Knee Injuries in Sports Medicine
When to treat?

Bradley S. Raphael M.D.
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Sports Medicine and Shoulder Service
RSM Medical Associates
Team Physician, Syracuse University
RSMMD.COM
Outline

- Anterior Knee pain
  - Osgood-Schlatter
  - Patellofemoral pain
  - Patella instability

- Meniscal Injuries

- ACL Injuries
Anterior Knee Pain

- Osgood-Schlatter Disease
- Patellofemoral Pain
- Patella Instability
Osgood-Schlatter Disease
Osgood–Schlatter Disease

- Traction apophysitis of the tibial tubercle
- Adolescent growth spurt in the young athlete
  - Common cause of sports disability in young active population
- Repetitive tensile stresses acting on immature patellar tendon and tibial tubercle resulting in minor avulsion and attempts at repair
Osgood–Schlatter Disease

Presentation

- Early adolescence
  - Males age 12-15 years
  - Females age 8-12 years
- M > F
- Bilateral 20-30%
- More common in adolescent athletes
  - 21% in athletically active
  - 4.5% in nonathletic
- Kujala et al, AJMS 1985

- Insidious onset pain and swelling
- Intermittent activity related pain
  - Jumping, running, kneeling
Osgood–Schlatter Disease
Physical Examination

- Tenderness, swelling and prominence of tibial tubercle
- Pain reproduced with resisted knee extension
- Diminished flexibility
- Patella alta is seen frequently, especially in rapidly growing children
  - Primary or secondary?
Osgood–Schlatter Disease
Imaging

- Plain radiographs
  - Rule out tibial apophyseal fracture, cyst, tumor, and infection
- Various patterns of tubercle ossification radiographically
  - Early: Irregularity and separation of apophysis
  - Late: Fragmentation
- Soft tissue swelling is universal
Osgood Schlatter - Natural History (Krause, JPO, 1990)

• Examined 69 knees in 50 patients
• Low incidence anterior knee pain and patellar instability
  • 76% report no limitation of activity
  • 60% discomfort with kneeling
• Identified two groups radiographically
  • Type I: soft tissue swelling alone • asymptomatic at review
  • Type II: fragmentation • persistent symptoms as well as XR abnormalities at follow-up
Osgood-Schlatter Disease Treatment

Nonoperative treatment
- Ice, NSAIDs, protective knee padding
- Activity modification if severe
  - Avoid extended immobilization due to quadriceps wasting
- Physical therapy: strengthen and improve flexibility of quadriceps, hamstrings, iliotibial band, and gastrocnemius muscles

Symptoms may persist until apophysis closes
Osgood-Schlatter Disease: Treatment

Surgical Treatment

- Indication: failure of conservative treatment
- Drilling of epiphysis or pegging with bone graft
  - Promote fusion of apophyseal plate
- Longitudinal incisions in patellar tendon
  - Decompress venous hypertension within tendon
- Excision of ununited ossicle and cartilaginous pieces
Patellofemoral Pain
Differential Diagnosis

Knee pain in a skeletally immature individual is hip pain until proven otherwise!
Etiology-History (Big Picture)

Å Work/Sports participation
  • WC
  • Return to play
  • Minnesota Multiphasic Personality Disorder

Å Genetic
  • Joint laxity
  • Cartilage

Å Systemic disease
  • Gout
  • Rheumatoid Arthritis
  • Lyme Disease
  • Fibromyalgia

Fulkerson JAAOS 1994
Anterior Knee Pain
Differential Diagnosis

**HIP PATHOLOGY**
- Legg Calve Perthes
- SCFE

**Osgood-Schlatter Disease**

**Osteochondritis Dessicans (OCD)**

**Rotational Malalignment**

**Plica**

**Hoffa Syndrome**

**Patella / Quad tendinosis**

**PATELLA**
- Chondromalacia
- Patellar Instability
  - Acute
  - Chronic
- Maltracking patella
- Bipartite Patella
- Sinding–Larsen–Johansson disease

**IDIOPATHIC**
Physical Exam

- Maltracking
  - Subluxation
  - Tilt
- Malalignment
  - Foot
  - Knee
  - Hip (Anteversion)
- Muscular Imbalance
  - Distal quadriceps (overuse or atrophy)
  - Tight extensor mechanism/Hamstrings/IT band
- Skin
  - Neuroma from previous surgery
  - RSD (CRPS)

Fulkerson JAAOS 1994
Patellofemoral Biomechanics

Patellofemoral Joint Reaction Forces

- Level Walking: 0.5 x BW
- Stair Climbing: 3.3 x BW
- Rapid Acceleration / Deceleration: 7 ÷ 8 x BW
Anatomically descriptive term originally described by Budinger in 1906 describing gross changes in articular cartilage.

A condition affecting young, healthy individuals who complain of pain arising from the posterior aspect of the patella. Outerbridge and Dunlop, CORR 1975
History

- Often nonspecific and poorly localized pain
  - "grab sign" grasp the entire anterior knee rather than indicating a specific area
- Discomfort following prolonged sitting, stair climbing, and increased activity
- Presence or absence of mechanical symptoms
History: Athletes

Assess the training program

- hills
- running stadium steps
- use of stair climber
- deep squats with or without weights.
Imaging

- Axial radiograph
  - *best view to determine alignment*

- Lateral radiograph
  - Patella rotational alignment

- MRI
  - Cartilage lesions
  - Ligament damage
History of instability:
- Medial facet
- Patella
- Lateral trochlea
Treatment

Å Non-Operative
   • Physical Therapy
   • Stretching
   • Injections
     • Steroid
     • Viscosupplementation
     • PRP?

Å Operative
   • Chondroplasty
   • Lateral release
   • Arthroplasty
   • Realignment

Grelsamer, Current concepts JBJS 2006
What about prevention?
Prospective study

N=282, age 18.6, no knee pain

2 year f/u

Examined

- Patellofemoral pain (6 weeks, retropatellar, activity related)
- Physical fitness tests
- Joint laxity
- Strength
- Psychosocial
Å Results:

- 9% of patients

- Significant variables:
  - Shortened quadriceps (prone)
  - Altered VMO reflex response time (EMG)
  - Decreased explosive strength (vertical jump)
  - Hypermobile patella (manual force)

- Conclusion: These 4 factors play a dominant role in genesis of anterior knee pain
Meta Analysis examining hip and quad weakness as cause of PF

Examined effects of:
- Hip strengthening
- PT restoring balance between VMO and VL
- Open vs. closed chain

Strong evidence (RCT) to support:
- Quad balancing
- Open and closed chain
Conclusion:

- Although no RCT studies support hip strengthening, hip weakness is associated with PFPS.
- Quad retraining associated with good outcomes.
- Both open and closed can reduce pain.
What about invasive treatments?

Å Viscosupplementation
  • Very little clinical literature
Å PRP
  • Recent studies for chondromalacia show encouraging results
Å Lateral release
Å Realignment procedures
Conclusions

- Many different causes of patellofemoral pain
  - Mechanical
  - Systemic
  - Anatomic
- Requires thorough history and examination
- Surgery as LAST resort
Patella Instability
Traumatic Patella Instability

Patient Presentation

- First dislocation is a memorable event
- Patient presentation may be ambiguous
- Most reduce spontaneously
  - Only 20% present dislocated
- Typical history is an acute, traumatic event with a painful, swollen, guarded knee
Acute Patellar Dislocation

History
 Å 2nd - 3rd decade
 Å Twisting non-contact injury
 Å Immediate effusion
 Å Locking catching

Å They do not tell you they dislocated
History

• Listen to patient
  • Insidious onset
    • Malalignment
    • Overuse
  • Injury
    • Instability
    • Blunt trauma
Physical Examination

Â Observation
  ï Skin, muscles, alignment, tracking, Q angle

Â Palpation
  ï Retinaculum, crepitus, apprehension, quadriceps tendon, patellar tendon

Â ROM
  ï Supine, prone, ITB tightness, hip rotators
Acute Patellar Dislocation
Physical Exam

- Effusion
- Tenderness and ecchymosis medially over adductor tubercle
- Apprehension
- Facet tenderness
- R/O ACL, MCL injury
Why did it dislocate?

Osseous abnormalities
- Patella alta
- Trochlear dysplasia

Soft tissue abnormalities
- MPFL pathology
- Weak VMO
- Tight IT band

Trauma

Colvin et al JBJS 2008;90;2751-62
Traumatic Patellar Instability Imaging — Plain Radiographs

- Useful for initial assessment
- Assess patella alta, trochlear dysplasia and PF congruence
- Assess for osteochondral fragments
Acute Patellar Dislocation
MRI
Patella Stability

Soft tissue static stabilizers
Â Medial patellofemoral ligament
Patella Stability

Dynamic stabilization

ï Vastus medialis
Initial Management

Â Aspiration
Â Recommended for moderate to severe effusions
Â Both diagnostic and therapeutic
  ï Increases patient comfort
  ï Presence of fatty globules is indicative of osteochondral fracture
  ï Allows for early quad function

Â Acute patellar dislocation
  ï 2nd most common injury associated with hemarthrosis (1st ACL)

Traumatic Patellar Instability
Nonoperative Treatment

- If dislocated, reduce it!
  - Sedation
  - Knee Extension
  - Gentle medial force to patella
- WBAT in extension and crutches
- Reevaluate patient within 3-5 days of injury
- Persistent pain heralds more significant pathology and warrants further investigation

- Once clinically improved, early mobilization and rehab initiated
  - Quad isometrics
  - SLR
  - Recruit the entire quad into rehab program
- Progression to running and sport-specific activities once symptoms allow
Patella Taping

- Theoretically medialize patella
- Alteration of patellar tracking has not been demonstrated
- Likely enhances proprioceptive feedback
- Placebo effect
Treatment Summary

Å Conservative
  ï Aspiration
  ï Immobilization
  ï Rehabilitation

Å Surgical
  ï Repair
  ï Reconstruction
Questions???
Meniscal Injuries
Anatomy/Function

- Shock Absorber
- 2 C-shaped structures
  - Medial (inside)
  - Lateral (outside)
- Very poor blood supply, limits healing potential
- Functions:
  - Load sharing
  - Distribute knee fluid
  - Secondary restraint for knee stability
Diagnosis of Torn Meniscus

- History usually involves trauma
- Medial or lateral pain, worse with activity, better with rest
- Possible swelling
- Locking / catching
- Giving way
- Consider concomitant ACL injury if a "pop" is felt at the time of injury
Imaging and Evaluation

- **Plain x-rays**: little benefit for meniscal evaluation however help rule out OCD, loose body, fracture, or tumor.

- **MRI**: key imaging procedure
  - Sensitivity and specificity rise with patient’s age
  - Can identify other injuries in the joint

- **Arthroscopy**: provides direct visualization and treatment
Current Treatment Options: 
*observe, repair, or excise*

Meniscal preservation is the goal to minimize articular compromise

Â Criteria for observation:
- Peripheral tears of outer 3-5mm
- <10 mm in length
- Partial thickness
- Patient co-morbidities

Â Physical Therapy to strengthen leg and regain motion
Treatment Options

Repair

- **Indications:**
  - Peripheral tears of outer 3-5mm (red-red)
  - No complex or degenerative component
- Most meniscal tears in young patients are peripheral and longitudinal → opportunity for repair, especially with ACL tears
- Even perfect repair can still fail!!!
Treatment Options
Partial Meniscectomy

- Most tears
- Long-term results unknown, however, studies suggest better than total meniscectomy
- Can increase contact pressures
- Better than a painful “broken” meniscus
- Better to remove shock absorber than to have a broken shock absorber
ACL Tears
ACL Injury

• Prevalence: 1 per 3000 Americans
• Majority: Ages 15-25, high level

• History:
  - Noncontact injury
    » Changing direction, landing from jump
  - “Pop”
  - Hemarthrosis
  - May have difficulty wt bearing/continuing play

Most return to pre-injury activity
What is the ACL?

- ACL (Anterior cruciate ligament)
- When athletes "blow out" their knee, this is the most common ligament injured
- Not normally stressed during day to day activities
- Crucial for cutting activities performed during many sports.
Anatomy

Composition:
- Collagen
  - Type I (90%)
  - Type III (10%)
- Elastin
  - Random coil formation
  - Tensile resistance, crimp pattern
- Proteoglycans
  - Viscoelastic properties

Two bundles: AM, PL
Average length: 38 mm
Average width: 11 mm
Biomechanics and Function

- Primary stabilizer
  - Anterior translation of tibia (90%)
- Secondary restraint
  - Tibial rotation, V/V stress in extension
- Young ACL:
  - Ultimate load: 1,725 +/- 270 N
  - Stiffness: 242 +/- 28 N/mm
- Important for knee stability
  - Athletes participating in sports
  - Jumping, cutting, and deceleration
ACL injuries occur when bones of the leg twist in opposite directions under full body weight.
CLINICAL SIGNS & SYMPTOMS

Physical Exam:
- Loss of motion
  - Effusion
  - Pain
  - Muscle spasm
  - ACL stump impingement
  - Meniscal pathology
**Imaging**

**X-ray:**
- Not as helpful
- Avulsion fx’s
- Segond fracture

**MRI:**
- Overall accuracy 95%
- Increased signal in ACL
- Irregular contour, loss of tautness
- 60% have accompanying “bone bruise”
- Assess for other lesions
  - Meniscal, Ligamentous, Chondral
TREATMENT OPTIONS

Operative vs. Nonoperative intervention

Consider:

- Presence or absence of other lesions
- Patient age and activity level
- Degree of instability, functional disability
- Potential risk of future meniscal damage
- Type of sports in which patient wishes to participate
- Ability to comply with operative rehabilitation
NONOPERATIVE TREATMENT

- Splinting, crutches for comfort acutely
- Early active ROM
- Strengthening using closed chain WB exercises
  - HS, quad strength to w/in 90% contralateral limb
- Avoid high-risk activities to prevent recurrent injury
- Role of functional knee bracing is controversial
Why do we fix?

• Instability
• Need to get back to high level sport/activity
• Protect the meniscus (shock absorber) and articular cartilage (smooth bone coating) from future damage
ACL Graft Options

- Autograft (own tissue)
  - Hamstring
  - Patella Tendon
- Allografts (Cadaver tissue)
Who's At Risk?

- Soccer
- Basketball
- Football
- Lacrosse
- Volleyball
- Skiers
Gender Specific Differences

- Females up to 2-8 times higher risk of ACL tear
Female ACL Injury Rate

- NCAA Soccer: 2.4 X higher
- Basketball: 4-5 X higher
- Volleyball: 4 X higher
THEORIES

-- ANATOMIC DIFFERENCES
   Pelvis Width, Q Angle, Size of ACL
   Size of Intercondylar Notch

-- HORMONAL DIFFERENCES
   Estrogen + Progesterone Receptors

-- BIOMECHANICAL DIFFERENCES
   Static and Dynamic Stabilizers
What do we do differently during ACL surgery in 2014?

- Restore anatomy
- Follow biological principles
Are we giving you a stronger ACL than you had before?

No, in the best case scenario we are simply restoring your native ACL anatomically, biomechanically, and functionally.
Consequences of ACL Injury

Average Cost surgical treatment rehabilitation per Athlete = $17,000
Loss of season
Academic performance
Scholarship funding
Mental health
Arthritis
Can we stop ACL injuries?

No, but we can minimize the great number of injuries.

Bracing
Prevention programs
Functional Bracing

Â ACL Deficient knee
Â Conservative Treatment
   ţ low-demand patients
   ţ Poor surgical candidates
Â Reduction in anterior translation
Â Limitation in reduction of pathologic pivot
Â *** Different effectiveness in WB compared to NWB
Â 2/3 of pts attempting conservative tx opt for ACL-R
ACL INJURY PREVENTION PROGRAM

• WARM UP
• STRETCHING
• STRENGTHENING
• PLYOMETRICS
• AGILITY DRILLS
• COOL DOWN
Conclusions

• There is evidence that neuromuscular training decreases potential biomechanical risk factors for injury and decreases injury incidence in athletes.
• Train athlete to put less force on ACL
• Many current studies analyzing effectiveness of ACL prevention programs
Questions?
Thank You

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