Pediatric/Adolescent Sports Injuries: Pearls and Pitfalls

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Learning Objectives

• Review the approach to sports related knee pain and current treatment recommendations
• Discuss the physical examination in the differential diagnosis of ankle pain
• Identify common hand and finger injuries, and how to treat them
Pearls:

- You can’t make a good decision on bad x-rays
- In doubt? Every patient should be followed to “declaration” or “resolution”

NORTHING CURES CONFIDENCE LIKE FOLLOW UP: don’t jump to conclusions!
Ankle Sprains—Most Common Problem to Me

• Three Main Types
  • Lateral Ankle Sprain—Most Common
    • Plantarflexion/inversion
    • ATFL/CFL
  • Medial Ankle Sprain
    • Eversion/External rotation
    • Often collision/contact injury
    • Deltoid Ligament
  • “High” Ankle Sprain
    • External rotation/dorsiflexion
    • AITFL

Ankle Sprains: Evaluation, Rehabilitation, and Prevention

Eric T. Chen, MD;1,2 Kelly C. McInnis, DO;1,2,3 and Joanne Borg-Stein, MD1,2,4
• Most prevalent musculoskeletal injury in physically active populations as well as a common condition in the general population and has numerous sequelae that contribute to a substantial healthcare burden.

• High recurrence rate

• Direct and indirect financial and societal costs for treating lateral ankle sprains and their sequelae are high.
Lateral Ankle Sprains

- **History - inversion**
  - Anteolateral Ankle Pain
  - DIFFERENTIAL DX
  - Ability to bear weight immediately?
  - Prior history of sprain/instability?
  - Fatigue? Eg tournaments/multiple sports

- **Physical - anterolateral pain/swelling**
  - IMPORTANT: Site of tenderness
  - Skeletally immature SHI fx
  - Range of motion
  - Drawer test/inversion/external rotation
Pearl-Ankle Anatomy

- All ligamentous structures attach distal to the physis to the epiphysis.
- Ligaments are stronger than physis.
- Physeal injury more common.
Medial Ankle Sprains/High ankle sprains

- Be wary of Fracture
- Syndesmosis injury-mechanism
- Significant ligamentous injury
- EXAM: Location of:
  - Tenderness
  - Swelling
  - Kleiger’s test
  - Hopkins “squeeze test”
Ankle Sprain Basic Physical Exam

- Pain may Prohibit
- My Comment on testing
  - Localize pain and swelling
  - Stabilize foot
- ANTERIOR or atypical tenderness caution
- Pain on external rotation
  - Syndesmosis
X-rays? -WEIGHT BEARING/simulated weight bearing if possible

The Ottawa ankle rules.

Malleolar zone pain AND any one of the following criteria:
Inability to walk four steps immediately after injury or in the emergency department

Tenderness along the distal 6 cm of posterior half of the tibia or the tip of the medial malleolus

Tenderness along the distal 6 cm of posterior half of the fibula or the tip of the lateral malleolus

X-rays of the ankle are indicated when the above criteria are satisfied.
Salter I Distal Fibula -
typical “goose egg” swelling over distal fibula with tenderness over distal fibular physis
Ankle Sprains- Treatment

• “PRICE”
• Immobilization
  • Cast/brace/splint
  • Facilitates mobility
• Early Rehab critical-re-injury common-21 articles 2009
  • Arch Phys Med Rehabil. 2009
• Protect (brace) on return to sport-my anecdotal guidelines-
  Balance deficits seen in chronic injury (MSSE Aug 2009
  • 1st-2-4 weeks after return to sport
  • 2nd-2-4 months
  • 3rd 6 months min
• Brace-(up to 1 yr recommended by some after first sprain)
Ankle Sprain Treatment - most common reason for repeat sprain is not healing the FIRST ONE

- Manual Therapy
  - Some support
  - Also in chronic
- Neuromuscular Training
  - Reduce overall injury rate in kids!
- Orthobiologics (PRP)
  - Not there yet
- Return to Play
  - Minimal Pain/swelling
  - Motion
  - Sport specific activity

Manual Therapy

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A School-Based Neuromuscular Training Program and Sport-Related Injury Incidence: A Prospective Randomized Controlled Clinical Trial

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- Study on female basketball/volleyball
- Reduced injury rate
- KNEE - particularly benefits
Ankle Instability -

• 40-75% of individuals experiencing an ankle sprain will have ongoing symptoms of pain or instability - Marshall et. al. MSSE Aug 2009.

• Ankle dysfunction is associated with proximal physiologic/balance compensations and adaptations - Nadler 1998
Core and Rehab-Data

Differential Diagnosis and Sprains that don’t heal

- Instability versus Pain
  - Note previous discussion
  - Overall evaluation
- Differential Diagnosis:
Ankle Sprain that didn’t Heal - Anterolateral Talar Osteochondritis Dissecans (OCD)
Fracture of the Lateral Process of the Talus
LELAND G. HAWKINS M.D. University of Iowa 1965

- Pain about the lateral side of the ankle
- The initial diagnosis was frequently missed.
Ankle Sprain that doesn’t heal-
continued

• Tarsal coalition- the stiff hindfoot/Rigid flatfoot
• Cavus foot -especially unilateral-neurologic cause
  • “BEWARE THE CAVUS FOOT”
  • NEUROMUSCULAR/SPINE
Peroneal Tendon Subluxation

Tenderness posterior to the lateral malleolus;

Subluxation of the peroneal tendons may be provoked by having the patient dorsiflex the foot from a position of dorsiflexion and eversion;

Consider in cases of recurrent sprains

Cast in inversion/plantar
Posterior Process talus

• Shepherd’s fracture (1882)
Os Subfibulare fracture
Sever’s Disease

- **Apophyseal focal heel pain in the skeletally immature athlete**
- Etiology overuse v smetaphyseal injury (Ogden 2004)
- Activity modification, ice, stretch, heel cups
- CAST
- Probably not an inflammatory condityion but repetitive microtrauma to an actively remodeling bone based on mri studies
- Xray not initially needed if no acute trauma
  - Pain resolves with Rx
- MRI not initially needed
Sever’s may be a “fracture” of metaphyseal bone where the apophysis attaches - Ogden JPO 2004

Immobilization in a short leg cast for 4-6 weeks may provide the quickest long term relief - Frush/Lindenfeld Sports Health 2009
Fifth metatarsal Base Fracture

- Inversion injury similar to sprain
- Focal tenderness MT5 base
- Differentiate from apophysis
  - Apophysis parallel to MT
- Three zones of injury
  - “Do not walk across this line”
- 2-4 weeks protection for apophyseal
- Any other fracture NWB in cast---?surgery
Stress Frx
Jones Frx
Avulsion Frx
Knee: Pain and selected Problems

- Quadriceps
- Patella
- Lateral Joint Line
- Patellar Tendon
- Fibular Side (actual bony prominence not visible)
- Medial Joint Line
- Anterior Tibial Tuberosity
- Tibia
- Quad Tendon and Suprapatellar Region
- Lateral Retinaculum
- Medial Retinaculum
- Patellar Tendon
Knee Anatomy - 2 tendons, 2 menisci, 4 ligaments
Patellofemoral Pain

- Pain behind or around patella
  - Particularly during loading
- Cause multifactorial
  - (still mostly unknown)
  - Malalignment
  - Muscle weakness
  - Core
- ? Altered Central Pain Processing
  - Chronicity
- May not be self-limiting
  - >50% after 5-20 years!!
  - Relation to Osteoarthritis unclear

Rethinking patellofemoral pain: Prevention, management and long-term consequences

Kay M. Crossley a,*, Marienke van Middelkoop b, Christian J. Barton a, c, Adam G. Culvenor a, d
Patellofemoral Pain Risk Factors

- POOLED evidence clearly implicates imbalance:
  - Quads
  - Hip Abduction Strength

↑ Hip abduction strength (adolescents only)
↓ Quadriceps strength (total population and military only)
Nothing is ever easy


- General mental health
- Anxiety/depression
- Fear avoidance
- Catastrophizing

- BMI
- Peak hip adduction, internal rotation & contralateral pelvic drop
- Peak hip flexion during running

- Quadriceps strength and size
- Delayed onset vastus medialis
- Sulcus angle
- Lateral patellar tilt & displacement
- Foot pronation & rear foot eversion

- Hip abduction, external rotation, internal rotation, adduction & extension strength

- Gluteal activation

- Q-angle

Delayed and decreased duration
Is Patellofemoral Pain Preventable?

• ”Braces” may help in:
  • Young adults - training increased
  • Military recruits

• Foot orthoses no proof

• Strengthening/stretching
  • Studies poor to date

• Neuromuscular control
  • ?
Consensus Statement

- 51 experts
- 10 countries

Welcome to iPFRR17
July 18, 2017 | QT Hotel, Gold Coast, Australia

5th International Patellofemoral Pain Research Retreat
We are delighted to welcome you to the 5th International Patellofemoral Pain Research Retreat...
Evidenced Based Management of Patellofemoral Pain

• Consensus of 2017 Patellofemoral Pain Research Retreat
• Six recommendations
  • 1. Exercise recommended to reduce pain in short, medium, and long term
  • 2. Hip and Knee Exercises
  • 3. Combined interventions exercise and one of the following:
    • Foot orthoses in the short term
    • Patellar taping
    • Manual therapy
  • 4. Foot orthoses
  • 5. Patellofemoral, knee, lumbar mobilization not in isolation
  • 6. Electrophysical Agents not recommended
Education

- Fig. 4. Manage My Patellofemoral Pain education leaflet (Printable version downloadable here. http://bmjopensem.bmj.com/content/bmjosem/2/1/e000086/F1.large.jpg).

Patellofemoral pain (pain around, behind or under the knee cap) is very common, and affects both males and females of all activity levels. It often results in pain during simple daily activities such as walking, running, sitting, squatting and walking up and down stairs.

Patellofemoral pain has many causes, and as such there are a lot of treatment options available. The information contained within this leaflet will help guide you on the most appropriate treatment for your knee pain. It is recommended you see an appropriately qualified health care professional to guide your treatment further.
Osgood Schlatter Syndrome

- Pain *directly over tibial tubercle*
  - *DIRECTLY!*
- Traction by the patellar tendon on the apophysis
- Age 8-12 girls a little older in boys
- Treatment:
  - Activity modification
  - Ice
  - NSAIDS
  - Quad Stretching
  - Immobilize for severe pain
Osgood Schlatter-treatment may take time

- NO prospective, randomized, controlled trials on treatment
- Krause (JPO 1990) low incidence of later anterior knee pain
- Most investigators -resolution of pain in 90% but it may take 9-24m
- Get the pain down to a minor “annoyance”
- WARN FAMILY: MAY TAKE TIME AND WAX/WANE
Pitfall: Hip or Knee?

- **Pitfall:**
  - Knee pain may be hip
  - Failure to Appreciate severity of pain/gait
  - Failure to Obtain an appropriate x-ray

- **Pearls:**
  - Knee hurts-check hip
  - Early referral
  - Expeditious X-ray
  - AP and Frog pelvis (both hips)
  - Lateral x-ray!

SCFE
My take - The Knee/Ankle is often the "victim" and not the "culprit"

• Check overall fitness level
  • Exercise is Medicine
    • But NOT TOO MUCH!? 
• Check hip/core/balance
  • Attention fatiguing of hip abduction and weakness of external rotators
  • Hip Drop on single leg stance
  • Fatigue/balance
• Xray?
  • Physical therapy
  • Bracing Options
    “Try before you buy”
  • ? Foot orthoses off shelf

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Changes in Knee Biomechanics After a Hip-Abductor Strengthening Protocol for Runners With Patellofemoral Pain Syndrome

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Some Acute Knee Injury Issues: Common
Pitfalls: Patellar Dislocations

- Almost always lateral-tear of retinaculum/medial patellofemoral ligament
- Younger age at initial dislocation, increased risk of recurrent dislocation
- Often reduce spontaneously with knee extension and present with hemarthrosis
- Pearl: Get xrays-important to check for associated fracture
- Immobilize for 4 weeks (subluxations can move earlier)
Patellar Dislocation
Note Medial Avulsion off Patella and Laxity in Medial Retinaculum-tear of medial patellofemoral ligament-
Growth plate injuries may be unstable and nondisplaced
Pearl:
Refer injuries that swell shortly after injury
Remember the weak growth plate

Pitfall:
Pain over a Bone not appreciated as fracture
Pitfall: Acute Hemarthrosis in Children-without Obvious Fracture x-ray/?mri

- Pearls-:
  - Anterior Cruciate Tear
  - Meniscal tear
  - Xrays yes
  - Patellar dislocation +/- osteochondral fracture
  - Strongly consider mri in primary traumatic patellar dislocation with large effusion and normal x-ray
  - need to state concern for mri approval
Patella Fractures- Pitfall: Patella Sleeve Fracture

- Remember small fleck principle
- Avulsion mechanism
- Restore articular surface and knee extensor mechanism
Pitfalls-Ordering X-rays

• Pearls:
  • Include joint above and below
  • Weight bearing joints taken in weight bearing position whenever possible-foot!!!!
  • Discipline Yourself: Where’s the tumor?
    • Distal femur may be missed on knee x-ray!!!!!!
    • Be careful on accepting x-ray report
    • Every patient should be followed up !!!!!
    • Persistent pain is a worry
Pitfall: “There is repetition everywhere, and nothing is found only once in the world.”
-Johann Wolfgang von Goethe

- Pearls: Remember x-ray ordering. Could you be missing a proximal tibial tumor not seen on an x-ray of the knee?
  - Trauma is often the gateway to tumor diagnosis and bone is a window to watch metabolic bone disease
  - Follow patients with persistent pain
  - Leukemia may present as bone pain
  - ? Vitamin D/Diet

Ewing’s Sarcoma
Initial Care of Fractures and Referral

- Fingers within three days
- Displaced epiphyseal fractures within 5 days
  - Reduction of epiphyseal fractures risky after 5-7 days
  - Risk of further growth plate injury

Pain is telling you something

- Elevation, elevation, elevation, elevation, elevation, elevation, elevation, elevation
Principles of Splinting

- Please splint, it’s humane
- Joint above and joint below
- Beware foam and aluminum-sores
- Beware heel pain in splint
- There are no hypochondriacs in casts or splints
Fingertip Injuries - distal phalanx and distal interphalangeal joint

- Avulsions
- Mallet fracture - can’t straighten distal phalanx
- Jersey finger - flexor tendon avulsion - can’t bend distal phalanx
- Fractures
Distal Phalanx - most common Childhood Injury/fracture

- Extensor epiphyseal
- Flexor metaphyseal
- Three layers of nail
- Subunquall hematoma
  - Drain vs nail removal
• **Hand Injuries - Mallet Finger**

  • Distal Interphalangeal Joint - (DIPJ)
  • Salter-Harris III fracture or extensor tendon avulsion
  • Unable to actively extend DIPJ
  • Dorsal Splint in extension full time 6-8 weeks
Distal Phalanx- “Seymour Fracture

- Open Fracture disrupt matrix and nailbed
- Reduce +/- pin, repair nail bed
- 6-0,7-0 ABSORBABLE suture
Hand Injuries - “Jammed Finger” Swollen PIP joint

- Proximal Interphalangeal Joint (PIPJ) hyperextension
  - *Consider early referral for anything more than minor sprain*
    - With or without subluxation or dislocation

- Treatment:
  - Reduction by linear traction
  - Check for fracture
  - Brief period of immobilization (splint then buddy tape)
  - Followed by edema control (elastic bandage)
  - Return to sports 1-2 weeks-longer if severe fracture
  - Pain/swelling may last months
Condylar neck Fractures
Phalangeal Base Fracture

- Does finger stick out?
- Closed reduction
- Check rotation
- Splint/cast 2-4 weeks
- Know splinting “safe position:
  - Padding
Fifth Metacarpal Fracture—“Boxers Fracture”

- Punching inappropriately
- Dropped knuckle
- Angulation?
  - 45-50 deg?
- Ulnar Gutter Splint/cast
- Heal fast 2-3 weeks
- Extensor Lag?
• **Splint fractures or suspected fractures**
  • Beware the compressive wrap
  • Pad, pad, pad splint
  • Foam on the inside of metal splints macerates skin quickly
  • When/How do you get x-rays interpreted?

• **Beware the jammed finger**
  • Consider Referral anything more than a minor sprain
  • Fingers heal and stiffen FAST refer soon 3-5 days
  • AP/Lat/Oblique xray centered on joint of interest

• **Hip/Groin Pain**-Beware the unilateral hip xray-
• If a knee is injured immediately swells big time- refer
Executive Summary - Referral
Pearls/Pitfalls

• ANY crooked injured extremity significantly swollen joint or extremity - if you send them to the ER or for urgent evaluation keep them NPO and please approve us for x-rays if possible

• Suspected SCFE: NPO and discuss with ortho
  • Creates a weird situation with family when you get x-ray report days after their visit to you, refer later and we tell them they need surgery NOW!

• If not absolutely sure don’t tell them specifics about what ortho will do. It creates confusion if there is ANY deviation in plan.

• Lack of “referral” or approval for care delays care and makes us all look bad - eg sending directly from x-ray to ortho
EXPERIENCE IS SOMETHING YOU LEARN JUST AFTER YOU NEEDED TO KNOW IT

One brick too many