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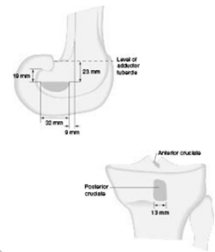
PCL INJURIES



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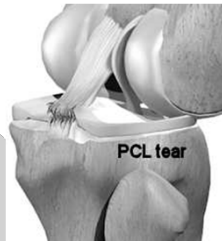
PCL Anatomy

- Intra-articular / Extra-synovial
- 38 mm length / 13 mm width
- Fan-shaped structure
 narrowest-midportion
 widest at MFC origin
 (32mm in AP diameter)
- Compact insertion @ posterior tibial shelf- 1 cm distal to the tibial plateau



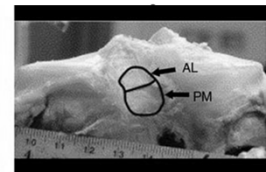
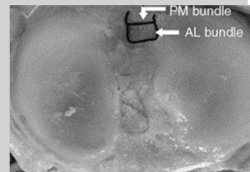
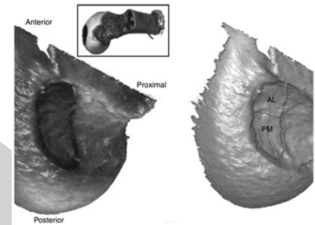
Epidemiology

- PCL injuries- only 5 to 10% of all knee ligament injuries.
- Incidence of PCL injury is 3%
- At NFL Rookie Combines- 2% isolated PCL laxity - players usually unaware



PCL Anatomy

- AL & PM Bundle
 Femoral & Tibial Insertions Sites
- Femoral site 1° influence on PCLR



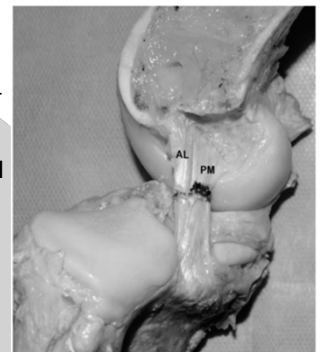
Epidemiology

- Associated injuries: PCL & PLC, PCL & ACL, and PCL & MCL
- Causes of injury :
 - > 50% vehicular trauma
 - > 40% sports injury
 - > 10% other



PCL Anatomy : Macroscopic

- Two fiber bundles
 - > Anterolateral band - tightens in flexion
 - > Posteromedial band - tightens in extension.



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Biomechanics : Normal PCL

- ⊙ PCL - 1° restraint to PD
 - > @ 90° flexion- 100% resisted by PCL
 - > @ 30° flexion- 55% resisted by PCL
 - > @ 0° flexion- 10% resisted by PCL
- ⊙ PCL injury alters:
 - > Knee biomechanics
 - > Proprioception



Mechanism of Injury- PCL

- ⊙ Posteriorly directed trauma
 - > dashboard injury
 - > fall onto a flexed knee with the foot in plantar flexion.
- ⊙ Hyper-flexion injury
- ⊙ Forced hyperextension beyond 30° (ACL 1st)
- ⊙ A rotational injury w/ varus or valgus stress can cause PCL injury w/ associated collateral ligament disruption.



Biomechanics of PCL Injury

- ⊙ Isolated PCLT- Minimal effect
 - > Rotational
 - > varus/valgus stability
- ⊙ With PLC injury:
 - > ↑ varus angulation
 - > ↑ tibial external rotation.



Good et al.

History : Acute PCL Injury

- ⊙ UNLIKE ACL-injured patients :
 - > Deny hearing or feeling a pop at time of injury.
 - > Report gradual, slow swelling over first few days.
 - > Are usually able to bear weight on the injured leg.



Biomechanics : Normal PCL

- ⊙ Anterolateral Bundle- 1120-1620N
 - > 1° restraint @ 90° flexion
- ⊙ Posteromedial Bundle- 258-419N
- ⊙ Menisocofemoral Ligaments- 300N each
 - > Contributes 28% of restraint to PD



History : Chronic PCL Injury

- ⊙ Isolated PCL injury is more subtle, and can be missed for long periods.
- ⊙ UNLIKE ACL-deficient patients:
 - > PCL-deficient pts rarely complain of giving way or buckling.
 - > 1° complain - pain & disability over time
 - > Pain w/ long distance walking.
 - > Anterior knee pain
 - > Unsteadiness on stairs



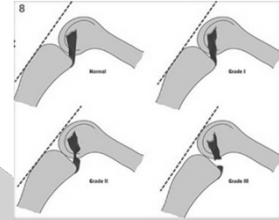
Physical Exam : Acute

- ⊙ Abrasions/ecchymosis @ tibial tubercle
 ───▶ suspect PCL injury
- ⊙ Mild-Moderate swelling
- ⊙ Posterior knee pain
- ⊙ Typically lack 10-20° of Knee flexion



Tests for PCL Instability

- ⊙ POSTERIOR DRAWER
 - > **Grade I** : anterior tibial stepoff is only 5 mm
 - > **Grade II** : there is no stepoff
 - > **Grade III** : tibial crest lies posterior to the condyles
- ⊙ **Grade III PD**
 - > usually combined ligamentous injury
 - > most often PCL & PLC



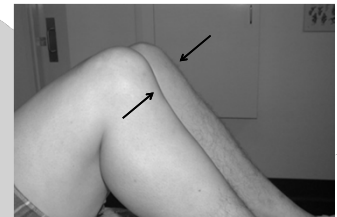
Physical Exam : Acute

- ⊙ Careful NV exam
- ⊙ Beware of subtle Multi-ligament Injuries
- ⊙ Suspect vascular injury
 ───▶ angiogram.



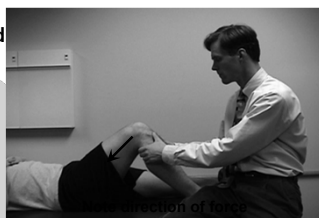
Tests for PCL Instability

- ⊙ Posterior Sag Sign:
 - > Supine -knee flexed 90 degrees, the tibia sags posterior subluxation
 - > Acutely, can be limited by quads spasm, effusion and pretibial swelling.



Tests for PCL Instability

- ⊙ Posterior Drawer :
 - > The most sensitive and specific test
 - > Performed @ 90° knee flexion
 - > Check MTP step-off



Tests for PCL Instability

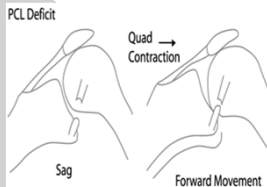
- ⊙ Godfrey test :
 - > A modification of the posterior sag test
 - > hip and knee both flexed to 90°
 - > Gravity accentuates the posterior subluxation.



Tests for PCL Instability

Quadriceps Active Test :

- > The quads contracted against resistance- knee flexed between 70 and 90 degrees.
- > With PCL tear-isometric quads contraction reduces the tibia.
- > This test is usually too painful to perform acutely, but is helpful with chronic cases.



Making the Diagnosis

- ◎ Because the symptoms of PCL injury are subtle, this diagnosis can initially be missed.
- ◎ *Shelbourne, AJSM 1994* :
 - > accuracy of the clinical exam
 - > 96% Accuracy & 99% Specificity. But only 90% Sensitivity (70% Grade I, 97% Grades II & III).
 - > Concluded that even in the best hands, the diagnosis is often not easy.



Tests for PCL Instability

Reverse pivot-shift test :

- > (+) if reduction sensation is appreciated as the flexed, ER knee is extended with a valgus stress.



Radiographic Evaluation

X-Rays :

- > R/O bony avulsions
- > Chronic- arthritic changes.



Physical Exam : R/O Combined Instability

**Occurs in 50-90% of PCL injuries

Assessing the PL Corner :

- > Dial Testing
- > Hughston ER/recurvatum test



Assessing the ACL :

- > Lachman, Anterior drawer, Pivot shift

Assessing the collateral ligaments :

- > Varus/valgus stress testing at 30 and 0 degrees



Radiographic Evaluation

MRI :

- > An important adjunct to diagnosing PCL injury
- > 99% accurate
- > evaluates menisci and other ligaments
- > PCL may appear "normal" in chronic grade I or II injuries



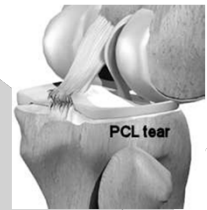
Natural History of PCL Deficient Knees

- ◎ Originally thought benign course with neglect
- ◎ Progressive disability and DJD
 - › Medial & PF compartments
- ◎ Shelbourne et al, 1999:
 - › 88% of patients > 4 year- x-ray evidence of DJD.
 - › Return to Sport: 50% same level/ 33% lower level/ 17 % changed sports
 - › No correlation between grade of laxity & DJD



Indications for Non-op Treatment

- ◎ All isolated acute Grade I-II PCL injuries.
- ◎ *Shelbourne et al.*
 - › acute isolated PCL injury
 - › can heal w/ a firm endpoint & minor residual laxity
- ◎ *Clancy et al.*
 - › If synovial sheath intact the healing PCL contracts
 - › laxity can improve one grade



Natural History of PCL Deficient Knees

- ◎ Parolie & Bergfeld, 1986:
 - › (+) correlation between improved scores & quad strength
 - › No correlation between laxity & RTS
- › Return to Sport: av 6 wks post-injury
 - 68% same level
 - 16% lower level
 - 16 % no sports



Non-Surgical Rehab: PCL Injury

- ◎ Knee brace in full extension 2-4 wks
 - › Prevent posterior tibial sag
- ◎ Protected WB
- ◎ ROM
- ◎ Quad strengthening/ SLR/ mini-flexion squats
- ◎ Avoid HS resistive exercises
- ◎ Return to sports – 6 + wks (I/II PCL)
 - › ≥ 3 mos (III PCL)
- ◎ Functional/Dynamic Brace
 - › Rebound PCL brace
 - › Jack PCL brace

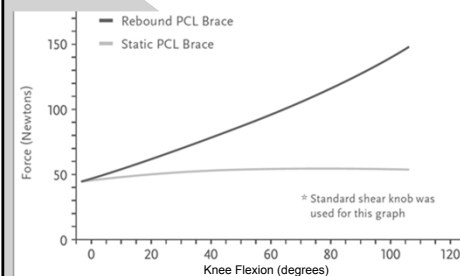


Treatment Decisions : Op vs. Non-op

- ◎ FACTORS:
 - › Acute vs. chronic.
 - › Degree of laxity.
 - › Associated injuries.
 - › Symptoms and complaints.
 - › Patient's activity level and demands.



Dynamic Bracing



Literature: Non-Operative Treatment

Favorable Results

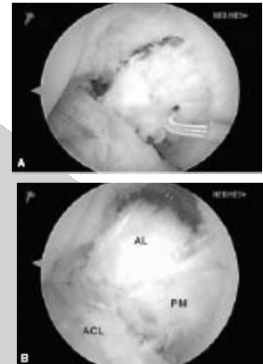
- Fowler & Messier, 1987
- Parolie & Bergfels, 1986
- Torg et al, 1989
- Shino et al, 1995
- Boynton & Tietjens, 1996
- Shelbourne et al, 1998

Poor Results

- Dandy & Dussey, 1983
- Clancy et al, 1983
- Keller et al, 1993
- DeJour et al, 1987
- Noyes, 1994

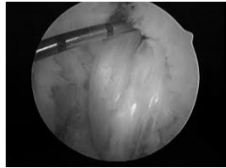
Surgical Decisions:

- *Single Bundle PCLR*
- *Double Bundle PCLR*
- *Trans-Tibial Technique*
- *Inlay Technique*
- *All-Inside Technique*



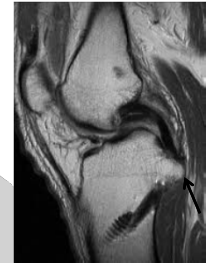
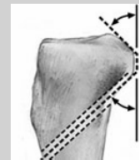
Indications for Operative Tx

- Isolated grade III PCL injuries
- Grade III PCL with combined instability patterns.
- Displaced bony avulsion → ORIF.
- Controversial-Grade II injuries in high-demand athletes.
- Chronic sx PCL pts w/ complaints of pain or instability.



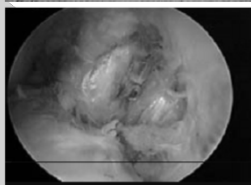
Trans-Tibial-WHY SO BAD ?

- “Killer turn”
 - > Difficult to effectively tension graft.
 - > predisposes graft to fraying and elongation.



Isolated PCL Reconstruction

- Acute PCLR outcomes > Chronic
- No graft type superior
 - > Achilles Allograft- most popular
- Most PCLR have residual laxity
 - > Improve 1+ grade



Possible Solutions

- Avoid “Killer turn” → Tibial inlay technique
 - > Bergfeld et al: less posterior tibial translation & graft degradation vs Trans-Tibial
 - > Biomechanical cadaver model
 - > Clinically- no advantage
- Trans-Tibial vs Inlay:
 - > Clinical studies-No differences
 - > Seon & Song, 2006
 - > MacGillivray, 2006
 - > Song et al., 2014

