Challenging Cases in Sports Medicine

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Case 1

A 19 year old basketball player jumped up for a rebound, and upon landing on her left leg she felt a sudden popping sensation of her left knee followed by pain.

- Unable to continue to play
- Swelling developed within one hour
- Her team’s athletic trainer applied ice and a compression wrap.
- She presents one week after the injury. She is able to bear weight without much pain, but the knee is quite stiff. She has been using crutches.
Case 1

- Additional History
  - No prior injury
  - Denies locking or instability
Case 1

• Exam
  – No ecchyhmoses
  – Moderate effusion
  – Limited range of motion
  – No focal tenderness
  – Neurovascular exam normal
Case 1

Given the history and exam findings so far, which of the following is the most likely diagnosis?

1. Tibial plateau fracture
2. Medial meniscal tear
3. Anterior cruciate ligament tear
4. Medial collateral ligament sprain
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ACL Injuries

Of ACL tears, what percentage are due to a non-contact injury mechanism?

1. 30%
2. 50%
3. 75%
4. 90%
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ACL Injuries

Among NCAA athletes, which of the following sports has the highest ACL injury rate:

1. Men’s basketball
2. Women’s Basketball
3. Men’s soccer
4. Women’s Soccer
ACL Injuries

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ACL Physical Exam

Which of the following tests performed in the office is most sensitive for diagnosing an ACL tear?

1. Anterior drawer
2. Lachman test
3. Pivot shift test
4. McMurray’s test
Which of the following tests performed in the office is the most sensitive for diagnosing an ACL tear?

1. Anterior drawer
2. **Lachman test**
3. Pivot shift test
4. McMurray’s test
Lachman Test

- Patient supine, knee flexed to 20-30 degrees

- Tibia in neutral alignment.

- The distal femur is stabilized with one hand and anterior force is applied at the tibia with the other hand, displacing the tibia anteriorly on the femur.

- Positive test: lack of a solid “endpoint” indicating the absence of anterior restraint normally provided by the ACL.

### ACL Exam

<table>
<thead>
<tr>
<th>Test</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior Drawer</td>
<td>62%</td>
<td>68%</td>
</tr>
<tr>
<td>Lachman</td>
<td>86%</td>
<td>91%</td>
</tr>
<tr>
<td>Pivot Shift</td>
<td>18-48%</td>
<td>98%</td>
</tr>
</tbody>
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Don’t be Fooled!

- **Pseudopositive Lachman**
  - Increased translation, but solid endpoint
  - PCL injury

- **Non-contact injury with acute swelling, and negative Lachman – Think Fracture**
  - Tibial plateau (non-displaced)
  - Fibular head
  - Femoral condyle
MRI ACL Tear
The patient is interested in surgical reconstruction. All of the following are true regarding treatment of isolated ACL tears EXCEPT:

1. Surgical reconstruction of the ACL can restore functional stability
2. ACL reconstruction generally provides good outcomes in active individuals
3. The patient’s desired future activity level plays a large role in determining operative vs. non-operative treatment
4. ACL reconstruction reduces the likelihood of the development of osteoarthritis
All of the following are true regarding treatment of isolated ACL tears EXCEPT:

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4. *ACL reconstruction reduces the likelihood of the development of osteoarthritis*
Treatment Options

• Operative vs. Non-operative
• Factors
  – Level of instability
  – Concomitant injury
  – Desired activity level
  – Prevention of secondary injury (meniscal tears)
  – Presence of osteoarthritis
Case # 2

A 13 yo right hand dominant pitcher complains of a 2 month history of right shoulder pain. No history trauma. No paresthesias of the extremity. Pain only occurs when throwing. He rested for 2 weeks, but the pain recurred when he resumed throwing.

The exam is unremarkable.
Which of the following is appropriate?

1. Obtain an MRI to rule a rotator cuff injury

2. Begin physical therapy to strengthen the rotator cuff

3. Obtain comparison x-rays of the left shoulder

4. Order a bone scan to assess the growth plate
Which of the following is appropriate?

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Proximal Humeral Physeal Stress Injury
“Little Leaguer’s Shoulder”
The growth plate, or physis, is located between the epiphysis and the metaphysis.

Center of endochondral ossification.

Injury to the physis can result in growth disturbance.
Branches of the epiphyseal artery pass directly through the reserve zone of the cartilaginous growth plate without contributing capillaries to it. But on reaching the proliferative zone, they arborize into capillaries that supply only top of cell columns. Metaphyseal and nutrient arteries subdivide into numerous small branches, which pass axially to bone-cartilage junction where they form loops or tufts but do not enter cartilage. Thus, metaphysis and bony portion of growth plate are well supplied with blood, but only uppermost portion of cell columns (i.e., proliferative zone of cartilage) is vascularized. Hypertrophic zone is avascular; cells are progressively poorly oxygenated and nourished from top downward, and lowermost cells degenerate and die. Peripherally located perichondral ring of La Croix and ossification groove of Ranvier have their own distinct blood supply. These vascular phenomena have profound physiologic significance (see Plate 16 for enlarged view of outlined rectangle).
Growth Plate Structure

Zones of chondrocytes:
- Germinal (resting layer)
- Zone of proliferation
- Zone of hypertrophy
  - Maturation
  - Degeneration
  - Zone of provisional calcification
Anatomy of the Physis

- Longitudinal growth occurs as a result of proliferation and hypertrophy of the chondrocytes
- Endochondral ossification occurs at the zone of provisional calcification
- Hypertrophic chondrocytes there are mineralized joining the newly formed metaphyseal bone
  - Dependent on vascular perfusion and MMPs
Physis - Vascular Supply

- The physis itself is avascular

- Nutrients are delivered via diffusion by the epiphyseal and metaphyseal arteries

- Epiphyseal artery supplies the germinal, proliferative and upper hypertrophic zones

- Metaphyseal artery supplies the zone of provisional calcification
Stress Injury of the Physis

• Occurs as a result of repetitive loading rather than acute trauma
• Appears to be due to disruption of metaphyseal blood supply, which in turn disturbs process of endochondral ossification
• Recent research suggests that MMPs also involved
Clinical Reports

• Proximal humeral physis
  – “Little League shoulder”
  – 12 published case reports/case series in young baseball players
  – Other sports
    • Gymnastics, badminton, cricket, swimming and volleyball
Proximal Humeral Physeal Stress Injury

13 yo pitcher with right shoulder pain
Lower Extremity Physeal Injuries

• At least 10 case reports/ case series
• Sites involved
  – Distal femoral and proximal tibial physes most commonly reported
• Sports: Distance running, basketball, tennis, soccer, baseball, basketball, gymnastics, football, rugby

12 yo girl with 1 yr hx of ankle pain
Mechanism of Physeal Stress Injury

1. Repetitive loading alters metaphyseal perfusion
2. Mineralization of growth cartilage within the zone of provisional calcification is disrupted, prolonging the life of the chondrocytes
3. Chondrocyte proliferation continues, but in the absence of calcification causes a “logjam” of chondrocytes
4. This may result in:
   a. Widening of the physis or
   b. Extension of physeal cartilage into metaphysis
5. Findings may be seen radiographically or with MRI
Physeal Widening

Normal Growth Plate

Thickening After Metaphyseal Injury

Physeal Cartilage Extension

Rabbit Tibia


Study of Chinese Acrobats


Young Gymnast

DiFiori et al MSSE 1996
Risk Factors

• Duration of loading

• Training intensity

• Growth Rate
Treatment of Physeal Stress Injury

• Most respond to rest from training
• Those with pain with daily activities may require immobilization
• At least 6 weeks required in most cases
• Repeat radiographs will show resolution
10 yo Soccer Player
Right Knee Pain

Initial Presentation

6 Week Follow Up
Potential Consequences of Physeal Stress Injury

Premature growth plate closure may occur and alter long bone growth

Partial closure of the right distal radial physis in a female gymnast who presented with a symptomatic right wrist (Howe, Caine, Keeler, et al., 1997).
11 yo Tennis Player with Knee Pain

Laor et al. AJR 2006; 186:1260–1264
Consequences of Physeal Stress Injury

Laor et al. AJR 2006; 186:1260–1264
Treatment

• Rest from all throwing for at least 6 weeks

• Repeat radiographs to assess healing

• Address issues underlying overuse injuries
  – Excessive throwing
  – Realistic expectations
  – Injury prevention education
Case 3

A 14 year old snow boarder fell onto his outstretched right wrist 1 week ago. He complains of persistent soreness of the wrist. He has not noted any swelling or skin discoloration.
Case 3 Exam

- No soft tissue swelling.
- The skin was clear.
- Full ROM
- NTTP at distal radius
- Focal TTP over the anatomic snuffbox.
- NV exam was unremarkable.
Case 3

The most likely diagnosis is:

1. Distal radial physeal fracture
2. Wrist sprain
3. Perilunate dislocation
4. Scaphoid fracture
5. Wrist contusion
Case 3

The most likely diagnosis is:

1. Distal radial physeal fracture
2. Wrist sprain
3. Perilunate dislocation
4. *Scaphoid fracture*
5. Wrist contusion
Scaphoid Fracture

• The most appropriate imaging test to order is at this point is:

1. MRI
2. Wrist x-rays with clenched fist view
3. Wrist x-rays with ulnar deviation
4. Wrist x-rays with carpal tunnel view
5. Bone scan
Scaphoid Fracture

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Scaphoid Fracture

• Are the x-rays normal?

1. Yes
2. No
Scaphoid Fracture

- Are the x-rays normal?

1. Yes
2. No
Scaphoid Fracture

The most appropriate next step in management is:

1. Order a bone scan
2. Order an MRI
3. Repeat x-ray in 2 weeks
4. Prescribe NSAIDs and follow up if pain persists
Scaphoid Fracture

The most appropriate next step in management is:

1. Order a CT scan
2. *Order an MRI* OR
3. *Repeat x-ray in 2 weeks*
4. Prescribe NSAIDs and follow up if pain persists
Scaphoid Fracture

- While awaiting follow up, the wrist should be immobilized, including the thumb to the IP joint level.
  - Thumb spica cast
  - Thumb spica brace
  - Fiberglass splinting
Scaphoid Fracture

The most appropriate next step in management is:

1. Order a bone scan
2. Order an MRI
3. Repeat X-ray in 2 weeks
4. Order a CT scan
Scaphoid Fracture

The most appropriate next step in management is:

1. Order a bone scan
2. *Order an MRI*
3. Repeat X-ray in 2 weeks
4. Order a CT scan
MRI Scaphoid Fracture
Scaphoid Fractures

All of the following are true regarding scaphoid fracture EXCEPT:

1. Can be treated with a long arm thumb spica cast
2. Can be treated with a short arm thumb spica cast
3. Duration of immobilization is typically 8-12 weeks
4. Distal fractures are less likely to heal than proximal fractures
Scaphoid Fractures

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Scaphoid Fracture

- Often occurs due to fall onto outstretched hand (FOOSH)
- Tenderness over anatomic snuffbox or scaphoid tubercle
- Include a scaphoid view when ordering x-rays (ulnar deviation)
- X-rays may be negative, even when repeated
- Must have high index of suspicion
- Treat presumptively with thumb spica cast until diagnosis established or excluded
Scaphoid Fracture

- Obtain an MRI if suspicion is high and x-rays are negative.
- Bone scan is an acceptable alternative to MRI.
Scaphoid Fracture

• Treatment
  – Blood supply to the scaphoid is tenuous
    • Decreases from distal to proximal
  – Patients should be informed that the fracture may not heal even with immobilization.
  – Location of fracture important in prognosis
    • More distal non-displaced fractures heal well
    • Proximal fractures have higher rates of non-union
Scaphoid Fracture
Scaphoid Fracture

• Treatment
  – For non-displaced fractures
    • Thumb spica cast
    • Either short arm or long arm effective

• Cast immobilization usually needed for 8-12 weeks
  – Longer duration for more proximal fractures
Scaphoid Fracture

- Follow up x-rays every 2-4 weeks
- Examine out of cast when healing anticipated
- Post-immobilization OT recommended due to length of immobilization
Scaphoid Fracture

• Referral
  – Displaced fractures
  – Proximal, non-displaced fractures
  – Circumstances in which rapid return to sport or other activity is of importance
    • Screw fixation allows earlier return to sport
  – If non-union develops despite treatment
  – If AVN develops or is suspected
Case 4

- A 7 year old girl presents with a 3 month history of a recurrent clicking sensation of the left knee.
  - Mom describes clicking over the lateral aspect of the knee.
  - No history of trauma.
  - Able to play soccer and swim without any limitations, but has had an occasional aching sensation of the knee after these activities.
  - No visible swelling, no locking, and no night pain.
Case 4

- Exam
  - Full range of motion
  - No effusion
  - Non-tender to palpation
  - Audible and palpable clicking over lateral joint line with passive flexion and extension
  - Ligaments stable
Case 4

The most likely diagnosis is:

1. Occult loose body formation due to osteochondritis dissecans
2. Snapping iliotibial band syndrome
3. Synovial plica syndrome
4. Discoid lateral meniscus
Case 4

The most likely diagnosis is:

1. Loose body formation due to osteochondritis dissecans
2. Snapping iliotibial band syndrome
3. Synovial plica syndrome
4. *Discoid lateral meniscus*
DLM

• Abnormal discoid shape

• Occurs in 0.4%-17%, highest in Asian population

• May or may not have associated tear

DLM

- **Clinical presentation**
  - <10 y snapping or clunking of knee
  - Older children, adolescents and adults – varies
    - Pain
    - Clicking
    - Locking
    - Swelling
DLM

• Exam
  – May be normal
  – Young children: palpable clicking along joint line
  – Older children, adults:
    • Effusion, joint line tenderness, palpable clicking

• Imaging
  – MRI confirms diagnosis
Discoid Lateral Meniscus

Lateral

Medial
The most appropriate treatment for this patient is:

1. Reassurance - no intervention is needed as sx will resolve with growth and development
2. Rest to allow for healing to occur
3. Bracing for 6 weeks
4. Arthroscopy to “re-shape” the meniscus
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DLM Treatment

• If asymptomatic (discovered incidentally on MRI), no treatment is necessary

• If symptomatic
  – Arthroscopic “saucerization”
    • Remove abnormal central portion
    • Treat any associated tears
  – If Wrisberg DLM – meniscal repair to reattach meniscotibial ligament
DLM

Normal medial meniscus

Discoid lateral meniscus
DLM Saucerization

DLM pre-procedure

DLM post-procedure
Thank you !