THE POSTERIOR CRUCIATE LIGAMENT
“AN UPDATE”

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Financial Disclosure

Dr. David Drez has no relevant financial relationships with commercial interests to disclose.

Epidemiology

- Posterior cruciate ligament tears have historically been underdiagnosed - often asymptomatic
  - NFL combine exams — 2% did not know PCL was torn!!

- Occur more frequently than previously appreciated
- Account for about one fifth of knee ligament injuries
  - probably more because of----
    - renewed interest in PCL injuries
    - improved diagnostic tools
  
- Better understanding of injury mechanism
- Improvements in surgical treatment

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Mechanism of Injury

- Most common mechanism is a posteriorly directed force to the proximal tibia (tibial tubercle) of the flexed knee.
- Frequently occurs during a motor vehicle accident when knee strikes the dashboard on impact.
- Similar mechanism can occur in sports when athlete falls on flexed knee with ankle in plantar flexion (if ankle in dorsiflexion – force is on patella)

A posterior force combined with varus, hyperextension and rotation leads to an injury to the posterolateral structures

Anatomy

**Femoral Attachment of PCL**
- PCL originates in an irregular semicircle on the lateral border of the medial femoral condyle
- Midpoint of the PCL attachment is approximately 1 cm posterior to the articular cartilage.

**Tibial Attachment of PCL**
- PCL inserts approximately 1.0 to 1.5 cm inferior to the posterior rim of the tibia in a depression between the posterior medial and lateral tibial plateaus called the PCL facet or fovea.
Average length of PCL = 38 mm
Average width of PCL = 13 mm.
PCL has two bands —
- Anterolateral
- Posteromedial
Anterolateral band is larger and stronger than the posteromedial band.

Biomechanics
- The PCL is the primary restraint to posterior tibial translation.
- It resists 85% to 100% of a posteriorly directed knee force at both 30 and 90 degrees of flexion
- Comprised of two bands or bundles
  - Anterolateral band - tightest when knee is in flexion — important to prevent posterior translation of tibia when knee is flexed
  - Posterior medial band - tightest when knee is in extension — important to prevent posterior translation of tibia when knee is in extension

Two bands of PCL
Named for attachment site on femur
(ACL bundles named for attachment sites on tibia)
AL – tightest in flexion
PM – tightest in extension
Secondary Restraints
- Lateral collateral ligament (LCL), posterolateral corner, and medial collateral ligament (MCL) are important secondary restraints.
- Play a minimal role in resisting posterior translation when the PCL is intact
- Amount of pathologic displacement increases substantially when both primary and secondary restraints are torn.
- Loss of the PCL results in an increase in posterior translation to a maximum of 15 to 20 mm at 90 degrees of flexion.
- When there is injury to the LCL, MCL, or posterolateral corner there are greater increases in posterior translation.

Clinical Evaluation
- ALWAYS do a neurovascular check !!!!
- Patients who have isolated PCL tear may have very little pain and only a small effusion.
- Always compare to non-injured knee
- Knee motion may be almost normal
- Always examine the knee for signs of collateral ligament and posterolateral corner injury.

Tests for PCL Tear
- The posterior drawer test, performed at 90 degrees of flexion, is an accurate test for PCL injury.
- Important to recognize that if the tibia is resting in a posteriorly subluxed position, the result may be a false-positive Lachman or anterior drawer test.
- In most normal knees, the medial tibial plateau step-off is approximately 1 cm anterior to medial femoral condyle.
- If the examiner cannot palpate the normal 1-cm step-off, a PCL injury should be suspected.

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Quadriceps active test

- Have the patient slide the foot down the table by contracting the quad – (hamstrings must be relaxed)
- Quadriceps contraction causes the tibia to translate anteriorly from a subluxed position—confirms PCL insufficiency.

Godfrey or Posterior Sag Test

- Look at position of tibial tubercle in relation to patella

Grading of PCL Injuries

Based on displacement of tibia on femoral condyles

- Grade 1 – slight displacement on femoral condyles
- Grade 2 – tibia at same level as femoral condyles
- Grade 3 - markedly posterior to femoral condyles
Exam for Posterolateral Instability

External rotation recurvatum

Dial test

Reverse Pivot Shift

Posterior lateral drawer

Radiologic Evaluation

- Any individual with knee trauma should undergo a complete radiographic evaluation (Standing AP, lateral, Merchant view, and tunnel views.)
- Occasionally, avulsion fractures of the PCL tibial insertion will be identified

MRI
Best Imaging Study to Evaluate PCL
Natural History of PCL Injury

- Natural history of “isolated” PCL tears is relatively benign.
- Not unusual to discover a PCL insufficiency as an incidental finding during routine preseason sports examinations.
- Parolie and Bergfeld reported in 1986 that about 2% of college-senior football players at the NFL predraft examination were found to have chronic PCL-deficient knees – (athlete did not know PCL was torn)
- MR imaging studies of patients with isolated complete tears usually demonstrate continuity of the ligament at 2-year follow-up. (Do not have normal stability)
- There is, however, a higher incidence of medial and patellofemoral arthritis in long term follow-up studies

Non-operative Treatment

- Acute isolated grade 1 or 2 PCL tears – immobilize in full extension for 4-6 weeks.
- Follow with range-of-motion and quadriceps-strengthening rehabilitation program. (avoid hamstring exercises)
- Many are able to return to sports within 8 weeks
- Treatment of an acute isolated grade 3 PCL tear is controversial.
- One must be certain there are no posterolateral corner, medial collateral, or lateral collateral ligament injury – if so, then surgery indicated
- Cast immobilization indicated when such an injury happens in a pediatric patient

Surgical Treatment of Bone Avulsion

- Most agree that acute surgical intervention is indicated when there is a displaced PCL bone avulsion.
- Avulsion fractures usually involve the tibial insertion and can be seen on routine lateral radiographs.
- The avulsion site is exposed through a standard posterior approach with the patient in the prone position.
- If the bone fragment is large, fixation is accomplished with one or two screws, with or without washers.
- For smaller or comminuted bone fragments, suture fixation through small drill holes may be necessary.
Suture Repair of Peel Off

- Primary repair with sutures is done when there is a "peel-off" at insertion site (can be done arthroscopically).
- Repair should be done in less than 3 weeks after injury.
- Most of these injuries are the result of avulsion from the femoral insertion.

Single-Bundle Reconstruction

- Both open and arthroscopic PCL reconstructions have been performed with a single graft bundle through a single femoral and tibial tunnel.
- Because of the size of the femoral origin, only a portion of the PCL can be reconstructed with a single-bundle technique.
- Since the anterolateral bundle is larger and stronger than the posteromedial bundle, the femoral tunnel is drilled where the anterolateral fibers of the PCL originate on the femoral condyle.
- The tunnel exits the posterior tibial cortex in the distal lateral aspect of the PCL footprint.

Tibial Inlay Technique

- This procedure is performed with the patient in the lateral decubitus position with the operative leg up.
- The patient is then repositioned for the posterior approach by extending the knee and placing the leg on bolsters or a Mayo stand.
- Not been shown to be any better.
Double-Bundle Reconstruction
- Single-tunnel PCL reconstruction replaces only the anterolateral bundle fibers.
- Major theoretical advantage of the double-bundle technique is that it also replaces the posteromedial bundle fibers on the femur.
- It is technically more challenging - clinical experience is limited.
- Superiority of this approach has yet to be documented clinically.

Posterolateral Reconstruction
- Fibular based reconstruction using hamstrings or allograft
- Designed to reconstruct ---
  - FCL
  - Popletius

Summary
- Injuries to the PCL - more commonly diagnosed now
- History and physical examination will identify most PCL injuries.
- Most recommend non-operative treatment for acute isolated PCL tears. — Grades 1 & 2
- Isolated Grade 3 — controversial — prob. surgery
- Absolute indication for surgical treatment —
  - acute combined ligament injuries
  - acute bone avulsions
  - symptomatic chronic high-grade PCL tears
- PCL reconstruction techniques do not restore normal stability — more likely to have medial and PF arthritis
- Newer double-tunnel and tibial inlay techniques — theoretical advantages - few long term studies have been done and clinical results are only preliminary.
THANKS FOR YOUR ATTENTION