Management of Acute Knee Injuries

Chris K. John, MD
Brook A. Mitchell
Carilion Clinic Orthopaedics
Virginia Tech Carilion School of Medicine
Objectives

• Background
• Anatomy
• History
• Physical Examination
• Radiology and Laboratory
• Case Studies
Anatomy
Anatomy

- Prepatellar Bursa
- Superficial Infrapatellar Bursa
- Deep Infrapatellar Bursa
- Pes Anserine Bursa
History

- Patient age
- Current symptoms and duration
- Pain with or after activity/changes in activity
- Catching/locking (“mechanical”) or Instability
- Stairs, squats, “theater sign”
- Exacerbating and relieving factors
- What treatment already tried (Rest, NSAIDs, brace, ...)
- Prior knee injury or surgery
- PMH
Knee Examination (6-step MSK exam)

- Inspection
- Palpation
- Range of Motion
- Strength
- Neurovascular (rare)
- Special Tests
Knee Examination

• Inspection
  – Alignment of lower extremities
    • Varus, valgus, recurvatum
  – Patellar position and motion (J tracking)
  – Inspection for asymmetries
    • Swelling, torsion, inability to extend knee
    • Atrophy
Knee Examination

• Palpate for effusion and warmth
• Palpate for tenderness
  – Tibial tubercle
  – Quadriceps tendons
  – Retropatellar tenderness
  – Joint line
  – Ligaments (MCL/LCL)
  – Bursa (incl. pes anserine)
Knee Examination

• ROM
  – Flexion: 130°/135°
  – Extension: 0° to -10°
  – Internal Rotation: 10°
  – External Rotation: 10°

• Strength
  – Hams
  – Quads: squat, duck walk
Knee Examination

- Special Tests (ligaments)
  - Valgus and Varus Stress Tests (MCL/LCL)
  - Lachman’s & Anterior Drawer (ACL)
  - Posterior Drawer & Posterior Sag Test (PCL)
  - Postero-lateral corner
  - Patellar stability
  - Flexibility
ACL Tear Risk factors

• Female
  – Relative quad deficiency
  – Jump landing pattern
  – Narrow notch (NWI)
  – Trapezoidal notch

• Contralateral injury
  – 16% risk of uninjured leg on return to same sport
ACL Tear Mechanism of injury

- Non-contact
  - Deceleration / direction change
- Contact
  - Usually, a combined injury
- Presentation
  - “POP”
    - I just changed direction and heard/felt something pop
  - Rapid effusion (hemarthrosis)
Ligament Exam

If you can’t see it…you can’t examine it

ALWAYS compare to contralateral side
ACL Examination

• Effusion

• Lachman
  – 20-30 degrees knee flexion
  – Anterior tibial translation

• Pivot shift
  – Reduction of tibial plateau
  – IR, valgus, flexion/extension
  – Reflects rotational instability

• Associated instability
  – MCL
  – FCL
  – FCL + PLC
Test of ACL

At 90° Flexion

+ is increased translation or soft end point

At 20-30 ° Flexion

(more sensitive)
Sideline Treatment

• Do not allow athlete to re-enter competition
• Ice, crutches, elevate
• Next steps
  – Referral to Saturday morning / first available clinic
PCL Tear Mechanism of Injury

Posterior load applied to flexed knee
- MVA: Dashboard vs tibia
- Sports: Knee flexed - tibial load (usually with ankle plantarflexed)

Occasionally hyperextension
PCL Examination

- Anterior tibial abrasion, bruise
- Posterior sag
- Posterior drawer
  - Hip and knee flexed 90 degrees
  - Posterior directed tibia load
- Quadriceps active test
  - Hip at 45, knee at 90 degrees flexion
  - Quadriceps contraction “reduces” tibia “forward”
Sideline Treatment

• Do not allow athlete to re-enter competition
• Ice, crutches, elevate
• Next steps
  – Referral to Saturday morning / first available clinic
MCL Tear Mechanism of Injury

- Trauma
- Valgus stress (usually hit from the outside)
MCL Examination

• Palpation: assess pain or palpable defect
  – Medial condyle
  – Mid-substance
  – Tibial insertion

• Valgus Stress examination: opening, endpoint
  0 and 30: superficial and deep MCL; other injury (PCL)
  0 degrees only: PCL and/or ACL
Grading of Ligament Injuries

• I
  – Minor injury
  – Minimal change in ligament length or physical properties
  – “a sprain”

• II
  – Fiber disruption
  – Side-to-side difference on exam BUT an endpoint

• III
  – Complete avulsion from bone
  – Extensive diffuse injury of all layers
Sideline Treatment

- Do not allow athlete to re-enter competition
- Ice, crutches, elevate
- Next steps
  - Referral to Saturday morning / first available clinic
Knee Examination

• Meniscal Tests
  – Joint line tenderness
  – Thessaly test
  – McMurray Test
  – Squatting & Duck Walk

• Multiple + tests is JUST as predictive of meniscal tear as MRI
Thessaly Test

- Pt stands on affected leg
- Knee bent at 20 degrees
- Examiner holds pt’s hands and rotates pt to both sides 3x
- Positive test: joint line pain
McMurray test for Meniscal injury

• Test Med and Lat meniscus separately

• 3 concurrent maneuvers:
  – Grind it (Rotate tibia AWAY from it)
  – Crunch it (varus or valgus)
  – Full ROM (flex/extend knee)

• Positive: Painful “pop”
McMurray test
Lateral Side Injuries

- FCL (aka LCL)
- PLC
  - Fibular collateral, Popliteus, PFL
Posterolateral corner (PLC)
Dial Test

- Normal
- Abnormal (PLC tear)
FCL

• Rarely isolated
• Medial side impact (varus injury)
• More common as a combined injury
  – Multiligament injury
Lateral Side Exam

• Lateral side opening to varus stress
  - 30 degrees only = isolated
  - 0 and 30 degrees = combined
• Increased ER (aka Dial test) on side of injury
• Neurovascular exam
Knee Dislocation

- Multiligament
- High energy
  - Sports
  - MVA
  - Industrial
- Low energy
  - Morbid obesity
Associated injuries

- Neurovascular 30-50%
- Popliteal artery
  - Posterior dislocation >> Direct transection
  - Anterior dislocation >> Intimal tear/flap
- Peroneal nerve
  - Nerve traction as it courses around fibular neck
- Compartment syndrome
Knee Dislocation

• Beware associated vascular injury!!
• MUST have high index of suspicion
  – Based on mechanism of injury
  – Based on associated injuries
  – Based on initial clinical presentation
• Missed vascular injury >>>> Amputation
  – Pulses
    • Initially present?
    • Return post-reduction?
Revascularization

• 6-8 hr window (max)
• Delayed revascularization
  – Myonecrosis
  – Rhabdomyolysis
  – Hyperkalemia
  – Compartment syndrome
Sideline Treatment

• Do not allow athlete to re-enter competition
• Ice, crutches, elevate
• Next steps
  – Immediate transportation to the ER
Take home points....

• Positive “theater sign”.  **Patellofemoral Syndrome**
• Knee pain with locking.  **Meniscal Injury**
• Twisted planted foot and heard “pop”.  **ACL Injury**
• Knee “came out of socket”.  **Patellar Subluxation**
• Good test for meniscal tears (hint: Disco)  **Thessaly test**
• Lateral knee pain training for marathon.  **ITB Syndrome**
• Anterior knee pain worse with jumping.  **Patellar tendinopathy**
• PFS best treatment:  **Try LOTS of things**
• Knee OA:  **Try LOTS of things: exercise, glucosamine**
  **Viscosupplementation injection, etc.**
Questions???
Cases for Review
Case #1

- 16 y.o. female soccer player presents to clinic 1 week after injury.

- Reports she was cutting while dribbling. Heard a pop in her knee and had pain. Taken from field and couldn’t return to game. Noticed that night knee was swollen.

- Now, 1 week later, almost normal gait. Knee feels much better.
Case #1

Physical exam
- Joint effusion present
- No sag
- No joint line tenderness
- No LCL/MCL laxity
- Negative McMurray/Thessaly
- Positive Lachman

Diagnosis: ACL Injury
Anterior Cruciate Ligament Injury

Clinical symptoms
- 1/3-2/3 report audible pop
- Mechanism of injury
  - Non-contact -- twisting with the foot planted
  - Contact -- valgus stress with twisting
- Immediate swelling (hemarthrosis)
- Usually non-ambulatory after injury
Anterior Cruciate Ligament Injury

- Half occur with meniscal tear; lateral more common with acute
- Can occur with MCL tear
- Rare with LCL or PCL tear
Features that should prompt an x-ray after acute knee injury include:

1. Unable to bear weight
2. Can’t flex >90 degrees
3. Patella TTP
4. Fibular head TTP
5. Age <18 or >55
6. All of the above
5 Ottawa Knee Rules
i.e. When to order a knee xray after acute injury

• Age > 55 or < 18
• Unable to walk
• TTP on PATELLA
• TTP on FIBULAR HEAD
• Unable to flex 90 deg
ACL: Radiographic Findings

- Avulsion of the intercondylar tubercle
- Anterior displacement of the tibia with respect to the femur
- Segond fracture (a thin sliver of bone avulsed from the proximal lateral tibia with the lateral capsular ligament)
Segond Fracture
Anterior Cruciate Ligament Injury

• Management
  – Brace knee first week (immobilizer)
  – Crutches for comfort, ice, advance to toe-touch and wean from crutches as tolerated
  – Work on ROM, edema control, quad strength

• Imaging
  • Initially, plain films
  • MRI if high clinical suspicion, likely refer first
Questions?
Case #2

- 16yo tennis player presents day after match for knee pain
- Remembers painful twist with planted foot during the game, but kept playing
- Swelled up overnight
- Now feels tight, sharp pain with twisting
Case #2

Physical exam
• Effusion
• Joint line tenderness
• Limited knee range of motion
• McMurray and Thessaly tests positive with painful click

Diagnosis: Meniscal Injury
Meniscal Tear

Anatomy

- Avascular inner 2/3, partly vascular outer 1/3
- Minimal innervation
- Held in place by coronary ligaments, painful when torn (meniscotibial ligaments)
- Lateral meniscus less firmly attached, less prone to injury
Meniscal Tear

• Function
  – Lubrication
  – Nutrition of joint
  – Shock absorption
  – Reduce friction
  – Disperse stress / weight
  – Decrease cartilage wear
Meniscal Tear

Vertical
Bucket handle
Displaced Bucket handle
Peripheral Bucket handle
Parrot beak
Flap
Inverted flap
Radial
Meniscal Tear

Clinical symptoms

• Traumatic tears
  – Twisting or hyperflexion injury

• Degenerative tears
  – In older patients, minimal or no trauma

• Insidious swelling (overnight or 2-3 days)

• Mechanical symptoms: locking, catching, popping

• Pain medial or lateral sides of knee, particularly with twisting or squatting
Meniscal Tear

• Management
  – Physical therapy, maximize ROM/strength
  – Non-surgical if no mechanical symptoms
  – Refer for catching, continued effusions, locked knee, symptoms more than 2 weeks, failed NSAIDs/PT
  – Surgery for:
    • Locking/catching
    • Persistent pain greater than 4-6 weeks
Case Knee “came out of socket”

• 16 y.o. male lacrosse player made sharp cut yesterday. Felt knee “come out of socket”. Immediate pain and swelling.
• Went to ER and x-rays negative for fracture.
• One week out can’t fully bend knee due to pain.
Case Knee “came out of socket”

Physical exam
- Patellar apprehension
- Medial patellar tenderness
- Increased patellar mobility

Diagnosis:
Patellar Subluxation
Patellar dislocation/subluxation

Clinical symptoms
• Severe pain
• Sometimes pop
• Occasionally see a deformity, usually lateral dislocation
• Often reduces spontaneously
• Swelling
• Loss of motion
Patellar dislocation/subluxation

Mechanism of injury

• Direct trauma
• Rotation over planted foot (i.e., softball swing)
• Sudden cutting movements
• “Stretched out” tissues from prior injury predispose for recurrence
Patellar dislocation/subluxation

• Management
  – Straight leg immobilization x 1-2 weeks
  – Weight bearing as tolerated
  – Cylinder cast if question compliance
  – MRI if skeletally immature to r/o sleeve fracture (peeling off sleeve of cartilage and periosteum) requiring surgical repair
  – Physical therapy after immobilization to return strength/motion

• Refer to Ortho for fracture, ligament injury, recurrence, swelling/catching symptoms