“My Knee Is Swollen”
Acute Knee Injuries in the Athlete

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The Knee Joint Complex

- Made up of 3 bones
  - Femur
  - Tibia
  - Patella
- The knee is really *two* joints
  - Patello-femoral joint
  - Tibio-femoral joint
Knee Anatomy

• **Articular Cartilage**
  - Cover the ends of the 3 bones

• **Menisci**
  - Separate the upper and lower bones of the knee
Anatomy

- patella (knee cap)
- lateral collateral ligaments
- lateral meniscus
- medial meniscus
- medial collateral ligaments
- articular cartilage
- the right knee

- Quadriceps tendon
- Patella
- Patellar tendon
Anatomy-Cruciate Ligaments
Anatomy-Menisci
X Rays

AP View

Lateral View

Merchant’s view

Tunnel View
MRI Anatomy

VasLm.=Vastus Lateralis Muscle
VasM.=Vastus Medialis Muscle
PCrL=Posterior Cruciate Ligament
Tb=Tibia
LTbCn=Lateral Tibial Condyle

MFMcn=Medial Femoral Condyle
MColL=Medial Collateral Ligament
MMen=Medial Meniscus
ITbT=Iliotibial Tract

QdT=Quadriceps Tendon
Pt=Patella
PTT=Patella Tendon
Tb=Tibia

Fm=Femur
IPTFp=Infrapatellar Fat Pad
ACrL=Anterior Cruciate Ligament
Ppm.=Popliteus Muscle
Gstmn.=Gastrocnemius Muscle
Things to Think About in History

- Mechanical Symptoms
  - Locking
  - Popping
  - Giving Way
- Effusion
  - Rapid (< 2 hours) – hemarthrosis
  - Slow (24-48 hours) – ligamentous strain, meniscal Injury
- Mechanism of Injury
  - Direct blow?
  - Foot planted
  - Decelerating or landing from a jump
  - Twisting
  - Hyperextension
- Medical History
  - Previous Knee pain or Surgery
History and Physical

• Important Questions
  – Mechanism of injury
  – When?
  – What did the patient feel?
  – What’s happened since? (instability, swelling, mechanical sx’s)
## The Knee

**Historical Clues to Knee Injury Diagnoses**

<table>
<thead>
<tr>
<th>Injury Description</th>
<th>Possible Diagnoses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non contact injury with “pop”</td>
<td>ACL tear</td>
</tr>
<tr>
<td>Contact injury with “pop”</td>
<td>MCL or LCL tear, meniscus tear, fracture</td>
</tr>
<tr>
<td>Acute swelling</td>
<td>ACL tear, PCL tear, fracture, knee dislocation, patellar dislocation</td>
</tr>
<tr>
<td>Lateral blow to the knee</td>
<td>MCL tear</td>
</tr>
<tr>
<td>Medial blow to the knee</td>
<td>LCL tear</td>
</tr>
<tr>
<td>Knee “gave out” or “buckled”</td>
<td>ACL tear, patellar dislocation</td>
</tr>
<tr>
<td>Fall onto a flexed knee</td>
<td>PCL tear</td>
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</tbody>
</table>
Physical Exam

- Observation
- ROM
- Palpation
- Special Tests
  - Apprehension
  - Lachman
  - McMurray
  - Varus / Valgus stress
Differential By Location

**Anterior**
- Patellar Subluxation
- Osgood-Schlatter
- Jumper’s Knee
- Patellofemoral Pain Syndrome
- Prepatellar bursitis

**Medial**
- MCL Sprain
- Medial Meniscal Tear
- Pes Anserine Bursitis
- Medial Plica Syndrome

**Lateral**
- LCL Sprain
- Lateral Meniscal Tear
- Iliotibial Band Tendonitis

**Posterior**
- Baker’s Cyst
- Posterior Cruciate Ligament Injury
The Growing Knee

- Growth cartilage
  - epiphyseal plate
  - articular cartilage
  - apophyses
- Physis vulnerable to injury
  - acute, overuse
  - tendon stronger
- Makes Dx difficult
Acute Knee Injuries

- Ligament Injuries
  - ACL
  - MCL
  - LCL
  - PLC
  - PCL
- Meniscal Injuries
- Evaluation and Management
Acute Hemarthrosis in Adolescents & Children-without Obvious Fracture

- Anterior Cruciate Tear
- Meniscal tear
- Patellar dislocation +/- osteochondral fracture
Knee Injuries
Acute Hemarthrosis

- ACL 50%
- Meniscal tear 40%
- Fracture 10%
Anterior Cruciate Ligament

- Plant and turn injury
- HX - often hears a pop and notes swelling in Knee
- PE – Joint Effusion + Anterior Drawer or Lachman if torn (most sensitive directly after injury or about 2 weeks later)
- Radiographs looking for tibial spine avulsion
- MRI prior to surgery if torn
- Treatment
  - Initial Treatment
    - RICE
    - Knee Immobilization
    - Crutches
    - NSAID’s
  - Definitive treatment
    - Based on Age, Activity level and degree of injury
    - Surgery vs prolonged immobilization
Anterior Cruciate Ligament

- Skeletally immature
  - incidence increasing
- Anatomy and Function
  - P-M condyle to Ant-ctr tibia
  - tension through ROM
  - Restrains tibia
    - 90% anterior displace
    - secondary IR, valgus
- Gender/maturation difference (kinematics)
ACL Injuries

- Most MOI are non-contact rotational forces
- Tibia displaced anteriorly on femur (or vice versa), rotational stress (cutting) or hyperextension
- May be isolated, but typically due to MOI, other structures (joint capsule, menisci) also injured
- Positive anterior drawer and/or Lachman’s tests
ACL Stress Test

- Anterior Drawer test
ACL Stress Test

- Lachman test
ACL - Management

- Natural History
  - poor prognosis if left untreated!
    - chondral, meniscal injury w/in 5 years

- Conservative Treatment
  - brace
  - strengthen
  - limit activity
    (YEAH RIGHT)
ACL - Management

• Surgical Treatment
  
  – Who/When
    • within 1-2 years closure
    • < 1 cm. Growth left
    • ACL +

  – Who not
    • “wide open physis”
    • no growth spurt yet
    • Tanner 1-2

  – Indications changing
Prevention of ACL injury

• Neuromuscular training programs: proven benefit
  – In and out of season
    • Structured, warm up
  – Focus on landing
  – Reduce mechanical risk factors
    • Knee abduction
    • Hip kinematics
Medial Collateral Ligament

- Anatomy and Function
  - several layers
  - attaches to meniscus
  - static stabilizer
  - primary role
    - resist valgus, ER
  - secondary role
    - anterior translation tibia
    - if ACL/MCL - bad injury
MCL Injuries

- Most common MOI is blow to lateral knee with resulting valgus tension forces
- May also be injured by non-contact and/or rotational stresses
- Positive valgus stress test
Medial Collateral Ligament

- **History**
  - pain, night pain
  - unstable sensation
- **Exam**
  - point tender
  - +/- swollen
  - valgus stress
    - 0, 20-30 degrees
    - lax at 0 = Grade III
MCL Surface Anatomy

Medial Collateral Ligament (MCL)*

Pes anserine bursa**

Medial joint line
Valgus stress test for MCL

Leg flexed at 30°

Note Direction Of Forces
Medial Collateral Ligament

- Imaging
  - Xray r/o physeal injury
  - MRI
    - not needed
    - protect, rehab, recheck
- Treat MOST non-operative
  - brace (ROM)
  - aggressive rehab
- Brace v.surgery if assoc. injury
- RTP depends on grade of injury and location
Posterior Cruciate Ligament

- Unusual but incidence on the rise
- Anatomy
  - hourglass, intrasynovial
  - medial femoral condyle to post tibia
  - Lig’s Humphrey, Wrisberg - lat meniscus
- Primary restraint to posterior translation
PCL Injuries

- Most common MOI is fall on flexed knee driving tibia posterior on femur
- May also occur with rotational and/or hyperextension MOI
- Often treated non-operatively as quadriceps muscles are able to minimize posterior displacement of tibia on femur
- Positive posterior drawer and/or posterior sag tests
Posterior Cruciate Ligament

- **History**
  - knee flexed, direct hit
  - hyperextension
  - +/- effusion

- **Exam findings**
  - posterior sag/drawer
  - may be false neg.
Posterior Cruciate Ligament
Posterior Cruciate Ligament

• Imaging
  – Xray
    • r/o avulsion
  – MRI

• Treatment
  – natural history unknown for lower grades
    • High Grade = OA
  – surgery v. conservative
Meniscal Injury

- 5-10% all sports injuries in children
- Unusual prepubertal
  - thick and vascular
  - as age
    - thins out
    - less vascular
    - more injury
Meniscal Injuries

- May be isolated from flexion/hyperflexion with rotation of the knee – “pinched” between tibia and femur
- Often injured in association with cruciate ligament injury
- “Classic” symptoms include joint line pain and clicking or locking – helpful but not definitive evaluative tools
- Limited reliability of special tests
Meniscal Injury

- **History**
  - typical mechanism
  - slow swelling
  - focal pain
  - catch/pop/lock
  - unstable

- **Exam**
  - lacks full extension
  - effusion
  - tender
  - meniscal signs +
Meniscal Injury

- **Xray**
  - to r/o bony injury
- **MRI**
  - adults >90% sens/spec
  - children less so (?)
    - 70-90% sens/spec
    - less so for younger

![Torn Meniscus](image-url)
Meniscal Injury

• Treatment is usually surgical in athletes
  – untreated do poorly
  – menisectomy
    • poor outcome
  – meniscal repair best
    • peripheral tear (MC)
    • requires stable knee
    • longer rehab
Discoid Meniscus

• Anatomical variant: types I-III
• Not rare (1-2%)
  – Meniscus injury < age 10 unusual unless associated with a discoid meniscus.
• Similar symptoms
  – intermittent
  – Vague
  – Snapping
• horizontal cleavage tears MC
• MRI - thin cuts
• Remove(saucerize) v. repair
Osgood-Schlatter disease

- Osgood-Schlatter (OS) disease is one of the most common causes of knee pain in the adolescent.
- During periods of rapid growth, stress from contraction of the quadriceps is transmitted through the patellar tendon onto a small portion of the partially developed tibial tuberosity.
- This may result in a partial avulsion fracture through the a small portion of the partially developed tibial tuberosity.

This may result in a partial avulsion fracture.
Osgood-Schlatter (Tibial Apophysitis)

- More common Teenage boys
- History
  - Knee pain waxing and waning for months
  - Worsens with squatting or stairs
- PE – tender on tibial tuberosity
- Treatment
  - Icing after activity
  - Decreasing activity – may need to stop activity for 2-3 months
  - NSAID’s
Osgood-Schlatter Disease (OSD)

First Aid

- Apply ice and compression.
- Refer to physician for specific diagnosis.
- Until inflammation subsides, rest is important.
Osgood-Schlatter disease
Patellar Tendonitis

• History
  – Teenage boys
  – Pain is anterior and has persisted for months

• PE – tender over patellar tendon, pain with knee extension

• Treatment
  – ICE
  – NSAID’s
  – Decreased Activity
Patellofemoral Pain Syndrome

- **History**
  - Anterior knee pain worse after sitting (theatre sign)

- **PE**
  - Patellar crepitus
  - Pain on contracting quad while putting pressure on Patella
  - Widened Q angle

- **Treatment**
  - Relative rest
  - Ice 20 minutes after activity
  - Quadracep strengthening (consider hip, hamstring, calf and IT band stretching)
  - Evaluation of Footwear
  - Consider NSAID’s
  - Consider Knee braces
  - Consider Knee taping – McConnell Taping
Medial Plica Syndrome

- Plica – A redundancy of the joint synovium
- Hx – Acute onset medial knee pain
- PE – tender mobile nodularity
- Treatment
  - NSAID’s
  - ICE
  - Injections
  - PT including phonophoresis and iontophoresis
  - Quad Strengthening Exercises
  - Excision if recalcitrant
Pes Anserine Bursitis

- Pes Anserine – insertion of Sartorius, gracilis and semitendinosus muscles
- Hx – pain on medial side of knee worsened with flexion and extension
- PE – tenderness posterior and distal to medial joint line valgus stress may reproduce pain
- Treatment
  - NSAID’s
  - ICE
  - Possible Injections
Knee Bracing

Prophylactic Braces

The general consensus regarding prophylactic knee braces indicates that they may prevent knee ligament injuries.

- Evidence mixed as to their effectiveness
- Choose the longest brace that fits the athlete’s leg
- Custom brace offer little extra benefit to off-the-shelf models
- Price vary considerably
- Need to wear brace with hinge near epicondyles
- Strength training, flexibility and technique refinement much more important
- DO not prevent rotation injuries

Prophylactic knee brace
Knee Bracing

Functional Knee Braces

- These braces tend to work better than prophylactic braces for assisting athletes after reconstructive knee surgery.
- Monitor athletes to make sure they wear braces during participation.
- Athletes should continue wearing braces until released by a physician.
  - No great studies
  - No studies showing custom fit better than pre-sized
  - More limitation than prophylactic braces (do prevent rotation injuries as well)
  - Limiting extension to 10-20 degrees may prevent hyperextension injuries
Bracing Options

- Patellar Stabilizer
  - S/P dislocation / subluxation
  - Patellofemoral syndrome
    - Studies mixed on effectiveness
    - Typically made of neoprene with butresses that support the patella
      - relatively inexpensive
Tips for Icing Knee

• Recommend 10-20 minutes per session (when it feels numb you are done)
• Recommend 2-3 times per day
• Ways to manage ice
  – Plastic bag with some water
  – Freeze water in styrofoam or dixie cup – then peel cup away from top of ice for use
  – Wet towel in Freezer
  – Commercially available ice packs
Basketball player

- Expected exam findings
- Clinical diagnosis
- Management
- Return to Sports