Common Sports Medicine Cases for the General Pediatrician

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Disclosure

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- I do not intend to discuss an unapproved/investigative use of a commercial product/device in my presentation.

Key Points

- Pain in the young throwing athlete may indicate a serious injury
- "FOOSH" events can result in different injuries
- Rules exist to help use ankle x-rays judiciously
- An acute knee effusion has a limited sports differential
- Location matters for tibial stress fractures
- Ergogenic drugs can have serious side effects

Case #1

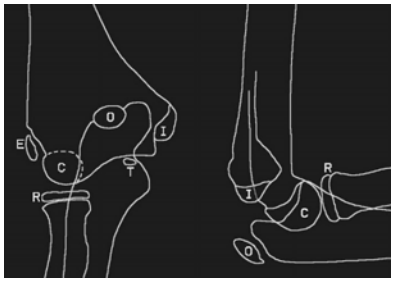
- 12 yo male baseball player (pitcher, OF)
- Felt a “pop” in his throwing arm
- Did not want to pitch any more
- Pain with any overhand throwing

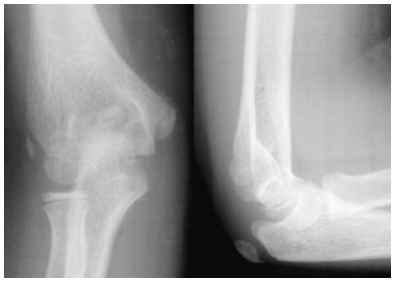
The Developing Shoulder

- Formation of the growth center occurs over the first 6 years of life
- Full maturity of the shoulder occurs ~age 20
- “Ball and socket”→ “golf ball on a tee”

The Developing Elbow

- The elbow has 6 different centers of growth
- These growth centers begin to develop at various ages
  - First center appears between 1-2 years of age
  - Last center appears around 12 years of age
- Skeletal maturity of the elbow occurs at about 16 years of age (~14 in girls)



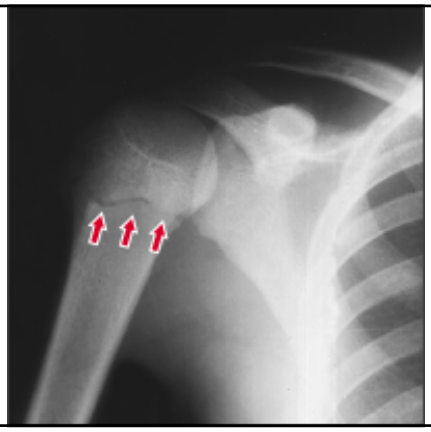


Injuries in Skeletally Immature Patients

- Growth centers are weaker in terms of bone strength
- Ligaments and tendons that control joint motion often attach near these growth centers
- In adults, many injuries occur to the connective tissues
- In younger athletes, injuries are often more likely to occur to the developing bone

Throwing Injuries

- Pain with throwing could suggest a growth plate injury
- Recent studies suggest:
  - 1 out of 4 young pitchers has elbow pain
  - 1 out of 3 young pitchers has shoulder pain
  - 1 out of 2 young pitchers has elbow and/or shoulder pain



Little League Shoulder

- Humeral apophysitis
- Wide lateral physis
- Cystic changes also
- Early rest, immobilization
- Formal rehab for advancing throwing

Figure: Courtesy of Joseph R. Martire, MD, and Edward G. McFarland, MD

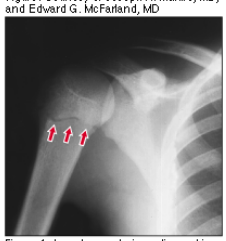


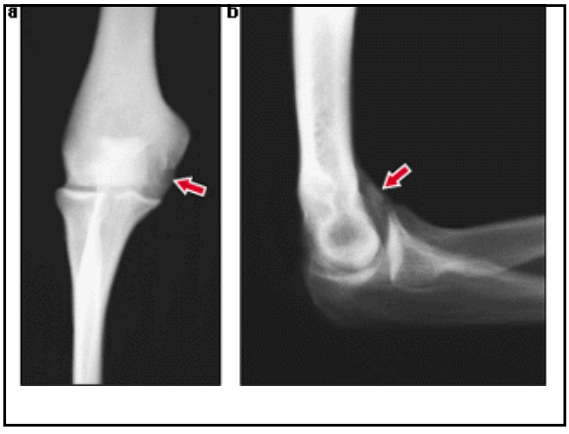
Figure 1. An anteroposterior radiographic view of the right shoulder of a 15-year-old male pitcher who complained of right shoulder pain; it demonstrates separation of the right proximal humeral epiphysis (arrows).

Little League Elbow

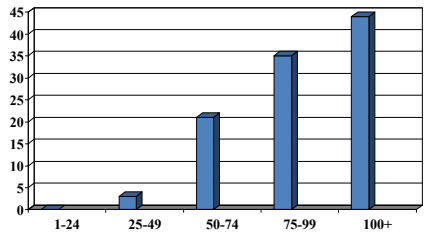
- Medial epicondylitis
- Flexor/pronator tendinitis
- Repetitive valgus stress – often as arm is brought forward in throwing motion
- Lateral compression – capitellar osteochondrosis in skeletally immature

Little League Elbow

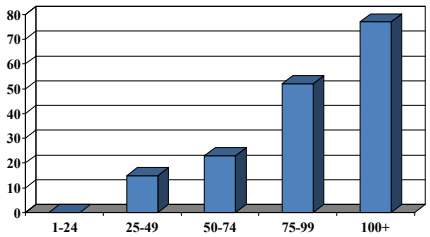
- Point tender at or just distal to medial humeral epicondyle
- Pain with resisted wrist flexion or forearm pronation
- For lateral injury, may see lateral joint line tenderness (also with valgus strain)
- Flexion deformity, effusion, or locking are suspicious for osteochondrosis



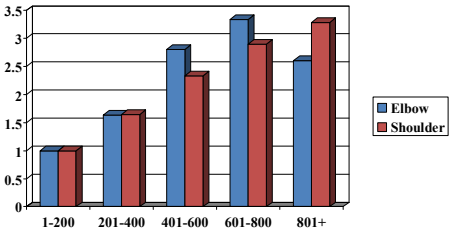
Elbow Pain in Young Throwers



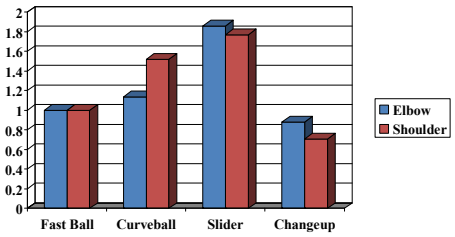
Shoulder Pain in Young Throwers



Cumulative Pitch Counts in a Season



Effects of Pitch Type on Throwing Pain



Recommendations

- Pitch types and age for introduction:
  - Fastball – 8 years
  - Change-up – 10 years
  - Curveball – 14 years
  - Knuckleball – 15 years
  - Slider – 16 years
  - Screwball – 17 years

Recommendations

- Pitch counts at ages 9-10:
  - 50 pitches per game
  - 75 pitches per week
  - 600 pitches per season
  - 1200 pitches per year

Recommendations

- When to seek medical attention:
  - Single pitch pain
  - Pain that does not resolve with 3-4 days of rest
  - Pain on successive pitching outings
  - Loss of velocity or control
  - Recurrent arm fatigue

Case #2

- 15-year-old male soccer player
- Tripped from behind on slide tackle
- Fell forward on outstretched hand (FOOSH)
- Pain at proximal forearm

Radial Head Fracture

- Nondisplaced fractures (type I) do very well with sling for pain control and early range-of-motion exercises (95% success)
- Displaced (type II) or comminuted (type III) fractures require orthopedic referral
  - Type III often undergo radial head excision within 48 hours

Case #3

- 15 yo female high school soccer player
- Slide tackled by an opposing player
- Fell onto her right wrist
- Pain at the base of her thumb and the thumb side of the wrist; no significant swelling
- “Sprained wrist”, returned to play

Scaphoid Fracture

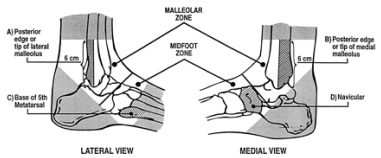
- Dorsiflexion and radial deviation
- Point tender at the “anatomic snuff box”
- Pain with longitudinal compression of thumb against the scaphoid
- X-rays negative in 15% of scaphoid fx

Scaphoid Fracture

- Immediate immobilization – thumb spica, short arm cast
- May not see fracture line for 2-6 weeks
- Poor blood supply, especially proximal pole
- Risk of non-union, may lead to chronic pain and disability

Ankle Injuries

- Think about the mechanism of injury.
  - Plantarflexion and inversion usually causes lateral injury, resulting in ligament sprain. (Common!)
  - Dorsiflexion and eversion usually causes medial injury, with a much higher incidence of bone injury.
- Palpate the medial malleolus. Also, squeeze the tib-fib joint. Significant tenderness in either location should lead to an x-ray.



a) An ankle x-ray series is only required if:
There is any pain in malleolar zone and any of these findings:
i) bone tenderness at A
OR
ii) bone tenderness at B
OR
iii) inability to bear weight both immediately and in ED

b) A foot x-ray series is only required if:
There is any pain in midfoot zone and any of these findings:
i) bone tenderness at C
OR
ii) bone tenderness at D
OR
iii) inability to bear weight both immediately and in ED

Ottawa Ankle Rules

- Original study done in adults
- Pain in the malleolar zone plus one of :
  - Age >55 years
  - Inability to bear weight at time of injury and at ED presentation (4 steps)
  - Bony tenderness at posterior edge or tip of either malleolus
- Near 100% sensitivity; 28% fewer x-rays

Ottawa Ankle Rules for Kids

- 6 studies of varying size, mostly ER visits
- Sensitivity ~ 99%
- Specificity ~ 30%
- Recommend x-rays if patient either cannot bear weight or has bony tenderness, with pain in either malleolar zone

Lateral Ankle Sprain

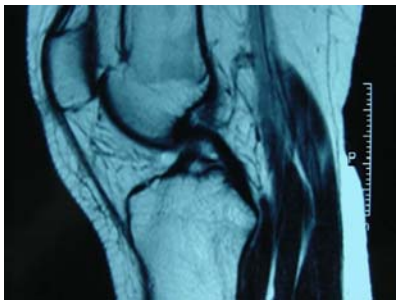
- Accounts for 85% of all acute ankle injuries.
- If tenderness is over soft tissues and the athlete can bear weight, it's OK to try to RTP.
- Functional testing:
  - Start simple with single leg stand, hop, and jump.
  - Use a simple straight line run to advance speed.
  - Start with "shuttle run" to test change of direction.
  - Progress from wide "figure-of-eights" to cutting.

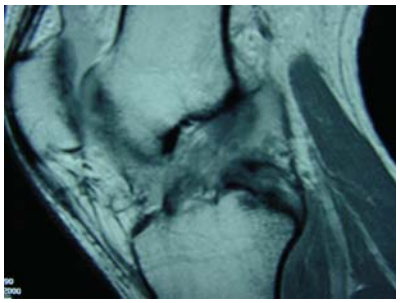
Case #4

- 19 year old female with sudden “pop” to knee during NCAA Soccer Tournament
- Sudden attempt to reverse field
- Acute hemarthrosis
- Sense of instability with weight bearing

What if the knee “pops”?

- Acute onset of effusion with a pop: 2/3 are ACL.
- Differential diagnosis:
  - Cruciate ligament injury
  - Collateral ligament injury
  - Patellar dislocation
  - Meniscus tear
  - Intraarticular fracture





Lachman Exam

- Anterior displacement of the tibia relative to the femur
- Top hand stabilizes femur
- Bottom hand pulls tibia forward
- Feeling for endpoint

Anterior and Posterior Drawer

- Stabilize lower extremity
- Anterior or posterior movement of tibia relative to femur
- Check “sag sign”
  - False positive for ACL when really PCL injury

Valgus Test - MCL

- Bottom hand abducts the tibia
- Top hand stabilizes femur
- Palpate medial joint line if hand large enough
- Zero and 20-30 degrees of flexion

Case #5

- 15-year-old female track athlete
- Shin splints during track season, increased over last two weeks
  - Inside of left shin and closer to the knee
- Treated symptomatically for tendonitis without results
- Pain is occurring early in runs and lasting longer after cessation of activity

Physical Exam

- Slight external rotation of left tibia
- Mild over-pronation left foot with gait
- Tender along medial edge of left tibia, especially near metaphysis and approximately 4-5 cm distal
- No tibial tubercle tenderness
- FROM hips, knees and ankles
- No ligamentous instability of right knee

Working Differential Diagnosis

- Medial tibial stress syndrome
  - "Shin splints" or more?
- Tibial stress fracture
- Compartment syndrome
  - Exertional versus chronic
- Bone tumor
  - Osteoid osteoma
  - Osteosarcoma

Discussion – Stress Fractures

- Training errors are major contributor
  - Quantity, Intensity, Novelty
  - Equipment, Surface
- Other contributors:
  - Diet
  - Bone mineral density/composition
  - Hormonal (menstrual dysfunction)
  - Biomechanics

Discussion – Stress Fractures

- Exam – careful palpation, "heel strike", biomechanics
- Imaging
  - Plain films: low sensitivity, high specificity
  - Bone scan: highest sensitivity, low specificity
    - Triple phase bone scan – 3rd phase
  - CT: good for cortical bone, often for surgical tx
  - MRI: high sens/spec, less effective for cortical bone

Discussion – Stress Fractures

- Removal of repetitive, weightbearing stress
- Calf-length pneumatic brace
  - Compressive force shown beneficial in studies
- Orthotics: shock absorption and biomechanics
- Physical Therapy: flexibility training, biomechanics, modalities for pain
- Return to play when symptom free, consider repeat imaging for evidence of bone healing

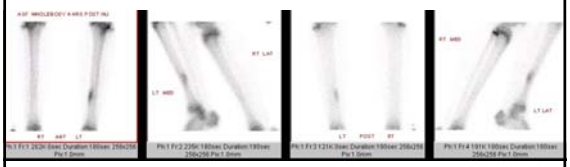


Figure 4: Courtesy of Peter Brukner, MBBS

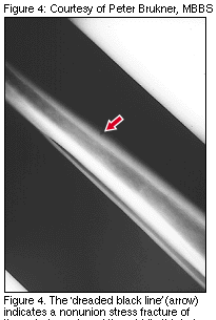


Figure 4. The 'dreaded black line' (arrow) indicates a nonunion stress fracture of the anterior cortex of the middle third of the tibia in a 21-year-old male footballer (soccer player).

Lower Extremity Pain

Stress fracture	Shin splints	Exertional compartment syndrome
Localized, often medial to posterior	Diffuse, anterior to medial	Tightness, posterior to medial
Increasing pain with activities	Pain at end of activity, longer soreness	Pain sooner into exercise, alleviates quickly with rest
Enforced rest, maybe NWB	Activity modification	Specialized ECS testing, Compartment release

Shin Splints (Medial tibial stress syndrome)

- #1 cause of exertional leg pain in athletes
- Continuum of symptoms ranging from aching discomfort to significant pain
- Pain typically located along posteromedial border of tibia
- No neurovascular abnormalities on exam

Medial tibial stress syndrome

- Traction of soleus muscle attachment on periosteum of tibia
  - Overpronation increases stress on soleus
- Tibialis posterior and flexor digitorum longus muscles have also been implicated
  - Pes planus contributes to tibialis posterior dysfunction

Exertional Compartment Syndrome

- Different from acute compartment syndrome
- Pain thought to be due to relative ischemia
  - MRI and nuclear medicine studies have raised questions regarding the true extent of ischemia
  - Inflammation not felt to play a major role

Exertional Compartment Syndrome

- Typical presentation is leg pain with exercise, relieved quickly with cessation of activity; no pain at rest; and a normal examination
- Diagnosis confirmed with exercise compartment pressure testing
- Up to 80% of cases involve anterior compartment (antero-lateral shin)

Exertional Compartment Syndrome

- Pulsating pain, numbness/tingling have been personal tip-offs for diagnosis
  - Character changes with chronicity of symptoms
- Exercise testing
  - Modified Bruce protocol initially
  - Exercise similar to sport/activity and to reproduce symptoms

Anabolic-Androgenic Steroids

- Well known ergogenic properties
  - Increased muscle mass and strength
- Studies have documented strength increases up to 20%
- Doses taken by users, or abusers, may not match study doses
- More recent studies focus on side effects and preventing youth from using

Negative Effects of Steroids

- Multiple organ systems are affected
- Negative effects on lipid profile
  - Lowered HDL levels, known since 1980s
- Cardiac hypertrophy has been associated with steroid use, but study results are mixed
- Steroids may cause abnormal left ventricular wall motion
  - Additive effect to resistance exercise

Negative Effects of Steroids

- Abnormal effects on RBC mass
  - Mediated through erythropoietin
- Negative effects on bone metabolism
- Increased levels of aggression and manic behavior
  - Varies between athletes at controlled doses

ATLAS Study

- ~ 3% of junior high students used steroids
  - Most were multi-sport athletes
- Rates of use in high school students 4-12%
- With education, adolescent use of steroids dropped, and young athletes reported being less likely to use
- One year after the intervention, actual rates of use did not decline

Creatine

- Useful for brief, anaerobic events
- Linked with increases in muscle mass
- Evidence of different potential mechanisms of effect
  - ATP regeneration
  - Increased mRNA and growth factors
- Utilized by *44%* of high school seniors

Creatine

- Not everyone benefits from its use
- Mixed results in short sprints
- Mixed results in sport-specific skills
- Evidence some are “creatine responders”
- Anecdotal reports of adverse effects
- No long-term safety data
- Concern for growth plate injuries

Caffeine

- Most studies involved caffeine-ephedrine compounds, now illegal
- Clearly has a performance benefit, especially for endurance events
- IOC threshold for caffeine is the equivalent of 5-6 cups of coffee

Caffeine

- 5 mg/kg has ergogenic effect
  - Below the threshold for most athletes
- Effect lasts for up to 6 hours
- More prominent effect in those who do not normally use caffeine or abstain for 6 days
- Appears to be relatively safe, but there are definite cardiovascular effects

Is it all a placebo effect?

- J Sport Ex Physiol 2007
- 16 endurance athletes, national level
- "Educated" regarding sodium bicarbonate
- Groups:
  - Told they got the supplement (actually did/not)
  - Told they did not get it (actually did or not)

Placebo vs. Ergogenic

- Timed 1000 m run
- If you were told you got the supplement, you shaved about 3.3 seconds off time
  - No actual difference between supplement or not
- If you were told you didn't get the supplement, your times were consistently slower whether or not you actually received the supplement.

Positive Placebo vs. Negative Placebo

- Int J Sport Nutr Exerc Metab 2007
- 42 athletes told they were receiving a substance (actually cornstarch)
  - ½ received positive info; ½ received negative info
- (+) info showed a trend toward faster times
- (-) info showed a 1.6% loss on sprint times

When Asked About Supplements…

- Nothing replaces proper nutrition and strength training.
- Dietary supplements are unregulated products – you really cannot be 100% sure of what they actually contain.
- For teenagers, there are either few or no studies for supplements, and most adult studies are short-term studies.

When Asked About Supplements…

- There are very real side effects to many supplements and ergogenics.
- Illegal use of ergogenics catches up with most athletes eventually.
- Too many athletes have died from use of dietary supplements and ergogenics.

Key Points

- Pain in the young throwing athlete may indicate a serious injury
- "FOOSH" events can result in different injuries
- Rules exist to help use ankle x-rays judiciously
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- Ergogenic drugs can have serious side effects

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