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AAP BRS podcast: Knee Ligaments and Meniscus

ACL:
Origin: *medial* wall of the lateral femoral condyle → runs *antero-inferomedially*
Insertion: *anterior* spine of the tibial
Anteromedial bundle tenses with knee *flexion*
Posterolateral bundle tenses with knee *extension*

- Test: Lachman (84% sensitive) or Anterior drawer (62% sensitive) – caution: hamstring contraction can complicate these tests.
- Injury is typically from *hyperextension* or a combo of valgus force with *external* rotation of the tibia relative to the femur.
- Often + for popping sound/sensation with pain and swelling at time of injury
- Management: RICE, PT, or Surgery
- Prevention: neuromuscular training

PCL:
Origin: medial femoral intercondylar notch → runs *postero-inferolaterally*
Insertion: *posterior* tibial spine
Anteromedial bundle tenses with knee *flexion*
Posterolateral bundle tenses with knee *extension*

- Injury is typically from blunt trauma to the anterior proximal tibia (i.e., dashboard injury).
- Often + popping sensation, swelling and stiffness at time of injury
- Management: Conservative treatment if isolated, surgery if multi-ligament injury.

"LAMP": Lateral femoral condyle = ACL
Medial femoral condyle = PCL
Overall: **ACL tight when *ankle is Anterior* (knee extension)**
PCL tight when *ankle is Posterior* (knee flexion)

MCL:
Origin: medial femoral epicondyle
Insertion: medial tibial plateau
(deep MCL fibers attach to the medial meniscus and can concomitantly tear).
MCL resists valgus force (especially at *30 degrees flexion*)

- Injury is typically a rupture at the femoral insertion site, proximal tears heal better than distal.
- Management: RICE, +/- knee immobilizer 1-2 weeks, gentle F/E exercises in first 1-2 weeks, full activity as tolerated over 1-4 weeks depending on severity.
- Isolated MCL injuries heal well with non-operative management.

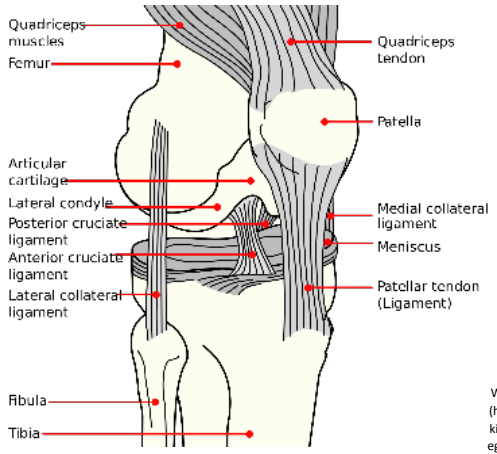

Image source: Wikipedia Commons (https://commons.wikimedia.org/wiki/Category:Ligaments_of_the_knee)

LCL:
Origin: lateral femoral epicondyle.
Insertion: head of the fibula
(*important because the common fibular nerve is in close proximity as it wraps around the fibular head and neck.)*
LCL resists varus force. Also resists external rotation

- Injury is much less common (about 5% of all knee ligament injuries).
- Assess foot dorsiflexion and eversion if LCL injury is suspected (*fibular nerve in close proximity to insertion*)

Intra-articular Injury: may present with swelling/effusion.

4 main causes of **knee effusion** following trauma:
1) ligament injury
2) intra-articular fracture
3) patellar dislocation
4) meniscus injury

Collateral (extra-articular) ligament injury:

- May hear a "pop" sound at time of injury.
- Imaging: usually always x-ray first to r/o other trauma, then MRI to see the ligament pathology.

Knee Sprain Grades:
1= no gross tearing
2=partial tear (increased laxity)
3=complete tear (no firm end feel).

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Medial Meniscus: C-shaped
Lateral Meniscus: O-shaped

- Vascularization to both is from the outer rim;
  - only outer 1/3 is considered well vascularized ("red-red zone")
- Centrally located tears (non-vascularized region) makes for a poor surgical candidate as well as older age due to osteoarthritis risk.
- Meniscus injury often occurs due to axial loading with rotation and can cause a popping or catching of the knee.
- Treatment with PT especially if inner 2/3. Consider surgery if outer 1/3.

O'Donoghue's Triad:
Also known as "terrible triad": concomitant injury to ACL, MCL, and medial meniscus.

Screw-Home Mechanism:

- Refers to the unlocking of the knee via an observable rotation with flexion and extension by the popliteus.
- Significant for knee stability and can be retrained

Helpful Resources:
AAPMR KnowledgeNOW: https://now.aapmr.org/meniscus-injuries-of-the-knee/, https://now.aapmr.org/acl-injury-and-rehabilitation/, https://now.aapmr.org/posterior-cruciate-ligament-pcl-injuries/, https://now.aapmr.org/posterior-cruciate-ligament-pcl-injuries/

	ACL	PCL	MCL	LCL
Anatomy	O: medial aspect of lateral femoral condyle in the intercondylar notch I: anterior to the intercondylar eminence of the tibia.	O: medial femoral condyle within the notch I: posterior aspect of the tibial spine	***Superficial:*** O: femoral medial epicondyle I: proximally blends into semimembranosus tendon, distally attaches at posteromedial crest of the tibia ***Deep:*** (tibial and meniscal parts) *meniscofemoral* O: femur just distal to sMCL I: medial meniscus *meniscotibial* O: from medial meniscus I: distal edge of articular cartilage of medial tibial plateau	O: lateral epicondyle of the femur I: fibular head
Most common pattern of injury	Pivoting or sudden deceleration with change in direction (cutting). Planted foot with valgus/internal rotation on flexed knee	Noncontact injury with knee hyperflexion, plantarflexed foot Direct posterior blow to a flexed knee (dashboard injury)	Valgus stress with possible ER (contact more common)	Contact: Varus stress with possible ER Noncontact injury (e.g, hyperextension stress)
Physical Exam	Positive: • Lachman test • Anterior drawer • Pivot shift test	Positive: • Posterior drawer test • Posterior sag sign • Quadriceps active test • Posterolateral drawer	Valgus stress -> widening of *medial* joint space	Varus stress -> widening of *lateral* joint space
Management	Conservative tx for mild instability- RICE, analgesics, PT Arthroscopic surgery	Conservative tx for mild instability- RICE, analgesics, PT Arthroscopic surgery	• X-rays and MRI used to r/o assoc. injuries • Conservative (functional brace and physical therapy) for isolated tears • Surgery if associated injuries are present.	• X-rays and MRI used to r/o assoc. injuries • Conservative (functional brace and physical therapy) for isolated tears • Surgery if associated injuries are present.
Other important details	Most commonly injured knee ligament Higher incidence in females		Often assoc. with medial meniscus tear More common than LCL	Usually assoc. with ACL or PCL tears. Isolated LCL is rare.