

Mini Medical School for the Public

WINTER 2014 – Tuesday Course Series
SPORTS MEDICINE: EXPERT TREATMENTS FOR OPTIMUM ACTIVITY

Date: Tuesday, March 11, 2014, 7:00 pm – 8:30 pm

Topic: COMMON KNEE INJURIES: “OH, MY ACHING KNEE”

Speaker:

**Christina Allen, MD, Professor, UCSF Department of Orthopaedic, Surgery,
Division of Sports Medicine**

Dr. Christina Allen specializes in the treatment of knee and shoulder injuries, especially those of women athletes. An avid soccer enthusiast, she is an expert in treating anterior cruciate ligament (ACL) injuries and shoulder athletic injuries. Dr. Allen is the Team Physician for the USA Taekwondo National Team and has traveled with the team to China, Azerbaijan, and Mexico for international and Olympic qualification competitions. Most recently, Dr. Allen has served as a Team Physician at the 2011 Pan American Games for Judo, Wrestling, and Taekwondo. Dr. Allen was also team physician for the USA Taekwondo National Team and a member of the US Olympic Team at the 2012 Olympic Games in London. She is also an Orthopaedic Team physician for the United States Soccer National teams and has traveled with teams to Brazil, Canada, Japan, Mexico, Germany, and the Netherlands. She traveled with the US Soccer team to Russia in August of 2006 for the FIFA U-20 Women's World Cup, and with the US Women's National Team to China in January 2008 for the Four Nations Tournament. She is also an Orthopaedic Team Physician for Cal athletics at the University of California at Berkeley.

Allen earned a bachelor's degree in biomedical engineering at Duke University and was chief of biomedical engineering at the Veterans Affairs medical centers in Philadelphia and San Francisco before attending the UCLA School of Medicine.

Mini Medical School for the Public

Bibliography:

1. David J. Magee "Orthopaedic Physical Assessment" 5th edition, Saunders Elsevier Publishing, St Louis Missouri, 2008

2) The rational clinical examination. Does this patient have a torn meniscus or ligament of the knee? Value of the physical examination.

Solomon DH, Simel DL, Bates DW, Katz JN, Schaffer JL. JAMA. 2001 Oct 3; 286(13):1610-20

3) Understanding the different physical examination tests for suspected meniscal tears. *Shrier I, Boudier-Revéret M, Fahmy K. Curr Sports Med Rep. 2010 Sep-Oct; 9(5):284-9.*

4) *Diagnostic accuracy of a new clinical test (the Thessaly test) for early detection of meniscal tears.*

Karachalios T, Hantes M, Zibis AH, Zachos V, Karantanas AH, Malizos KN. J Bone Joint Surg Am. 2005 May; 87(5):955-62.

Short class description:

This course will discuss the causes, diagnosis, and possible treatment options for different types of traumatic knee injuries. Injuries may range from meniscus tears and ligament injuries, to cartilage and tendon injuries.

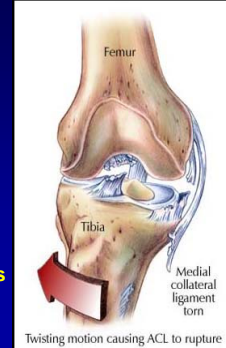
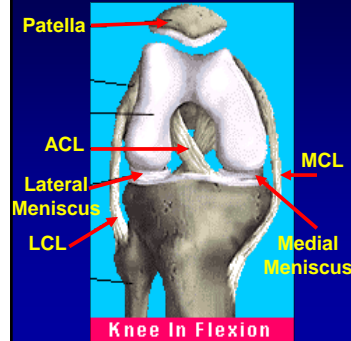
Common Knee Injuries: "Oh, My Aching Knee"



Christina R. Allen, MD
Clinical Professor
UCSF Sports Medicine



Knee Anatomy 101



Common Knee Injuries/Problems

- Patellar maltracking/lateral tilt
- Quadriceps and patellar tendinopathy
- Hamstring injuries
- Bursitis
- ITB friction syndrome
- Meniscus tears
- Ligament Injuries
- Patella instability
- Tendon injuries
- Chondral injuries

History- 95% of the Diagnosis



- What, How, When did the injury happen?
- Is the injury acute or chronic?
- Where does it hurt?
- Did you hear/feel a "pop"?
- Swelling? If so, immediate or delayed?
- Locking, or inability to go through a FROM?
- What activities make the symptoms worse/better?

Traumatic Knee Injuries/Problems



- Meniscus tears
- Ligament injuries
- Patella dislocation
- Chondral injuries
- Tendon injuries

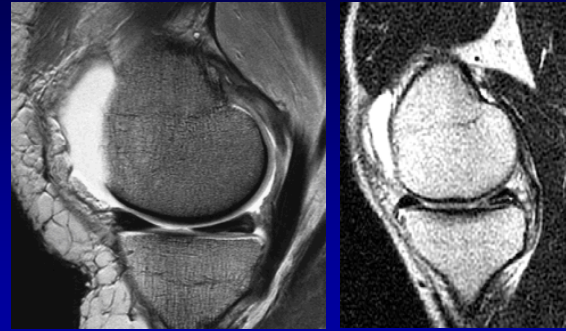
CASE 1

- A 35 year-old recreational basketball player makes a rapid pivot on his fixed leg and feels a tearing sensation in his knee. He tries to continue playing but has a moderate amount of discomfort in his knee along the medial (inner) joint line. His knee swells a moderate amount over the next few days. He notes pain along the joint line with squatting and climbing up and down stairs. The most likely diagnosis is:
 - a Meniscus tear
 - b Patellar tendon rupture
 - c Chondromalacia patella/patella maltracking
 - d Anterior Cruciate Ligament Tear

Meniscal Tears

- Mechanisms:
- Rotation of the femur against a fixed tibia during flexion and extension (twisting injury)
- History of twisting, squatting, or cutting
- Clinical signs:
- Joint line pain, giving way, clicking, and effusions. Locking of the joint in fixed flexion may occur after displacement of a meniscal fragment

Meniscal Injury - MRI

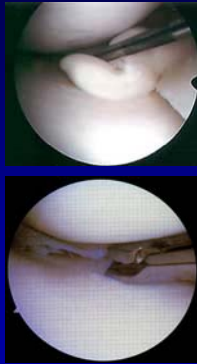


Normal Meniscus

Posterior Horn Tear

Meniscal Tear Treatment

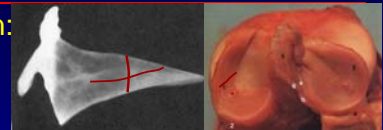
- Treatment based on mechanical symptoms of patient (PT)
- If meniscal tear disrupts mechanics of knee and patient does not respond to physical therapy, surgery is indicated
- Surgical options: Debridement (remove as little as possible) vs Repair



Meniscus tears- Classification

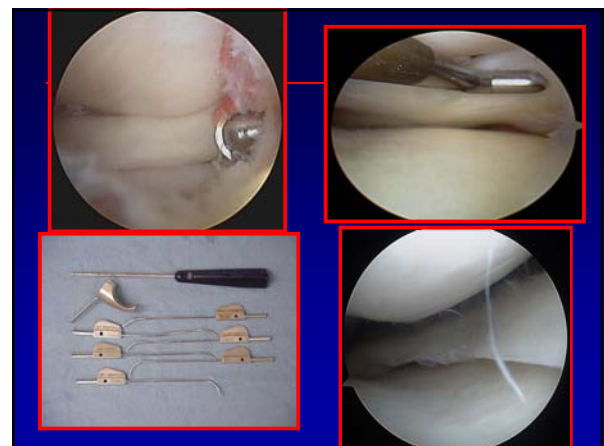
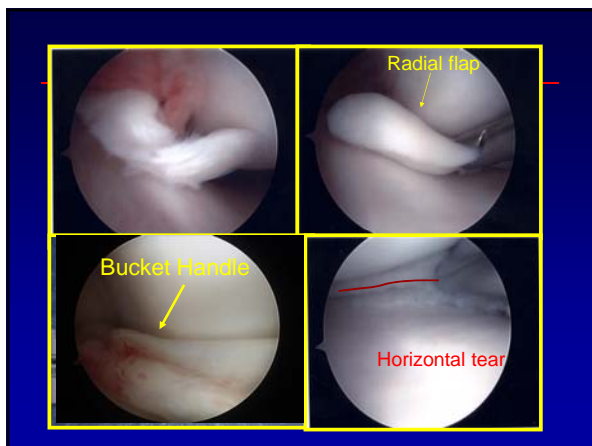
Tear Pattern:

- Vertical
- Horizontal
- Radial
- Combined



Vascularity:

- peripheral
- red white
- white-white



CASE 2

A 20 year-old soccer player attempts to avoid an oncoming defender by making a rapid cut and change of direction. As she pivots to change direction, she hears a loud pop in her knee. She tries to continue playing but has a moderate amount of discomfort in her knee, and her knee "gives out" on her the next time she tries to make a rapid change in direction. Her knee swells a great deal in the next few hours. The most likely diagnosis is:

- a Meniscus tear
- b Patellar tendon rupture
- c Chondromalacia patella/patella maltracking
- d Anterior Cruciate Ligament Tear

ACL Injury



ACL Injury

- Mechanisms: Contact vs. Non-contact
- #1: Forced valgus in external rotation: causes disruption of the MCL and medial supporting structures (clipping injury)
- #2: Hyperextension, associated with a meniscus tear (volleyball, gymnastics, basketball)
- #3: A sudden deceleration to change direction can also produce an anterior drawer force on the proximal tibia from forceful quadriceps contraction (football players, basketball)

ACL Injury: Non-Contact



ACL Injury on MRI



Normal ACL

Torn ACL

Injury Considerations

- Pain
- Effusion
- Range of motion
- Muscle function
- Other injured structures (ligaments, Meniscus)



ACL Treatment after injury

- Modalities to decrease pain and swelling
- Resolve the presence of a knee extensor lag prior to surgery
- Establish 0-120 degrees of ROM



Decision-Making: Surgery?

YES

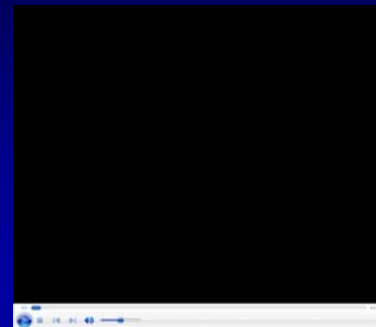
- "High Demand" patients
- Job requirements
- Meniscus tears, other ligaments injured
- Instability with ADL's

NO/Wait?

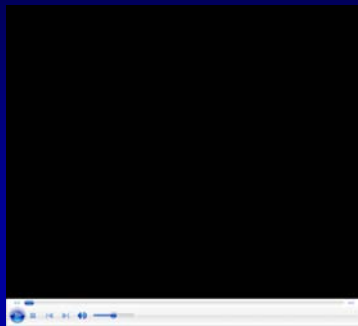
- Triathlon Sports
- "Copers?"
- Open growth plates



Exam under anesthesia- Lachman's

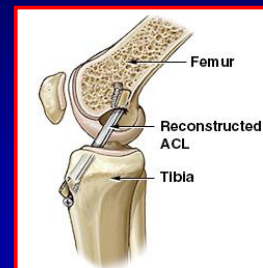
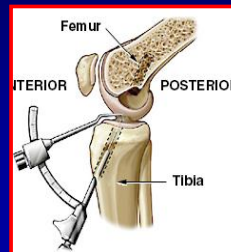


Exam under anesthesia- Pivot Shift



ACL Reconstruction

- Graft passed through tunnels drilled in the tibia and femur



ACL Surgery

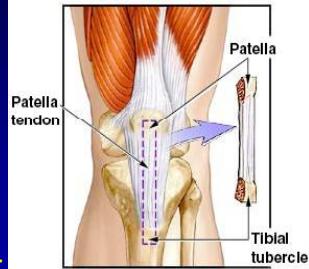
Graft Options

Autograft

- Patellar tendon
- Hamstrings
- Quad tendon

Allograft

- Patellar tendon
- Achilles tendon
- Hamstrings
- Tibialis Posterior



Considerations for Graft Selection

- 1) Strength of Graft
- 2) Graft Cross-sectional area
- 3) Strength of fixation
- 4) Biological Properties
- 5) Patient "toughness"
- 6) Vocation/Sport
- 7) Hx of PF problems
- 8) MCL injury



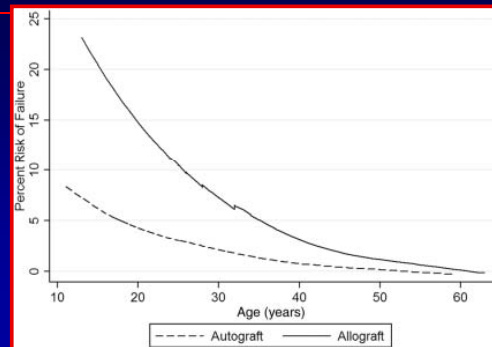
A Word About...

Allografts

- Radiation of >3 Mrads required to kill HIV
 - Affects structural and mechanical properties
- Freezing destroys cells
 - Doesn't adversely affect grafts- except bone may be softer, need to compress
- Delayed Incorporation in Animal Studies
 - Loss of cellular DNA by 4 weeks
 - Similar process, just delayed
 - Should we slow rehab??



Graft Failure rate by age and graft type



Kaeding 2011

CASE 3

- A 21 year old football linebacker is hit on the outside of his leg at the level of the knee by an opposing player. He feels his knee collapse inward at the moment of impact, and a tearing sensation on the inner part of his knee. He is assisted to the sideline by the trainer and is unable to return to the game. His knee swells a mild amount after the injury and mostly over the inner part of his knee/thigh
- The most likely diagnosis is:
 - a Patellar tendon rupture
 - b Medial Collateral Ligament tear
 - c Bursitis
 - d Patella dislocation

MCL Injury



MCL Injury

- Mechanisms:
- Valgus force applied to the flexed knee
- Occasionally caused by forced ER of tibia
- Ruptures or sprains frequently involve attachment to the femur side
- May be associated with tears of the ACL and the medial meniscus
- A contusion/ fx due to impact of the lateral femoral condyle or lateral tibial plateau is common (bone bruise with lateral pain)

MCL Instability



MCL Injury- Treatment

- Generally non-operative
- Hinged Knee Brace +/- crutches
- Early range of motion, physical therapy
- Time away from sports and length of bracing depends on initial degree of injury

CASE 4

- An 18 year old female gymnast turns on a planted foot while performing a tumbling routine. She immediately feels a pop in her knee and has excruciating pain. Her leg “gives out” on her and she falls to the mat. As she attempts to straighten her knee out, she notes a deformity of the knee that corrects itself as the knee is straightened out. Her ligament exam is stable immediately after the injury. The most likely diagnosis is:
 - a Meniscus tear
 - b Anterior Cruciate Ligament tear
 - c Hamstring strain
 - d Patellar dislocation

Patella Dislocation



Patellofemoral Instability

- Mechanism:
- Femoral internal rotation on a fixed, externally rotated tibia
 - Often a twisting injury
 - 38% during athletics (ER + valgus)
- Direct blow to knee
- Acute hemarthrosis
- Young females > males

Patellar Apprehension Sign



Patellofemoral Instability

Management - Non-operative

- Rehabilitation -VMO strengthening
hamstring stretching
- Patellar stabilization braces
- McConnell Taping
- ? Return to Play: 1 - 3 months?... not likely



Patellofemoral Instability

Management - Operative

“Acute” Surgery: Not the Standard of Care

CONTROVERSIAL- Young athlete with dislocation by indirect mechanism.

YES- “First time dislocator” with presence of displaced osteochondral fracture

Patellofemoral Instability

Management - Non-operative

Outcomes

- Despite therapy, variable recurrence rates reported (30-50%)

Hawkins AJSM, 1986

- ? efficacy of taping / bracing

Kowall et al. AJSM, 1996

Patellofemoral Instability

Recurrent Instability-Operative Management



Lateral Release-arthroscopic



Lateral Release-open



Medial Reefing or Reconstruction with graft

Patellofemoral Instability

Recurrent Instability-Operative Management

Distal Realignment

- Tibial tubercle medialization +/- distal transfer
- Changes Q-angle
- Can correct Patella alta with distalizing tubercle, but may increase pain!!!



Anteromedialization-Fulkerson



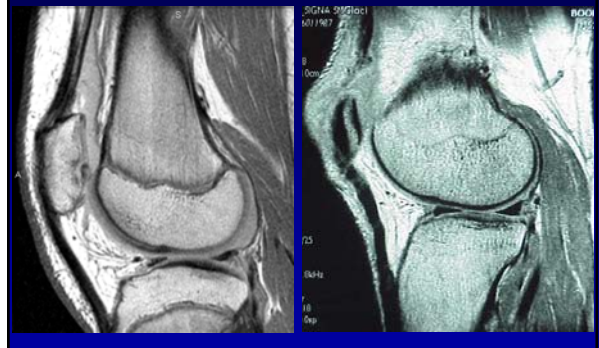
CASE 5

- A 55 year old heavy-set male is walking down the stairs when he has a miss-step. As he attempts to catch himself to prevent falling down the stairs, he feels a painful tearing sensation in his knee and his knee collapses underneath him. He presents for evaluation with significant swelling in the front of his knee, difficulty with performing a straight leg raise, and patella baja (kneecap is lower) is noted. The most likely diagnosis is:
 - Meniscus tear
 - Anterior Cruciate Ligament tear
 - Patellar tendon rupture
 - Quadriceps tendon rupture

Quadriceps Rupture

- Mechanisms:**
- Indirect Trauma: forced/eccentric muscle contraction with foot planted and knee flexed
- Typically patients older than 40 years
- Young athlete: forced mm contraction/direct trauma
- 3X more common than Patella tendon ruptures
- Bilateral ruptures can occur
- Normal tendons do not rupture under stress loading
- Midsubstance tears : intrinsic pathology

Quadriceps Rupture



Quadriceps Rupture



Extension Lag

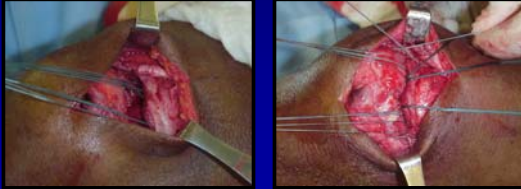
Quadriceps Rupture



Palpable Quad defect near patellar insertion, patella can be displaced inferiorly

Quadriceps rupture

- Goal is to restore strength, gait
- Surgical repair



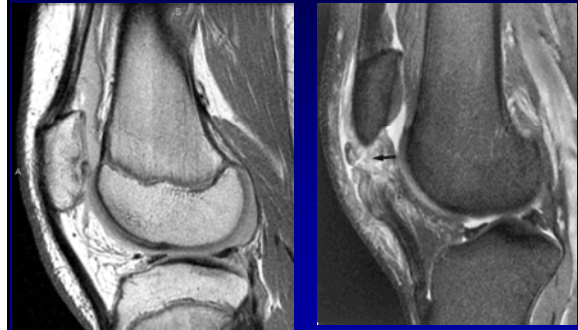
CASE 6

- A 40 year old male recreational basketball player is driving to the basket during a pick-up game. As he lands after doing a layup, he feels a painful pop in his knee and his knee collapses underneath him. He presents for evaluation with significant swelling in the front of his knee, difficulty with performing a straight leg raise, and patella alta (kneecap is higher) is noted. The most likely diagnosis is:
 - a Meniscus tear
 - b Anterior Cruciate Ligament tear
 - c Patellar tendon rupture
 - d Quadriceps tendon rupture

Patellar Tendon Rupture

- Mechanisms:
- Direct Trauma most common cause
- Typically patients younger than 40 years
- Bilateral ruptures can occur
- Avulsion injuries from the inferior pole of the patella > tibial tubercle
- Midsubstance ruptures unusual
- Normal tendons do not rupture under stress loading (often a history of pain)

Patellar Tendon Rupture



Patellar Tendon Rupture

- Extensor lag on straight leg raise
- Tenderness at inferior pole of patella
- Patella can be displaced superiorly or is sitting high
- Swelling, bruising



Patellar Tendon Rupture

- Goal is to restore function and strength
- Acute surgical repair

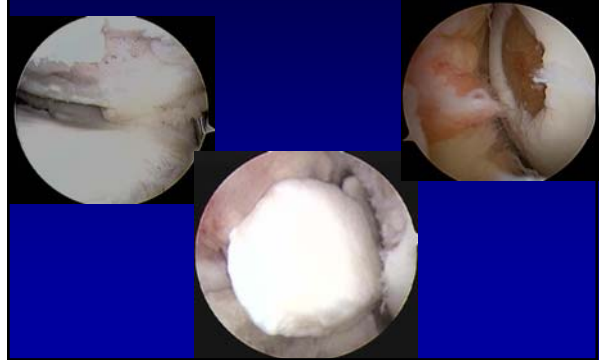


Chondral/Osteochondral Defects

- May be due to direct trauma or blow to knee
- Can also be caused by progressive wear and extreme overuse
- Cartilage flap may be loose, causing pain and catching symptoms, swelling
- Surgery may be needed to treat pain and mechanical symptoms



Chondral Defects



Microfracture



Microfracture or "Steadman Drilling"

- Microfracture of trochlea and patella not very effective due to bone and cartilage architecture and loading characteristics



Autologous Chondrocyte Implantation (Cartilage Cell Repair) "Carticel"

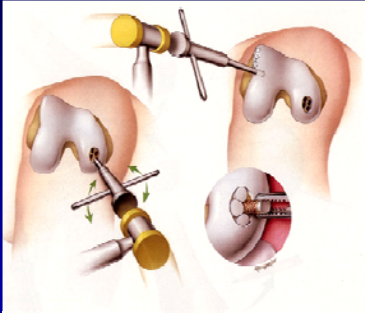


ACI

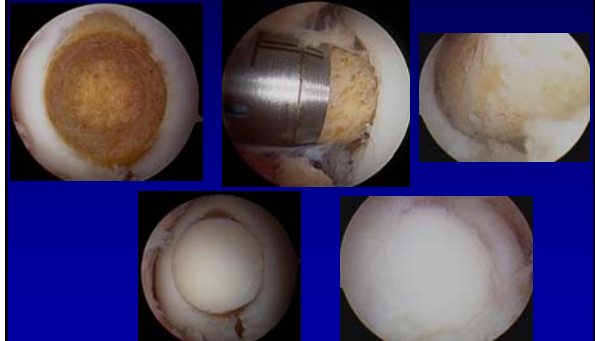
- ACI of patella or trochlea not very effective due to bone cartilage architecture and loading characteristics



Osteochondral Plugs



Osteochondral Autograft/Mosaicplasty



Mosaicplasty/ OATS

- Recent trend toward OATS/Mosaicplasty
- Better for small defects of Trochlea
- Patella has mismatch of donor and recipient cartilage height



IN SUMMARY....



When you should be seen in a week:

- Knee Dislocation (ligaments)
- ACL injuries
- Ligament Injuries
- Locked Knee (can't straighten knee)
- Fractures
- Tendon Ruptures (patellar tendon, quadriceps tendon)
- Patella dislocation (kneecap popped out)
- Meniscus tears in young patients, especially if the knee is locked
- Note that the common THEME in all these injuries is a sudden traumatic injury with significant swelling.

What could probably get better in a week with rest, stretching, nsaid:

- Meniscus tears in older patients (>50)- likely to be arthritis with a degenerative meniscus tear
- Bilateral knee pain (usually patellofemoral pain or arthritis)
- Patellofemoral pain
- Tendinitis (patellar tendon, Hamstring, Iliotibial Band)
- Note that the common THEME in all these injuries is usually a gradual onset, minimal swelling, often due to overuse



Contact Information

Christina R. Allen, MD
UCSF Sports Medicine
415.885.3832

www.ucsf.edu/orthopaedics/faculty/allen.html

Additional References

AAOS Patient Information Website
"Your Orthopaedic Connection"
<http://orthoinfo.aaos.org>

Emedicine Online: Sports Medicine
<http://www.emedicine.com/sports>