CAOM Knee Review

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Anatomy and Biomechanics

- 2 functional joints, the tibiofemoral joint and patellofemoral joint, but the proximal tibiofibular joint can also be a pain generating structure.

- The *tibiofemoral joint* transmits load from the femur to the tibia acting in the sagittal plane in a hinge with a degree of tibial torsion. Dynamic stability is provided by the quadriceps as the primary dynamic antagonist to the anterior cruciate ligament (ACL) and supports the posterior cruciate ligament (PCL). Conversely the hamstring is antagonist to the PCL preventing anterior subluxation as well as having the ability to tense/tighten the medial and lateral capsular ligaments. Screw home mechanism – tibial internal rotation with terminal knee extension is guided by the ACL. Static stability is provided by ligamentous structures and the menisci.

- The *patellofemoral joint* (extensor mechanism) acts to decelerate forward movement during the stance phase of gait and has a large sesamoid bone (patella) with proximal tendon attachments of the vastus intermedius and distal attachments to the patellar tendon. Boney stability of the patellofemoral joint occurs at 45 degrees knee flexion.

- *Capsular ligaments* – Divided into thirds with the anterior third originating from the medial and lateral retinaculum with distal attachments to the anterior horns of the menisci and proximal tibia. The patellofemoral ligaments both medially and laterally serve as anchor points for the vastus medialis and vastus lateralis muscles distally originating from the adductor tubercle and the proximal lateral epicondyle respectively. The medial patellotibial ligament is primarily static and attaches to the anteromedial physeal scar of the tibial. The lateral patellotibial ligament attaches from the inferolateral pole of the tibia to the lateral tibial tubercle.

- *Menisci* – Medial meniscus is broader and thinner than the lateral and is anchored posteriocentrally at the tibial spine and anteriorly at the intermeniscal ligament and peripherally with the meniscotibial fibers of the capsular ligaments. The lateral meniscus attaches anterocentrally with the insertions of the ACL and posteriorly to the tibial eminence. It attaches peripherally by the meniscotibial fibers of the capsular ligaments.

- *Posteromedial and posterolateral corners* – In the posteromedial corner the meniscocapsular fibers couple with the semimembranosis to allow bowstringing of the capsule and increased joint contact by retracting the medial meniscus. The popliteus muscle attaches to the lateral meniscus at the posterolateral corner.

- *Cruciate ligaments* – The ACL is made up of anteromedial and posterolateral bundles that tighten with extension and flexion respectively and tibial internal rotation for both bundles. It attaches from the medial aspect of the lateral femoral condyle to the anterior tibia. The ACL's blood supply is often disrupted in injury resulting in poor healing. The PCL has posteromedial and anterolateral bundles that tighten with extension and flexion respectively. At full extension the PCL resists posterior translation and coronal plane rotation (abduction/adduction).

- *Collateral ligaments* – Medial collateral (MCL) and lateral collateral (LCL) ligaments originating from the medial and lateral femoral condyles and attach to the anteromedial tibia and to the superolateral fibular head respectively.

Injury Patterns

- *ACL* – Awkward landing or plant and twist followed by a pop and swelling. Hearing a "pop" or "snap" or feeling a tear is an ACL injury until proven otherwise.
- *PCL* – Dashboard type injury. Skiing injury.
- *MCL* – Valgus blow with medial knee pain.
- *LCL* – Varus blow with lateral knee pain.
- *PLC* – Posterolateral knee pain, rotational injury.
- *Meniscus* – Plant+Twist injury resulting in catching/locking. Joint line pain can also be due degenerative meniscus tears.
- *Patella* – Direct contact/impact to patella. Retropatellar pain with stairs.

Examination

- *Ottawa Knee Rules* – Radiograph if any of the following - >55yo, tenderness of fibular head/patella, inability to flex past 90 deg, inability to take 4 weight bearing steps.
- *Observation* – Standing, Walking, Supine. Look at the HIP and ANKLE mechanics!
- *AROM/PROM.*
- *Palpation* - Patellofemoral joint, MCL/LCL, medial and lateral joint lines, and posterior structures. ?Hemarthrosis – Cruciate ligament injury, osteochondral fracture, meniscus.
- *ACL* – Lachman's (Sn 81/Sp 81), Anterior Drawer test (Sn 38, Sp 81).
- *PCL* – Posterior Sag Sign (Sn 46-100, Sp 100), Posterior Drawer test (Sn 22-100, Sp 98).
- *MCL* – Valgus instability. If Valgus instability between 0-30 degrees considering concurrent ACL and PCL injuries.
    - Video
- *LCL* - Varus instability. If Varus instability between 0-30 degrees considering concurrent ACL and PCL injuries.
- *PLC* – Dial test at 30 degrees knee flexion. Posterolateral drawer test. Reverse Pivot Shift.
- *Meniscus* – McMurray's test ("Click", Sn 61, Sp 84) with joint line tenderness (Sn 83, Sp 83).
- *Patella* – Patellar apprehension and Patellar grind (compression).

    - Video
- *Pes Anserine structures* – Palpation, Manual muscle testing the adductor tendons.
    - Video

Management options

- *Conservative Care* – Physiotherapy, Athletic Therapy, Manual Therapy, Bracing.
- *Surgical Consult Indicated* – Locking or giving away of the knee, Positive Ottawa Knee Rules, Positive McMurray's test with a "clunk" or minimal knee flexion, Little improvement with 6 weeks of non-surgical management.
- *Regenerative injection sites based on suspected pathology*
    - Intraarticular for osteoarthritis, ACL sprain, and meniscus injuries.
    - MCL and LCL – superior and inferior attachments.
    - Meniscus injuries – Treat the coronary ligaments, intermeniscal ligament and capsular ligaments. Intrameniscal injections can also be done for degenerative tears.
    - Patellar tendon, patellar retinaculum and patellofemoral ligaments for patellar tendon injuries and patellar instability.
    - Posterolateral and posteromedial corner structures for rotational laxity.
    - Proximal tibiofibular joint and capsule for fibular head laxity.

Marking for Landmark Guided Injections

See Regenerative Injections: The Art of Healing 7th ed. J. Baumgartner. 2017.

US Guided Injections

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References

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