Knee Cartilage and Meniscal Injuries

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Contributors

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Overview

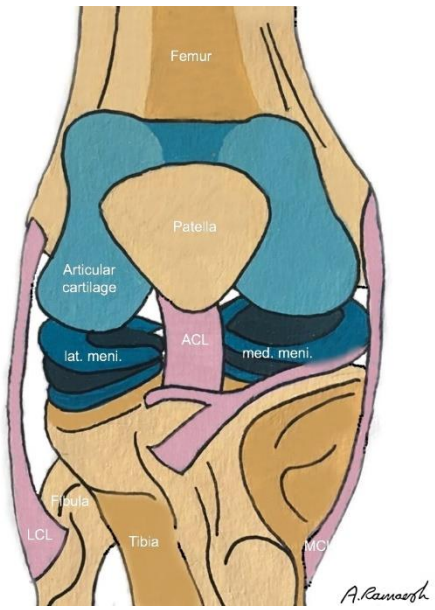
Common sport related knee injuries include meniscal tears and articular cartilage injuries. Mobility impairments and knee pain associated with articular cartilage and meniscal tears can be the result of a non-contact or contact incident, which can result in damage to one or more structures.[17]

Articular cartilage injury: Most commonly occur as a result of chronic loading or acute traumatic injury. Chronic repetitive loading of the articular cartilage during sports activity can lead to articular cartilage degradation, resulting in progressive breakdown of the articular surface. Acute traumatic athletic cartilage injury can frequently occur in association with other joint injuries, such as ligament or meniscal tears, or dislocations.[20] A chondral injury involves damage to the cartilage covering the end of the bones at the knee joint. An osteochondral injury is where the underlying bone itself is also damaged.[2] Articular cartilage damage often precedes the development of osteoarthritis in the knee joint, a condition more common in athletes compared with non-athletes.[27]

Meniscal injuries: Most commonly occur when the shear stress generated within the knee in flexion and compression, combined with femoral rotation, exceeds the meniscal collagen's ability to resist these forces. Meniscal injuries are usually classed as acute or degenerative.[7,18]Acute meniscal injury classically occur in the young patient who experiences a considerable acute force that damages the morphologically pristine articular surfaces.[11]Degenerative meniscal injury **c**lassically occur in the older patient (over 40) with acute knee pain secondary to asymptomatic degenerative meniscus and articular cartilage damage. Usually has no clear mechanism of injury and an insidious onset of pain.[11]

Anatomy

The medial and lateral menisci are intra-articular and attach to the capsule layer at the level of the joint line. The menisci buffer some of the forces placed through the knee joint and protect the otherwise exposed articular surfaces from damage. The menisci help to stabilise the knee by increasing the concavity of the tibia, while also contributing to joint nutrition and lubrication.[7] Only 10 – 25% of the menisci (peripheral part) have a vascular supply, thus making it a poor healer post injury. This vascular supply also diminishes with age.[1]



The medial meniscal attachment to the medial joint capsule and Medial Collateral Ligament decreases its mobility, thereby increasing its risk for injury compared with the more mobile lateral meniscus.[23] The menisci are responsible for transmitting over 50% of the force across the knee joint.[21]

Articular cartilage covers the gliding surfaces of the knee joint and is hyaline in nature.[5,16] Hyaline cartilage decreases the friction between gliding surfaces (aided by synovial fluid), withstands compression by acting as a shock absorber by redistributing forces applied to it, and resists wear during normal situations by maintaining its natural shape[5,8]. Many lesions remain asymptomatic and are non-progressive.[13]

Aetiology[3,17]

Injuries to the menisci are the second most common injury to the knee, with a prevalence of 12% to 144%. 128 A high incidence of meniscal tears occur with injury to the anterior cruciate ligament (ACL), ranging from 22% to 86%.
Injury prevalence of articular cartilage pathologies is reported to be between 60% and 70%. 32% to 58% of all articular cartilage lesions are the result of a traumatic, noncontact mechanism of injury. Articular cartilage has a very limited capacity to repair at the joint surface, resulting in scar tissue formation post injury.

Clinical Features[7,17]

The differences in presentations between meniscus and articular cartilage injuries are outlined in the following table.

Acute Meniscal Lesions	Degenerative Meniscus Lesions	Articular cartilage Lesions
• Knee pain • Joint line tenderness* • History of twisting knee mechanism injury • Gradual onset of pain and swelling over 24 hours • More severe meniscal injuries may present with pain and restriction soon after injury • Intermittent locking, as a result of torn flap impinging between articular surfaces (bucket handle tear) • Clicking sensation (may be unlocking spontaneously if an impinged bucket handle tear & often is associated with ACL injuries) • Positive McMurray's (flexion/rotation) test**	• Knee pain • Occur generally in the middle aged or older person • Often no clear history of an acute knee injury • Develops slowly • Often coincides with osteoarthritis • Typically involve a horizontal cleavage of the meniscus • Frequent in the general population and often incidental findings on MRI • Positive McMurray's (flexion/rotation) special test** • Limited evidence that knee pain is attributed directly to a degenerative meniscus lesion	• Intermittent knee pain & swelling • Acute trauma with hemarthrosis (0-2 hours post trauma) (associated with osteochondral fracture) • Insidious onset aggravated by repetitive impact • Effusion • Joint-line tenderness • History of "catching" or "locking"

* Joint line Tenderness has a sensitivity of 85% and specificity of 29% for meniscal injury.[12]

** Mc Murrays test has a sensitivity of 29% and specificity of 95%.[6]

Objective Examination Findings:

1. Joint line tenderness (palpated with knee flexed at 45-90 degrees)
2. Pain (usually present with knee hyperflexion, especially with posterior horn tears) - get the patient to squat
3. Restricted range of motion of knee joint (due to effusion or torn meniscal flap)
4. Joint effusions (often present, but absence of effusion does not rule out meniscal lesion)

Investigations

Knee radiographs can be used as first-line imaging tool to support a diagnosis of osteoarthritis or to detect rare pathologies of the knee (AP weight bearing semi flexed knee radiograph, including a lateral view). Findings in osteoarthritis would include joint space narrowing, osteophyte formation and subchondral sclerosis. It is worth noting that there is little correlation between x ray findings and clinical symptoms.[4]

[Knee MRI may be indicated with refractory symptoms, in presence of red flags or localised symptoms signifying rare diseases. Knee MRI may be useful to identify structural knee pathologies that may/may not be relevant for symptoms should surgical intervention be considered.[7]]

The indications for knee MRI would include investigating acute knee pain where x ray has ruled out a fracture, assessing for an osteochondral defect, internal knee derangement, suspected stress fracture or osteonecrosis, or persistent unexplained knee pain.[25,26] Knee MRI has about a 90% sensitivity on detecting medial meniscal tears. Incidental findings are common.[10]

Management Options

Meniscus Conservative Management: Management options vary depending on age, severity and presence of meniscal pathology. First line management consists of conservative management with appropriate rehabilitation. This is often successful, particularly in the athlete who does not participate in twisting activities. Management of degenerative meniscal lesions are usually managed effectively non-surgically. This may consist of POLICE (protection, optimal loading, ice, compression and elevation), relative rest from aggravating activities, analgesia, activity modification, bracing, intra-articular injections, local and global strengthening, flexibility, control and proprioception exercises.[14, 30]

Meniscus Surgical Management: Urgent arthroscopic surgery may be required in a large painful 'bucket handle' tear. The aim of surgery is to preserve as much of the meniscus as possible. Some meniscal lesions are suitable for repair. The decision as to whether or not a meniscal repair should be attempted is dependent on patient age, acuity of tear, tear location, tear orientation, and stability of the knee. Tears in the outer third of the meniscus rim have a blood supply and can heal.[7,17]

Degenerative, horizontal cleavages, complex tears and flap tears are poor candidates for repair. Younger patients have a higher success rate. If pain/mechanical symptoms persist after 3 months, despite appropriate rehabilitation (with normal x-ray), arthroscopic partial meniscectomy may be proposed. Recent research has identified no clinically relevant difference between exercise therapy and partial meniscectomy at 2 years.[21]

Articular Cartilage: Short term articular cartilage damage causes swelling and recurrent pain, whilst long term damage accelerates development of osteoarthritis. Various methods are used to encourage articular cartilage defect healing. Four methods of operative care that are most widely used are **arthroscopic lavage and debridement, microfracture** (piercing subchondral bone with an "ice pick" to recruit pluripotential stem cells from the marrow), **autologous chondrocyte implantation (ACI)** (a two stage procedure where cartilage is harvested from the knee joint, the chondrocytes are cultured and are re-implanted to the chondral defect), and **osteochondral autograft transplantation (OAT)**. As hyaline cartilage has a complex layered structure, no method of treatment has yet been able to reproduce it.[9]

Optimising preservation of the integrity of articular cartilage when an injury requires a length period of partial/non weight bearing is key. This can be done by passive motions, swimming, cycling or hydrotherapy. Further conservative management includes biomechanical abnormality correction to reduce stress on damaged articular cartilage and to further reduce load bearing in the early stages, pool running, mini trampoline work and anti-gravity treadmill can also be used. Proprioceptive and strength exercises are also important.[7,9]

Classification

Meniscal Tear Types[7]: Longitudinal, Degenerative, Flap, Radial, Bucket Handle, Horizontal Cleavage

It is important to be aware of the tear location, type, and vascular supply to the portion of the meniscus lesion when considering whether surgical or conservative management will be more appropriate.

ICRS Cartilage Injury Classification[28]

Grade 1	Superficial lesions A. Soft indentation B. Superficial fissures/cracks
Grade 2	Lesions < 50% cartilage depth
Grade 3	A. Lesions > 50% depth B. Down to calcified layer C. Down to, but not through, subchondral bone D. Blisters
Grade 4	Full thickness into subchondral bone

Chondral injury is graded according to the International Cartilage Repair Society (ICRS) grading system. Articular cartilage damage varies from gross, macroscopically evident defects in which underlying bone is exposed (grade IV), to microscopic damage that appears normal on arthroscopy but is soft when probed (grade I).

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