Common Sports Medicine Cases for the General Pediatrician

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Disclosure

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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
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.
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
Lower Extremity Pain

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