Sports Injuries
What you “Knee’d” to know

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Essentials of Primary Care 2011

Introduction
- Traumatic vs. atraumatic
- Characteristics of pain
- Swelling - internal derangement
- Instability
- Mechanism important

The Knee
- Hinge joint
- Function of ligaments, menisci, muscles
- Needs to be stable

It’s all connected
Acute Hemarthrosis

The BIG THREE

1. ACL
   (almost 50% in children, >70% in adults)
2. Fracture (Patella, tibial plateau, femoral supracondylar, Physcal)
3. Patellar dislocation

More rare
- Tendon Rupture (Quadriceps, Patellar)
- Osteochondritis dessicans
- Unlikely meniscal lesions

Case 1

LOOK 5’ 6”, 145 lbs
- Moderate effusion

FEEL
- Tender over medial joint line in full flexion

MOVE
- ROM 0° to 100°

SPECIAL TESTS
- Lachman and Pivot shift tests positive

WHAT DO YOU WANT TO DO? TAP THE KNEE?

Treatment Case 1

- RICE (Rest, Ice, Compression, Elevation)
- Immobilization – knee immobilizer or posterior splint
- Crutches
- Analgesics
- Physical Therapy – Need ROM back
- Refer to Orthopaedic Surgery
Ligament
Anatomy and Biomechanics

Ultimate Ligament Tension Failure
- ACL: 2200 N (Anterior)
- PCL: 2500 N (Posterior)
- MCL: 4000N (Valgus)
- LCL: 750N (Varus)
- Posteromedial Corner
- Posterolateral Corner

Biomechanical Studies

Forces on the ACL/Graft
- Level Walking = 169 N
- Ascending Stairs = 67 N
- Descending Stairs = 445 N
  - Morrison, Biomech, 1970
- Normal Walking = 400 N
- Sharp Cutting = 1700 N
  - Butler, Clin Orthop, 1985
- Sports = 2000+ N

ACL Tear

Classification
- Partial
- Complete (midsubstance)
- Tibial eminence avulsion fracture

ACL Tear History

Mechanism
- Landing from a jump, pivoting or decelerating suddenly
- Foot fixed, valgus stress
Anterior Cruciate Ligament (ACL) Tear

Symptoms
- Audible pop heard or felt
- Pain and tense swelling in minutes after injury
- Feels unstable (bones shifting or giving way)

ACL physical exam

LOOK
- Effusion (if acute)

FEEL
- “O’Donaghue’s Unhappy Triad” = Medial meniscus tear, MCL injury, ACL tear
- Lateral meniscus tears more common than medial
- Lateral joint line tender - femoral condyle bone bruise

MOVE
- Maybe limited due to effusion or other internal derangement

Special Tests ACL

- Lachman's test – test at 20°
  Sens 81.8%, Spec 96.8%
- Anterior drawer – test at 90°
  Sens 22 - 41%, Spec 97.8%
- Pivot shift
  Sens 35 - 98.4%, Spec 98% *

* - denotes under anesthesia

Special Tests ACL

- Lachman's test – test at 20°
  (Sens 81.8%, Spec 96.8%)
- Anterior drawer – test at 90°
  (Sens 40.9%, Spec 95.2%)
- Pivot shift
  (Sens 81.8%, Spec 98.4%)
**X-ray**
- Usually non-diagnostic
- Can help rule in or out injuries
- Segond fracture – avulsion over lateral tibial plateau

**MRI**
- Sens 94%, Spec 84% for ACL tear
- ACL tear signs
  - Fibers not seen in continuity
  - Edema on T2 films
  - PCL – kinked or Question mark sign

**Diagnosis**
- Often has associated lateral bone bruise
- +/- meniscal tear (Lateral > medial)
- +/- MCL

**ACL Tear Treatment**
**Conservative**
- No reconstruction
  - 1/3 do well, 1/3 go on decide to get surgery, 1/3 do poorly and need surgery
- Physical therapy
  - Hamstring strengthening
  - Proprioceptive training
- Patient should be asymptomatic with ADL’s

**Surgery**
- Reconstruction
- Depends on activity demands
  - Reconstruction allows better return to sports
  - Reduce chance of symptomatic meniscal tear
  - Less giving way symptoms
- Recovery ~ 6 months
Case 2

Who? 26 year old male skier
When? 2 days ago
What? Unable to extend the knee, has large swelling
How? Fell on downhill run, leg twisted
Where? Pain over medial knee

LOOK 5’ 10”, 170 lbs
- Large effusion
FEEL
- Tender over medial joint line
MOVE
- ROM 20° to 70° “Locked knee”
SPECIAL TESTS
- Lachman negative, valgus stress test positive

Urgent Orthopedic Referral
- Fracture
- Patellar Dislocation
- “Locked Joint”
- Tumor
Red Flags

- Locked knee – lacks full extension (compare with other side)
- Unable to extend against gravity – check extensor mechanism (quad tendon, patella, patellar tendon)
- Requires urgent orthopaedic referral

The Locked Knee

- Bucket handle meniscus (usually medial)
- ACL tear/stump
- Effusion
- Loose body/Osteochondritis Dissecans
- Osteoarthritis
- Pseudolocking (usually MCL sprain)

Initial Treatment

- Consider immobilizer or brace
- Crutches
- Begin Physical Therapy
- Analgesia (usually NSAIDs)
- Consider referral to Orthopaedics/Sports Medicine

Medial Collateral Ligament (MCL) Injury

Mechanism
- Valgus stress to partially flexed knee
- Blow to lateral leg

Symptoms
- Pain medially
- May feel unstable with valgus
**Medial Collateral Ligament (MCL) Injury**

*Physical Exam*
- Tender medially over MCL (often proximally)
- May lack ROM “pseudolocking”
- Valgus stress test – test at
  - Sens = 86 - 96 %

Malanga GA, Nadler SF.  *Musculoskeletal Physical Examination.* Mosby, 2006

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**MRI**

- X-ray non-diagnostic (rarely avulsion)
- MRI not usually necessary
- Rule out meniscal tear

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**MCL Injury**

- Tibial Sided tear
- Med. Compartment Opening
- Femoral Sided injury MCL

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**MCL Treatment**

- **Conservative**
  - Analgesia
  - Protected motion +/- hinged brace +/- crutches
  - Early physical therapy

- **Surgery**
  - Rarely needs surgery
How do you tell MCL from meniscal tear?

Meniscus Tear

Mechanism
- Occurs after twisting injury or deep squat
- Patient may not recall specific injury

Symptoms
- Catching
- Medial or lateral knee pain
- Usually posterior aspects of joint line
- Swelling

Special Tests: Meniscus

<table>
<thead>
<tr>
<th>Test</th>
<th>Sensitivity</th>
<th>Specificity</th>
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</thead>
<tbody>
<tr>
<td>Joint line tender</td>
<td>85.5%</td>
<td>29.4%</td>
</tr>
<tr>
<td>Hyperflexion</td>
<td>50%</td>
<td>68.2%</td>
</tr>
<tr>
<td>Extension block</td>
<td>84.7%</td>
<td>43.7%</td>
</tr>
<tr>
<td>McMurray Classic (Med Thud)</td>
<td>28.75%</td>
<td>95.3%</td>
</tr>
<tr>
<td>McMurray Classic (Lat pain)</td>
<td>50%</td>
<td>29%</td>
</tr>
<tr>
<td>Appley (Comp./Dist)</td>
<td>16% / 5%</td>
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Modified McMurray Testing

- Flex hip to 90 degrees
- Flex knee
- Internally or externally rotate lower leg with rotation of knee
- Fully flex the knee with rotations

Courtesy of Keegan Duchicella MD
**Thessaly Test**

- Hold patient’s hands for support
- Patient bends knee to 5° while he/she twists on knee
- Twisting movement will reproduce pain from meniscal injury
- Repeat with 20° knee flexion

**Medial side:** Sens 89%, Spec 97%
**Lateral side:** Sens. 92%; Spec 96%

Karachalios et al. J Bone Joint Surg Am, 2005; 87: 955-962

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**X-ray**

- May show joint space narrowing and early osteoarthritis changes
- Rule out loose bodies

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**MRI**

- MRI for specific exam
- Look for fluid (linear bright signal on T2) into the meniscus

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**Meniscal Tear Treatment**

**Conservative**
- Often if degenerative tear in older patient
- Similar treatment to mild knee osteoarthritis
- Analgesia
- Physical therapy
  - General Leg Strengthening

**Surgery**
- Operate if internal derangement symptoms
- Meniscal repair if possible
Meniscectomy

- Partial meniscectomy preserves some function
- Partial meniscectomy of 15-34% of meniscus increases contact pressures about 350%
- Arthritis proportional to amount of meniscus removed
- 50% or greater reduction in contact area
- Increased load/area = degeneration
  - Fairbank changes:
    - Narrowing
    - Flattening
    - Ridging

Case 3

LOOK 5’10”, 162 lbs
- Mild effusion
FEEL
- Tender over anterior and posterior knee
MOVE
- ROM 0° to 110°
SPECIAL TESTS
- Lachman seems positive, Sag sign positive

Posterior Cruciate Ligament (PCL) Injury

Mechanism
- Fall directly on knee with foot plantarflexed
- “Dashboard injury”

Symptoms
- Pain with activities
- “Disability” > “Instability”

Case 3

Who? 31 year old male soccer player
When? 2 weeks ago
What? Right knee pain diffusely and limp, had mild swelling immediately after
How? Was pushed over and fell directly on the knee with the knee in flexion
Where? Pain over anterior and posterior right knee
Posterior Cruciate Ligament (PCL) Injury

**Physical Exam**
- Sag sign
- Posterior drawer test

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Specificity</th>
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<tbody>
<tr>
<td>79%</td>
<td>100%</td>
</tr>
<tr>
<td>90%</td>
<td>99%</td>
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- X-ray - often non-diagnostic
- MRI is test of choice

PCL Treatment

**Conservative**
- Acute: hinged post-op brace in extension (0-10° flexion)
- Crutches
- Early physical therapy

**Surgery**
- May require surgery if complete Grade 3 tear and symptomatic
- Needs urgent surgery if lateral side is unstable → postero-lateral corner injury

Early and urgent referral!!

Knee Emergencies

1. Neurovascular injury
2. Knee Dislocation
   - Associated with multiple ligament injuries (posterolateral)
   - High risk of popliteal artery injury
   - Needs arteriogram
3. Fractures (open, unstable)
4. Septic Arthritis / Acute Infection

Case 4

- Who? 13 year old female Irish dancer and basketball player
- When? Over 3 years, worse x 1 yr
- What? Bilateral knee pain with running, sitting in class; feels the kneecap “moves”
- How? No injury
- Where? Both kneecaps
Case 4

LOOK
- Height 5’3” Weight 106 lbs
FEEL
- Tender over Right medial patellar facet
MOVE
- ROM 5° to 140° - pain with hyperflexion, squat
SPECIAL TESTS
- Osmond Clarke’s tender

Patellofemoral Pain

- Excessive compressive forces over articulating surfaces of PFP joint
Symptoms
- Anterior knee pain
- Worse with bending (5x body wt), stairs (3x body wt)
Mechanism
- Too loose/hypermobile
- Too tight – XS pressure
- Crepitus under kneecap
- May sublux if loose

Patellofemoral pain

Problems with:
- Bending?
- Stairs?
- Kneeling?

PFP Syndrome

- Tender over facets of patella
- Apprehension sign suggests possible instability
- X-rays may show lateral deviation or tilt
Look (Standing)
- Alignment
- Ankles together
- Ankles apart
- On toes
- Walk
- Red flag – can’t do it
- Hop test

Q-angle

Arch type

Too Loose?
Hyperlaxity
- Associated with subluxation of the patellae
- Medial facet more commonly affected
Too Tight?
- Lateral hyperpressure syndrome
- Tight hamstrings, iliotibial bands, high flexors and quadriceps

Treatment Options
Too Loose/Weak
- Strengthen quads (Vastus Medialis Obliquus), Hip abductors
- Correct alignment (+/-orthotics)
- Support (McConnell Taping, Bracing)

Too Tight
- Stretch hamstring, quadriceps, hip flexor
- Strengthen quads, hip abductors
- Correct alignment (+/-orthotics)

Surgical (RARE)
- Last resort
- Lateral release
- Patellar realignment

One Leg Squat

Modify Risk Factors
Intrinsic Risk Factors
- Growth
- Anatomy
- Muscle/Tendon imbalance
- Illness
- Nutrition
- Conditioning
- Psychology

Extrinsic Risk Factors
- Training
- Technique
- Footwear
- Surface
Extensor problems

DDx - PFP, Quads tendon, OSD, SIJ

Patellar tendinosis
“Jumper’s knee”
- U/S and MRI useful for confirming diagnosis

Iliotibial band friction syndrome

- 10-21% of running overuse injuries
- ITB crosses the lateral femoral epicondyle at 30°
- Associated with “varus” moment at the knee
- Comes on after several minutes of activity
- Pain going downhill or down stairs

Case 5

LOOK 5’ 4”, 180 lbs
- Mildly R antalgic gait, mild R effusion
FEEL
- Tender over M&L patella, Tender M&L joint line tenderness, R > L knee
MOVE
- ROM Right 0° to 115°; Left 0° to 130°
SPECIAL TESTS
- McMurray mildly positive, Ligament tests negative

Who? 66 year old female, works part time
What? Chronic knee pain
When? Two years, already seen by Ortho
How? Pain with walking (5 blocks max), prolonged sitting, getting on and off bus
Where? Right > Left diffuse pain

PMH – HTN, hypothyroid, depression
What to do?

Inject? If so, what?
- Viscosupplementation
- Bent knee approach preferred over lateral approach (on right side)
- 3 cc 1% lidocaine, 2 cc Viscosupplementation
- Expectations: Pain should decrease, but not zero; may do previous level of activities
- Patient having Left done now
- Would agree to repeat if at least 4 months of pain improvement

Cartilage Damage

Outerbridge Classification, 1961
What is Osteoarthritis?

- OA is a disease characterized by cartilage degeneration.
- Cartilage loss and OA symptoms are preceded by damage to the collagen-proteoglycan (PG) matrix.
Arthritis
- Irreversible Articular Cartilage Change
- Cure Not Possible
- Try To Maintain Activity Level

Symptoms
- Pain
- Mechanical
  - Grinding
  - Catching
  - Locking
  - Giving Way
- Swelling

Diagnosis - Radiographs
- Little Use In DJD
- Does Not Show Fairbanks Changes
- New Sequences Show Articular Cartilage

Diagnosis - MRI
Try Conservative Management First

- Lifestyle
- Shoe Wear
- Brace Wear
- Rehabilitation

Conservative Treatment

Unloader Brace

- Off Load Arthritic Compartment
- Pain Relief

Conservative Treatment

Medications

- NSAID / Tylenol
- Analgesics
- Glucosamine / Chondroitin
- Steroid injections
- Viscosupplementation (Hyaluronic Acid injections)

"I hope you're not one of these people who have trouble swallowing pills."

Surgical Treatment

Arthroscopy for OA

- Prospective, Randomized Placebo Controlled Study
- 165 VA Patients
- Placebo vs Lavage vs Debridement had similar Knee Specific Pain Scores at 1 and 2 years follow up
- No difference in outcomes: WOMAC, SF-36 Physical component summary score

High Tibial Osteotomy

Technique Opening Wedge

Results
Good To Excellent
73% - 95% @ 5 yrs
45% - 80% @ 10 yrs
30% – 46% @ 20 yrs

Unicondylar Arthroplasty

Results
87% - 98% @ 10 yrs

Fails due to:
- Excessive Poly Wear
- Progression of OA into Other Compartment

Total Knee Arthroplasty

Replace All Joint Surfaces
Excellent, Reliable Pain Relief
Total Knee Arthroplasty

Meta Analysis – 11 Series
- 3 – 18 yr f/u of 682 Knees
- 93% Good – Excellent
- 11% Complications
- 4% Revision
- 21% Radiolucent Lines
- Survivorship 90 – 95% @ > 10 – 15 yrs

Differential Diagnosis

TRAUMATIC
- Ligament injury
- Internal derangement (meniscus, OA exacerbation)
- Fracture
- Patellar dislocation

ATRAUMATIC
- Patellofemoral pain
- Osteoarthritis
- Pre-patellar bursitis
- Tendinopathies (ITB, Patellar tendinosis)

You may not have seen it, but it has seen you.

- Worry especially if problems greater than 6 months
- No relief or worse with physiotherapy
- Internal derangement symptoms

6th UCSF Primary Care Sports Medicine conference
December 2-3, 2011 in San Francisco

Thank You.