Sports Injuries of the Knee

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No Disclosures
Sports Injuries of the Knee

- Cruciate Ligaments
- Menisci
- Posterolateral Corner
- MCL

- Extensor Mechanism
  - Chronic Stress
  - Acute Tibial Avulsion
- Physeal Fractures
- Patella
  - Maltracking/Dislocation
  - Normal Variants
- OCD vs Normal Variant
ACL tears

- **Mechanism of injury**
  - Most common – Pivot shift
    - Valgus and axial force on flexed knee
    - Varus force with internal rotation of the tibia can lead to ACL tear with Segond fracture at lateral tibia
    - Hyperextension, with ACL and sometimes PCL or posterolateral corner injuries.
  - All may be associated with injury to collateral ligaments, menisci, articular cartilage
ACL tears

Pediatric Considerations

• Girls > boys
  – joint laxity
  – hormonal factors
  – limb alignment
  – configuration of intercondylar notch
  – earlier physeal fusion.

• Can see bony contusion pattern of tibial translation w/o ACL tear, due to increased ligamentous laxity (28%).
ACL tears

• Location/Type
  – Avulsion (Proximal/Distal)
  – Intrasubstance
ACL avulsion

- Kids - forced flexion of the knee with internal rotation of the tibia
- Adults - severe hyperextension. Associated with MCL and PCL tears.
ACL avulsion

- Meyers and McKeever classification
  - I – minimally displaced fragment
    - Cast immobilization
  - II – anterior elevation of fracture fragment
  - III – complete separation of fragment from tibia
  - IV – III + rotational component or comminution
ACL avulsion

6 yo male. Fall from bike with knee pain
ACL avulsion
14 yo male with skiing injury. Went off a small jump, right leg struck the ground, twisted relatively violently and his ski stayed in place.
ACL avulsion

[Images of MRI scans of knee joints]
ACL avulsion

Status post arthroscopy and suture fixation
ACL tears

- Location/Type
  - Avulsion (Proximal/Distal)
  - Intrasubstance

- MRI appearance
  - Focal tear/discontinuity
  - Diffuse or focal abnormal signal
  - Mass like appearance
  - Abnormal orientation (>15 degrees between roof of intercondylar notch and ACL or less than 45 degrees between distal ACL and tibia)
  - Non-visualization (chronic)
ACL tears

• Location/Type
  – Avulsion (Proximal/Distal)
  – Intrasubstance

• Stable
  – Normal or partial tear with no instability/laxity on exam

• Unstable
  – Partial or complete tear with instability/laxity on exam.
17 yo female. During a scrimmage in soccer game, she jumped up to head a ball, planted and turned on her right knee, with a valgus-type injury.
ACL repair – Physeal sparing

Physeal Sparing Reconstruction of the Anterior Cruciate Ligament in Skeletally Immature Prepubescent Children and Adolescents

Surgical Technique
Physeal sparing ACL repair

13 yo male who jumped on knee and twisted it playing basketball
Physeal sparing ACL repair
Physeal sparing ACL repair

9 months later, landed with straight knee – not wearing brace...
PCL tears

- Relatively rare
- 45% 2/2 to road traffic accidents
  - Dashboard injury - anterior blow to proximal tibia
- 40% from athletic trauma
  - Fall on flexed knee
  - Hyperflexion (may be isolated to anterolateral, with PMB intact, and sparing of posterior capsule)
  - Hyperextension (less common) – more associated with ACL and PLC or PMC injuries
PCL avulsion

11 yo male who fell on flexed knee
13 yo male with hyperflexion injury to left knee while going down stairs
PCL avulsion

13 yo male with hyperflexion injury to left knee going down stairs
PCL tear

16 yo football player with helmet to the knee
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Pitfalls in menisci

- Anterior root attachment of lateral meniscus with striated appearance
- Way anterior attachment of the med meniscus, looking like extrusion
- Meniscal flounce
Pitfalls in menisci

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Mensical tears

• Criteria
  – Change in shape or size of meniscus
  – Signal contacts articular surface
    • Grade 1 – Uniform hypointense signal
    • Grade 2 – Hyperintense signal does not extend to meniscal surface
      – Especially important in pediatrics (vs. vascularity/degeneration)
    • Grade 3 – Hyperintense signal extends to meniscal surface
      – Exception – horizontal tear
Meniscal signal

Grade 2  Grade 3?

12 yo girl  14 yo girl
Mensical tears

- Longitudinal Vertical  
  - (Bucket handle)
- Horizontal
- Radial
- Flap
- Root
- Complex
Longitudinal Tear
Longitudinal Tear

- Associated with ACL injury
- ↑ vascularity at outer 10-25% of meniscus → amenable to healing/repair.
Bucket Handle Tear
Horizontal Tear
Radial Tear
Flap Tear
Meniscal tears

• Longitudinal Vertical
  – (Bucket handle)
• Horizontal
• Radial
• Flap
• Root
• Complex
Root Tear

13 yo female twisted knee running to first base
Root Tear

15 yo female twisted knee coming down from basketball hoop
Meniscal tears

- Longitudinal Vertical
  - (Bucket handle)
- Horizontal
- Radial
- Flap
- Root
- Complex
Discoid Meniscus

- Lateral
- Greater than 15 mm TR dimension
  - 3 slice rule depends on slice thickness.....
- Asymptomatic \(\rightarrow\) to pain and locking
- Increased risk of degeneration and tearing
Discoid Meniscus
Discoid Meniscus
Discoid Meniscus
Discoid Bucket Handle Tear

9 yo male with intermittent catching and locking
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Posterolateral Corner

- Frequently associated with PCL tears
- Secondary to:
  - blow to the anteromedial proximal tibia, directed posterolaterally w/knee in extension
  - noncontact external rotation with hyperextension
- Failure to dx → chronic instability and cruciate graft failure.
Posterolateral Corner

- **Superficial layer**
  - Iliotibial band
  - Biceps femoris
- **Middle Layer**
  - Quadriceps retinaculum, patellofemoral ligaments, patellomeniscal ligament
- **Deep Layer**
  - Lateral joint capsule/meniscal attachments
  - Popliteus/popliteofibular ligament.
  - Mid third lateral capsular ligament (Segond)
  - Coronary, fabellofibular, fibular collateral, and arcuate ligaments
Biceps Femoris/FCL tear

15 yo male with right knee hyperextension injury while playing football
Proximal avulsion
Proximal avulsion
Proximal avulsion
Popliteus tear

10 yo male s/p twist and fall
Arcuate ligament tear
Arcuate ligament tear...& ACL

ACL tear

Popliteus strain
Posterolateral Corner

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Segond Fracture

- Associated with ACL and meniscal tear (also with avulsion of fibular attachment of long head of biceps femoris and fibular collateral ligament)
- Mechanism is internal rotation of the knee and varus stress
- Mid third lateral capsular ligament
  - (? ITB and anterior oblique band of FCL)
Posterolateral Corner

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[Image of knee anatomy with labels: BFM, ITT, FCL, LCL, AOB, ITT]
Posterolateral Corner

- Superficial layer
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  - Mid third lateral capsular ligament (Segond)
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Second Fracture
Segond Fracture
17 yo male football player with knee dislocation
17 yo male football player with knee dislocation
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Medial Collateral Ligament

- Tears with:
  - Valgus stress (clipping injury in football or hockey)
  - Pure rotational force (skiing)
  - Combo valgus and rotation → MCL, ACL, menisci.

- Grade 1 - normal appearing ligament with mild adjacent edema
- Grade 2 – moderate to high grade partial tear with edema and thickened or partially disrupted ligament.
- Grade 3 – Complete tear
Grade 1 MCL injury
MCL (ACL and PCL) tear
Tear of Deep Layer (meniscofemoral)
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Chronic Stress Injuries of Extensor Mechanism

- Osgood Schlatter
- Sinding Larsen
- Johansson (vs patellar sleeve fracture)
Chronic Stress Injuries of Extensor Mechanism

- Osgood Schlatter
- Sinding Larsen Johansson (vs patellar sleeve fracture)
Chronic Stress Injuries of Extensor Mechanism

- Osgood Schlatter
- Sinding Larsen Johansson (vs patellar sleeve fracture)
Chronic Stress Injuries of Extensor Mechanism

- Osgood Schlatter
- Sinding Larsen
  Johansson (vs patellar sleeve fracture)
SLJ vs patellar sleeve fracture

9 year old female gymnast

7 months earlier
Tibial Tubercle Avulsion

- Powerful contraction of knee extensors (take off from jump)
- Rapid passive flexion of knee with contracted quad (land from jump, or fall from height)
- Active adolescent males
- Occurs as the growth plate fuses.
Tibial Tubercle Avulsion

13 yo male skiier
Type 3B Tibial Tubercle Fracture

LEFT

RIGHT
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Physeal Injuries

- Physeal fractures can be complicated by entrapment of tendons, ligaments or periosteum
- Persistent widening of physis >3 mm on radiographs
- Periosteum → bone formation and increased risk of physeal bar.
Periosteal Entrapment

15 yo male – jumping up and down on one leg (calisthenics at football camp). Severe pain at point of impact, with knee moving in lateral direction.
Periosteal Entrapment
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Trochlear morphology
TT-TG interval

TT-TG – 2.9 cm
Patellar dislocation

- Risk factors
  - trochlear dysplasia
  - Increased TT-TG
  - Patella alta
- Women > men
- 2nd decade of life

- Dislocates laterally
- Flexed knee, internal rotation, with valgus force
Patellar Dislocation
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Dorsal defect of patella
Bipartite patella
Right knee pain
Right knee pain
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OCD vs normal variant
OCD vs normal variant
OCD vs normal variant

Over 8 yo

Girls less than 10 yo
Boys less than 13 yo
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