Learner Outcome

The participant will implement strategies to better serve his or her own pediatric athlete population.

Background

- Nearly 30 million children and adolescents participate in youth sports in the United States.
- More than 3.5 million kids under age 14 receive medical treatment for sports related injuries each year.
- Children ages 5 to 15 account for nearly 40% of all sports-related injuries treated in hospitals.

The Talented Young Athlete

- “Too much given up too soon for what turns out to be too little”
- Statistics
  - 1/50 high school athletes make a college team
  - 1/1000 make it to the pros
- Needs life beyond sports

Background

- Every year, high school athletes account for:
  - 1.5 million injuries
  - 500,000 doctor office visits
  - 30,000 hospitalizations
- Overuse injuries are responsible for nearly 1/2 of all sports injuries to middle and high school students.
  - Incidence have quadrupled in recent years.
  - More Kids participating
  - More competitive leagues
  - Year round participation

Conflict of Interest

I hereby certify that, to the best of my knowledge, no aspect of my current personal or professional situation might reasonably be expected to affect significantly my views on the subject on which I am presenting.
**What’s Different about Pediatric Athletes?**

- Growing skeleton predisposes children to special injuries
- Growth spurts decrease flexibility & agility
- Peri-articular & articular injuries

**Factors Leading to Sports Injuries**

- Lack of coaching education
- Inadequate preparticipation training
- Conditioning and training errors
- Playing injured
- Grouping athletes by age not size
- Improper technique
- Inadequate supervision

**Other Causes**

- Hazardous playing field
- Lack of safety equipment
- Poor nutrition
- Psychological stress
- Weather conditions

**Ankle Exam**

- History:
  - MOI? (inversion, eversion, IR/ER, Etc...)
  - History of multiple injuries
  - Ability to WB
- X-rays: A/P, Lateral, Oblique (3 views)
- Exam:
  - Check for gross instability
    - Eversion – Deltoid Ligament
    - Inversion – Calcaneofibular Ligament
    - Anterior Drawer – ATFL

**Sprain vs. Strain**

- **Sprain:**
  - Injury to a ligament
  - Ligaments attach bone to bone
  - Most Common is Ankle (ATFL)
  - Different degrees: G1, G2, G3

- **Strain:**
  - Injury to a muscle or tendon
  - Tendons attach muscles to bone
  - Different degrees: G1, G2, G3

**Ankle**

- Hx of inversion injury
- Lateral ankle swelling/pain
- Fracture (consider physeal fracture)
- Ankle sprain
  - Instability or NWB
Sprains
Partial Rupture of Ligament

• Grade 1 – Microscopic
• Grade 2 – Partial
• Grade 3 – Complete

Ankle Exam

• History:
  - MOI (eversion, inversion, IR, ER, etc.)
  - History of multiple injuries
  - Ability to walk

• X-rays: A/P, Lateral, Oblique (3 views)

• Exam:
  - Check for gross instability
    - Eversion – Deltoid Ligament
    - Inversion – Calcaneofibular Ligament
    - Anterior Drawer – ATFL

That Must Be Broken!

• Black and blue does not always mean broken.

• A bad sprain can often appear worse than a fracture on clinical exam.

Pediatric Sprain vs Fracture

• Be alert for physeal (growth plate) injuries

• Younger the patient the less likely to be “just a sprain”

• Be aware of SH1 Fractures

Sprains vs Fracture

Sprains

Treatment:

Protection
Rest
Ice
Compression
Elevation
Medication
Motion
Rehab

Grade 2/Grade 3 Sprains: Brief immobilization (2-3 wks) & consider PT referral for ROM and strengthening protocol.
“Is just a sprain”
Right?

- Be alert for physeal (growth plate) injuries
- Younger the patient the less likely to be “just a sprain”
- Be aware of SH1 (Salter Harris I) Fractures

Rehabilitation Phases

- Acute
  - Assess, RICE – Rest (Crutches, Air Cast, Cast)
- Fibroblastic
  - Regain ROM, strengthening/stretching as tolerated
- Maturation and Remodeling
  - Regain full ROM, strength, flexibility
  - Strengthening, endurance
  - Agility

Acute Knee Injuries

ACL History:
- Need good history / reliable historian
- Immediate effusion (15min or so after event) → change ACL
- ACL incidence in skeletally immature patients is going up.
- Most often described as a “twisting injury”
- 1 in 3 report hearing/felling a “Pop”

Meniscus/LCL/MCL:
- Need good history / reliable historian
- Delayed effusion (delayed effusion hours/days) → change Meniscus/LCL
- Often described as “twisting injury” but high incidence related to blunt trauma to the knee.
- C/D Pain usually focal at the “joint line”

Knee Exam

- History:
  - MOI extremely important
  - Effusion (Immediate/delayed)
    - heard/felt a “Pop”, Locking, “giving out”, giving out, ability to WB
- X-rays:
  - A/P, Lateral, Sunrise,
  - MRI? (check with the Ortho providers you refer to)
- They may prefer to see the patient first
- Is it going to change your POC?
- Exam:
  - Joint Effusion vs. Swelling (know the difference)
  - ROM
  - Lachman
  - Anterior/Posterior Drawer
  - Varus/Valgus Stress
  - McMurray
  - Patella Apprehension
  - Location of pain? “one finger, one spot”

Evaluation

Knee Exam

Varus/valgus stress (MCL/LCL sprain)

Evaluation

Knee Exam

McMurray test (meniscus tear)
Patellar apprehension test (Patellar Subluxation/Dislocation)

Where is the PMT?

Medial patellar retinaculum

Distal pole of patella (Sinding-Larsen-Johannsen Syndrome)

Joint line (meniscus)

Tibial tubercle (Osgood Schlatter’s Disease)
Evaluation

Posterior knee (popliteal cyst)

Evaluation

Ill-defined ("inside") (PatelloFemoral Syndrome)

Evaluation

PE findings

Effusion

– Size
– Speed of accumulation

Anterior Cruciate Ligament Injuries

• ACL Injury
  – Knee Valgus / Rotation / Minimal Flexion
  – Effusion
  – "Giving way"
  – Asymmetric Lachman testing

"Knee Sprain" in a Young Athlete

• Determine mechanism of injury.

• Find point of maximum tenderness.

• Always get X-rays.

"Knee Sprain" Treatment

• MCL injury
  • Hinged knee brace for 6 wks
  • Weight bearing as tolerated

• Physeal Fracture
  • 3-6 weeks of immobilization
Patellar Dislocation/Instability

**History**
- Direct and indirect mechanism.
- “Knee dislocated” or gave out laterally.
- Relocated with knee extension.

**Risk Factors**
- Generalized ligamentous laxity
- Terrible Triad
  - anteversion, valgus, planus
- Patella
  - alta, high Q angle, dysplasia

**Treatment**
- Rest
- Aspirate hemarthrosis
- Cast/immobilizer for 2 weeks
- Rehab
- Quadriceps/brace/modify activity
- Evaluate need for surgery to prevent recurrence
- PATELLAR STABILIZATION BRACE
  - Provide support for patella from laterally subluxation/dislocating

**Don’t Miss a “SCFE”**

Slipped Capital Femoral Epiphysis
- Boys 10-16 / Girls 12-14
- Higher risk:
  - Obesity, Metabolic Disorder
  - Males 2.5 x more
- Presentation:
  - C/O hip and/OR knee pain
  - (acute or gradual onset)
  - +/- Intermittent limp
  - Decreased Hip flexion and IR
- Always get x-rays to R/O if unsure of source of symptoms

**SCFE**
- X-rays:
  - A/P and Frog of pelvis
- Treatment:
  - URGENT referral to ER +/- call Ortho to inform
  - Wheelchair and NBW
Overuse Injuries

**Risk Factors**

**Intrinsic**
- Anatomic malalignments
- Growth process
- Vulnerability of growth cartilage
- Muscle tendon imbalance
- Nutritional factors
- Underlying disease states

**Overuse Injuries in Children**
- Now account for the majority of sport injuries seen in children
- Direct consequence of the rise in organized sports and the repetitive training programs associated with these activities

**Myo-osseous Disproportion**
- Equivalent to overuse syndrome
  - Microtrauma
- Bone too long
- Muscle too short
- Rx – Stretching
- AKA – GROWING PAIN

**Stress Fracture**
- Activity-related pain relieved by rest
- XR often negative; Bone scan, MRI may be diagnostic
- Treatment – Forced rest until pain-free, gradual return to sports
Medial Tibial Stress Syndrome (Shin Splints)

- Tenderness along the shin.
- Check tight Achilles tendon.
- Check for flatfoot.
- Often mimic stress fractures.

Sever’s Disease
Calcaneal Apophysitis

- Traction/impact apophysitis at the site of insertion of the Achilles tendon at the posterior heel.
- Secondary ossification center appears at age 8-9 and fuses at age 11-13.
- Self limiting condition.

Sever’s Disease
Common cause of heel pain in adolescent athletes 9-12 y/o

<table>
<thead>
<tr>
<th>History:</th>
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<tbody>
<tr>
<td>Gradual or sudden onset</td>
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<tr>
<td>No significant trauma</td>
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<tr>
<td>Worse with activities</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Exam:</th>
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</thead>
<tbody>
<tr>
<td>X-rays not always required</td>
</tr>
<tr>
<td>Focal tenderness to palpation with squeeze of the calcaneus</td>
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<tr>
<th>Treatment:</th>
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<tbody>
<tr>
<td>Rest</td>
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<tr>
<td>Heel Cups/Insoles</td>
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<tr>
<td>Proper shoe wear</td>
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<tr>
<td>Ice (20-30min after activities)</td>
</tr>
<tr>
<td>NSAIDs</td>
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<tr>
<td>Stretches (tight Achilles and Gastrocnemius)</td>
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<tr>
<td>Resolves as apophysis (growth center) closes</td>
</tr>
<tr>
<td>Often bilateral</td>
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Osgood-Schlatter Disease

- Tibia Tubercle Apophysitis:
  - Usually during rapid growth phase (9-15yr)
  - Focally TTP over the Tibia Tubercle
  - Anterior Activity related knee pain
  - Trauma can increase inflammation and pain

<table>
<thead>
<tr>
<th>Osgood-Schlatter’s Treatment</th>
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</thead>
<tbody>
<tr>
<td>Stretching exercises to increase flexibility of the quads and hamstrings.</td>
</tr>
<tr>
<td>Knee strap for activities (may or may not help symptoms).</td>
</tr>
<tr>
<td>Ice (20-30min after activities).</td>
</tr>
<tr>
<td>NSAIDs.</td>
</tr>
<tr>
<td>“Forced Rest”</td>
</tr>
<tr>
<td>When do you call it and for how long?</td>
</tr>
<tr>
<td>Must commit to it!!</td>
</tr>
</tbody>
</table>

Sinding-Larsen-Johansson Syndrome

- Traction at inferior pole of patella.
- Boys 10-12 involved in jumping sports.
- Quad stretching, relative rest.
Prognosis

- May significantly interfere with sports.
- Without significant long term problems.
- Will cease as growth completes.

Patellofemoral Pain Syndrome

- Pain under or around the kneecap classic “horse shoe pattern”
- Worse with activity, running, using stairs, sitting long periods of time
- Typically an overuse injury, but may also be caused by trauma
- One of the most common causes of knee pain in runners
- Patellar Maltracking......Need to build up quads

Patellofemoral Syndrome

Physical Exam
- "Q" angle
- Poorly Developed VMO
- "J" Sign
- Pain with PP Compression
- Pat/Instability with Apprehension Sign

Treatment for Patellofemoral Pain

- Identify and correct underlying causes....patella tracking .
- Relative rest when needed.
- Activity Modification .
- NSAIDs.
- Knee brace / kinesiotape +/-.
- Core strengthening.
- Stretching and strengthening exercises.
  - Focused (PT)
  - Must fully commit to rehab
  - Can take 3 months or more to see improvement

Iselin’s Disease

- Traction Apophysitis from Peroneus Brevis
  - Base of the 5th Metatarsal.
  - 8-13 yrs.
  - Soccer, gymnastics, basketball, baseball & dance.
  - Often tight calf muscles.
  - Pain, swelling, palpable “knot” at base of 5th MT.
  - Focal TTP.
  - Possible localized swelling.
Iselin's Disease

- Treatment
  - Modification of activities/ “Forced Rest”
  - Ice
  - Stretching
  - NSAIDs
  - +/- brief immobilization (3d boot)
  - proper shoe wear/ fits
  - +/- shoe inserts

- Return to play
  - FROM
  - Pain free: jog, run, hop

Return to Play Guidelines

- Clear return to play guidelines.
  - DO NOT EXIST

- Determined individually.

- Depends on demand of sport.

- Availability and use of physical therapy.

- Response to rehabilitation.

Pediatric Fractures

Unique Challenges

- Distinctive properties of the growing bone require special attention to recognize:
  - Normal Variants vs Fractures
  - Dangerous Fracture Patterns
  - Physeal Fractures (and associated risks)
  - Remodeling Potential

- Goal: Insure adequate healing while avoiding growth disturbance

Office Management

- X-ray availability ?

- Should have splints available for both UE and LE injuries.
  - Ortho Glass, plaster, volar splints
  - Sling
  - 3d boot

- NV exam: pulses, CR, sensation, ect..

- Don’t try and predict definitive treatment!!
  - This can cause un-necessary worry and confusion for the family.

  - Be able to describe location of the fracture

Location in Bone

Epiphysis
Physis
Metaphysis
Diaphysis

Fractures closer to the physis have higher remodeling potential and remodeling is better in the plane of motion.

To the ER!

- Gross Deformity
- Open Fracture
- NV / Swelling Concerns

- Always Send NPO !!!
7 y/o F fall from trampoline

- Mid-shaft radius & ulna fractures.
- 30% Apex Volar Angulation
- Radius 1cm short
- Ulna 50% Translated

Stages of Fracture Healing

1) Reactive phase
   - Fracture and inflammatory stage/forms hematoma (will be either/hour)
   - Granulation tissue formation (hours – days)

2) Reparative phase
   - Cartilage (soft callus/early callus) formation (1-3 weeks)
   - Lamellar bone deposition (2 months – 1 year)

3) Remodeling phase
   - Remodeling to original bone contour (may continue for several years)

“Remodeling”

- Why can many fractures in a child be treated with a cast while the same fracture in an adult requires surgery and fixation?....
  - Open growth plates = thick periosteum = greater potential to remodel
  - Younger the Age Higher potential to remodel
  - Adult bone does has very limited ability to remodel
Periosteum

"Acts like bark on a twig"

• "Peri" = surrounding
• "Osteum" = the bone
• Can help maintain alignment of simple fractures.
• Can aid in the reduction of fractures.
• < age = thicker periosteum = > remodeling potential.

"Remodeling"

Office Management of Fractures

• Office Referral to Ortho
  — ND or Minimally displaced
  — Involving the joint
  — Mild to Moderate swelling
  — Unclear diagnosis
  — Non-acute injuries

• Urgent Referral (ERC?)
  — NV concerns
  — Severe swelling
  — Clinical deformity
  — Open fractures

If sending for urgent referral or to ERC make them NPO just in case....

No Referral Needed!!

• Buckle Fractures
• Most Clavicle Fractures
• Toddlers Fractures

Literature supports management of these common fractures by the PCP without referral to an orthopedic provider.

Buckle (Torus) Fractures

• Most often at the metaphyseal/diaphyseal junction
• Mild swelling
• Mild to Moderate TTP
• NV
• No clinical deformity

• Tx:
  — Volar splint vs sugar tong splint 3-4 wks
  — Contact sports restrictions 4-5 wks
  — +/- re-eval after 4 wks (not required)
  — Release to full activities no sooner than 4 weeks and after all symptoms have resolved
Simple Clavicle Shaft Fractures

- Good NV exam
- Sling for comfort and FFWB restrictions 5-6 wks
- Pain meds (especially at night)
- Discuss bone remodeling and palpable “bump” that will improve over 12 months
- Return to contact sports after 6-8 wks if all symptoms have resolved

Clavicle Fractures

Toddler’s Fractures

- Treatment is comfort driven!
- Don’t always show up on initial films
  - Suspicious = R/O infection or other causes, possibly repeat x-rays in 1-2 weeks.
- +/- immobilization and climbing/playground restrictions x 4-5 wks.
- WBAT
- Advance activity and D/C immobilization when symptoms resolve
- Motrin for pain control

Toddler’s Fractures

- Non-displaced tibia shaft fracture
- Age 9m – 4 years
- MOI: torsion, down slide with parent, fall
- +/- mild swelling, pain with or refusal to WB, focal TTP
- TX: (Comfort driven/stable fractures)
  - 3D boot
  - Posterior splint
  - Soft splint < 2yrs
  - Cast (not always necessary)

References

- AAOS Guideline for the Treatment of Pediatric Fractures, 2009
- AAOS Comprehensive Orthopaedic Review, Jay R. Leiberman. Published by American Academy of Orthopaedic Surgeons, Rosemont IL. Copyright 2009
- AAOS Guideline for the Treatment of Pediatric Thighbone Fractures, 2009

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- Upper Extremity Orthopaedic Trauma in Children. Presentation by Laura Winderly, MD. Children’s Medical Center Dallas. 2011