ATHLETIC KNEE INJURIES

Bradford H. Stiles, M.D., FAAFP

A CASE OF THE “KNEESLES”

DISCLOSURES

• I have no financial disclosures
• I have no finances

ANATOMY

• Not a simple hinged (ginglymus) joint
• 6 degrees of motion
• Structural integrity provided by ligaments & joint capsule (no significant bony stability)
• Very susceptible to injury
• Three independent articulations (compartments)
  • Patellofemoral
  • Medial (medial femoral condyle and medial tibial plateau)
  • Lateral (lateral femoral condyle and lateral tibial plateau)

HISTORY: OVERUSE VS. TRAUMA

• Two types of knee problems
  • Overuse injury
  • Specific traumatic injury
  • Mechanism of injury (MOI) and symptom description and location can often give you the diagnosis
    • Internal vs. external force
    • Timing of symptoms
    • Aggravating factors
HISTORY KEY FACTS
- Onset of symptoms: sudden or gradual
- Type of pain: sharp, dull, “ache”, “stabbing pain”
- Location of pain: anterior, posterior, medial/lateral, general
- Inciting factors and timing of symptoms: constant, intermittent, beginning of activity (start-up pain) or after onset of activity
- Any swelling, and when (immediate, next day, after activities)
- Painful pop/click
- Buckling (giving way) or locking

OVERUSE
- Insidious onset
- Often associated with new activity, change in training routine, new equipment
- Play Sherlock Holmes

PATELLOFEMORAL PAIN SYNDROME
- AKA: PFPS, PFS, retropatellar pain syndrome, “runner’s knee”
  chondromalacia patella (misnomer…actual surgical diagnosis)
- Up to 30% of visits to sports clinics
- Common in teenage athletes
- Biomechanical/misalignment issue; unequal force across patellar facets (medial, lateral, odd)
- Etiology of the pain remains elusive

MECHANICAL ADVANTAGE
- Patella increases mechanical lever arm by 50%
- Engages trochlea of femur at 10-20 degrees
- Compressive forces progressively increase with increasing flexion
  - 0.1 times body weight at 5 degrees of flexion
  - 2.1 times body weight at 30 degrees of flexion
  - 8.0 times body weight with full squat
- Patellar cartilage is thickest in the whole body (5mm)

PREDISPOSING FACTORS
- Quadriceps tightness
- Weak medial stabilizers (VMO, adductors)
- Tight lateral structures (IT band, lateral retinaculum)
- Increased Q angle?
  - Intersection angle between lines from ASIS to center of patella and center of patella to tibial tubercle
HISTORY
• Anterior knee pain
• Usually worse with first few steps; ‘theater sign’
• May have painful anterior click with motion
• Worse with down > up stairs
• Can produce effusion

PHYSICAL EXAM
• Tenderness to palpation on patellar facets
• Positive patellar inhibition (Clarke’s) test
• May or may not have effusion
• May have VMO atrophy
• May have palpable, painful click (a painless click means nothing)
• Look at gait: overpronation is a common problem
• Usually a clinical diagnosis, but x-rays may show patellar misalignment (sunrise or Merchant view); consider dynamic CT

TREATMENT
• Rehab, rehab, rehab; you must “tune-up” the knee
• Patella stabilization program through physical therapy
  • Quadriceps stretching
  • VMO and adductor strengthening
  • Soft tissue mobilization of lateral tissues
  • May use patellofemoral stabilizing brace initially
• Surgery a last resort…and a crap shot

FAT PAD IMPINGEMENT
• Hoffa’s fat pad; cushions patellar tendon
• Inflammation due to pinching of patella
• Stretching is key
• Consider corticosteroid injection
### PATELLAR TENDONITIS

- Common in running, jumping sports (e.g., basketball)
- Repetitive loading → microtears → initial inflammatory response → failed healing response (poor vascular supply) → mucoid degeneration of tendon
- Symptoms: anterior knee pain, increased with loading activities, may have giving way (quad inhibition due to pain)
- PE: tenderness on patellar tendon, may have palpable patellar crepitus, increased pain with resisted knee extension

### PATELLAR TENDONITIS (CONTINUED)

- Imaging studies generally not indicated
- May see calcification on x-ray, tendon thickening and mucoid degeneration on US, MRI
- Early treatment: relative rest, icing, patella tendon strap (Chopat)
- Physical therapy geared towards stretching, soft tissue mobilization (ART)
- Surgical debridement for recalcitrant cases

### ILIOTIBIAL BAND SYNDROME (ITBS)

- Thickened fascial band running from iliac crest past the lateral knee to the anterior lateral tibia (Gerdy’s tubercle)
- Includes the tensor fascia lata
- Repetitive friction across lateral femoral condyle leads to inflammation and bursitis (can also occur at greater trochanter)
- Predisposing factors: tight ITB, genu varum, overpronation, leg length discrepancy
- Training errors: slanted surface (beach, side of road), hills or stair-steppers, worn shoes

### ITBS (CONTINUED)

- PE: tenderness on ITB at lateral femoral condyle (above lateral joint line); painful arc 20°- 40°; positive Ober’s test; gait analysis
- Imaging not indicated
- Early treatment: icing, NSAIDs
- Key treatment: ITB stretching (foam roller)
- May consider corticosteroid injection if not improving

### PES ANSERINE BURSITIS

- Pes anserine consists of sartorius, gracilis, semitendinosus tendon confluence (“goose foot”)
- Bursa protects against medial tibial plateau
- PE: point tender on pes anserine bursa inferior to joint line
- Treatment: similar to ITBS, just directed medially
- Must consider medial tibial plateau stress fracture if not improving
OSGOOD-SCHLATTER’S DISEASE
- Disorder rather than disease
- Apophysitis of the tibial tubercle at insertion of patella tendon
- Disorder of teenagers (associated with adolescent growth spurt)
- May be bilateral (20-30%)
- Localized pain; exacerbated by stairs, partial squat
- PE: point tender on tibial tubercle, may have local edema and warmth
- Treatment: ice, patella tendon strap, stretching (quads, hamstrings, ITB)
- Sinding-Larsen-Johansson Syndrome: similar problem of patella tendon origin on distal patellar pole

PREPATELLAR BURSITIS
- AKA: housemaid’s knee, coal miner’s knee, carpet layer’s knee, nun’s knee
- Repetitive microtrauma usually from kneeling; fall onto knee
- Aseptic (more common) vs. septic
- Red, swollen, warm, tender superficial bursa
- Septic bursitis may have overlying lesion (abrasion), lymphangitic streaking, extremely painful ROM
- Aspirate for fluid analysis, culture if septic bursitis suspected
OSTEOCHONDRITIS DESSICANS

- Knee second most common location
- Lateral aspect of medial femoral condyle
- Avascular necrosis of subchondral bone
- Leads to overlying cartilage degeneration, fragmentation and loose bodies
- Surgical condition

TRAUMATIC KNEE INJURIES

- Single, specific injury
- MOI, if known, helps with diagnosis (value of "game tape")
- Benefit of early, on-the-field exam
- Initial exam may be very limited
  - Stabilize and rule out bad players (fracture, dislocation, etc.)
  - Brace, medications for comfort
  - Re-examine in 7-10 days

PATELLAR DISLOCATION

- MOI usually twisting injury with a strong quadriceps contraction
- May or may not have accompanying blow to the knee
- Almost always dislocates laterally
- Often self reduces with knee extension
- Patient often reports feeling kneecap "pop out", then "pop in" with straightening of the knee
- Usually presents in clinic with large effusion/hemarthrosis

PATELLAR DISLOCATION: TREATMENT

- If large hemarthrosis, consider aspiration for comfort, ROM
- May use knee immobilizer, but encourage early ROM
- Patella stabilizing brace
- Physical therapy
  - Emphasize medial stabilizer strengthening (VMO, adductors)
- Surgery indicated if medial structures (VMO) torn or if patient is a recurrent dislocator
PATELLA FRACTURE

- Usually from direct blow to anterior knee, such as a fall onto a hard surface
- Can be from indirect trauma (violent contraction of quadriceps), but most likely pathologic (e.g., stress fracture going to completion)
- X-rays are diagnostic
- Treat with knee immobilizer and refer to Orthopedic Surgery for ORIF

COLLATERAL LIGAMENT INJURIES

MEDIAL COLLATERAL LIGAMENT (MCL) INJURIES

- MCL restrains valgus stress
- MOI: blow to the lateral knee with foot planted
- Often associated with medial meniscal tear (investing fibers from MCL into MM)
- Graded I-III depending on severity (strain to complete tear)
MCL INJURIES: TREATMENT
• Isolated MCL injuries are treated conservatively
  • MCL is intraarticular; can heal on its own
  • Ligament brace (hinged ROM brace)
  • Early ROM/physical therapy
  • Healing time varies based on grade of tear: 4-12 weeks

LATERAL COLLATERAL LIGAMENT (LCL) INJURIES
• AKA: fibular collateral ligament
  • LCL resists varus stress
  • MOI: blow to medial knee with foot planted
  • LCL is extraarticular, so will not heal on its own
  • Makes up part of the “posterolateral corner”
  • Isolated LCL injuries can be treated conservatively, but should be surgically reconstructed if other ligaments (ACL) are also injured

MENISCUS INJURIES
• Medial and lateral menisci
  • Semilunar (“C” shaped) wedges of fibrocartilage
  • Specific injury vs. degenerative tears
    • Cadaver study revealed a 60% incidence of degenerative meniscal tears at an average patient age of 65 years old
    • Initially thought to be a vestigial structure, but now known to be of extreme importance in joint stability
  • Carries 30-70% of load across the joint
  • Helps keep cams of femoral condyles in proper alignment

MENISCUS INJURIES (CONTINUED)
• Outer rim of meniscus is vascular (“red zone”)
• Majority of meniscus is avascular (“white zone”)
• MCL has investing fibers into the medial meniscus; LCL does not
• Many different types of tear (horizontal, radial, flap, bucket handle, parrot beak)
• MOI: rotational moment through a weight bearing knee
• Symptoms: pain with plant/ twist (cutting sports), often OK with nonimpact in-line activity (bike, elliptical)
• PE: joint line tenderness, effusion (chronic or recurrent), positive McMurray’s and Thessaly’s tests
• MRI test of choice; want to see tear extending onto a free edge
• In athletes, usually require surgical intervention (repair vs. resection)
POSTERIOR CRUCIATE LIGAMENT

- PCL resists posterior translation of the tibia
- "Dashboard" injury: direct blow to the proximal anterior tibia
- Physical exam: posterior sag sign; posterior drawer sign
- Can be treated conservatively if isolated injury
- Surgical reconstruction becoming more favorable, especially if other structures are injured

ACL TEARS

- Very common sports injury
- Women have a 4-10x higher risk than men
- ACL resists anterior translation of tibia on femur
- Contact vs. noncontact injuries (multiple structures involved vs. isolated injury)
- "Unhappy triad" ("O'Donoghue's triad"): ACL, MCL and medial meniscus tears (valgus blow to a planted leg)

ACL INJURIES (CONTINUED)

- PE: positive Lachman’s test and anterior drawer test; often have a large hemarthrosis
- May have "intact ACL" on MRI but have ACL insufficiency
- Usually requires ligament reconstruction (patella tendon, hamstring, cadaver grafts)
- "Pre-hab" important; post-op rehab is key: VMO strengthening
- 9-12 months recovery time
- Graft failure: posterolateral corner injury

POSTEROLATERAL CORNER

- LCL, popliteus muscle and tendon (popliteofibular ligament) and lateral/posterolateral joint capsule
- Provides rotational stability to the knee
- Probably most common reason of ACL graft failure
- Physical exam: positive "dial test"
- Should be surgically corrected prior or at the time of ACL reconstruction
QUESTIONS?