Understanding and Treating Posterolateral Corner Injuries

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Disclosure:
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I will not discuss off label use and/or investigational use in my presentation.

I have no financial relationships to disclose.
Objectives

- Review anatomy of the posterolateral corner (PLC) of the knee
- Biomechanics of the posterolateral corner of the knee
- Diagnosis of PLC Injuries
- Physical examination
- Treatment options
- Rehabilitation and return to play
Incidence

- Overall incidence of posterolateral corner (PLC) injury is unknown
  - Accurate incidence is difficult as it is believed they often go undiagnosed
  - <2% of all acute ligamentous knee injuries
  - Most commonly occur in combined ligamentous knee injury patterns
The anatomy of the lateral and posterolateral aspect of the knee is complex.

Confusion has been created due to reported variability in anatomy as well as competing nomenclature.

In 2003, LaPrade et al published in AJSM a defining study on the posterolateral anatomy of the knee.
Anatomical Structures of the Posterolateral Corner

- Iliotibial Band
- Biceps Femoris
- Lateral Gastrocnemius
- Fibular (Lateral) Collateral Ligament
- Popliteus
- Popliteofibular Ligament
- Posterolateral Joint Capsule
- Lateral Meniscus
Posterolateral Corner Anatomy

- **Iliotibial band**
  - Seldom injured so is an important surgical landmark

- **Biceps femoris (long and short heads)**
  - Direct arm of the long head is the most important and attaches to the posterolateral aspect of the fibular head
  - Fabellofibular ligament is part of the capsular arm of the short head
Posterolateral Corner Anatomy

- Posterolateral joint capsule
  - Mid-third lateral capsular ligament
    - Meniscofemoral and meniscotibial components
  - Meniscotibial component is more commonly injured as an avulsion (Segond’s fracture)

- Lateral Meniscus
  - Coronary ligament of the lateral meniscus is the meniscotibial component of the posterior joint capsule
Posterolateral Corner Anatomy

- “The Big 3”
  - Fibular Collateral Ligament
    - Primary static stabilizer to varus stress
  - Popliteofibular Ligament
    - Important stabilizer to external rotation of the knee
  - Popliteus Muscle and Tendon
    - Provides static and dynamic stability to the posterolateral knee

LaPrade et al. AJSM 31(6); 2003
Confusing Posterolateral Anatomy

- Arcuate Ligament
  - NOT A DISTINCT LIGAMENT
  - Variable combination of structures
  - This is a Y-shaped complex made up of components of the popliteofibular ligament, fabellofibular ligament, capsular arm of the short head of the biceps, and oblique popliteal ligament.
    - In general, this structure reinforces the posterolateral corner structures of the knee.
  - Given the confusion in the literature, some authors recommend that it not be used.
Biomechanics of the PLC

- The posterolateral and lateral structures of the knee combine with the cruciate ligaments to offer static and dynamic stability to the lateral knee.
- They resist varus rotation and posterolateral tibial rotation
  - Primary restraint to external tibial rotation
- Also involved in varus, anteroposterior, and internal/external rotation stability
Kannus reported in 1989 a clinical increase in osteoarthritis in knees with PLC injuries.

Skyhar et al showed in 1993 that the contact pressures increased in the patellofemoral and medial compartments with sectioning of the PCL and PLC structures.
Diagnosis -- History

- Athletic injuries and motor vehicle crashes are two leading causes of PLC injury
- Mechanism of injury
  - Direct blow to the anteromedial knee
  - Hyperextension
  - Varus force
- Symptoms are quite variable given the frequent combination of associated injuries.
Diagnosis -- Physical Exam

- A thorough PE is important especially due to the frequency of combined injuries.
  - Gait, alignment, ligamentous stability, and neurovascular status
  - Comparison with the contralateral knee is important

- Varus thrust gait pattern may be present in chronic injuries.
Physical Exam Tests

- External rotation recurvatum test
Physical Exam Tests

- External rotation recurvatum test
- Varus stress test
  - 0 & 30 degrees
Physical Exam Tests

- External rotation recurvatum test
- Varus stress test
  - 0 & 30 degrees
- Dial test
  - 30 & 90 degrees of knee flexion
  - Supine or prone position
Physical Exam Tests

- External rotation recurvatum test
- Varus stress test – 0 & 30 degrees
- Dial test – 30 & 90 degrees of knee flexion – Supine or prone position
- Posterolateral drawer test
Physical Exam Tests

- External rotation recurvatum test
- Varus stress test
  - 0 & 30 degrees
- Dial test
  - 30 & 90 degrees of knee flexion
  - Supine or prone position
- Posterolateral drawer test
- Reverse pivot shift test
Physical Exam Tests

- External rotation recurvatum test
- Varus stress test
  - 0 & 30 degrees
- Dial test
  - 30 & 90 degrees of knee flexion
  - Supine or prone position
- Posterolateral drawer test
- Reverse pivot shift test
- Posterior tibial translation
  - 30 & 90 degrees of knee flexion
Physical Exam Tests

- External rotation recurvatum test
- Varus stress test
  - 0 & 30 degrees
- Dial test
  - 30 & 90 degrees of knee flexion
  - Supine or prone position
- Posterolateral drawer test
- Reverse pivot shift test
- Posterior tibial translation
  - 30 & 90 degrees of knee flexion
- Lachman’s test
Diagnosis -- Imaging

- **Radiographs**
  - AP weightbearing (extension/flexion)
  - Lateral
  - Sunrise
  - Standing alignment views*

- Often normal in isolated PLC injuries
  - Segond’s fracture, fibular head fractures
  - Degenerative changes in chronic cases*

- Stress radiographs
Imaging

- MRI
  - Extremely valuable
  - Defines location of injury
  - Coronal oblique images
  - 1.5 Tesla or higher
Diagnosis -- Procedures

- Exam under anesthesia
  - Fluoroscopy is quite beneficial
Diagnosis -- Procedures

- **Arthroscopy**
  - “Drive-through” sign
  - >1cm of lateral opening
- **Mid-third capsular ligament, popliteus, popliteomeniscal fascicles, coronary ligament**
Classification

- Varus instability
  - Grade I (0-5mm opening)
  - Grade II (6-10mm opening)
  - Grade III (>10mm opening)
**Classification**

- Based on physical exam involving the posterolateral drawer test, external rotation stability at 30 & 90 degrees, and varus stress testing as defined by LaPrade

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
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<tbody>
<tr>
<td>I</td>
<td>Minimal increase in varus, external rotation, and posterolateral rotation</td>
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<tr>
<td>II</td>
<td>Grade II varus instability with endpoint, increased posterolateral rotation no more than 1 grade above contralateral</td>
</tr>
<tr>
<td>III</td>
<td>Grade III varus instability, increased external rotation (10-15 degrees) at 30 degrees, and 1-2 grade increase in posterolateral drawer</td>
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Treatment

- Isolated grade I and II PLC injuries
  - Often missed in the acute setting
- Fortunately, these injuries are treated nonsurgically
  - Immobilization in extension for 3 weeks then PT for ROM
  - In general, WBAT can be allowed though in more severe injuries weightbearing may be protected for 3-6 weeks
  - Functional rehabilitation begins at 6 weeks
    - Aggressive hamstring strengthening should be limited
Treatment

- Grade I or II injuries with cruciate injuries
  - Treat cruciate instability accordingly with PLC being treated conservatively
  - Posterolateral instability must be critically evaluated as increased laxity will cause increased stress on the cruciate reconstruction which could lead to failure.
Treatment

- Isolated grade III PLC injuries
  - Limited potential to heal nonoperatively
- Baker et al reported in 1983 that acute repairs have improved outcomes over chronic reconstructions
- Stannard et al reported in 2005 that repair had a higher failure rate compared to reconstruction
- ISAKOS recommends repair be performed within 2 weeks of the injury as by 3 weeks the scar tissue limits dissection and suture purchase
Treatment

- Grade III injuries with cruciate injuries are best treated in the acute setting when swelling decreases.
- Multi-trauma patients may require delayed treatment depending on injuries.
Treatment -- Repair

- **Femoral sided injury**
  - Recession into tunnels for popliteus and FCL
  - Suture anchors to reattach capsule structures

- **Intrasubstance**
  - Popliteomeniscal fascicles or coronary ligament

- **Tibial sided injury**
  - Suture anchors to reattach capsule

- **Biceps avulsion**
  - Slips repaired anatomically
Treatment -- Reconstruction

- Nonanatomic
  - Biceps tenodesis or variations
Treatment -- Reconstruction

- Nonanatomic
  - Biceps tenodesis or variations
  - Fibula based reconstruction
Treatment -- Reconstruction

- Nonanatomic
  - Biceps tenodesis or variations
  - Fibula based reconstruction
  - Stannard’s modified two-tail reconstruction
Treatment -- Reconstruction

- **Nonanatomic**
  - Biceps tenodesis or variations
  - Stannard’s modified two-tail reconstruction

- **Anatomic**
  - Isolated structures
  - PLC reconstruction
    - FCL, popliteus, PFL

Adapted from LaPrade, *AJSM* 2004
Complications

- Infection or wound breakdown
  - Incision and swelling planning
- Peroneal nerve injury
  - 15-29% occurrence rate from the injury itself
- Popliteal artery injury
- DVT
- Symptomatic hardware
- Recurrent laxity
Postoperative Rehabilitation

- NWB for 6 weeks
- 2 weeks in an immobilizer for extension and then T-ROM brace for 4-12 weeks depending on surgery and associated injuries
  - Straight leg raises and quad sets in immobilizer
  - Slowly progressed through strengthening though open chain hamstring exercises are avoided for 3-4 months
  - Varies depending on energy involved with the injury
- Return-to-play is often 6-9 months
  - LaPrade has reported a return of some high level collegiate athletes at 4 months
Summary Points

- PLC injuries are underdiagnosed
- “Big 3” – FCL, popliteus, PFL
- PLC provides varus, external rotation, and posterior stability to the knee
- PLC injuries are often associated with concomitant injuries.
- ACL and PCL failure rates increase with untreated PLC injuries.
Summary Points

- Acute treatment improves outcomes over chronic treatment
- Reconstructive procedures are showing improved outcomes compared to primary repair
Questions?

Thank You!
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