Posterolateral Corner Injuries of the Knee

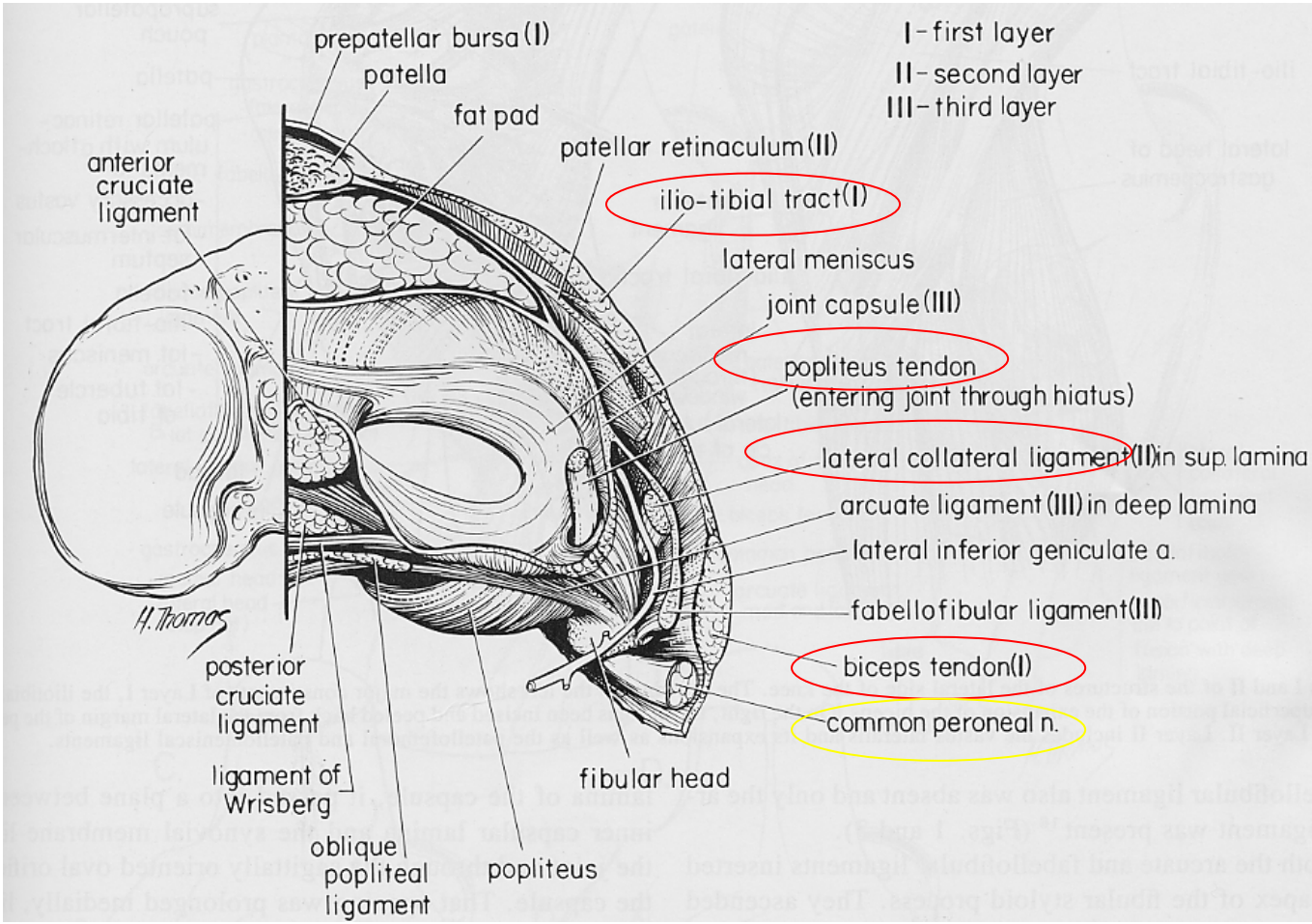
Objectives

- Review epidemiology of PLC injuries
- Review anatomy of the lateral side of the knee
- Review clinical diagnosis of PLC injuries
- Review management options for PLC injuries
- Review outcomes and available literature for PLC injuries

Epidemiology of the problem

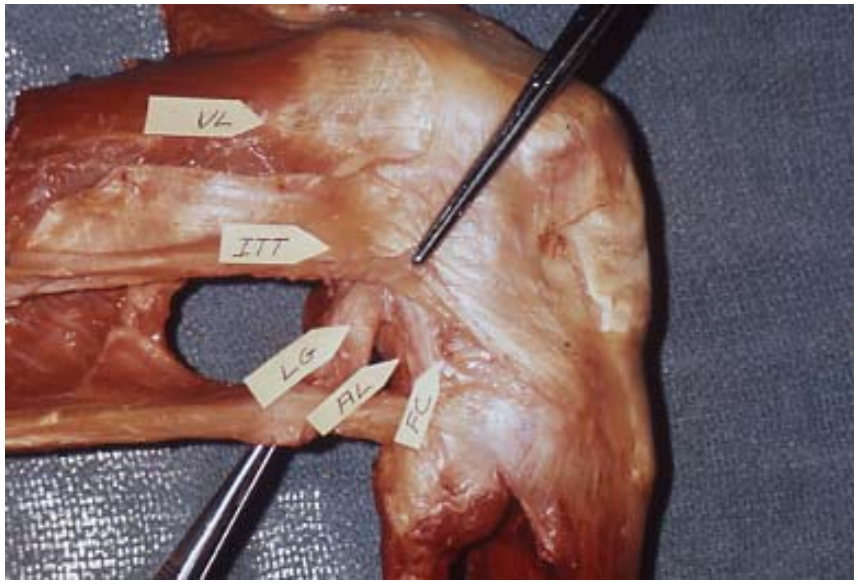
- Isolated PLC injuries are uncommon, making up <2% of all acute knee ligamentous injuries. *Covey JBJS 2001*
- Incidence of PLC injuries associated with concomitant ACL and PCL disruptions are much more common (43% to 80%). *Ranawat JAAOS 2008*
- A recent (MRI) analysis of surgical tibialplateau fractures demonstrated anincidence of PLC injuries in 68% of cases. *Gardner JOT 2005*

Anatomy


I - first layer
II - second layer
III - third layer
prepatellar bursa (I)
patella
fat pad
patellar retinaculum (II)
anterior cruciate ligament
ilio-tibial tract (I)
lateral meniscus
joint capsule (III)
popliteus tendon (entering joint through hiatus)
lateral collateral ligament (II) in sup. lamina
arcuate ligament (III) in deep lamina
lateral inferior geniculate a.
fabellofibular ligament (III)
biceps tendon (I)
common peroneal n.
H. Thomas
posterior cruciate ligament
ligament of Wrisberg
oblique popliteal ligament
popliteus
fibular head

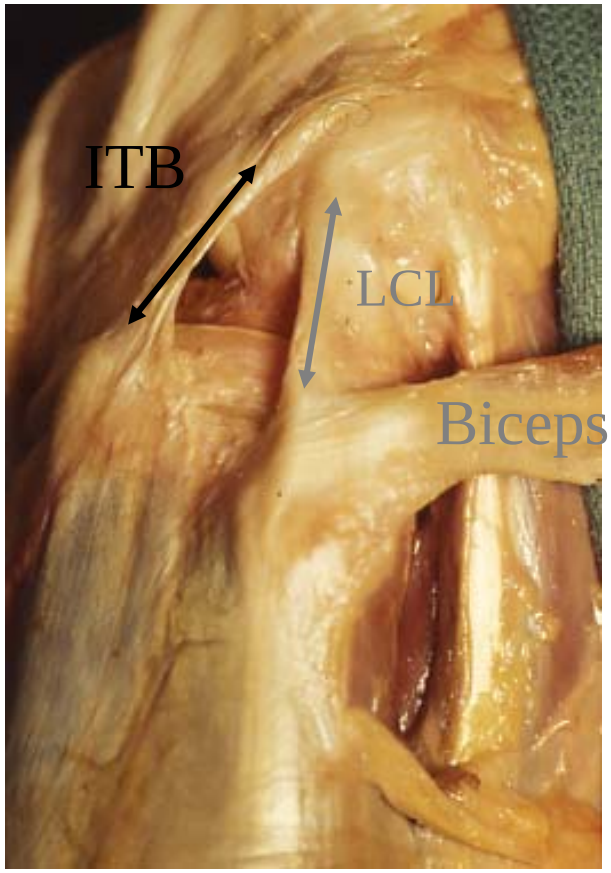
Iliotibial Band

- Proximally, part of gluteus maximus and the TFL insert on the IT band
- The IT band inserts on Gerdy's tubercle on the proximal – lateral tibia
- Acts as an accessory anterolateral ligament.
- With flexion – ITB moves posteriorly exerting ER and posterior force on lateral tibia.
- With extension – acts as a restraint to varus stress and posterolateral rotation.



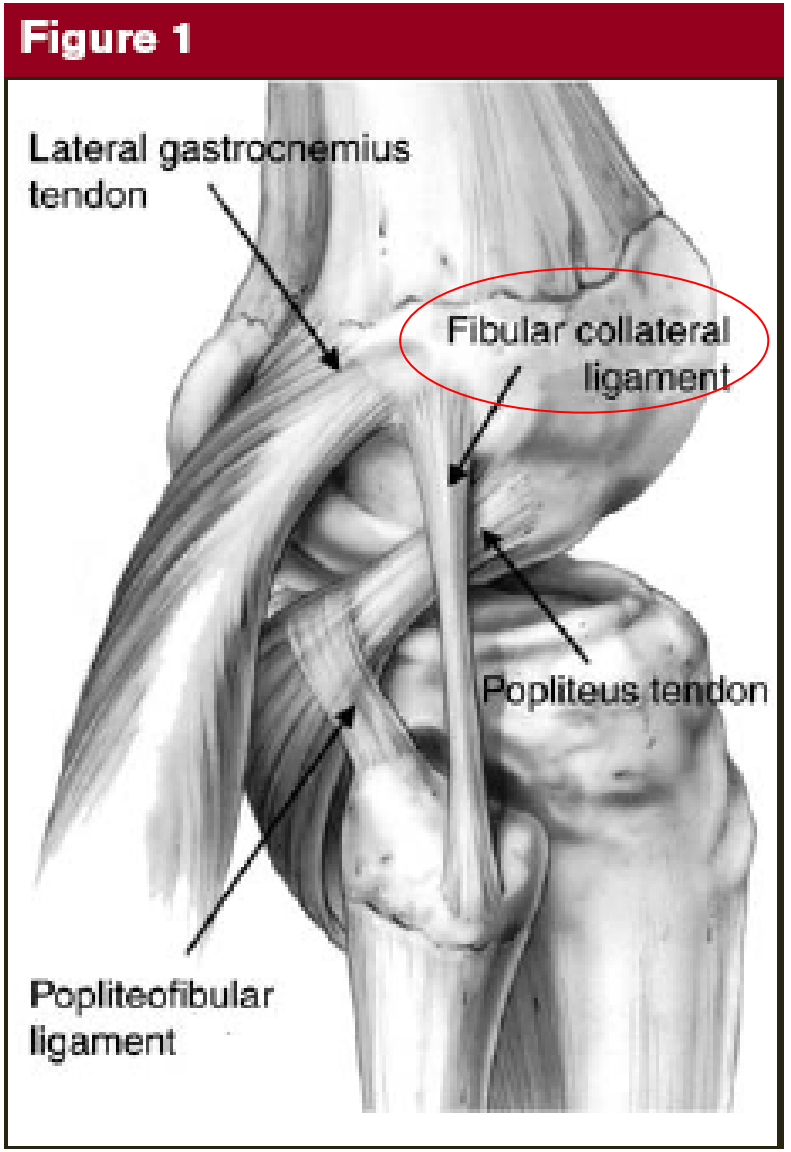
Biceps Femoris

- Consists of a long and short head
- Courses posterior to the ITB, inserting primarily in to the fibular head, but also sends attachments to the ITB, Gerdy's tubercle, the LCL, and the posterolateral capsule.
- Powerful dynamic ER of the tibia and contributes as a lateral stabilizer.



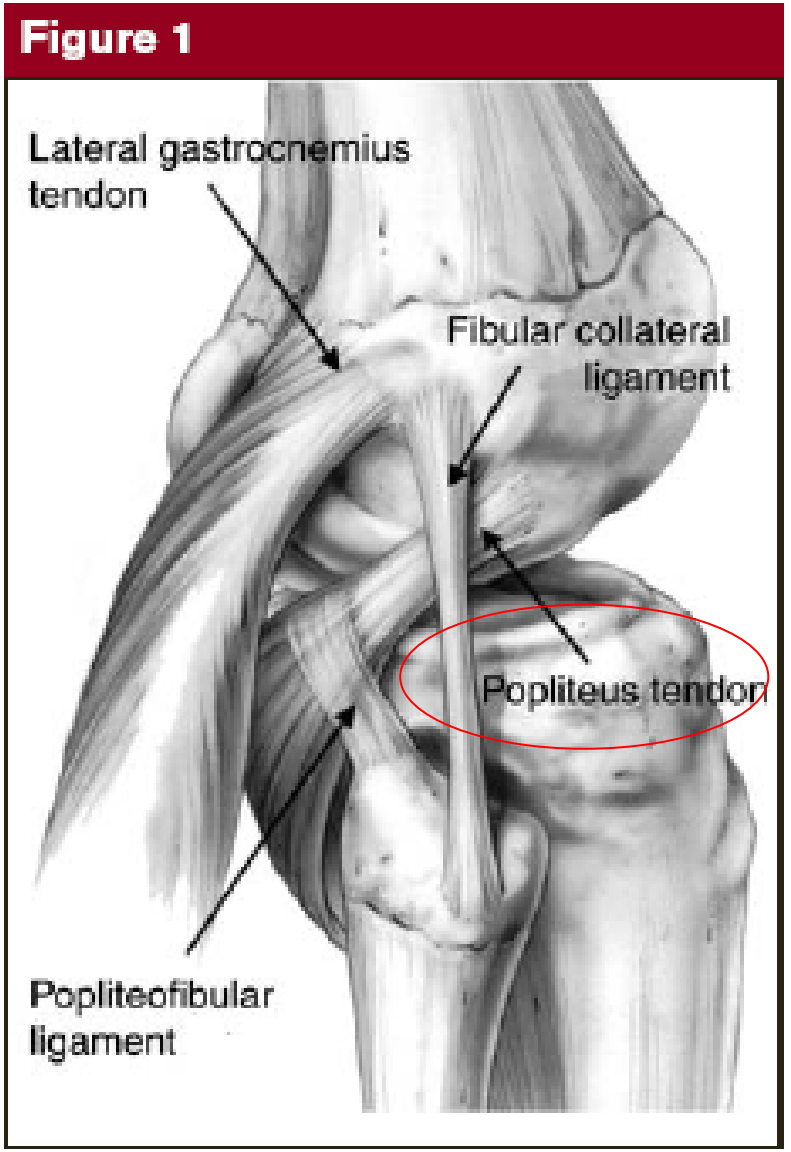
Anatomy

- The LCL is the primary static varus restraint for the knee (esp at 30 deg flexion)
- The LCL also functions to limit external rotation at 30 deg of flexion
  - Femoral side: insertion is just posterior and proximal to lateral epicondyle
  - Fibular side:8 mm from anterior border of fibular head



Anatomy

- The popliteus is a muscle that originates on the proximal posterior tibia and has an intra-articular tendon that inserts just anterior and distal to the LCL attachment
  - Important attachments include the popliteofibular ligament, the poplitealtibial ligament and popliteameniscal ligament



Anatomy

- The popliteus and poplitealfibular ligament provide restraint against tibial external rotation at higher flexion angles (~60 deg)
- The popliteus is also a secondary restraint to posterior tibial translation (assists PCL / protects PCL reconstruction)

Typical Mechanism of Injury

- Sports injuries / high energy trauma account for most mechanisms of PLC injury
- Posterolaterally directed blow to the medial tibia with the knee in extension is the most common mechanism.
  - Results in forceful hyperextension with external rotation and varus.
- Noncontact hyperextension, external tibial rotation and varus stresses are also common mechanisms
- *Ranawat JAAOS 2008*

Clinical diagnosis

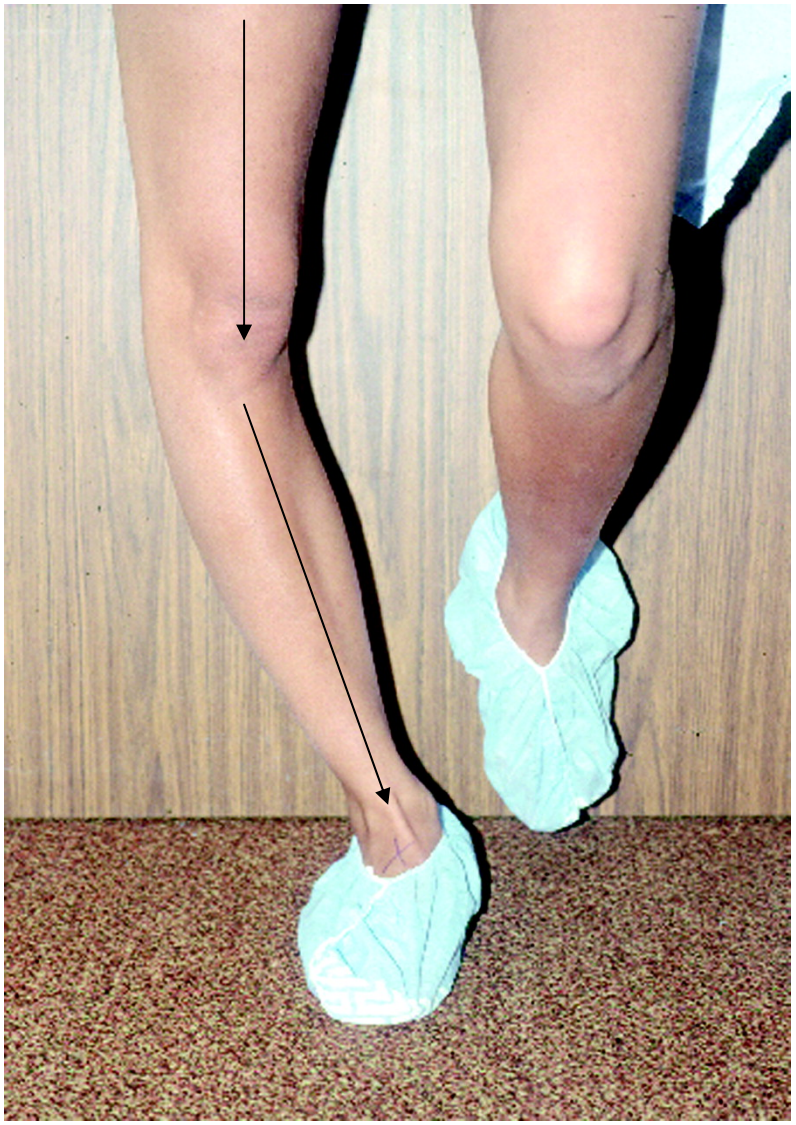
- In the acute setting, always consider that a multiligament knee injury may represent a reduced dislocation:
  - Check distal neurovascular status
  - Pulses, ABI, angio if needed
  - Make sure you can hold the knee in a reduced position (brace, splint, ex-fix)

Clinical diagnosis

- Hx:
  - Patients may relay sx of instability and posterolateral pain
  - Note the knee is most unstable near full extension.
  - Knee buckles into hyperextension.
  - Difficulty with stairs.
  - Difficulty with cutting requiring lateral movement

Physical exam

- Phys exam:
  - Acutely may have posterolateral ecchymosis
  - May walk with a varus / hyperextension thrust



Varus Stress Test

- Test with knee at 0 and 30 degrees of flexion.
- Varus laxity at 30 degrees = PLC injury.
- Varus laxity at full extension = PLC plus cruciate ligament injury

Dial Test

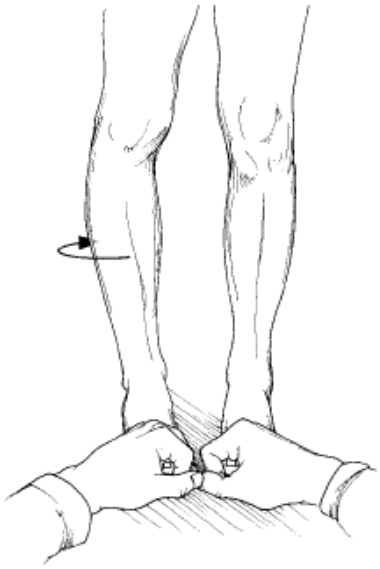
- Best test for loss of external rotation restraints (popliteus, PFL) is dial test
- Need to compare to contralateral side

Dial Test

- A 10˚ difference in external rotation between limbs at 30˚ is evidence of pathology to the PLC
- When there is further increased external rotation at 90˚, then a combined PCL/PLC injury is present.
- *Veltry AJSM 1995*

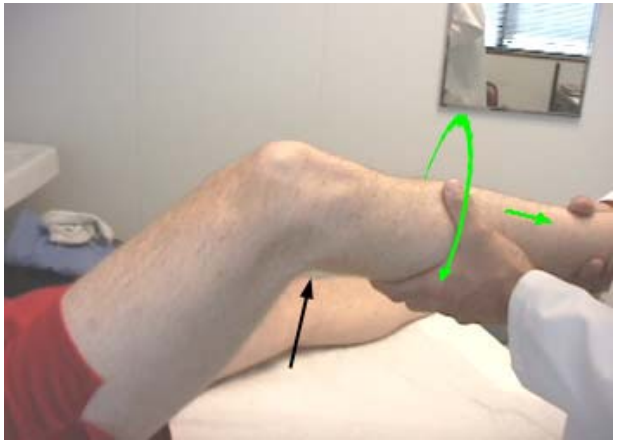
External Rotation Recurvatum Test

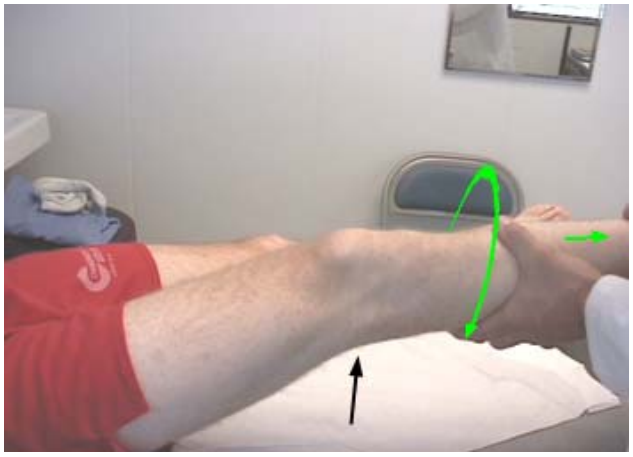
- With a PLC injury, the knee falls in to varus and recurvatum and the tibia externally rotates.



Reverse Pivot Shift

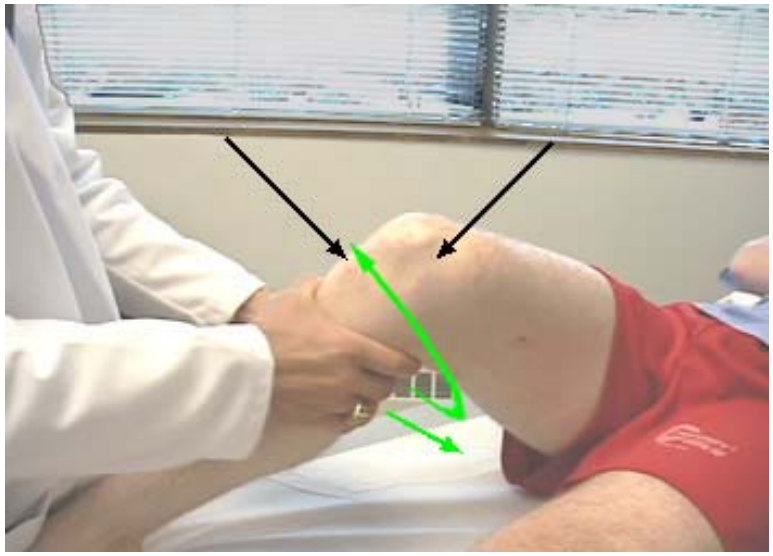
- Dynamically assesses for posterolateral knee rotation.
- Knee flexed 80-90 degrees, a valgus and ER force applied.
- Knee is then extended. If the tibia is posterolaterally subluxated, the iliotibial band will reduce it as it goes from a flexor to an extensor of the knee (@20-30 deg flexion)





Posterolateral drawer test

- the knee is flexed to 80°, and the foot is externally rotated while a posterior load is applied.
- A positive result occurs when the lateral tibial plateau rotates posteriorly and externally relative to the medial tibial plateau



Grading system

- grade I injuries have minimal instability (either varus 0-5mm opening or rotational instability 0° to 5°)
- grade II injuries have moderate instability (6 to 10mm or 6° to 10°)
- grade III injuries have significant instability (>10 mm or >10°)
- Grading system not validated…

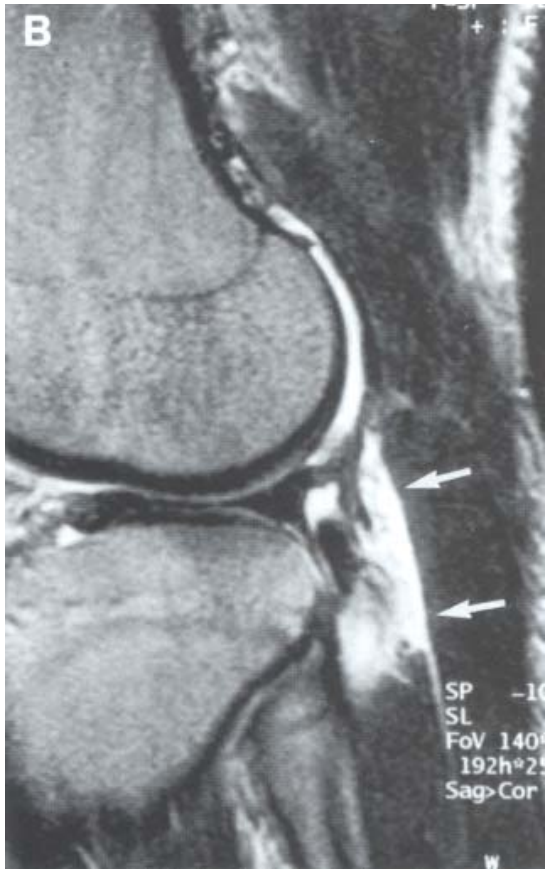
Imaging

- Plain x-rays
  - Look for avulsion fracture
- MRI
  - Confirm injury
  - Look for associated injuries


S
R

Popliteus Rupture

- T2-weighted image showing soft tissue edema about the popliteus centered at the level of the rupture at the myotendinous junction.



Treatment

- Grade 1 and 2 injuries successfully treated non-operatively with good results at 8 yrs
- Patients with grade III injuries treated nonsurgically reported fair functional outcomes, poor strength, and persistent instability.
- Up to 50% of these patients had osteoarthritic radiographic changes in both the medial and lateral compartments
- *Krukhaug Knee Surg 1998*
- *Kannus AJSM 1989*

Non-operative

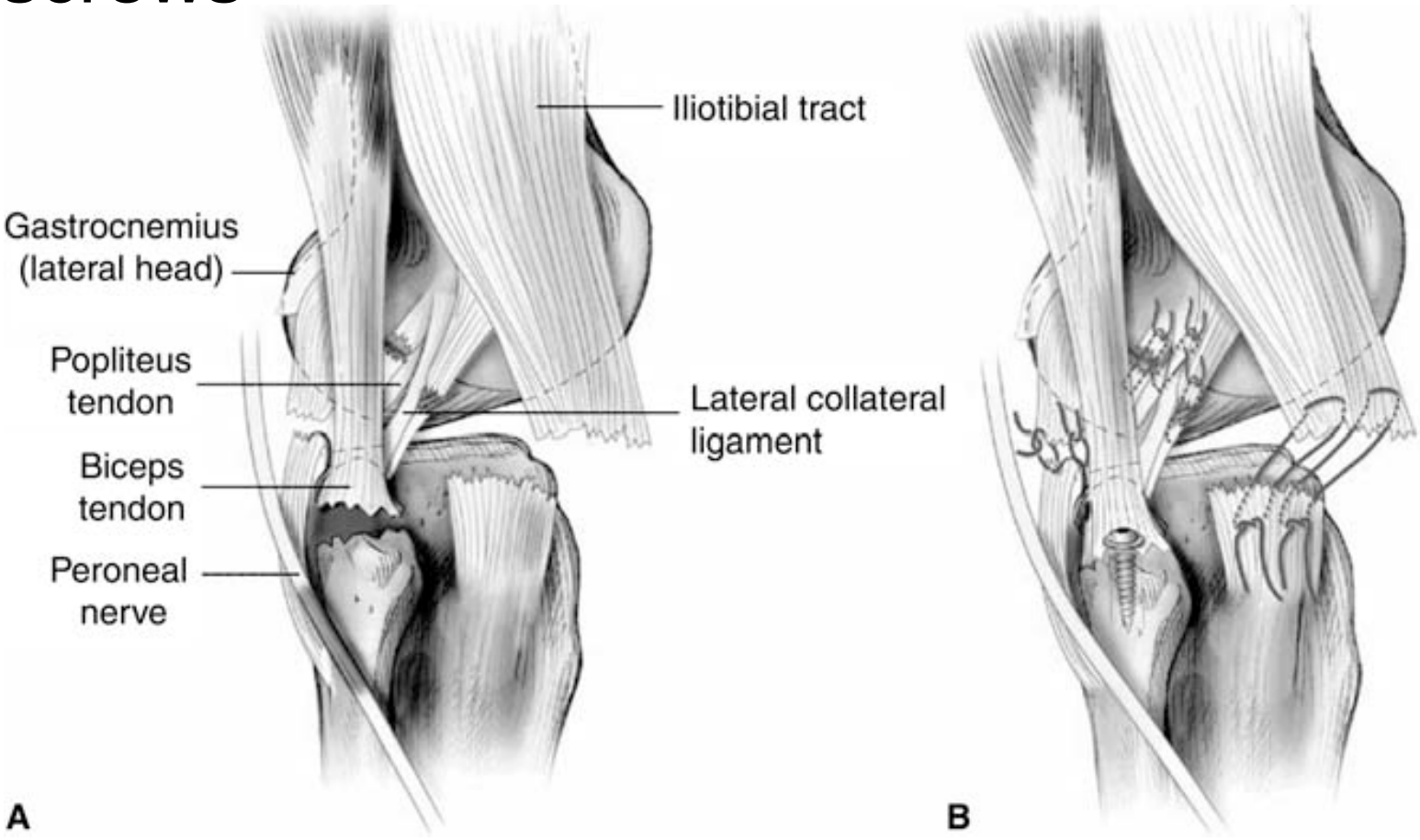
- Hinged knee brace x 6 weeks
- Locked in extension for ambulation
- Progressive ROM, WB, strengthening with return to activity at 3-4 mos

Surgical indications

- Accepted:
  - Avulsion fractures
  - Multiligament knees
  - Grade 3 injuries
- Controversial
  - Grade 2 injuries
    - Improved varus stability and functional results
    - *Krukhaug Knee Surg 1998*
    - *Kannus AJSM 1989*

Acute injuries (less than 3 weeks)

- Acute repair with sutures / anchors / screws



Repair vs Reconstruction

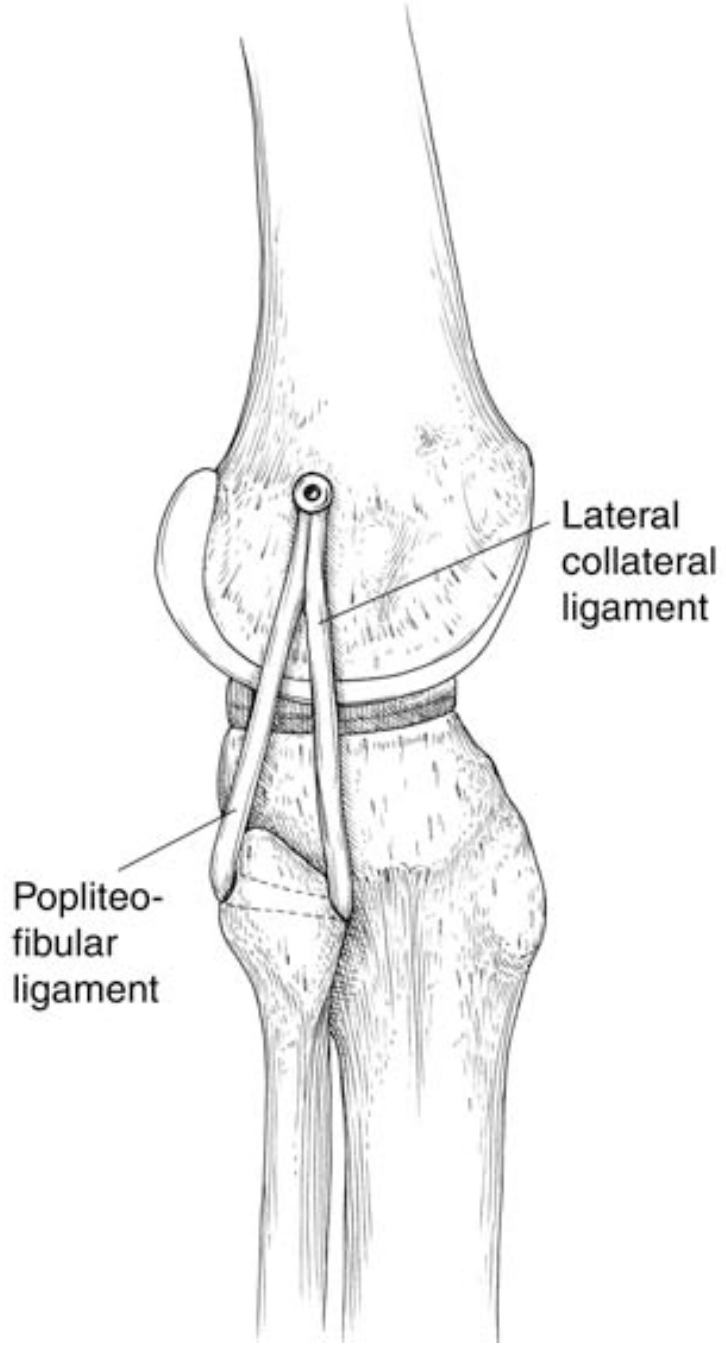
- Acute (immediate) repair generally gives more favorable results than does chronic (late) reconstruction because of the restoration of native anatomy and normal biomechanics
- *Ranawat JAAOS 2008*

Reconstruction

- Many different surgical options exist
  - Fibular based
  - Anatomic based (reconstruct LCL, popliteus)
- Short term outcomes good (64->90%)
- Long term studies lacking

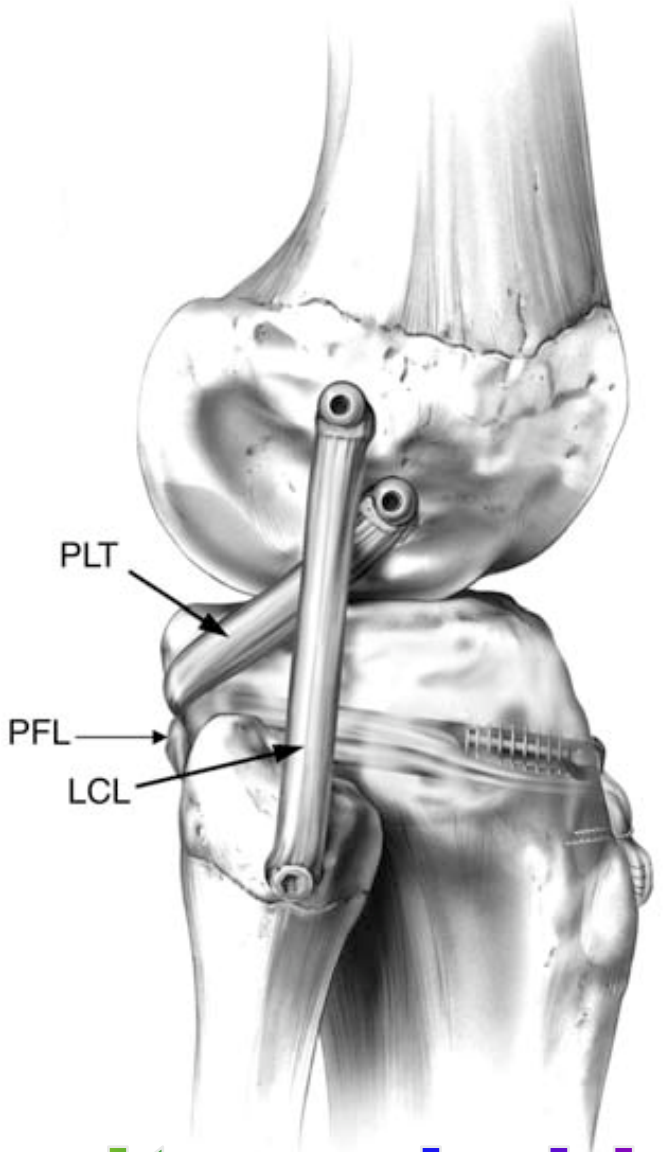
Recon

- Larson type fibular based reconstruction



Recon

- Laprade style anatomic reconstruction



Clinical Outcomes of Chronic Anatomic Reconstruction of the Posterolateral Corner

Study	No. of Knees	Type of Reconstruction	Mean Follow-up (yr)	Outcome Scores ($P < 0.05$)	External Rotation >5°	Varus Laxity >5 mm
Yoon et al[63]	25	Sling procedure	3.2	Lysholm: 32% excellent, 52% good	12%	28%
Yoon et al[63]	21	Anatomic LCL, PFL, popliteus reconstruction	1.8	Lysholm: 57% excellent, 38% good	5%	14%
Noyes and Barber-Westin[61]	14	Anatomic LCL reconstruction	4.7	IKDC: 93% normal or nearly normal; Cincinnati: 14% excellent, 50% good	7%	7%
Buzzi et al[65]	13	Anatomic LCL reconstruction: 6 ACL, 7 PCL	5	IKDC: 83% normal, 17% nearly normal	0%	0%
				IKDC: 28% normal, 72% nearly normal	8%	0%
Latimer et al[55]	10	Anatomic LCL reconstruction	2.3	Lysholm: 50% excellent, 40% good	10%	0%

ACL = anterior cruciate ligament, Cincinnati = Cincinnati Knee Rating Scale score, IKDC = International Knee Documentation Committee Subjective Knee Evaluation Form score, LCL = lateral collateral ligament, Lysholm = Lysholm knee scale score, PCL = posterior cruciate ligament, PFL = popliteofibular ligament