Evaluation and Management of PCL and Posterolateral Corner Injuries of the Knee

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PCL and Posterolateral Corner Injuries occur frequently together

Of 90 patients with PCL injuries treated surgically, only 4 pts did NOT have a concomitant PLC injury (Fanelli et al. 2012)

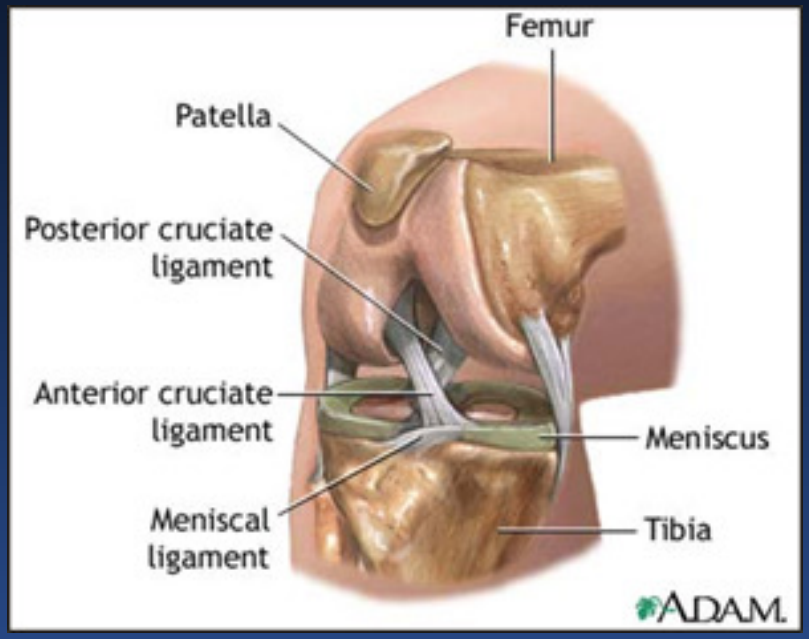
PCL and Posterolateral Corner Injuries

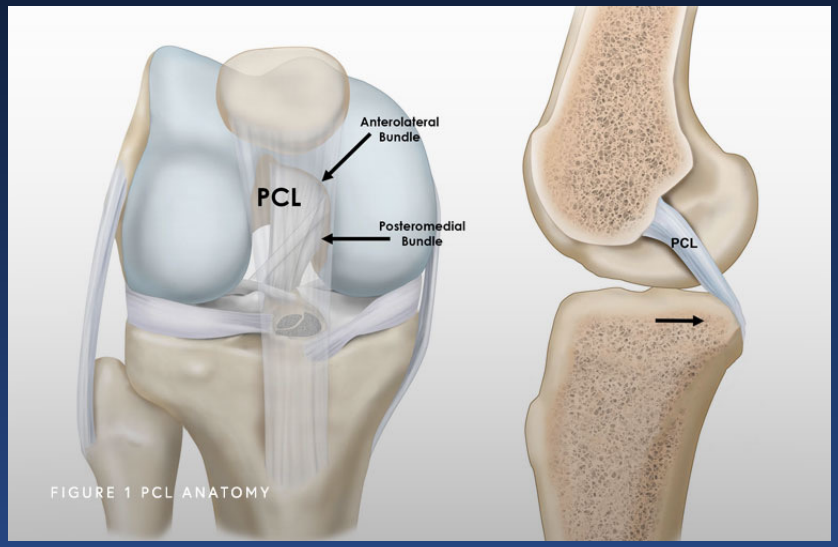
- Injuries to the PCL and Posterolateral corner rarely occur alone.
  - 87% of posterolateral corner injuries occur in combination with at least one other ligament injury, most commonly the PCL.
  - 52% of PCL injuries occurred in combination with another ligamentous injury in the ipsilateral knee.

  (LaPrade et al, Arthroscopy 2007)

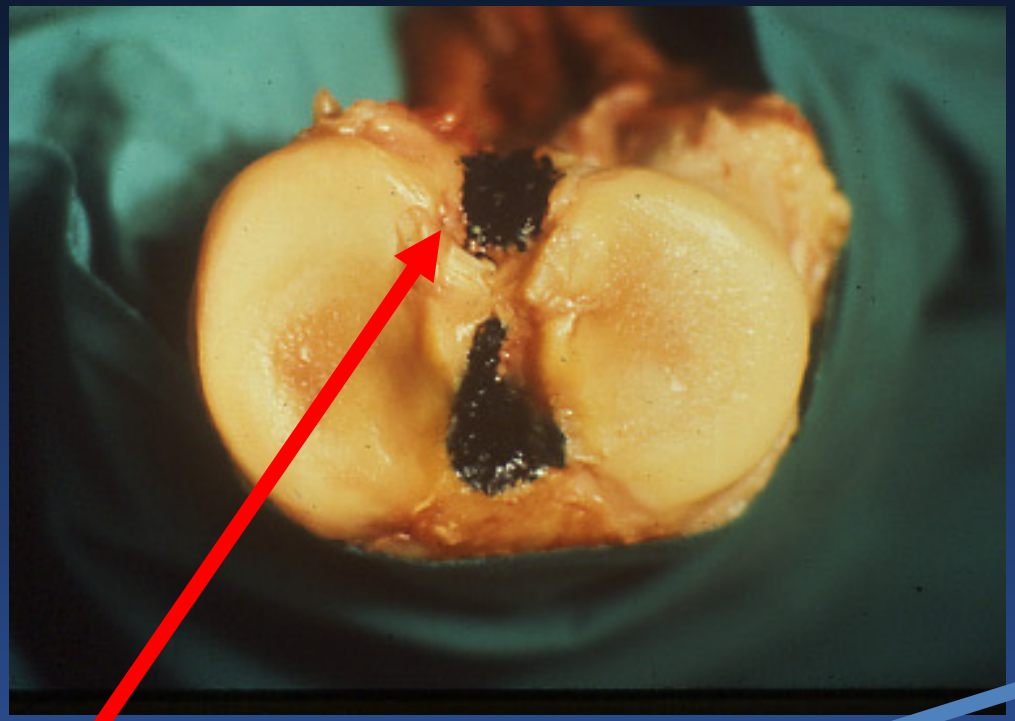
- The PCL and posterolateral corner work in conjunction to prevent posterior tibial translation.
  - >12mm of laxity on posterior drawer (by Telos), posterolateral or posteromedial corner (or both) must also be injured in addition to complete PCL injury. (Garavaglia et al AJSM 2007).

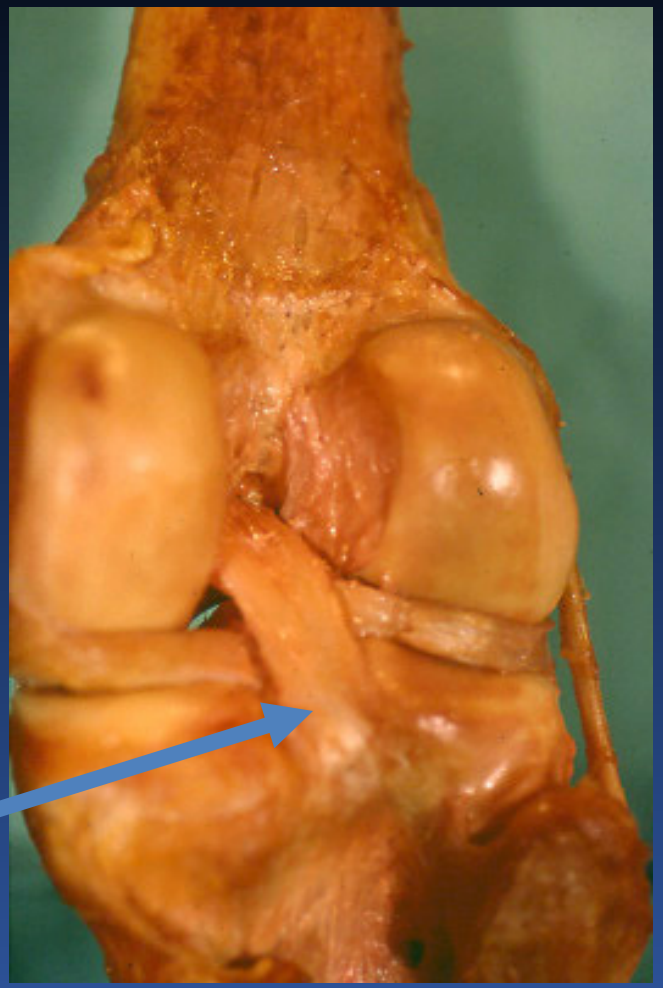
Posterior Cruciate Ligament





PCL Anatomy

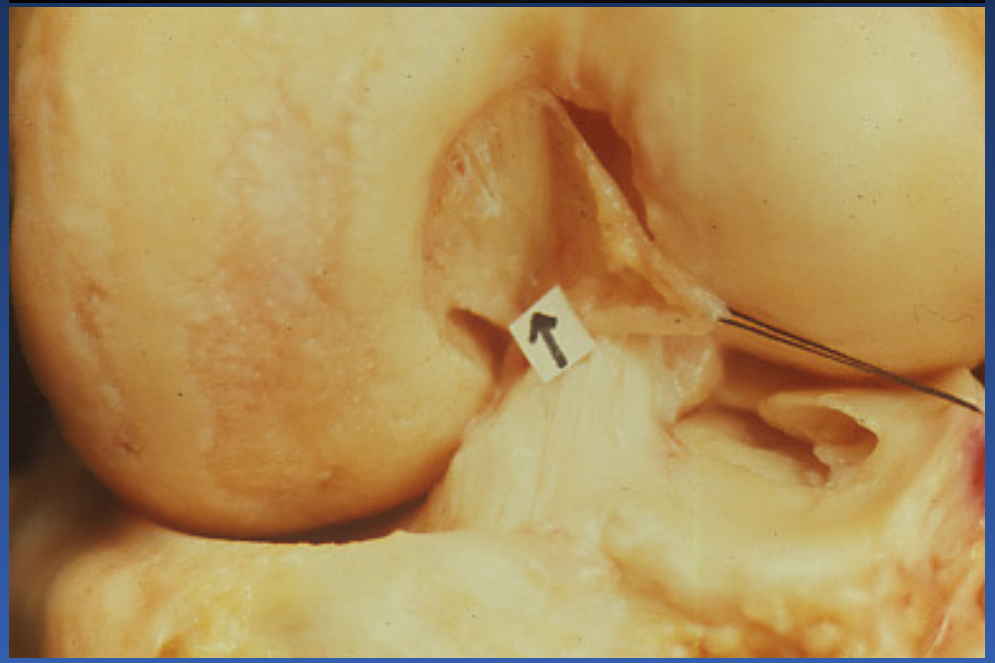




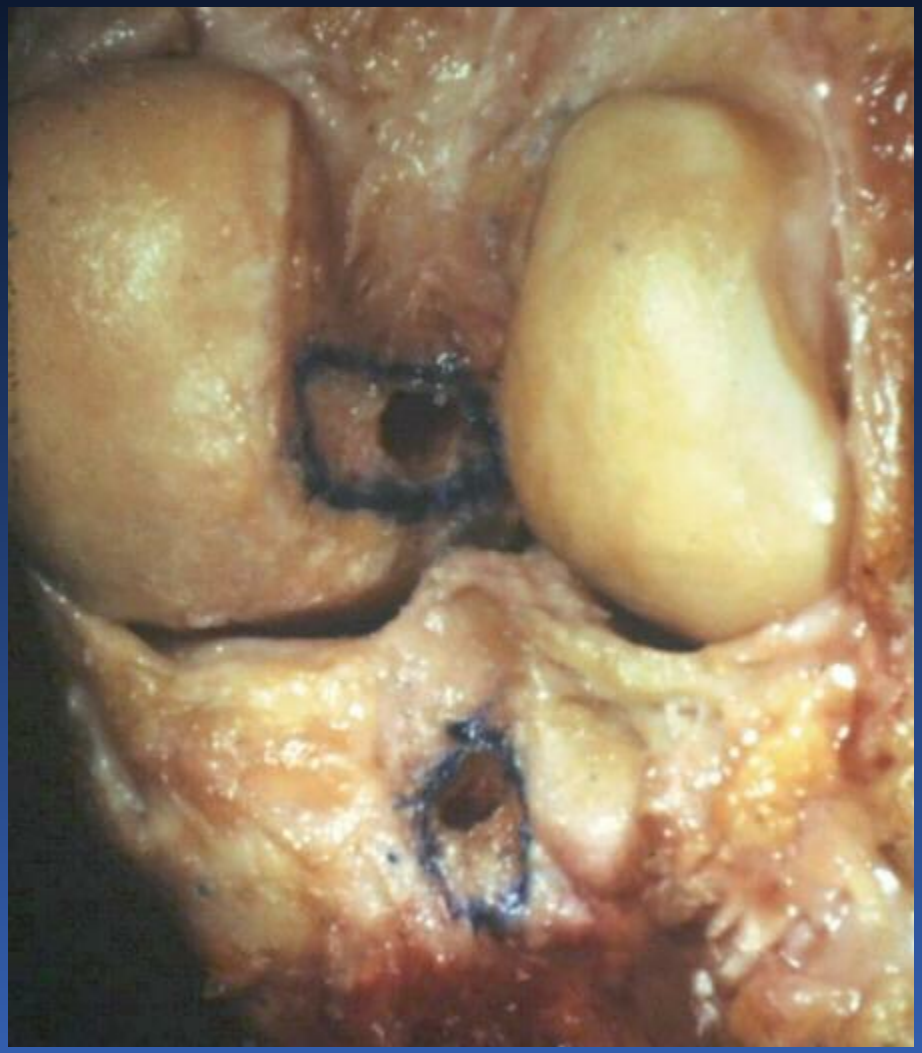
- Tibial Insertion:
  - 10-12mm inferior to posterior tibial plateau
  - 2-4 mm lateral of midline

PCL Anatomy

- Femoral Insertion:
  - Broad insertion:
    - 88° ± 5.5° angle to the roof
  - Midpoint of femoral insertion:
    - 1 cm proximal to articular cartilage of MFC



Posterior View - Extended

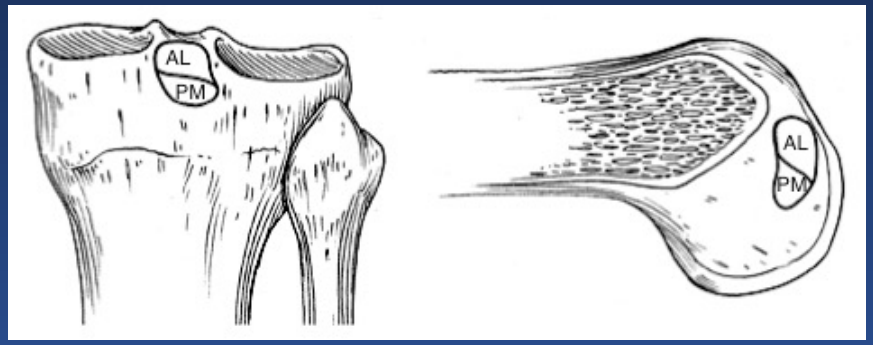


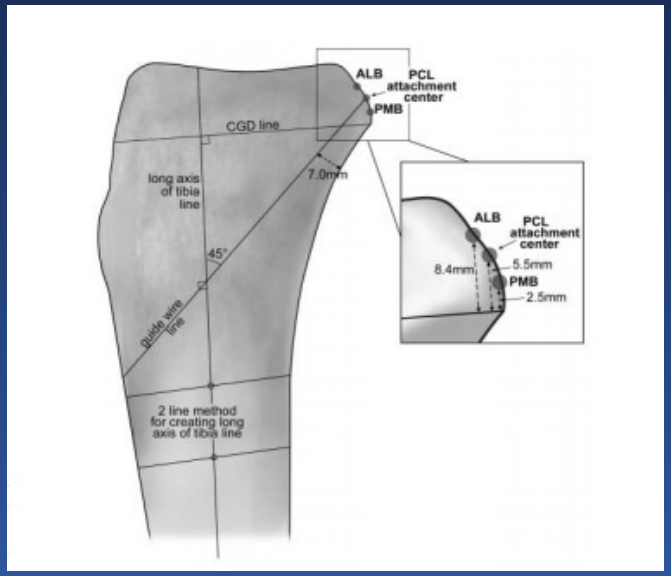
PCL anatomy

- Average length: 32-38 mm
- Cross Sectional Area:
  - 31.2 mm^2
    - Nearly twice that of ACL
- Insertional cross sectional area:
  - 3x larger than midsubstance
  - Makes anatomical reconstruction difficult

PCL Anatomy

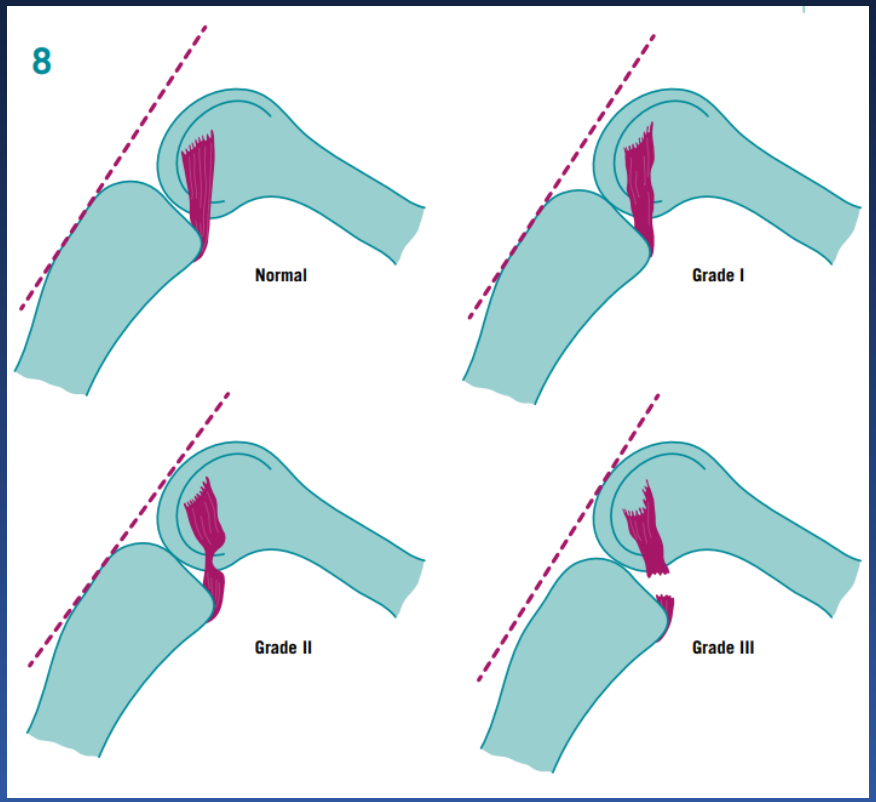
- Two bundles, AL and PM





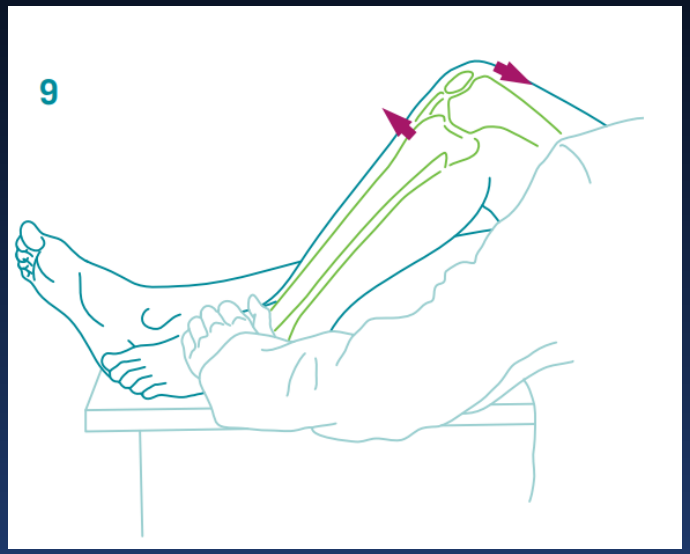
Evaluation

- Posterior drawer -

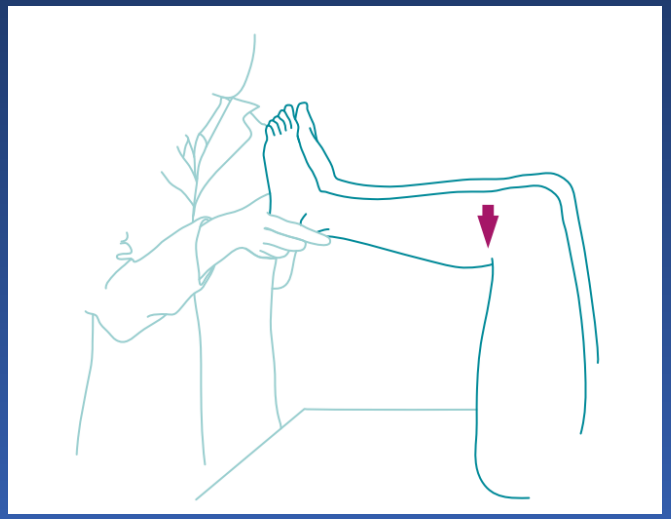


Evaluation

- Quadriceps Active Test

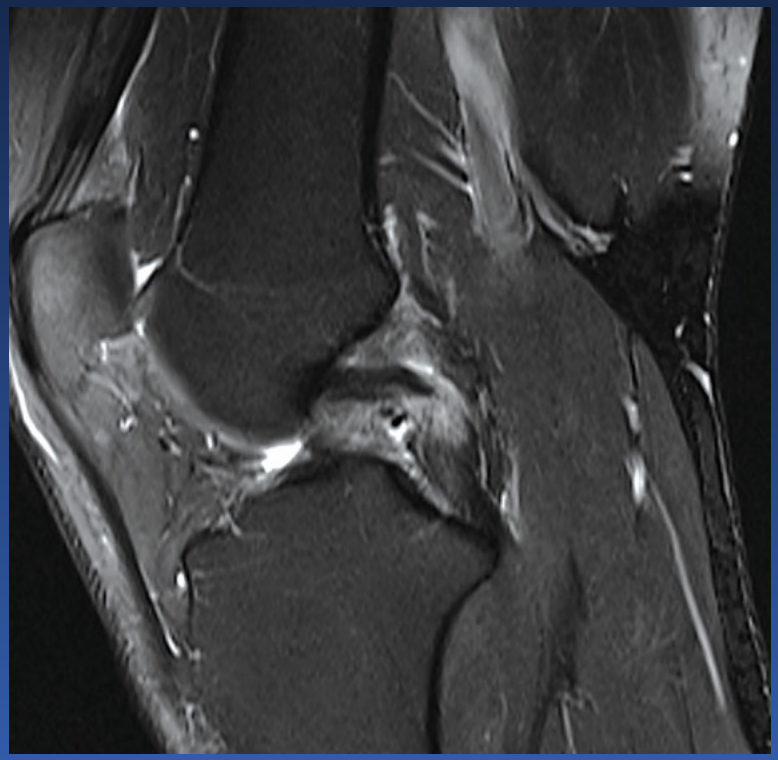


- Posterior Sag Test

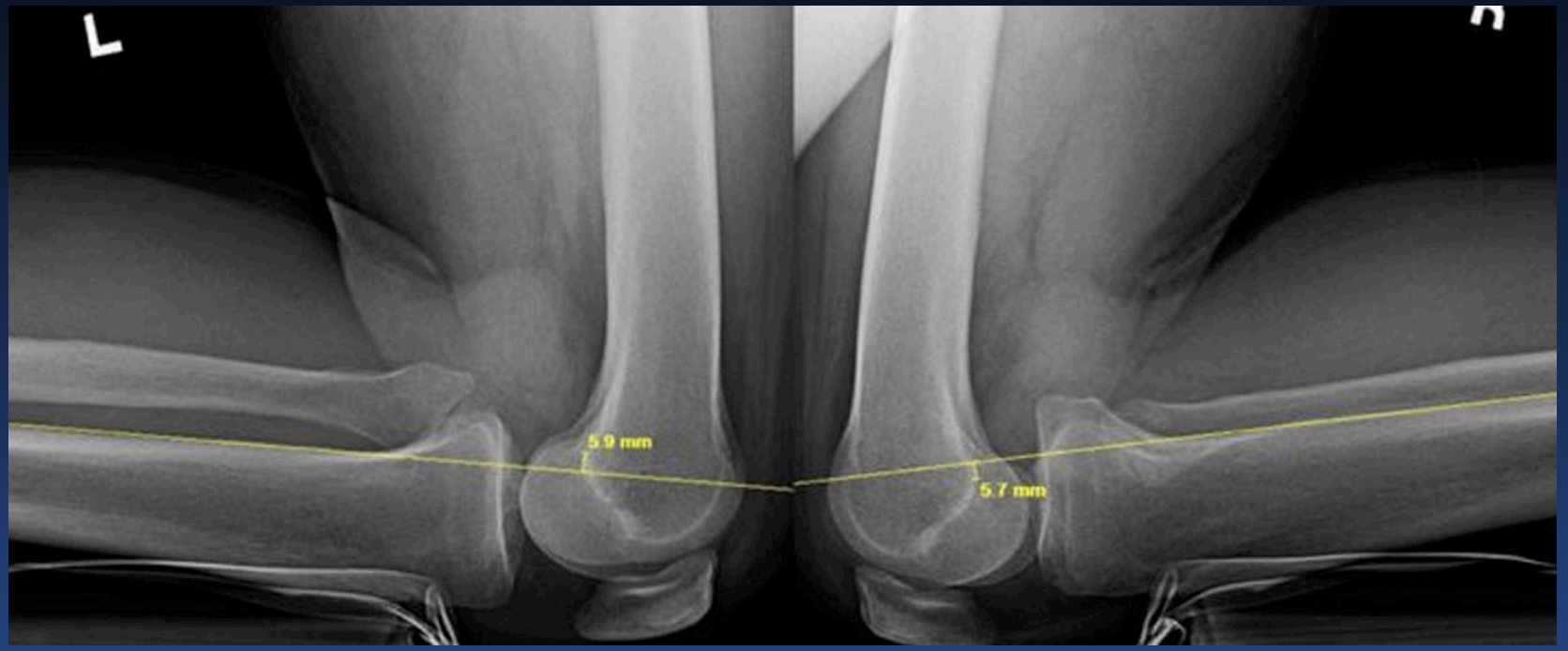


MRI Evaluation

- MRI with high sensitivity, moderate specificity in evaluation of PCL injuries



Radiographic Workup beyond MRI- Stress Radiographs



- Kneeling stress radiographs: Reproducible and Accesible
- Side to Side Difference:
  0-7 mm indicates partial PCL injury
  8-11 mm indicates complete isolated PCL injury
  12mm or more indicates Combined PCL and PLC or PMC injuries

- Chahla et al 2016

Non-Operative Treatment

- Vast majority of Grade I and II PCL injuries can be managed successfully non-operatively
- Initial treatment (First 6 weeks) PRICE

  - Protect, Rest, Ice, Compression, Elevation

  - PCL specific brace (provides anterior drawer to the proximal tibia)

- At 12 weeks - Progressive strengthening, gentle running, agility/cutting/pivoting with brace starting at 3 months

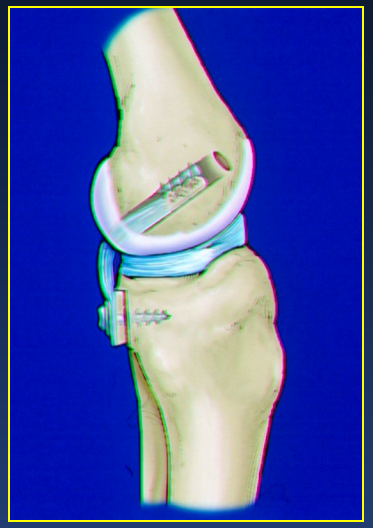
Surgical Treatment Indications

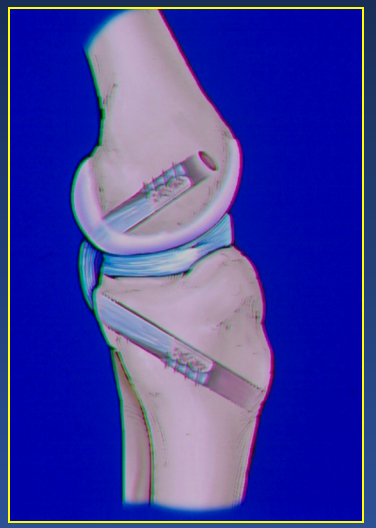
- Indications for acute surgical treatment
- insertion site avulsions
- Greater than 10mm posterior drawer – Combined injury with PLC or PMC
- PCL tears combined with other structural injuries (Menisci, MCL, PLC, ACL, etc)

- Indications for chronic surgical treatment
- Isolated PCL tear becomes symptomatic
- Progressive functional instability develops.
- PCL tears combined with other structural injuries

PCL Reconstruction

- Tibial Inlay Technique
- Transtibial Technique
- Single/Double Bundle





- I perform ***Double Bundle Transtibial PCL Reconstruction*** because:

DB vs SB

- Signif improved objective posterior tibial stability and Patient Reported Outcomes (IKDC scores) with DB PCLR compared with SB PCL reconstruction in randomized clinical trials
  - Chahla et al Arthroscopy 2017

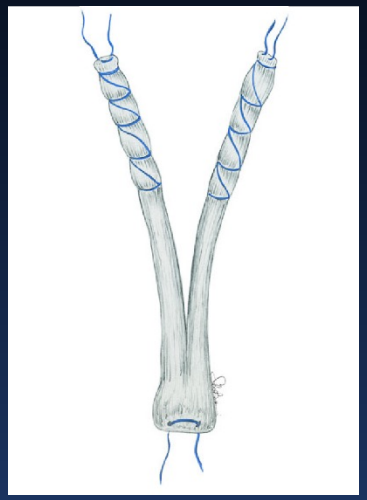
TT vs Inlay

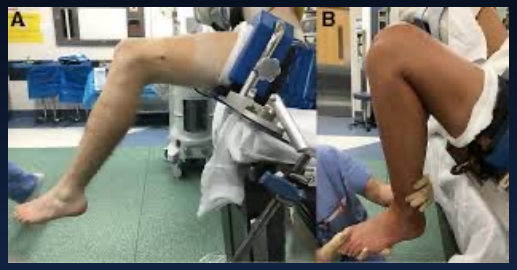
- No Differences in posterior tibial stability and patient reported outcomes transtibial vs tibial inlay – Panchal et al Arthroscopy 2011

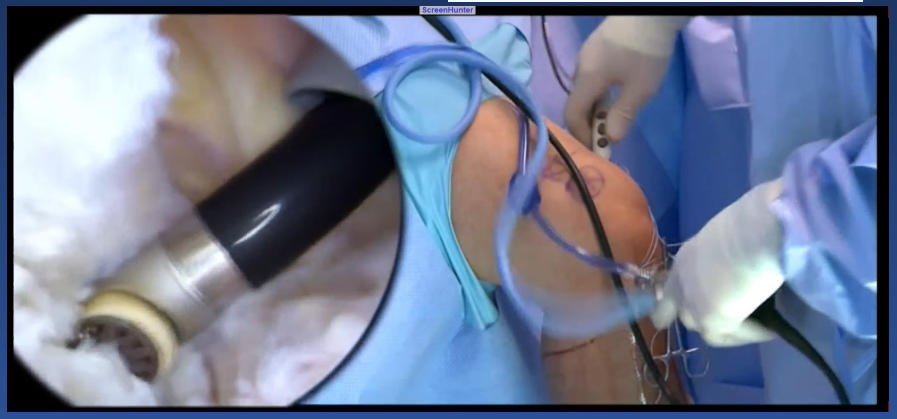
Transtibial DB PCL Reconstruction

Reconstruction

- Supine position, blue knee holder, contralateral knee in stirrups
- Split Achilles Tendon Graft (ALB 9mm, PMB 6mm). Single Bone Block distally
- Diagnostic knee arthroscopy, use 70 degree scope to work on PCL facet
- Posteromedial portal to help clear off PCL facet with RF and shaver

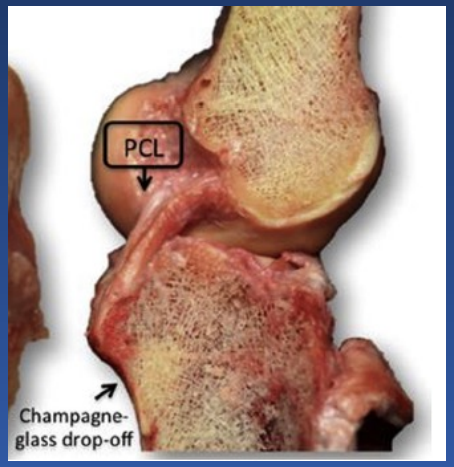


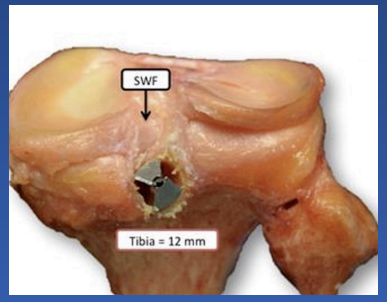


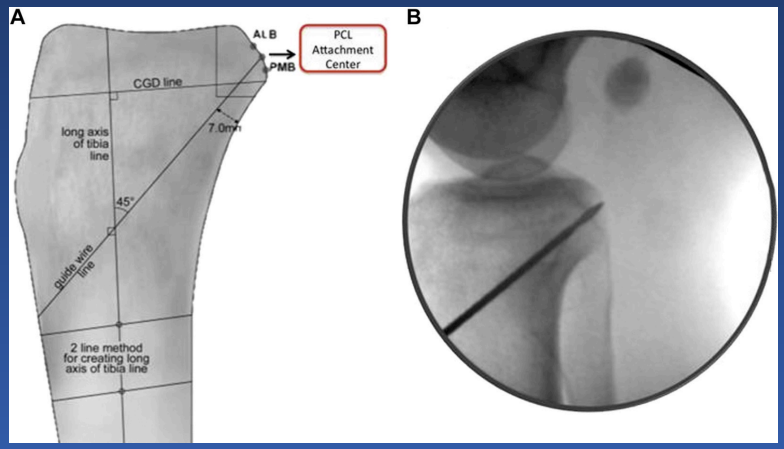


Transtibial DB PCL Reconstruction – Tibial Tunnel

- Drill transtibial tunnel under fluoro
  - Proximal aperture: On AP - in line with medial aspect of lateral tib spine (2 mm lateral of midline). On Sagittal -approx. 6 mm proximal to “champagne glass drop-off)

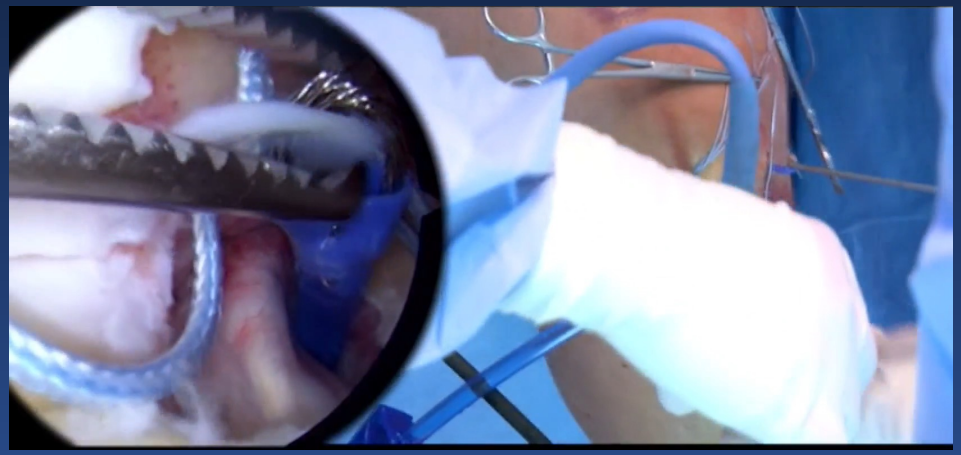






Transtibial DB PCL Reconstruction

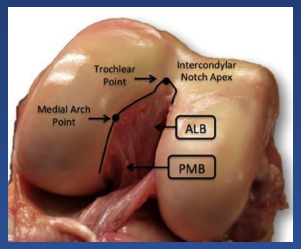
- Use Gore Smoother to smooth tibial tunnel, and chamfer anterior edge of proximal aperture of tibial tunnel

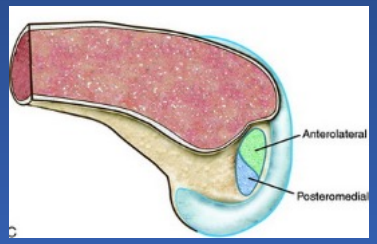


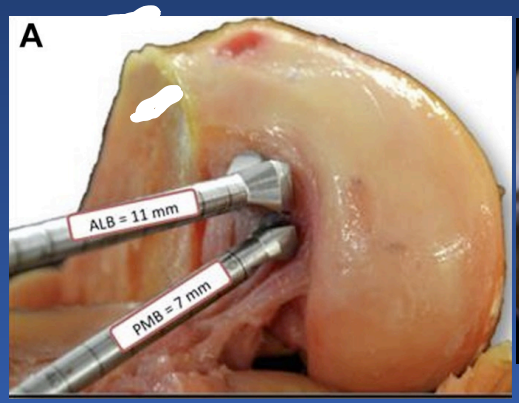
Transtibial DB PCL Reconstruction – Fem Tunnels

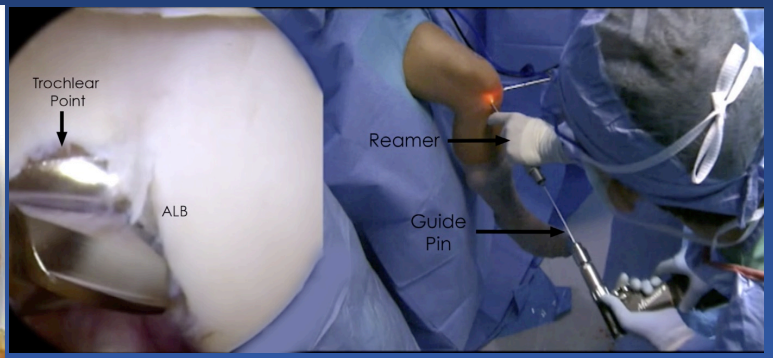
- Drill Femoral Tunnels through anterolateral scope portal. Drill these all the way through far cortex

- Use reamer to “template” tunnel and ensure no articular cartilage violation or tunnel convergence









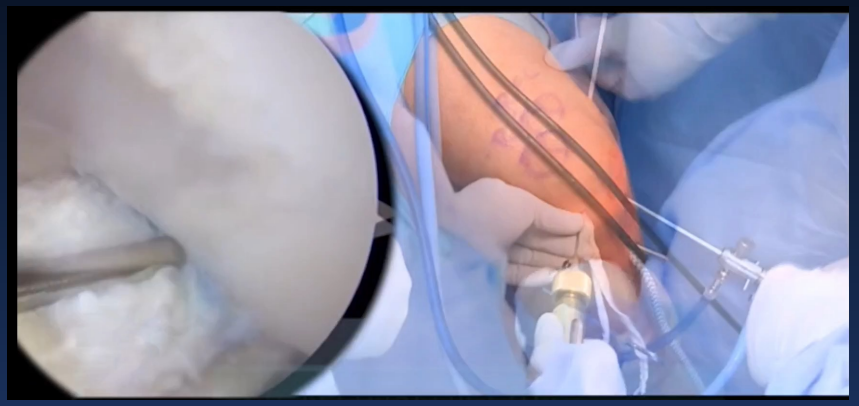
Transtibial DB PCL Reconstruction

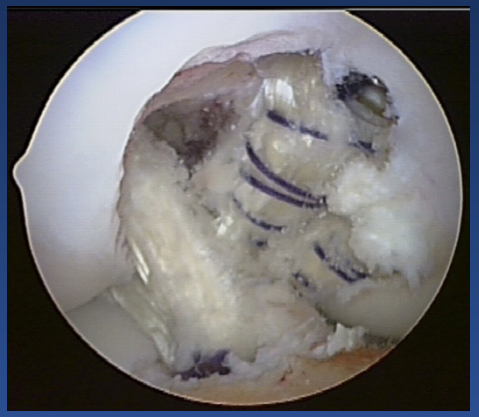
- Chamfer back of femoral tunnel apertures (shaver/burr). Can use Gore smoother for this as well

- Place passing sutures retrograde
- Pass graft retrograde, use posteromedial arthroscopy portal to assist with the turn around tibia. Bone block is distal (at distal aperture of tib tunnel

Transtibial DB PCL Reconstruction

- Dock grafts and fix:
  - PMB femoral tunnel inside out with Interference Screw
  - Tibial tunnel distal aperture with Interference screw with knee in extension and tension distally (PMB now fixed)
  - ALB femoral tunnel inside out with Interference screw with knee at 90 degrees flexion and tension proximally
- Fix PCL first, set the central pivot and then proceed with PLC/PMC recon/repair as needed

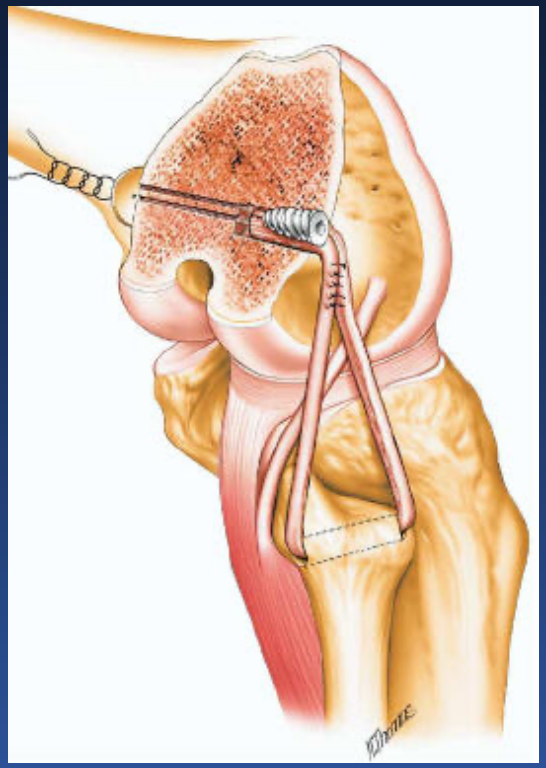


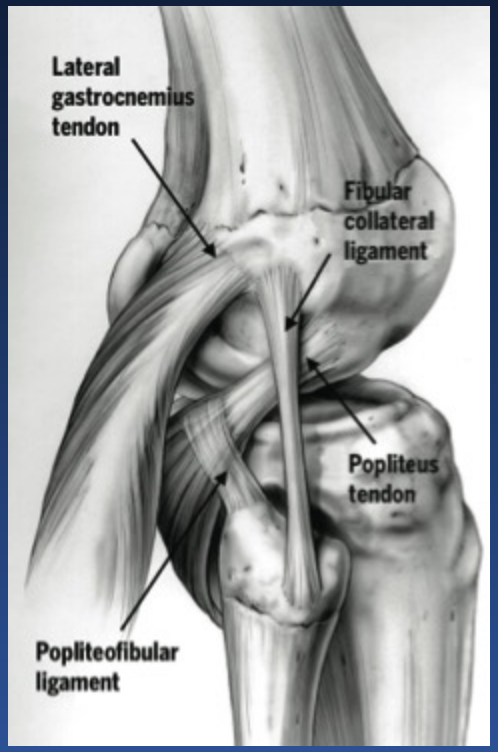


Postop and Rehab

- 6 weeks of NWB
- At 1-2 week postop (suture removal) goes into a PCL counterforce brace (Jake Brace or Rebound)
- Brace stays on 6 months at all times except for bathing, then until 2 yrs postop with activities
- Early quads activation and prone knee flexion 0-90 deg for first 6 weeks
- At 6 wks, allow progressive WB and strengthening.
- 8 months repeat kneeling stress radiographs. Begin agility work.
- Cleared for RTP when LSI >85% and at least 12 months postop

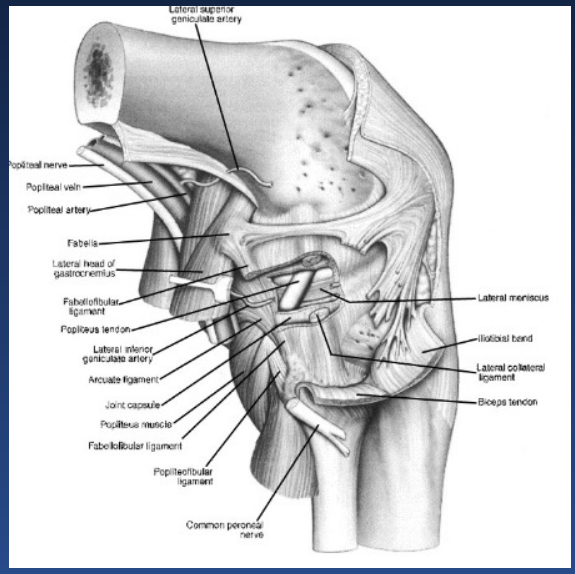
Posterolateral Corner Injury





Posterolateral Rotatory Instability of the Knee

- Complicated and misunderstood anatomy
- “Dark side of the knee”
- Isolated injuries represent less than 2% of all knee injuries
- Clinical implications affect outcome of treatment of concomitant injury



Anatomy

- Posterolateral Corner – Main Anatomic Structures

LCL, Popliteofibular Ligament (Main static stabilizers), Posterolateral capsule

Popliteus (Main dynamic stabilizer)

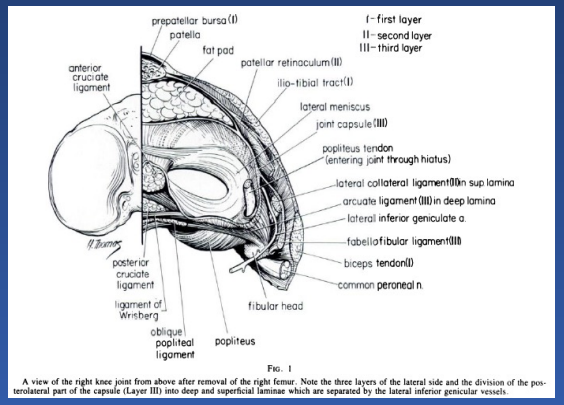
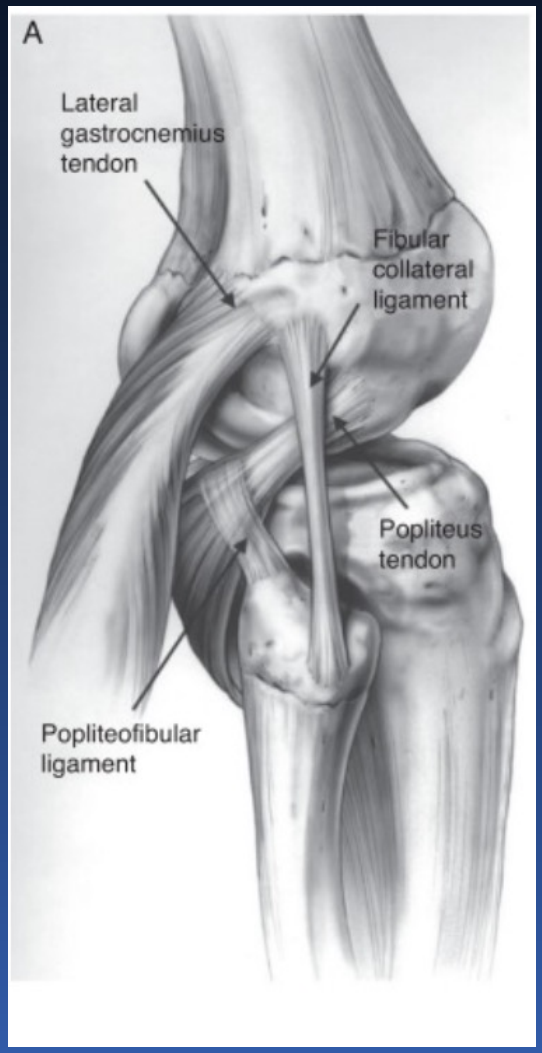


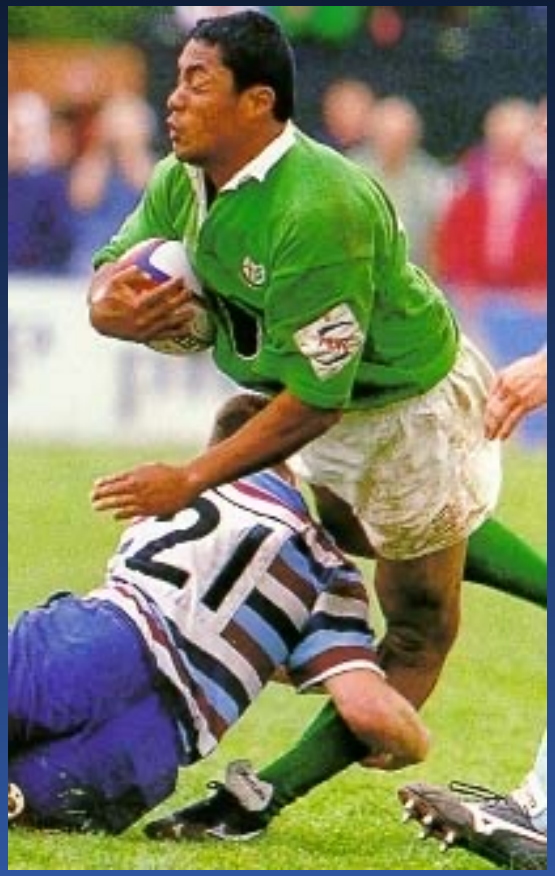
FIG. 1

A view of the right knee joint from above after removal of the right femur. Note the three layers of the lateral side and the division of the posterolateral part of the capsule (Layer III) into deep and superficial laminae which are separated by the lateral inferior genicular vessels.



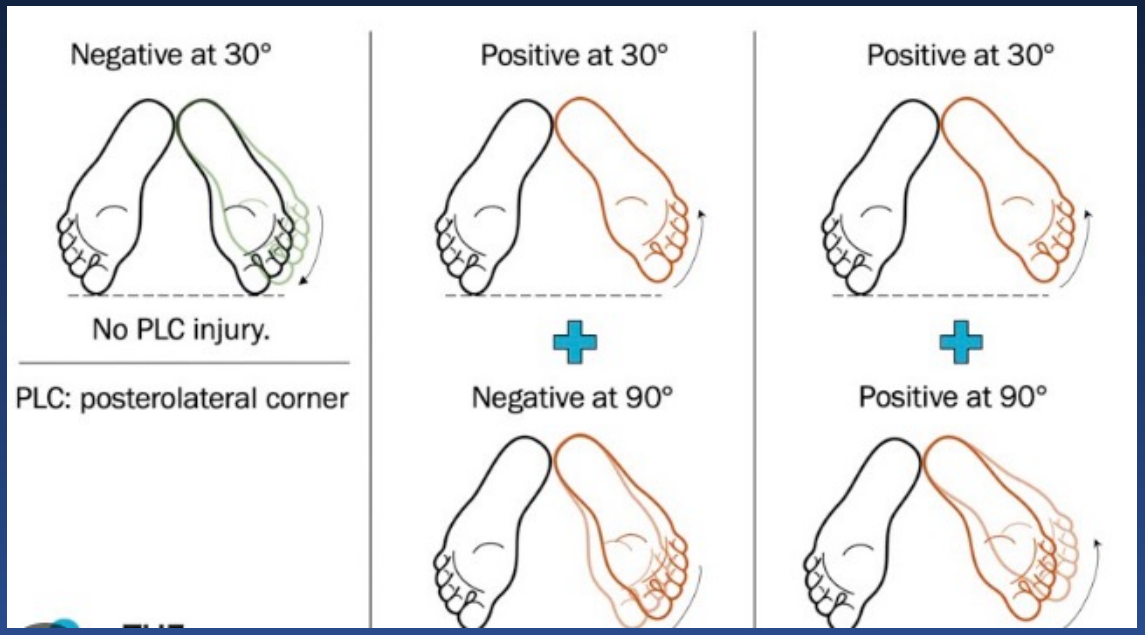
Mechanism of Injury

- 40% sport related
- Posterolateral blow to anterior medial tibia with the knee in extension
  - most common
- Hyperextension with varus and ext rotation
  - PLC primary restraint in extension



Evaluation of Posterolateral Corner Injury

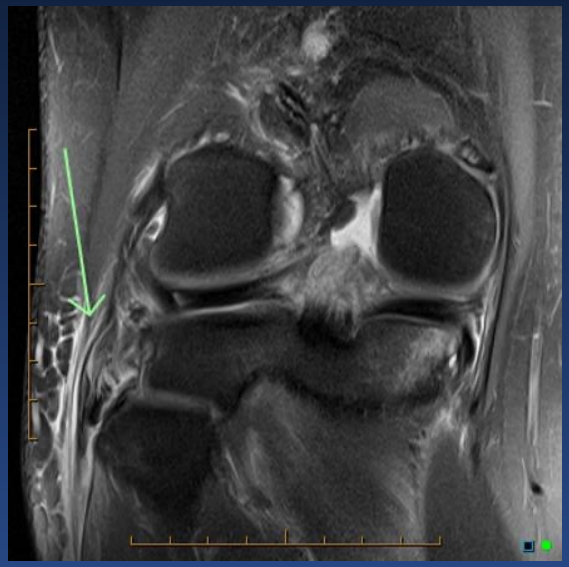
- Dial test



PLC Injury

PCL and PLC Injury

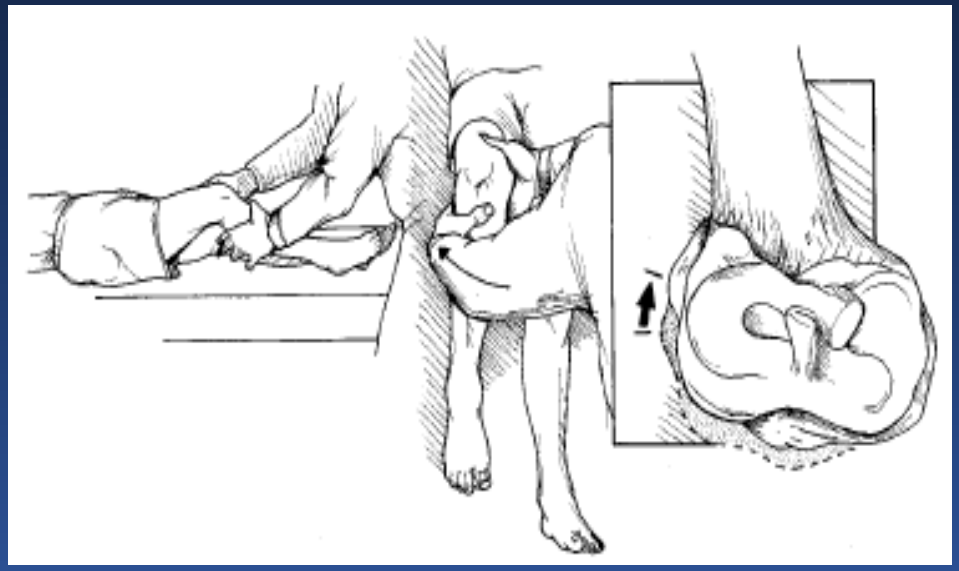
MRI



How do we treat these?

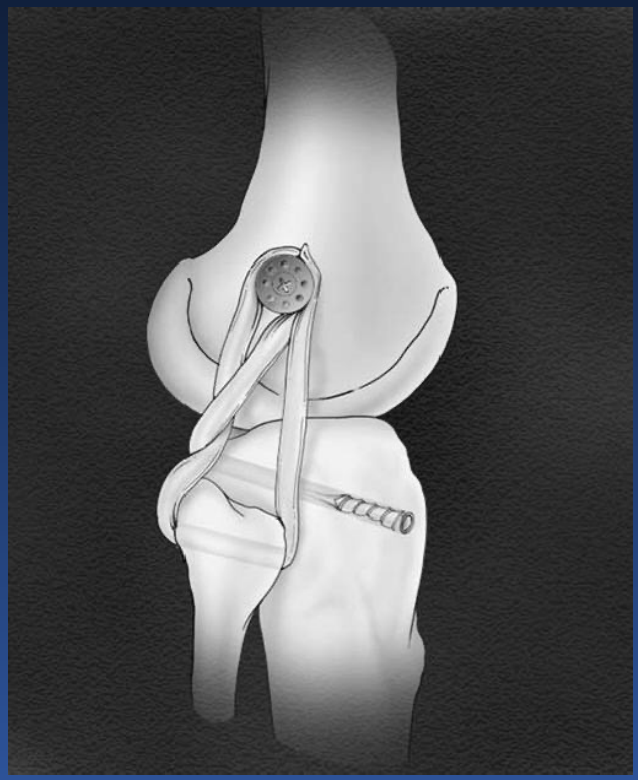
Treatment

- Surgical Indications:
  - Symptomatic instability
  - Concomitant ligament Injury
  - Fibular head avulsion fx



Acute Injury - Treatment

- Acute repair vs primary reconstruction
  - Stannard (AJSM 2005)
    - 35 acute repairs, 13 failures (37%)
    - 22 primary recons, 2 failures (9%)
    - 14/15 underwent successful revision recon



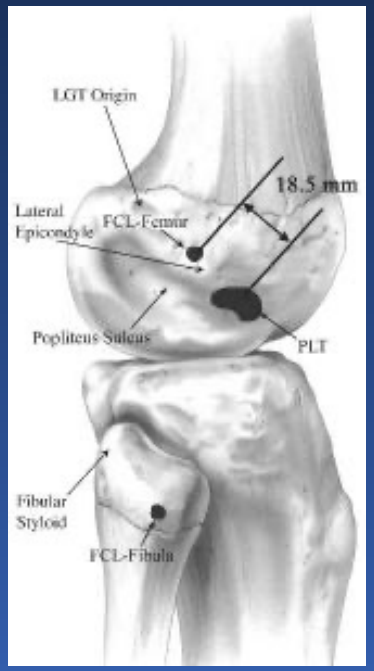
Reconstruct, do not repair. Exception is with fibular head fracture.

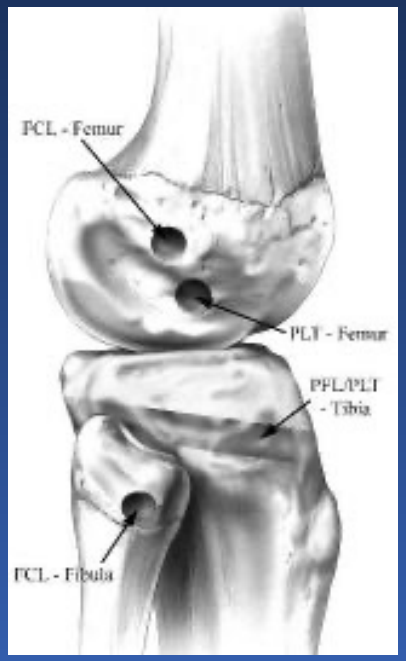
Chronic Injury - Treatment

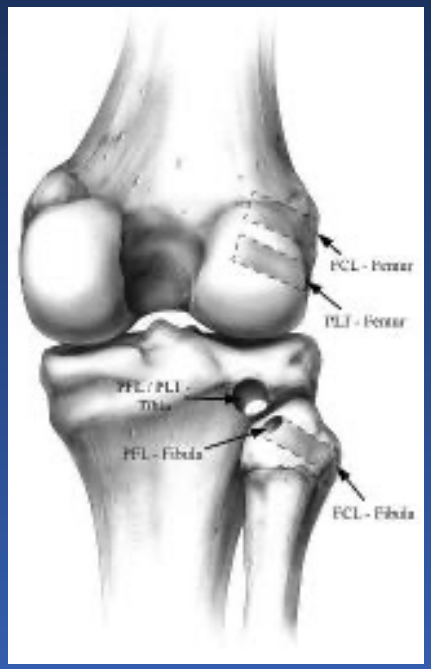
- Reconstruction
  - No consensus on best technique
  - LCL, Popliteus, PFL (Do all need be reconstructed?)
  - Allograft vs Autograft
  - For maximal functional gain, all associated injuries (especially cruciates) should be addressed
  - Genu Varum, consider Valgus Tibial Osteotomy

PLC Reconstruction

- Anatomic Reconstruction, LaPrade (AJSM 2004)
  - LCL/Popliteus/PFL reconstructions
  - 2 grafts

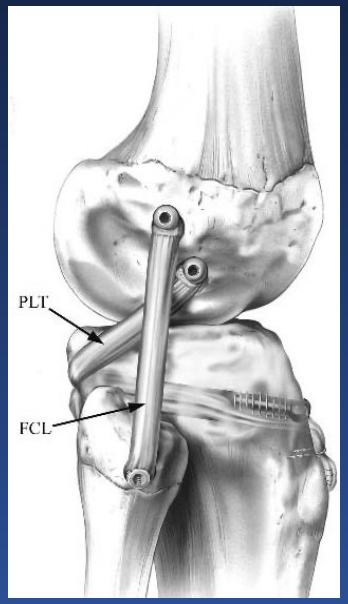


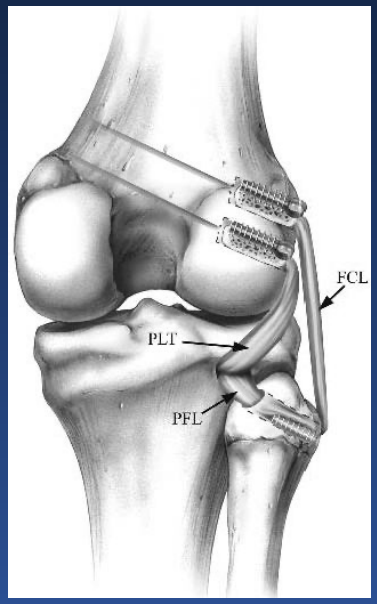




PLC Reconstruction

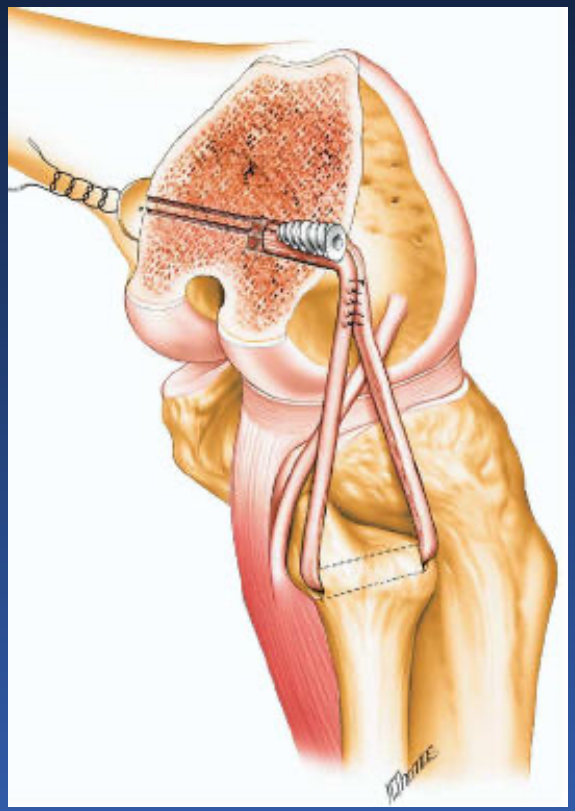
Anatomic PLC Reconstruction
(LaPrade technique)

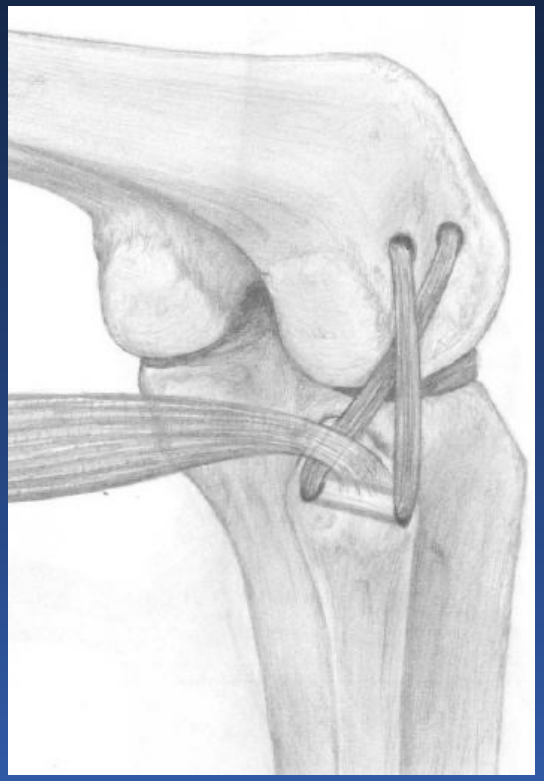




PLC Reconstruction

Fibular Based Reconstructions
- LCL and PFL reconstructed



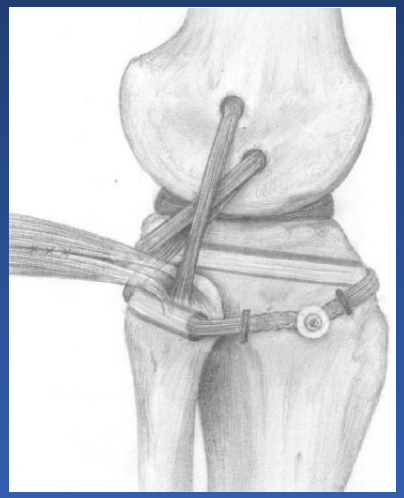


PLC Recontruction

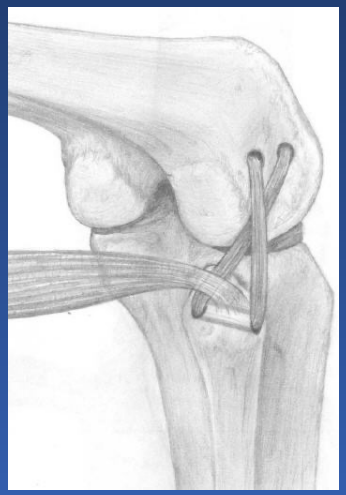
Comparison of 2 Surgical Techniques, Nau et al. AJSM 2005

- Static Testing (Varus, External Rotation) at various angles of flexion

- Dynamic 6 degrees of freedom kinematic testing through path of motion from 0-90 degrees flexion arc.



"Anatomic" Recon. (LCL/Pop/PFL)



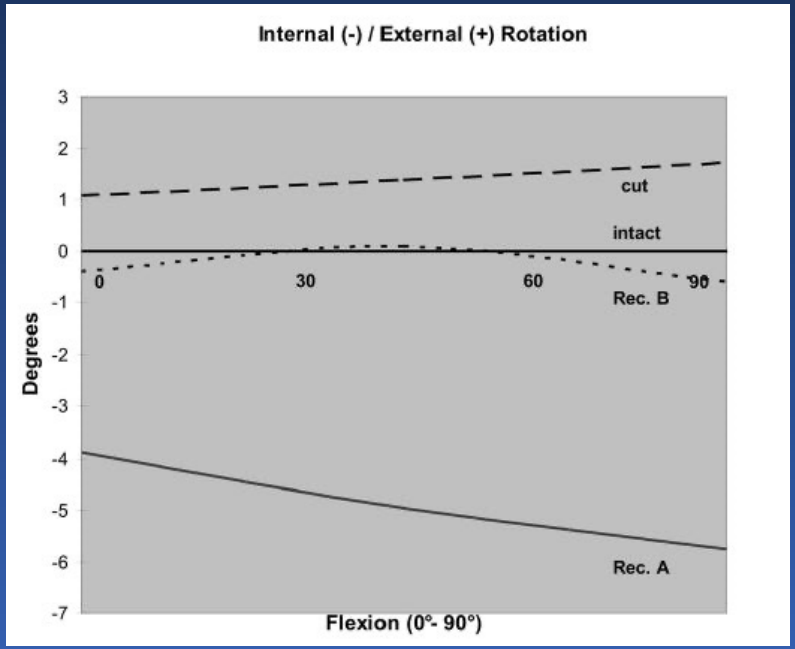
LCL and PFL Recon

PLC Recontruction

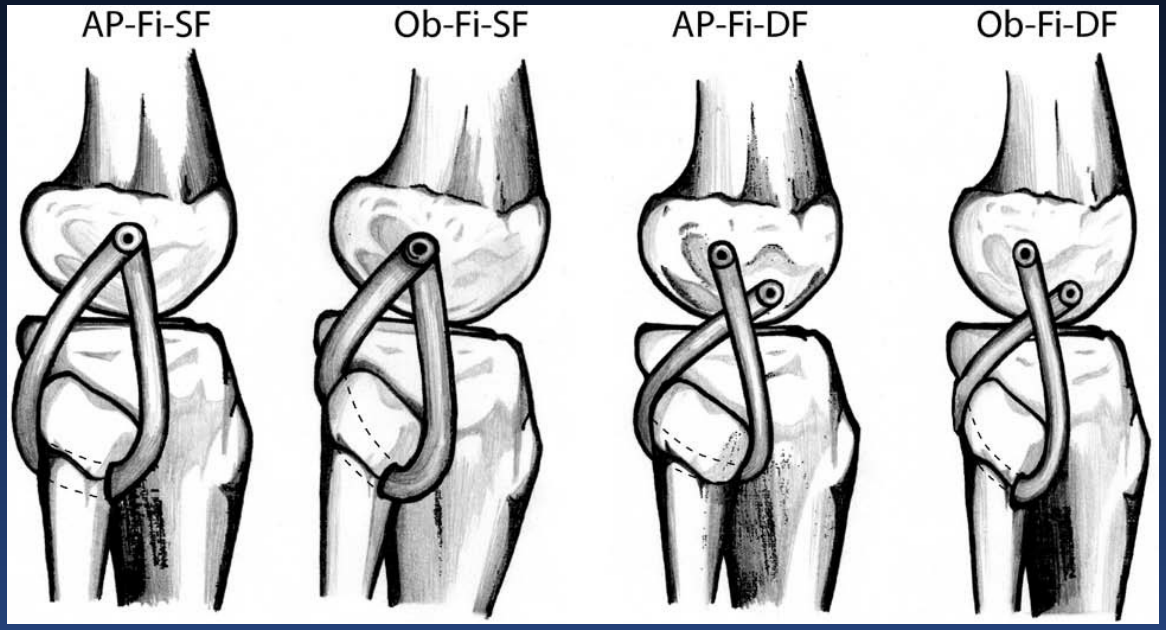
Comparison of 2 Surgical Techniques, Nau et al

- Both surgical techniques demonstrated restoration of stability in the static laxity tests.

- "Anatomic" reconstruction demonstrated abnormal internal tibial rotation during dynamic testing



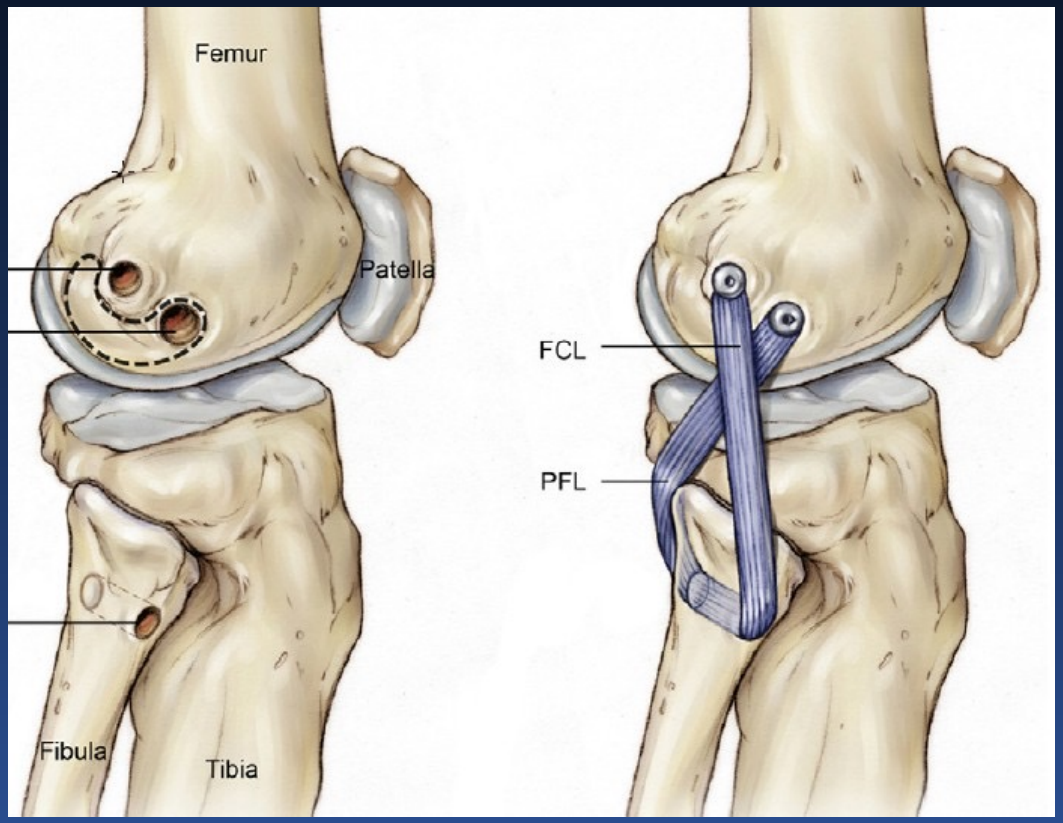
Comparison of Fibular Based Posterolateral Corner Reconstructions Using Computer Assisted Navigation
Feeley et al. Arthroscopy 2010



- Varus opening and External rotation evaluated with stress at 0, 30, and 90 degrees

- "A double femoral tunnel with an oblique fibular tunnel best restored native knee kinematics to the lateral side of the knee."

Fibular based PLC reconstruction with dual femoral tunnels



Incision

Cadaveric Demo – Robert Arciero MD

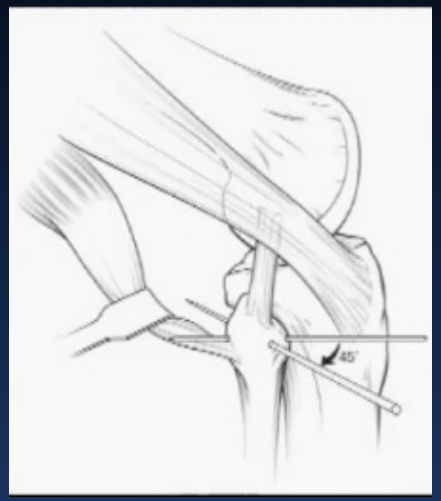
Live Surgery – Aman Dhawan MD

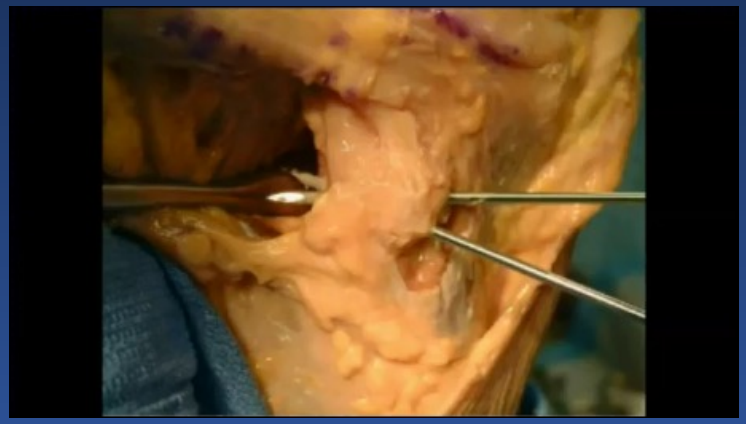
Curvilinear – Femoral Epicondyle to just anterior to Fibular Head

PLC Technique

- Tag Common Peroneal Nerve
- Expose of proximal fibula
- Split Biceps F. Insertion to find start point for guidepin

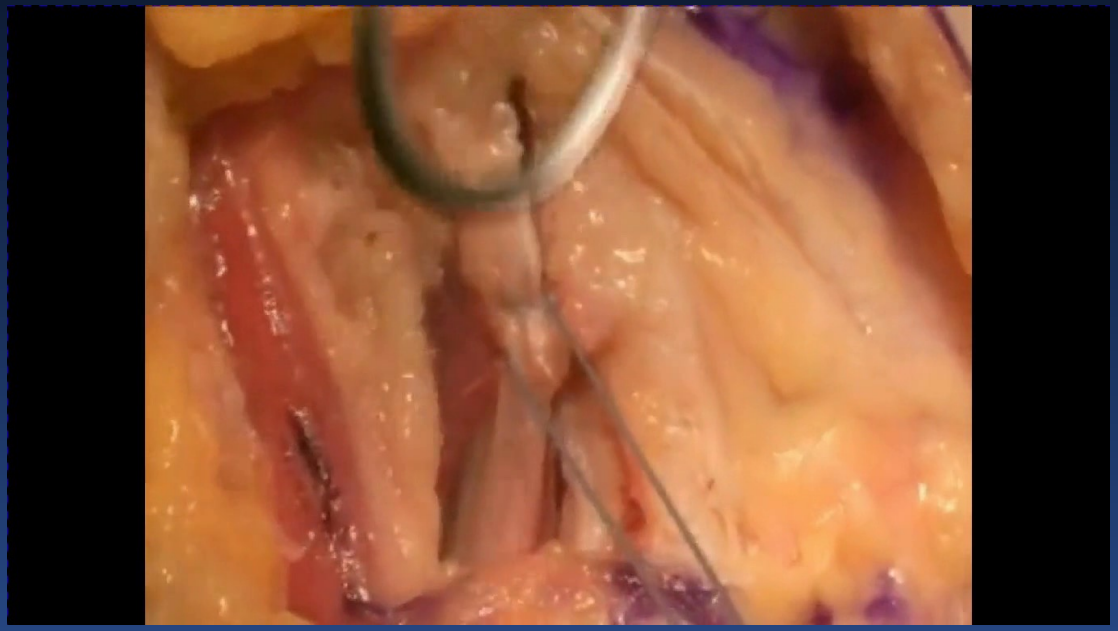
PLC Technique



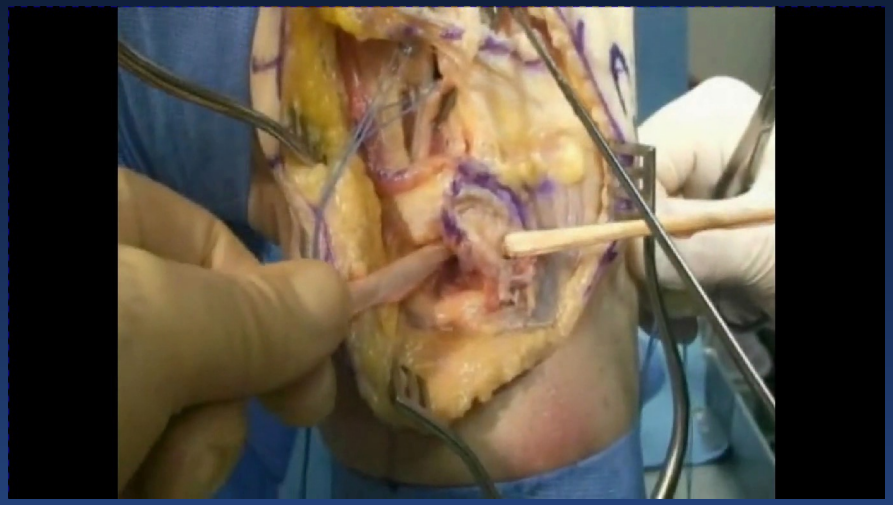


PLC Technique

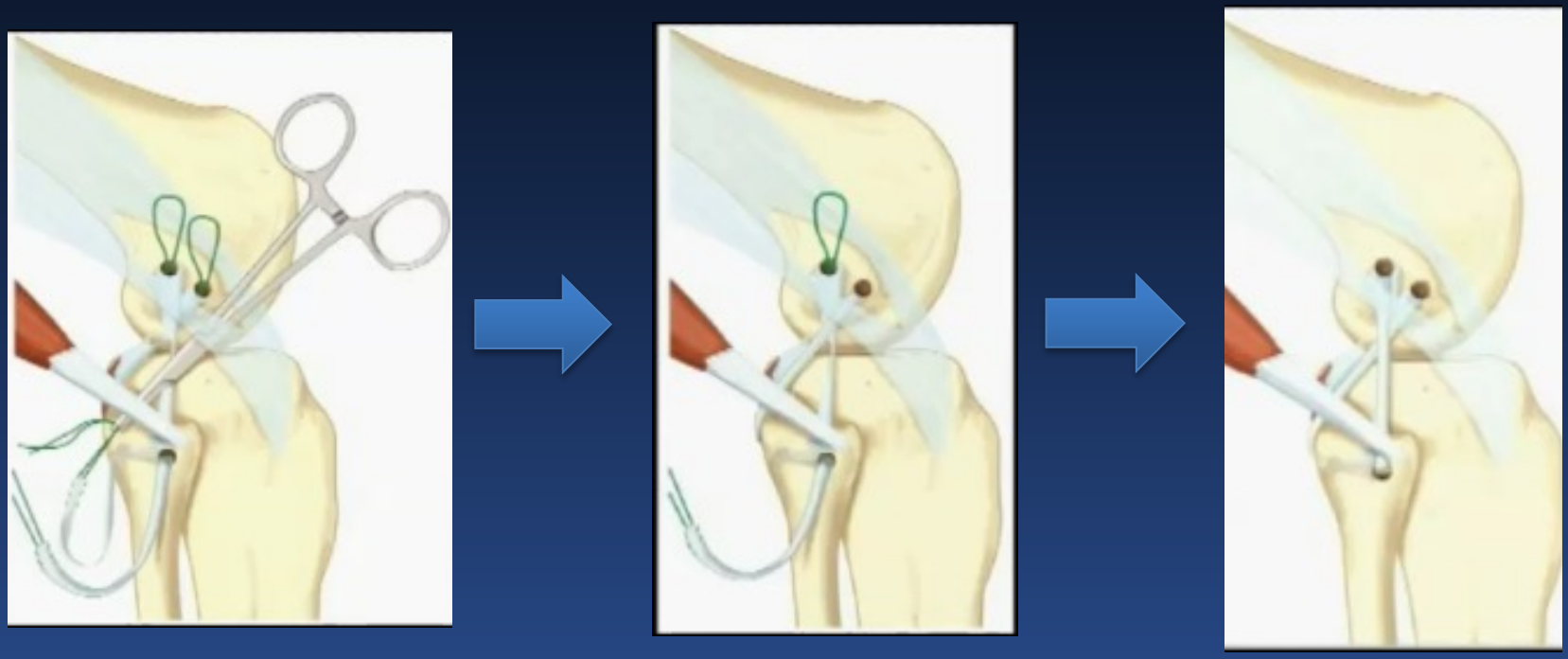
- Using fascial window between ITB and Biceps - Incise posterolateral capsule



PLC Technique



PLC Technique



PLC Technique

Outcomes after Fibular based posterolateral corner reconstruction

Rios et al AJSM 2010

- 29 patients with Posterolateral corner and concomitant cruciate ligament reconstruction
- The mean Lysholm and Tegner knee scores were 83 and 6
- The mean difference in total anterior-posterior side-to-side KT arthrometry measurements was 1.4 +/- 1.3 mm.
- The varus stress radiographic mean side-to-side difference measured at 20 degrees of flexion was 0.2 +/- 1.9 mm.
- The mean radiographic posterior tibial displacement with a 15-kg stress at 90 degrees of flexion was 3.2 +/- 4.5 mm in patients undergoing posterior cruciate ligament reconstruction.

Summary

- PCL and Posterolateral corner injuries occur together frequently
- MOST PCL injuries (Isolated grade I and II) can be managed non-operatively with rehab focusing on quads control and strengthening and PCL specific bracing
- Surgery for PCL injuries for combined injuries, symptomatic grade III injuries that have failed non-op tx
- PCL reconstruction surgery is not as successful as ACLR, and the recovery is almost twice as long
- I perform transtibial double bundle PCL reconcstruction
- Posterolateral corner injuries are common and need to have high suspicion for these
- Most relevant surgical anatomy include the LCL, Popliteofibular ligament, Politeus and Posterolateral casule
- While there have been good outcomes with repair in limited series, in general and in chronic cases reconstruct over repair
- In my practice, I generally stage or delay treatment until swelling has subsided, range of motion is regained, capsule has repaired, concomitant injuries have been reconciled. I find less surgery needed, less arthrofibrosis and return to the OR for stiffness, and overall better outcomes

Thank You

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