The knee contains two menisci. These are crescent shaped structures which lie on the tibia increasing congruity of the tibiofemoral joint. They add to the stability, lubrication and nutrition within the knee. They can be injured leading to tears and can also be congenitally deformed, leading to symptoms. Injuries to the menisci are the most frequent injury sustained in the knee. Degenerative tears can also occur secondary to osteoarthritis.

Anatomy
There are two menisci within the knee; medial and lateral. The medial meniscus is large and C shaped and increases the depth of the concavity on the medial tibial plateau which in turn increases the contact area load is spread over. It is significantly wider posteriorly than anteriorly. At its lateral aspect it is continuous with the joint capsule and is attached to the deep medial collateral ligament.

The lateral meniscus is smaller and O shaped. It has loose capsular attachments at its anterior and posterior thirds but is free in the middle third where the popliteus tendon lies. It has no attachment to the lateral collateral ligament. The image below, taken from ‘Grey’s Anatomy’ shows the tibial plateau seen from the top, with the menisci in place.

The lateral meniscus is even more important in spreading the load as the lateral tibial plateau is actually flat, bordering on convex, so without the meniscus in place the plateau will point-load, rapidly leading to osteoarthritis.

Etiology
The two menisci are quite different and have different anatomic and mechanical properties. This leads to different injury patterns and frequency of injury between them.

The usual mechanism of injury is a twisting force applied to the knee when the knee lies in partial flexion. Risk of tears is increased by a number of factors including previous injury or surgery, joint laxity, weak muscle control (especially quadriceps function) and associated ligamentous injuries. All these factors contribute to abnormal movement of the knee joint. Medial meniscal injuries are particularly associated with ACL tears.

The medial meniscus is less mobile than the lateral with excursion of around 5mm. It can become trapped between the condyles during movement leading to injury. The lateral meniscus is more mobile with excursion of around 10mm moving with the rotation of the femur on the tibia during flexion.

There are four main types of meniscal tear which you should know about:
1. Longitudinal tears (including the ‘bucket handle’ tear when displaced).
2. Transverse tears.
3. Oblique tears.
4. Degenerative tears.

The regeneration and healing potential of meniscal tears is poor. Only the peripheral 25% of a meniscus has a direct blood supply, the so called ‘red zone’. In certain circumstances, tears in this region may be surgically repaired with a reasonable chance of healing. The inner 75% of the meniscus is avascular; the ‘white zone’. In vivo this portion derives nutrition by direct diffusion from the synovial fluid. Tears in
the white zone have no healing potential and if a patient has a symptomatic tear then resection is usually the only option.

Epidemiology
Injuries to the menisci are common and should always be considered in patients complaining of knee pain. The causative injury may be quite trivial.

They are sustained more commonly by men with a ratio of roughly 2.5:1. Men tend to present later with the condition in the third decade of life. Women more commonly sustain the injuries in their teenage years and 20s.

While commonly considered as a condition of the young related to trauma they are often also seen in older patient with knee osteoarthritis where degenerative tears are common.

History and Examination
The first thing to consider in the history of any patient suspected of having a meniscal injury is the mechanism of injury. The key point to remember here is that the mechanism may be trivial and can be related to an event in normal activities of daily living. However, a twisting injury with the knee in flexion is the classical history for injury.

Patients commonly complain of pain. This is often intermittent and related to movement of the torn piece of meniscus. Pain may not be well localised although it is often felt around the joint line. Mechanical symptoms are common with ‘locking’ and ‘giving way’ being two of the most frequently reported.

The presence of swelling is variable. An initial haemarthrosis may occur when tears occur in the red zone. Later, swelling is variable and may be absent. It is more common in degenerative tears where the osteoarthritis itself leads to recurrent effusions.

Examining the patient in the acute setting may be in the context of a locked knee. The patient will have a marked fixed flexion deformity of the knee and this will be a true mechanical block with loss of extension both passively and actively.

In the chronic setting examination findings are usually less specific. Looking at the knee may demonstrate an effusion. When palpating, tenderness may be present on the joint line medially or laterally depending on where the injury lies. This is a sensitive finding being present in about 80% of patients but it is not very specific as it may represent injury to the collateral ligaments.

There are two special tests which can be employed to look for a meniscal tear and they aim to create compression and shear at the site of the tear to elicit pain or mechanical symptoms.

McMurray’s test is performed with the patient lying supine. Place the affected knee into full flexion. To test the lateral meniscus externally rotate the tibia using the foot and gradually extend the knee putting valgus stress on the knee.

To test the medial meniscus reverse the forces by internally rotating the tibia and placing a varus stress on the knee. The test has a sensitivity of around 60% but a specificity of up to 90%.

The Apley grind test is performed with the patient lying prone. The knee is flexed to 90 degrees and an axial load is placed through the knee using the heel. The lower leg is then internally and externally rotated with a positive test being reproduction of the patient’s pain. The test has a sensitivity of only 38% but the specificity is still around 90%.
Imaging

A good initial investigation for any patient with knee pain and mechanical symptoms is an AP, lateral and skyline x-rays. They should be performed to exclude the presence of a fracture or osteoarthritis. However the mainstay of imaging for the menisci is MRI, which is both sensitive and specific and will pick up over 90% of tears.

The MRI below shows the medial and lateral menisci marked by the arrows. They are normal in this image. On this T2 weighted MRI the menisci show up as solid black triangles.

In the next MRI scan a complex tear of the medial meniscus can be seen. Instead of a uniform black appearance there are patchy areas of high signal within it which represent the torn areas. This is a tear of the ‘posterior horn’ and the slice is more towards the posterior aspect of the knee than in the previous normal example.

In the final example below there is a displaced bucket handle tear of the medial meniscus. This occurs when an extensive longitudinal tear flips out of position and comes to lie in the intercondylar notch. It is often associated with an irreducibly locked knee.

Non Surgical Management

Non surgical management is an option for many patients with a meniscal tear. The only exception to this are patients with a locked knee where the only option is arthroscopy. Patients with meniscal tears often present late to elective outpatient clinics with pain and mechanical symptoms. The majority of these will have an arthroscopy performed. However, when the patient has a degenerative tear secondary to osteoarthritis a more conservative approach may be appropriate. Degenerative meniscal tears do not respond as well to arthroscopic debridement, as the arthritis itself often causes the symptoms. If the symptoms are not bad enough to warrant knee replacement then activity modification and analgesia in the acute phase followed by a course of physiotherapy may be more appropriate.

Surgical Management

Many patients with persistent symptoms require surgical intervention. The age and activity level of the patient are important factors in this decision as especially in the younger patient, small avascular tears may propagate and can accelerate a process of secondary arthritis.

The vast majority of meniscal surgery is performed arthroscopically. The first image below shows an intact meniscus taken during a knee arthroscopy.
Meniscal tears amenable to repair are those in the ‘red - red’ zone or ‘red - white’ zone. There are three main methods of repair; outside-in, inside-out and all-inside techniques. The all-inside method is achieved using specifically designed tools which essentially transfix the meniscus in place using biodegradable darts.

More commonly tears are not amenable to repair and in these patients partial meniscectomy is the procedure of choice. A total meniscectomy should be avoided at all costs as the meniscus is an important part of knee biomechanics and its absence leads to the early onset of secondary osteoarthritis. A partial meniscectomy involves identifying the damaged unstable part of the meniscus and debriding it back to a stable rim.

The next image shows an intraoperative photo of a torn medial meniscus. This tear was debrided to prevent ongoing mechanical symptoms.

Outcomes following Meniscal Surgery

Patients who have undergone partial meniscectomy may return to normal low impact activities as pain allows after surgery. They can resume normal activities as they feel able without restriction.

In patients who have undergone repair this needs to be protected for a period to allow healing. Most patients are placed in a knee brace for the first 6 weeks, which is unlocked to allow a full range of motion. They should be encouraged to keep the knee moving when they are non weight bearing to prevent stiffness. Some surgeons prefer the patient to be non weight bearing throughout this 6 weeks while others permit weight bearing in the brace from day one.

Those who undergo partial meniscectomy usually have good outcomes but must be aware of the potential for early secondary osteoarthritis. Patients who have a meniscal repair should be aware that the healing rate is of the order of 90 - 95% provided the tear is in the red-red zone. If however, their tear fails to heal they may need revision surgery involving partial meniscectomy.

If a total meniscectomy is required then the patient is likely to develop secondary osteoarthritis quite quickly. This is particularly true of the lateral meniscus where significant osteoarthritis will develop within a small number of years following surgery.