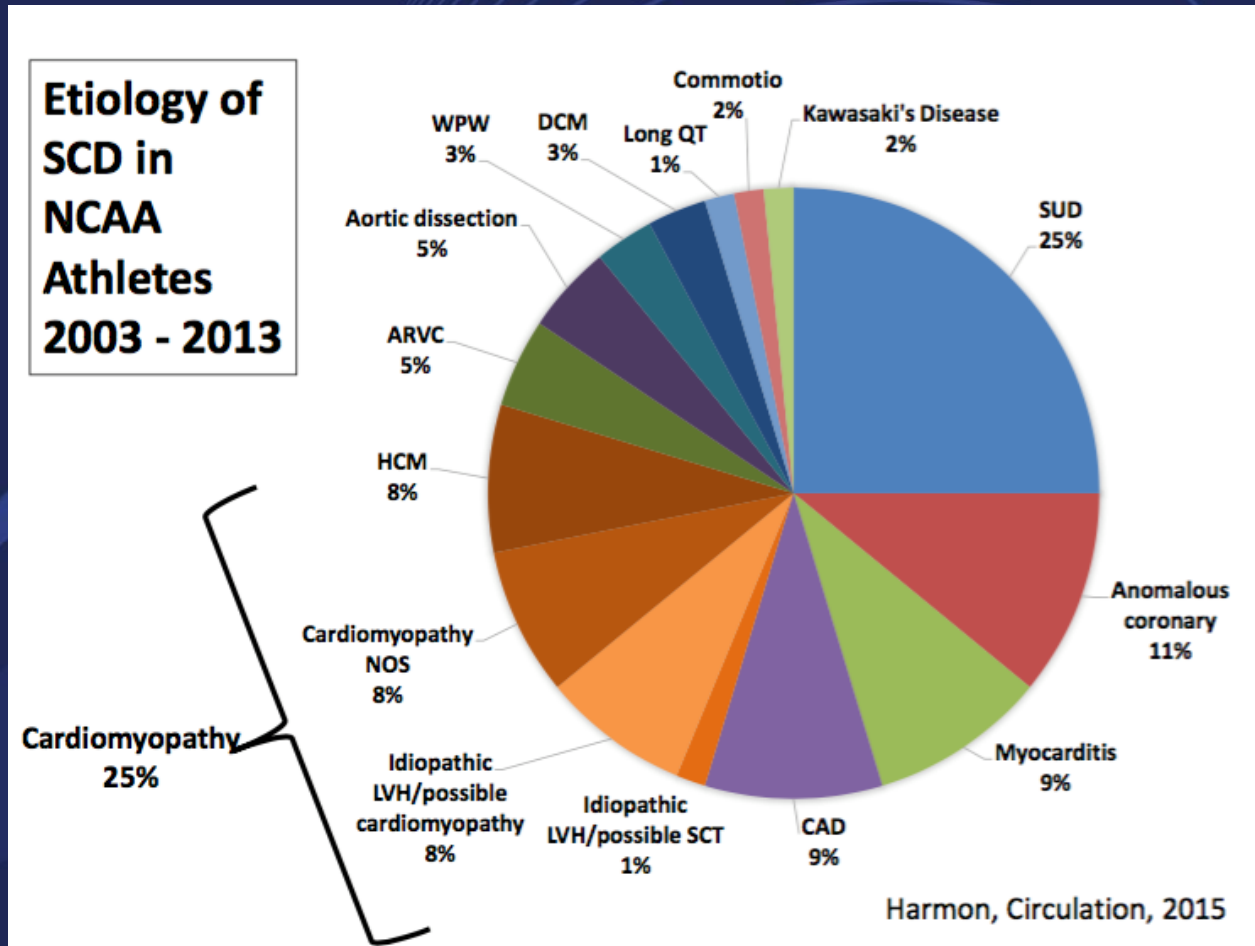
## PPE - Cardiac Screening

- 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



# Cardiac Screening - Causes of SCA in US





# 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

Yes No

- 1. Chest pain/discomfort/tightness/pressure related to exertion
- 2. Unexplained syncope/near-syncope\*
- 3. Excessive exertional and unexplained dyspnea/fatigue or palpitations, associated with exercise
- 4. Prior recognition of a heart murmur
- 5. Elevated systemic blood pressure
- 6. Prior restriction from participation in sports
- 7. Prior testing for the heart, ordered by a physician

### Family history

Yes No

- 8. Premature death (sudden and unexpected, or otherwise) before age 50 attributable to heart disease in  $\geq 1$  relative
- 9. Disability from heart disease in close relative  $< 50$  y of age
- 10. Hypertrophic or dilated cardiomyopathy, long-QT syndrome, or other ion channelopathies, Marfan syndrome, or clinically significant arrhythmias; specific knowledge of certain cardiac conditions in family members

### Physical Examination

Yes No

- 11. Heart murmur\*\*
- 12. Femoral pulses to exclude aortic coarctation
- 13. Physical stigmata of Marfan syndrome
- 14. Brachial artery blood pressure (sitting position)\*\*\*

\*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



Student's Name \_\_\_\_\_ Age \_\_\_\_\_ Grade \_\_\_\_\_

**SECTION 5: HEALTH HISTORY**

Explain "Yes" answers at the bottom of this form. Circle questions you don't know the answers to.

<p>1. Has a doctor ever denied or restricted your participation in sport(s) for any reason? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>2. Do you have an ongoing medical condition (like asthma or diabetes)? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>3. Are you currently taking any prescription or nonprescription (over-the-counter) medicines or pills? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>4. Do you have allergies to medicines, pollen, foods, and/or things in the air? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>5. Have you ever passed out or nearly passed out DURING exercise? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>6. Have you ever passed out or nearly passed out AFTER exercise? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>7. Have you ever had discomfort, pain, or pressure in your chest during exercise? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>8. Does your heart race or skip beats during exercise? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>9. Has a doctor ever told you that you have (check all that apply):  <input type="checkbox"/> High blood pressure <input type="checkbox"/> Heart murmur  <input type="checkbox"/> High cholesterol <input type="checkbox"/> Heart infection</p> <p>10. Has a doctor ever ordered a test for your heart? (for example ECG, echocardiogram) <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>11. Has anyone in your family died for no apparent reason? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>12. Does anyone in your family have a heart problem? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>13. Has any family member or relative been disabled from heart disease or died of heart problems or sudden death before age 50? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>14. Does anyone in your family have Marfan syndrome? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>15. Have you ever spent the night in a hospital? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>16. Have you ever had surgery? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>17. Have you ever had an injury, like a sprain, muscle, or ligament tear, or tendonitis, which caused you to miss a Practice or Contest? If yes, circle affected area below:  <input type="checkbox"/> Head <input type="checkbox"/> Neck <input type="checkbox"/> Shoulder <input type="checkbox"/> Upper arm <input type="checkbox"/> Elbow <input type="checkbox"/> Forearm <input type="checkbox"/> Hand/Fingers <input type="checkbox"/> Wrist/Ankle <input type="checkbox"/> Chest</p> <p>18. Have you had any broken or fractured bones or dislocated joints? If yes, circle below:  <input type="checkbox"/> Upper back <input type="checkbox"/> Lower back <input type="checkbox"/> Hip <input type="checkbox"/> Thigh <input type="checkbox"/> Knee <input type="checkbox"/> Calf/Ankle <input type="checkbox"/> Foot/Toes</p> <p>19. Have you had a bone or joint injury that required x-rays, MRI, CT, surgery, injections, rehabilitation, physical therapy, a brace, a cast, or crutches? If yes, circle below:  <input type="checkbox"/> Head <input type="checkbox"/> Neck <input type="checkbox"/> Shoulder <input type="checkbox"/> Upper arm <input type="checkbox"/> Elbow <input type="checkbox"/> Forearm <input type="checkbox"/> Hand/Fingers <input type="checkbox"/> Wrist/Ankle <input type="checkbox"/> Chest</p> <p>20. Have you ever had a stress fracture? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>21. Have you been told that you have or have you had an x-ray for atlantoaxial (neck) instability? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>22. Do you regularly use a brace or assistive device? <input type="checkbox"/> Yes <input type="checkbox"/> No</p>	<p>23. Has a doctor ever told you that you have asthma or allergies? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>24. Do you cough, wheeze, or have difficulty breathing DURING or AFTER exercise? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>25. Is there anyone in your family who has asthma? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>26. Have you ever used an inhaler or taken asthma medicine? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>27. Were you born without or are you missing a kidney, an eye, a testicle, or any other organ? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>28. Have you had infectious mononucleosis (mono) within the last month? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>29. Do you have any rashes, pressure sores, or other skin problems? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>30. Have you ever had a herpes skin infection? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p><b>CONCUSSION OR TRAUMATIC BRAIN INJURY</b></p> <p>31. Have you ever had a concussion (i.e. bell rung, ditz, head rush) or traumatic brain injury? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>32. Have you been hit in the head and been confused or lost your memory? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>33. Do you experience dizziness and/or headaches with exercise? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>34. Have you ever had a seizure? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>35. Have you ever had numbness, tingling, or weakness in your arms or legs after being hit or falling? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>36. Have you ever been unable to move your arms or legs after being hit or falling? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>37. When exercising in the heat, do you have severe muscle cramps or become ill? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>38. Has a doctor told you that you or someone in your family has sickle cell trait or sickle cell disease? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>39. Have you had any problems with your eyes or vision? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>40. Do you wear glasses or contact lenses? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>41. Do you wear protective eyewear, such as goggles or a face shield? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>42. Are you unhappy with your weight? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>43. Are you trying to gain or lose weight? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>44. Has anyone recommended you change your weight or eating habits? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>45. Do you limit or carefully control what you eat? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>46. Do you have any concerns that you would like to discuss with a doctor? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p><b>FEMALES ONLY</b></p> <p>47. Have you ever had a menstrual period? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>48. How old were you when you had your first menstrual period? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>49. How many periods have you had in the last 12 months? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>50. Are you pregnant? <input type="checkbox"/> Yes <input type="checkbox"/> No</p>
--	---

#s	Explain "Yes" answers here:

I hereby certify that to the best of my knowledge all of the information herein is true and complete.

Student's Signature \_\_\_\_\_ Date \_\_\_\_/\_\_\_\_/\_\_\_\_

I hereby certify that to the best of my knowledge all of the information herein is true and complete.

Parent's/Guardian's Signature \_\_\_\_\_ Date \_\_\_\_/\_\_\_\_/\_\_\_\_

**SECTION 6: PIAA COMPREHENSIVE INITIAL PRE-PARTICIPATION PHYSICAL EVALUATION AND CERTIFICATION OF AUTHORIZED MEDICAL EXAMINER**

Must be completed and signed by the Authorized Medical Examiner (AME) performing the herein named student's comprehensive initial pre-participation physical evaluation (CIPPE) and turned in to the Principal, or the Principal's designee, of the student's school.

Student's Name \_\_\_\_\_ Age \_\_\_\_\_ Grade \_\_\_\_\_

Enrolled in \_\_\_\_\_ School Sport(s) \_\_\_\_\_

Height \_\_\_\_\_ Weight \_\_\_\_\_ % Body Fat (optional) \_\_\_\_\_ Brachial Artery BP \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_ RP \_\_\_\_\_

If either the brachial artery blood pressure (BP) or resting pulse (RP) is above the following levels, further evaluation by the student's primary care physician is recommended.  
**Age 10-12:** BP: >126/82, RP: >104; **Age 13-15:** BP: >136/86, RP >100; **Age 16-25:** BP: >142/92, RP >96.

Vision: R 20/\_\_\_\_ L 20/\_\_\_\_ Corrected: YES NO (circle one) Pupils: Equal \_\_\_\_\_ Unequal \_\_\_\_\_

MEDICAL	NORMAL	ABNORMAL FINDINGS
Appearance		
Eyes/Ears/Nose/Throat		
Hearing		
Lymph Nodes		
Cardiovascular	<input type="checkbox"/> Heart murmur <input type="checkbox"/> Femoral pulses to exclude aortic coarctation	<input type="checkbox"/> Physical stigmata of Marfan syndrome
Cardiopulmonary		
Lungs		
Abdomen		
Genitourinary (males only)		
Neurological		
Skin		
MUSCULOSKELETAL	NORMAL	ABNORMAL FINDINGS
Neck		
Back		
Shoulder/Arm		
Elbow/Forearm		
Wrist/Hand/Fingers		
Hip/Thigh		
Knee		
Leg/Ankle		
Foot/Toes		

I hereby certify that I have reviewed the HEALTH HISTORY, performed a comprehensive initial pre-participation physical evaluation of the herein named student, and, on the basis of such evaluation and the student's HEALTH HISTORY, certify that, except as specified below, the student is physically fit to participate in Practices, Inter-School Practices, Scrimmages, and/or Contests in the sport(s) consented to by the student's parent/guardian in Section 2 of the PIAA Comprehensive Initial Pre-Participation Physical Evaluation form:

**CLEARED**  **CLEARED**, with recommendation(s) for further evaluation or treatment for: \_\_\_\_\_

**NOT CLEARED** for the following types of sports (please check those that apply):

COLLISION  CONTACT  NON-CONTACT  STRENUOUS  MODERATELY STRENUOUS  NON-STRENUOUS

Due to \_\_\_\_\_

Recommendation(s)/Referral(s) \_\_\_\_\_

AME's Name (print/type) \_\_\_\_\_ License # \_\_\_\_\_  
 Address \_\_\_\_\_ Phone (\_\_\_\_) \_\_\_\_\_

AME's Signature \_\_\_\_\_ MD, DO, PAC, CRNP, or SNP (circle one) Authorized Date of CIPPE \_\_\_\_/\_\_\_\_/\_\_\_\_

# 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

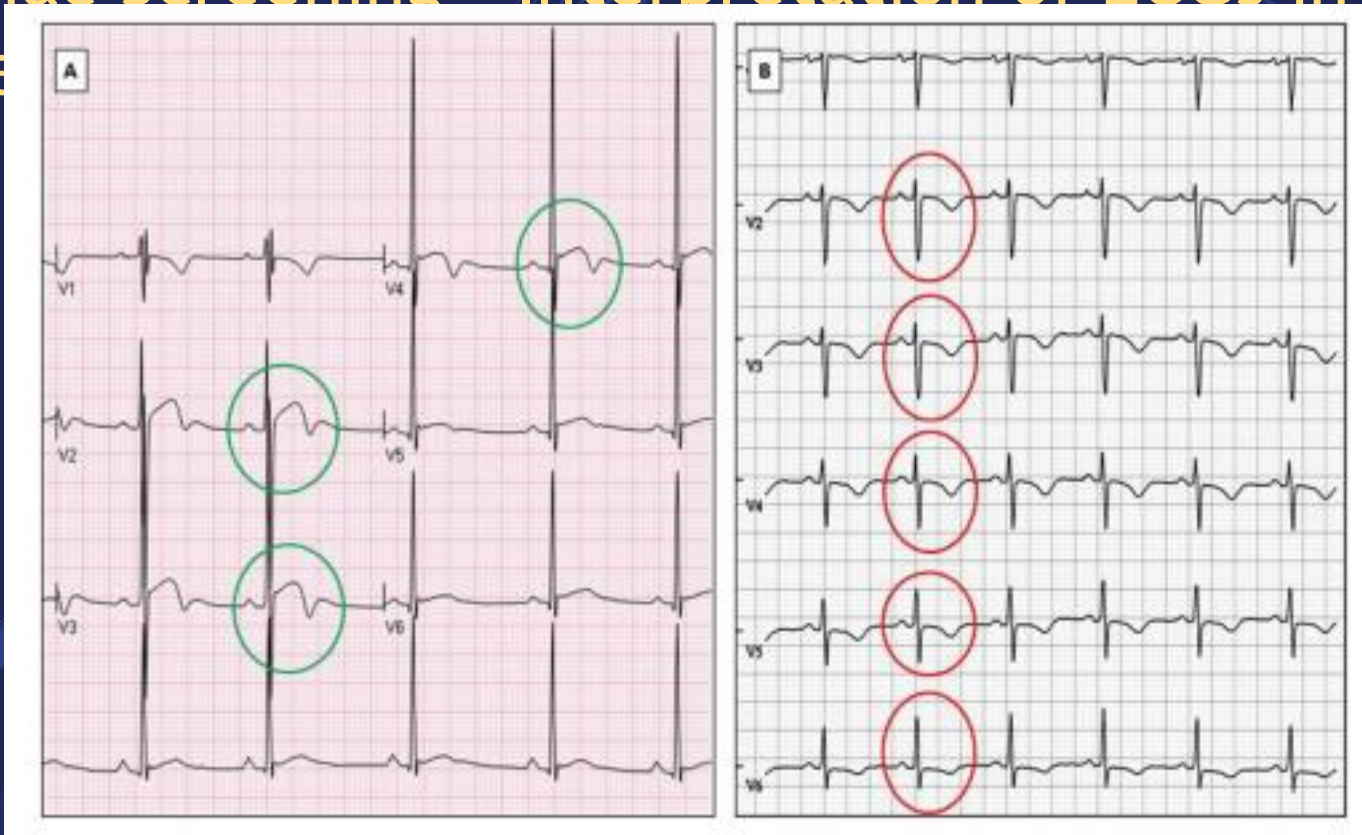
- To ECG or not to ECG...



# 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



of Cardiology (ACC) affirms the value of this document. ACC supports the general principles in the document and believes it is of general benefit to its membership.

Drezner, J. A., Sharma, S., Baggish, A., Papadakis, M., Wilson, M. G., Prutkin, J. M., ... Corrado, D. (2017). International criteria for electrocardiographic interpretation in athletes: Consensus statement. *British Journal of Sports Medicine*, 51(9), 704-731. <https://doi.org/10.1136/bjsports-2016-097331>



Jefferson™  
HEALTH IS ALL WE DO

# Cardiac Screening - Eligibility for Play

Journal of the American College of Cardiology  
© 2005 by the American College of Cardiology Foundation  
Published by Elsevier Inc.

Vol. 45, No. 8, 2005  
ISSN 0735-1097/05/\$30.00  
doi:10.1016/j.jacc.2005.02.004

---

## **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



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?



**Jefferson™**

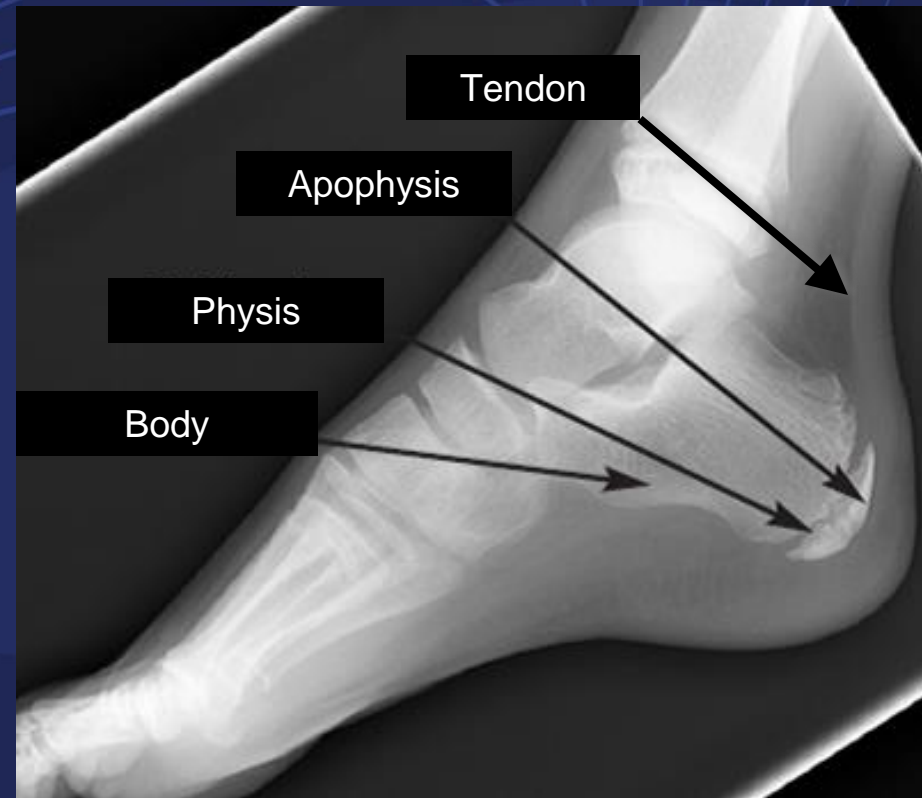
HEALTH IS ALL WE DO

# Growth Plate Injuries

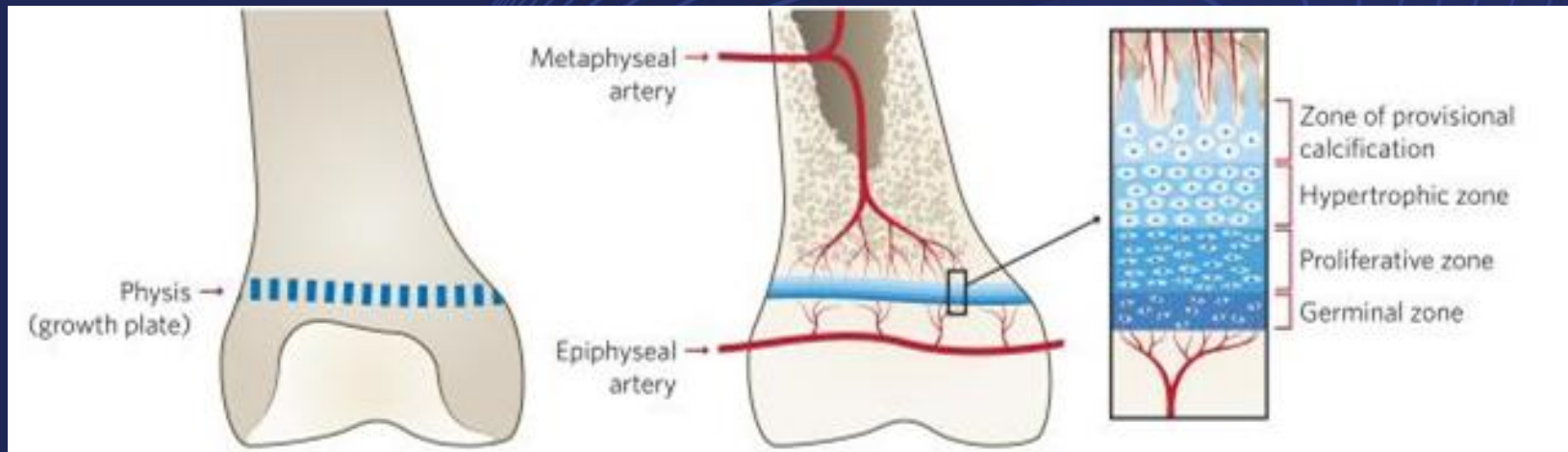
- Terminology
- Apophysitis
  - Osgood-Schlatter
  - Sinding-Larson-Johansson
  - Severs
  - Iselin
- Review of growth plate fractures - Salter Harris 1 and 2



# Terminology



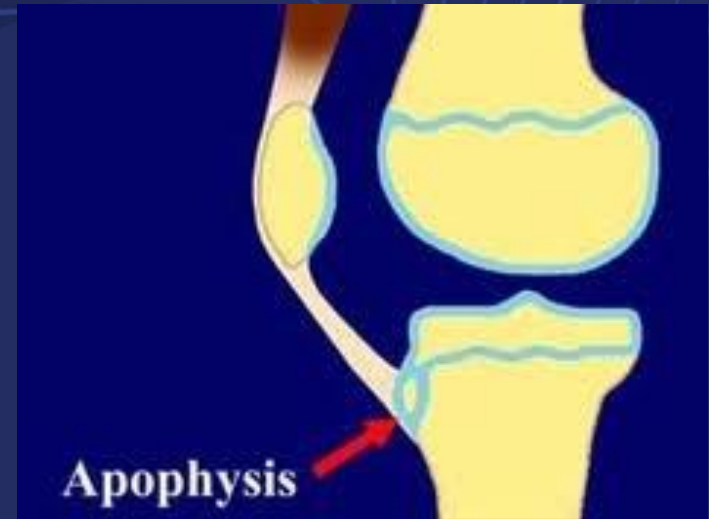
## Terminology - Physis (Growth Plate)



- Source of longitudinal growth
- Physeal fractures through the hypertrophic 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 if 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-Johansson 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.

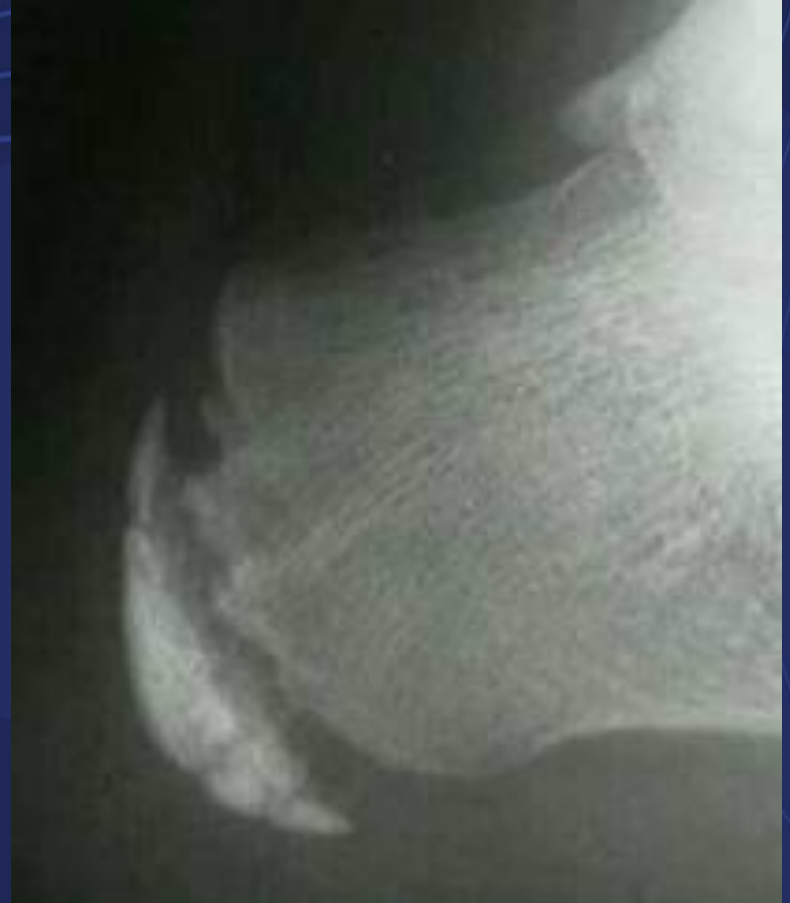


## Sinding-Larsen-Johansson - Treatment

- 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 apophysis 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 5<sup>th</sup> 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 5<sup>th</sup> 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

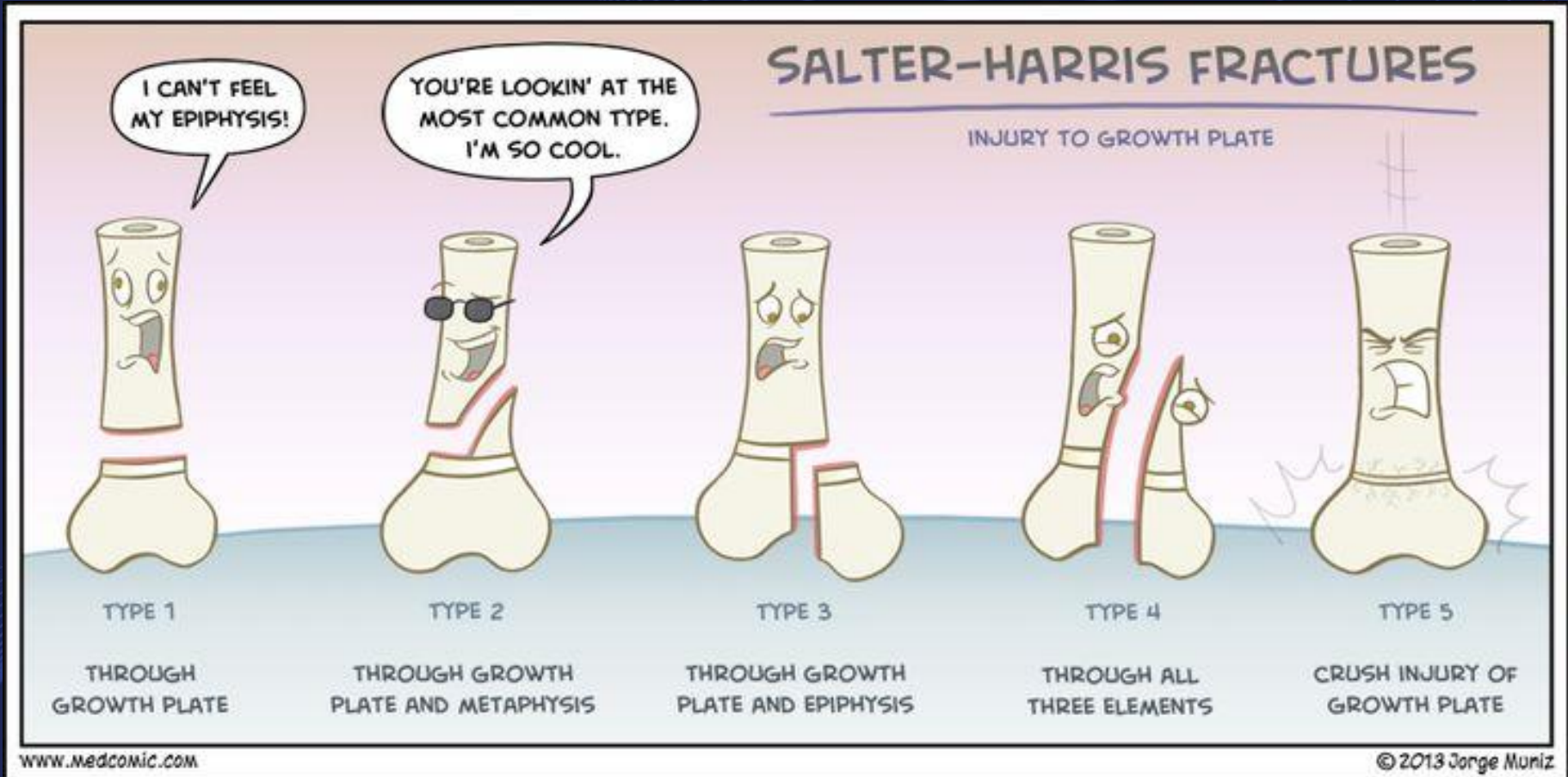
- Limitation of activity based on severity of symptoms
- Ice, NSAIDs, PT
- Consider immobilization/walking boot 2-4 weeks
- Benign and self limiting
- Rarely non-union may occur with symptoms later in life - consider surgical excision in these cases

# Growth Plate Fracture

- Salter Harris Classifications
- SH 1
- SH 2



# Salter-Harris Fracture Classification



# 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?



Jefferson™

HEALTH IS ALL WE DO





# 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

	Disease	Typical Age	M:F ratio	Other
Sick	Septic arthritis	Any, peak 0-6	1.2-2:1	
	Transient synovitis	3-8yrs, mean 6	2:1	Fall/winter
Not Sick	Perthes disease	4-10yrs, peak 5-7yrs	4:1	Rare in blacks
	Slipped capital femoral epiphysis	Early adolescence	1.5:1	Obese children
		Mean 12 years, girls		Endocrinopathies
		Mean 13.5 years, boys		Blacks > whites, hispanics
Apophysitis, avulsion fractures	Prior to growth plate closure		Growth plates in hips close later than most	

## Painful hip - Case 1

- 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



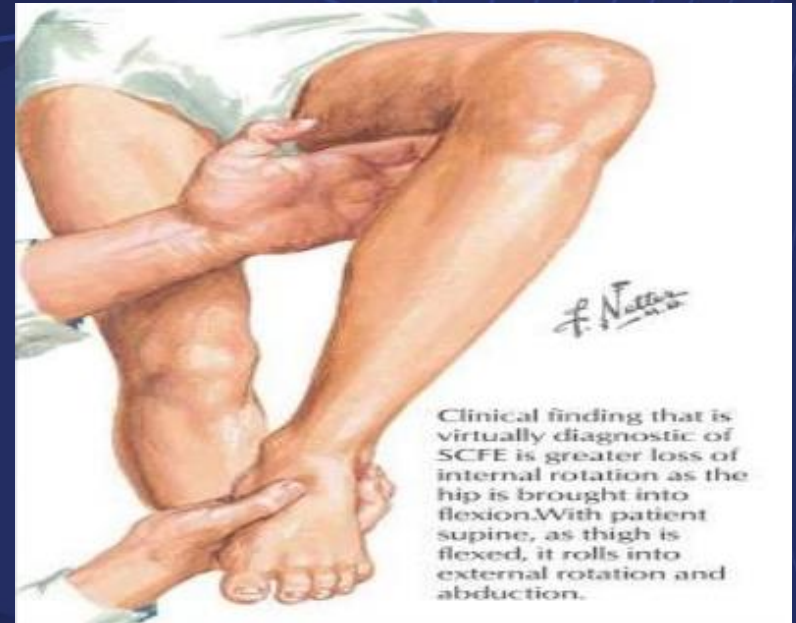
# SCFE

- 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



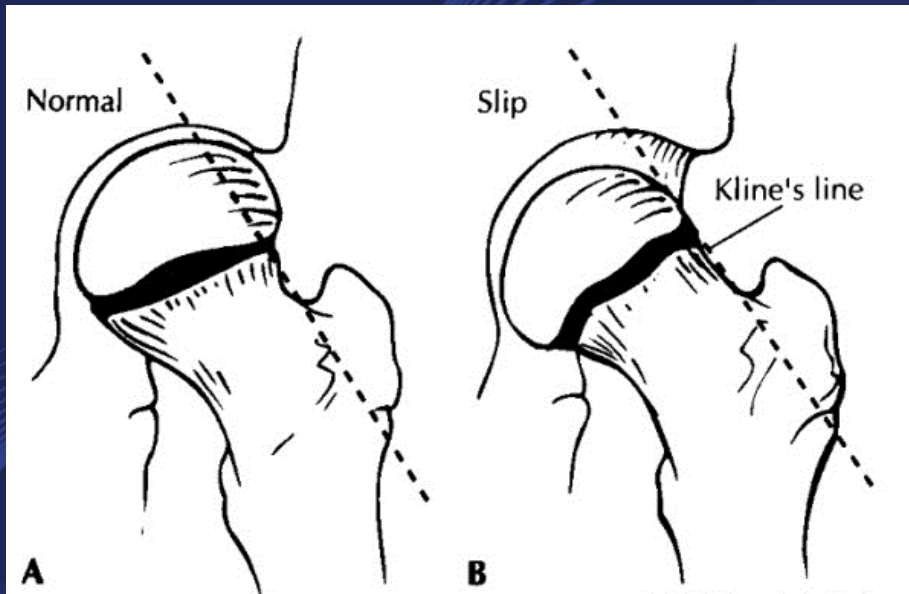
## SCFE - Exam

- 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

## SCFE - Summary

- Obese preteen with groin/thigh/knee pain and a limp
- If very reliable - crutches and send to ortho
- If unreliable - ED

## Painful hip - Case 2

- Case 2: 7yo male presents with complaints of left thigh pain for 4 weeks, worsening and now causing a limp.



# Legg-Calve-Perthes Disease

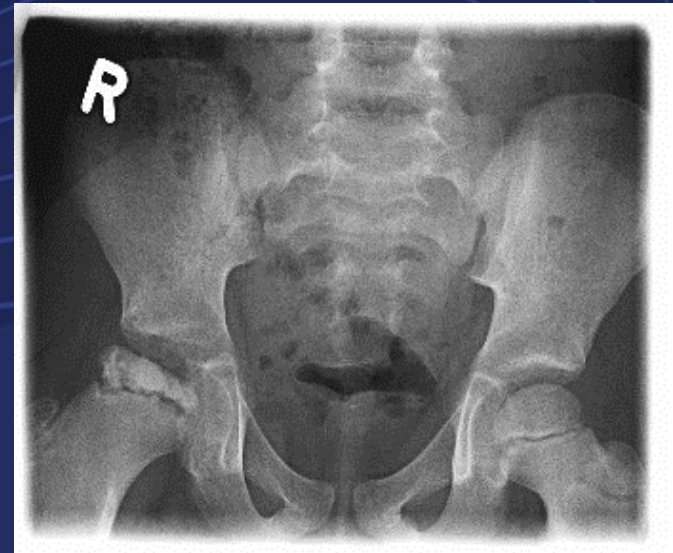
- Idiopathic avascular necrosis/osteonecrosis of the femoral epiphysis
- Epidem:
  - Age 4-10 years, peak 5-7
  - Male:female = 4:1
  - Caucasian more common than black
- Not obesity related

## 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

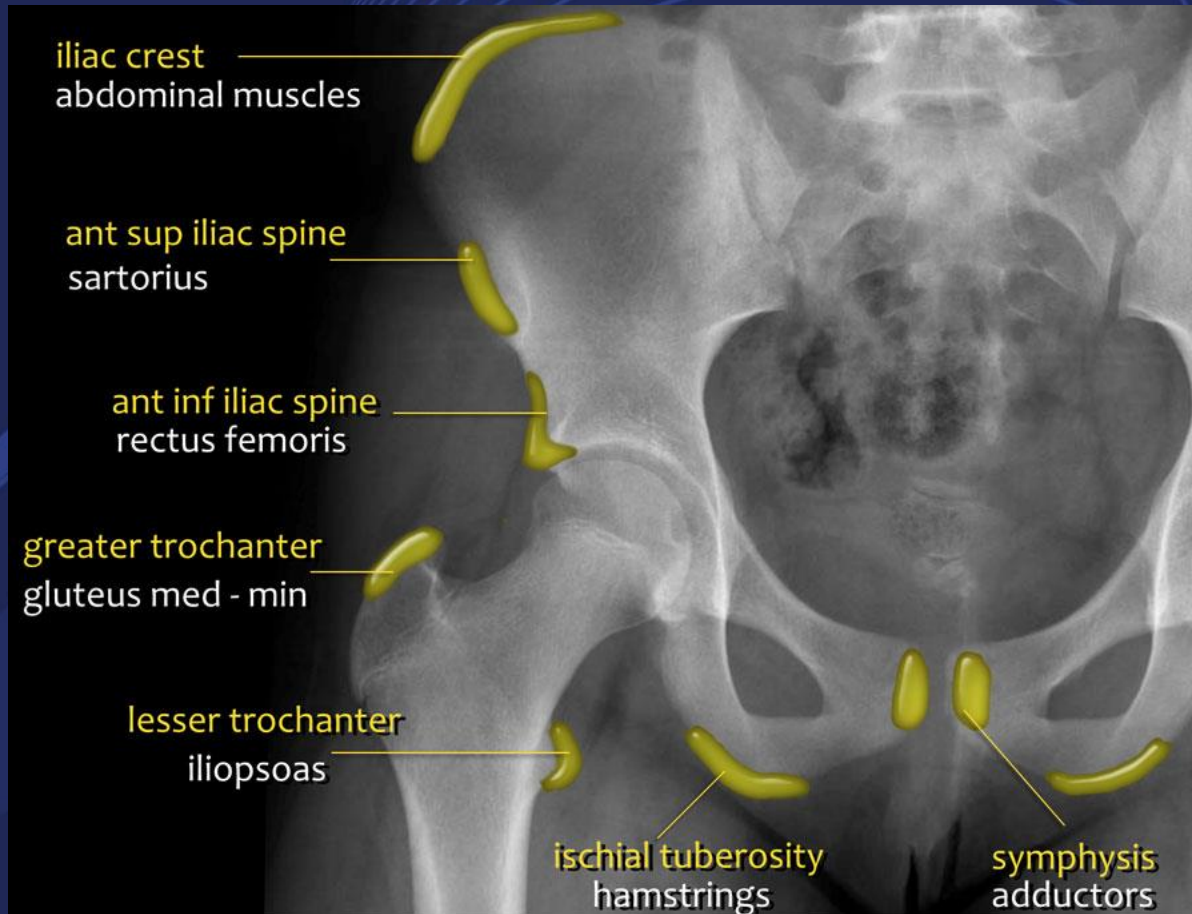
- Referral to Pediatric Orthopedics
- Treatment:
  - Non weight bearing, rest
  - Braces/orthotics occasionally
- Prognosis dependent on amount of femoral head involved



## 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



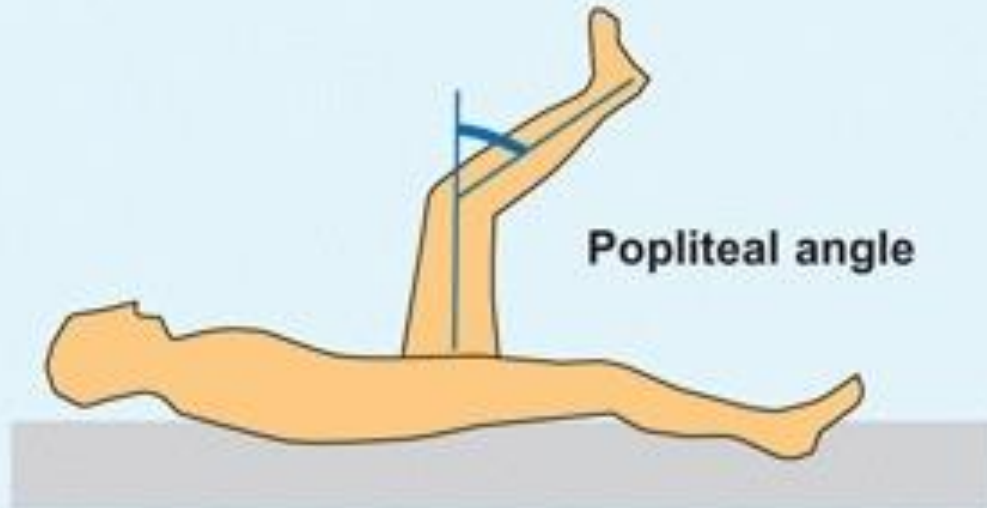
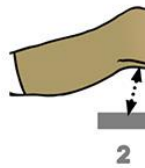
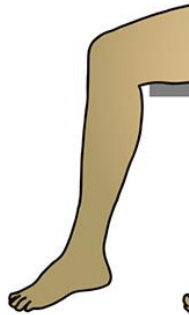
# Apophysitis

- Apophysitis:
  - 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

## THOMAS TEST

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

- 1: normal condition
- 2: restricted condition



Ap

- Y
- M
- T
- M

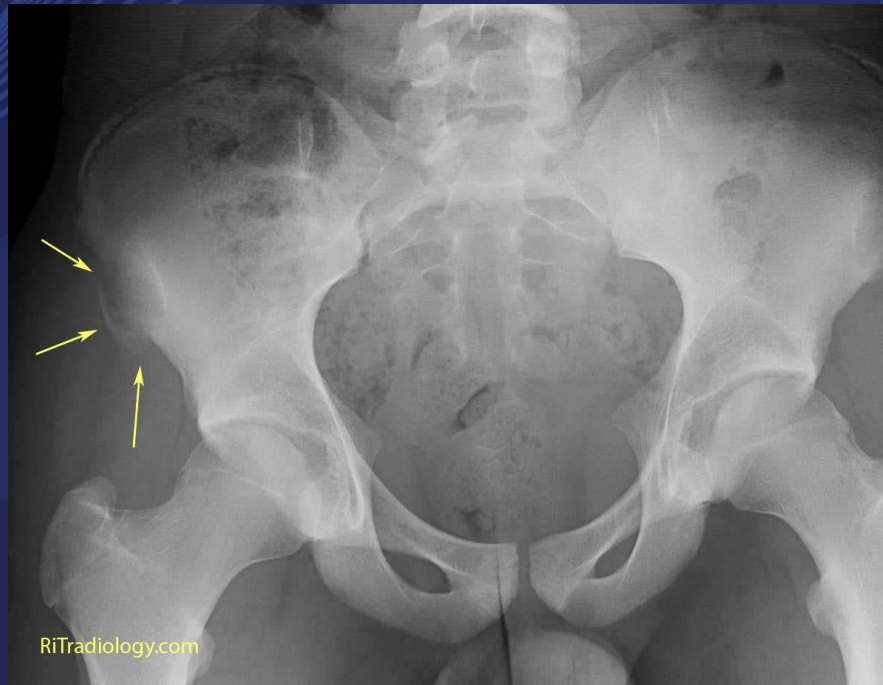


## Apophysitis - Management

- 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

- Drezner, J. A., O'Connor, F. G., Harmon, K. G., Fields, K. B., Asplund, C. A., Asif, I. M., ... Roberts, W. O. (2016). AMSSM Position Statement on Cardiovascular Preparticipation Screening in Athletes: current evidence, knowledge gaps, recommendations and future directions. *British Journal of Sports Medicine*, bjsports-2016-096781. <https://doi.org/10.1136/bjsports-2016-096781>
- Drezner, J. A., Owens, D. S., Prutkin, J. M., Salerno, J. C., Harmon, K. G., Prosis, S., ... Asif, I. M. (2016). Electrocardiographic Screening in National Collegiate Athletic Association Athletes. *The American Journal of Cardiology*, 118(5), 754-759. <https://doi.org/10.1016/j.amjcard.2016.06.004>
- Drezner, J. A., Sharma, S., Baggish, A., Papadakis, M., Wilson, M. G., Prutkin, J. M., ... Corrado, D. (2017). International criteria for electrocardiographic interpretation in athletes: Consensus statement. *British Journal of Sports Medicine*, 51(9), 704-731. <https://doi.org/10.1136/bjsports-2016-097331>
- Harmon, K. G., Asif, I. M., Maleszewski, J. J., Owens, D. S., Prutkin, J. M., Salerno, J. C., ... Drezner, J. A. (2015). Incidence, Cause, and Comparative Frequency of Sudden Cardiac Death in National Collegiate Athletic Association Athletes. *Circulation*, 132(1), 10-19. <https://doi.org/10.1161/CIRCULATIONAHA.115.015431>
- Houghton, K. M. (2009). Review for the generalist: evaluation of pediatric hip pain. *Pediatric Rheumatology*, 7(1), 10. <https://doi.org/10.1186/1546-0096-7-10>
- Kienstra, A. J., & Macias, W. P. (2017). Evaluation and management of slipped capital femoral epiphysis (SCFE). In *UpToDate*.
- Maron, B. J., Doerer, J. J., Haas, T. S., Tierney, D. M., & Mueller, F. O. (2009). Sudden Deaths in Young Competitive Athletes: Analysis of 1866 Deaths in the United States, 1980-2006. *Circulation*, 119(8), 1085-1092. <https://doi.org/10.1161/CIRCULATIONAHA.108.804617>
- Maron, B. J., Friedman, R. A., Kligfield, P., Levine, B. D., Viskin, S., Chaitman, B. R., ... Thompson, P. D. (2014). Assessment of the 12-Lead ECG as a Screening Test for Detection of Cardiovascular Disease in Healthy General Populations of Young People (12-25 Years of Age): A Scientific Statement From the American Heart Association and the American College of Cardiology. *Circulation*, 130(15), 1303-1334. <https://doi.org/10.1161/CIR.0000000000000025>
- Peck, D. M., Voss, L. M., & Voss, T. T. (2017). Slipped Capital Femoral Epiphysis: Diagnosis and Management. *American Family Physician*, 95(12), 779-784.
- Price, D. E., McWilliams, A., Asif, I. M., Martin, A., Elliott, S. D., Dulin, M., & Drezner, J. A. (2014). Electrocardiography-inclusive screening strategies for detection of cardiovascular abnormalities in high school athletes. *Heart Rhythm*, 11(3), 442-449. <https://doi.org/10.1016/j.hrthm.2013.12.002>

# References

- McCrory P, Meeuwisse WH, Aubry M, et al. Consensus statement on concussion in sport the 4th International Conference on Concussion in Sport held in Zurich, November 2012. Br J Sports Med 2013;47:250-258.
- McCrea, M. Guskiewicz, K. et. al. Incidence, Clinical Course, and Predictors of Prolonged Recovery Time Following Sport-Related Concussion in High School and College Athletes. J Int Neuropsychol Soc. 2012, 18, 1-12.
- Zuckerman SL, Lee YM, Odom MJ, Solomon GS, Forbes JA, Sills AK. Recovery from sports-related concussion: Days to return to neurocognitive baseline in adolescents versus young adults. Surg Neurol Int. 2012;3:130
- Dormans,ed. PediatricOrthopaedicsandSports Medicine. St Louis: Mosby. 2004.
- Madden,Putukian,Young,McCarty,eds. Netter's Sports Medicine. Philadelphia: Saunders. 2010.
- Wilson JC. Apophysitis of the lower extremities. Contemporary Pediatrics. 6/1/11.





erson™  
ALTH IS ALL WE DO