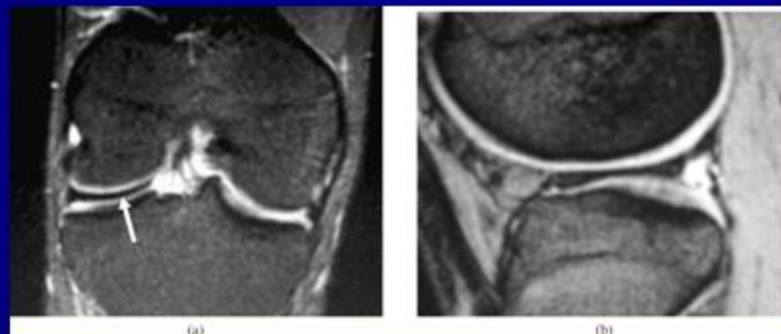


Knee Pain

Thomas Tran, MD

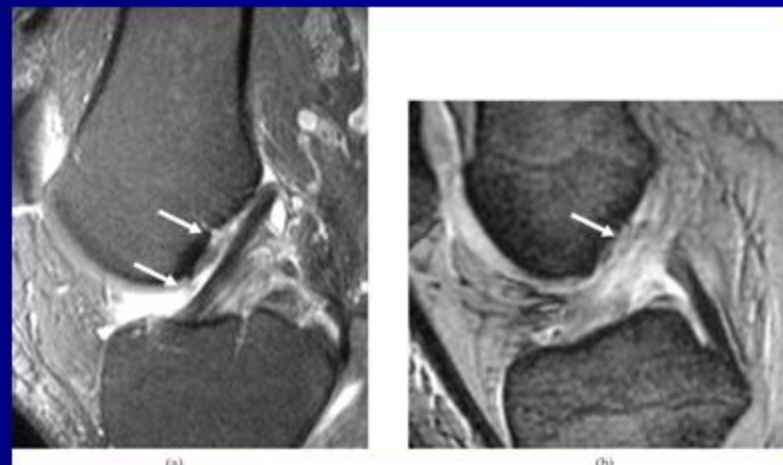
Discoid Meniscus

- A congenital anomaly
- Usually involves the lateral discoid meniscus.
- Predisposes the meniscus to tears
- The meniscus has a discoid shape and covers the entire tibial articular surface.
- The meniscus may tears in children and adolescents but may remain asymptomatic into adulthood.



ACL tear

- Usually diagnosed on clinical evaluation
- MRI is invariably performed prior to surgery to confirm the clinical findings and identify associated lesions.
- The normal ligament is seen as a fairly loose collection of low signal fibers with a well defined anterior border.
- On MRI, the most prominent feature of an acute tear is an ill-defined mass representing focal hemorrhage replacing the normal low signal linear ligament
- The tear usually involves the mid portion. The MRI signs are less obvious when the ligament is avulsed at its femoral end as the ligament may retain a fairly normal alignment



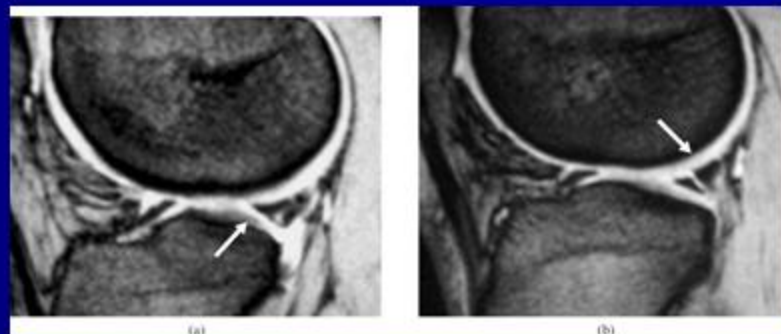
ACL tear associated injuries

- At the time of injury there is usually valgus strain, external rotation and anterior translation of the tibia relative to the femoral condyle which frequently results in an impaction injury of the posterior lip of the lateral tibial plateau against the femoral condyle.
- The typical appearance of this injury on MRI is edema in the posterior portion of the plateau, occasionally accompanied by a small fracture of the posterior lip, and a focal osteochondral impaction fracture of the mid portion of the lateral femoral condyle (terminal sulcus)



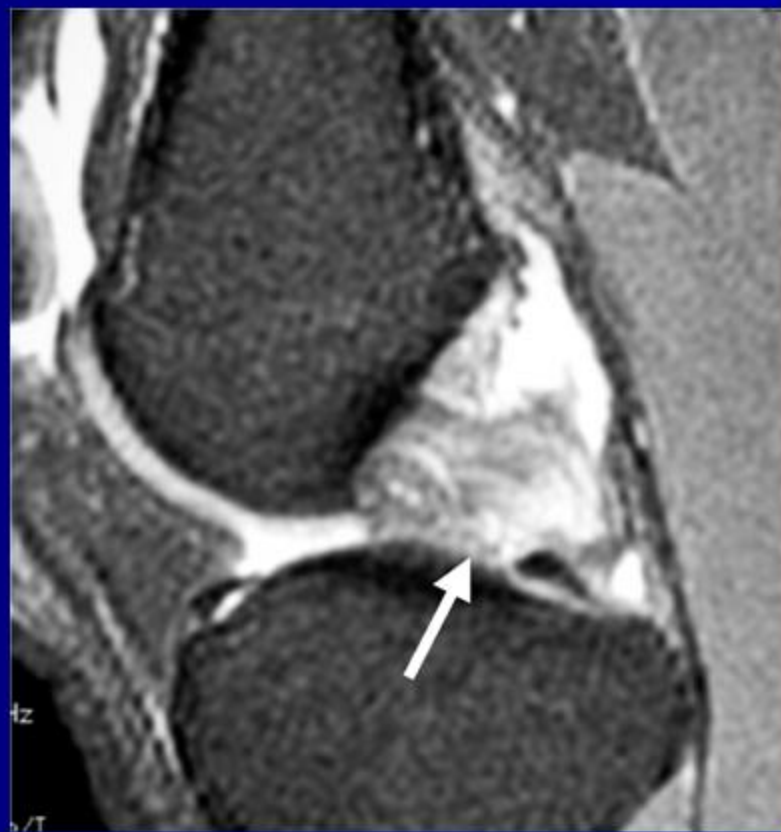
ACL tear associated injuries

- Associated meniscal tears
 - the most characteristic of which is a vertical circumferential tear of the posterior third of the lateral meniscus.
- There may be signs of anterior translation of the tibia



PCL tear

- The normal PCL is a compact low signal intensity structure that is easily identified on MRI.
- The ligament may be partially or completely torn as result of a hyperextension injury, an external rotation injury or forced posterior translation of the tibia (dashboard injury).
- Partial and complete tears may occur. Tears usually involve the mid portion of the ligament. The torn ligament is widened and contains increased signal



MCL tear

- Medial collateral ligament (MCL) injuries are common and usually partial.
- Any injury involving a valgus force is likely to result in injury to the MCL.
- Isolated tears of the MCL are treated conservatively and imaging is rarely required. However, a torn MCL is often seen on MRI as part of a more complex injury.
- The ligament is made up of deep and superficial fibers.



MCL tear

- The ligament usually tears near the femoral insertion.
- Minor bony edema may be seen in the adjacent condyle at the site of the avulsion.
- In minor injuries the tear may be confined to the deep fibers and is seen on MRI as high signal on water-weighted sequences deep to the superficial fibers
- The valgus injury responsible for the MCL tear will often result in an impaction injury on the lateral side of the knee with subchondral edema seen in the lateral femoral condyle and tibial plateau.



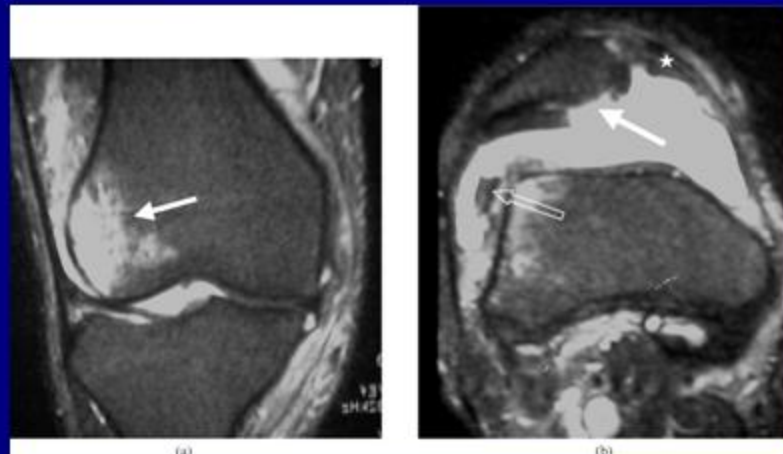
LCL tear

- Tears of the lateral collateral ligament are rarer.
- Although isolated injuries can occur, usually at its distal attachment to the fibula, tears are often associated with injuries to other structures particularly those of the posterolateral corner injury



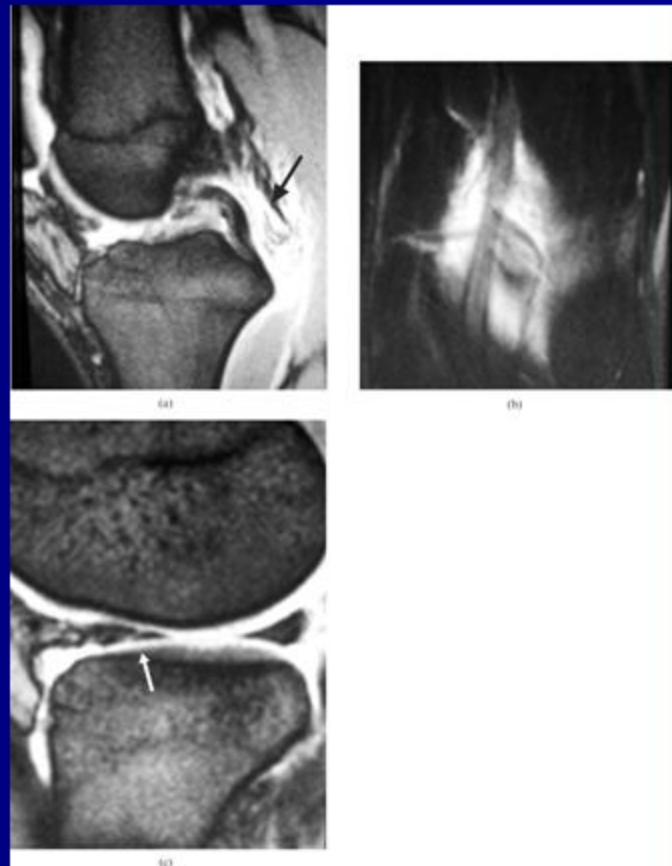
Patellar Dislocation

- Dislocation of the patella is another cause of post-traumatic hemarthrosis.
- The diagnosis is often not suspected by clinician or patient.
- Dislocation may result from a relatively innocuous twisting injury. MRI will show a characteristic appearance with subcortical edema at the anterolateral aspect of the femoral condyle at the site of patellar impaction.
- There may be corresponding edema of the medial aspect of the patella or signs of a medial patellar osteochondral fracture with or without loose body. The medial retinaculum is usually torn



Hyperextension injury

- Hyperextension injuries are associated with tears of the anterior third of the menisci and trabecular edema in the anterior femoral condyle and tibial plateau.
- ACL, PCL, posterior capsule and popliteus muscle tears may be present.
- The posterior capsule is not a well defined structure on MRI and the most obvious sign of a tear of this structure may be the presence of free fluid dissecting the tissue planes posteriorly

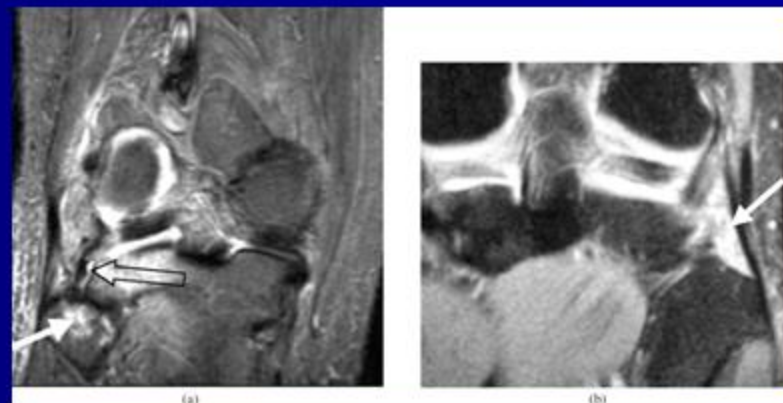


Knee pain

- Due to
 - an acute injury or
 - an insidious development of symptoms
- Imaging
 - Plain films adequate for most cases of uncomplicated arthropathies and trauma.
 - For suspected internal derangement MRI is the optimum technique. Routine plain films are not indicated and are inferior to MRI
 - CT arthrography is also an accepted technique but requires an intra-articular injection.

Posterolateral corner

- Damage to the posterolateral structures is an important injury that may result from a variety of mechanisms.
- Incompetence of the structures results in rotational instability (allowing excessive external rotation of the tibia) and may be responsible for the poor results following ACL repair.
- The major stabilizing structures in this region are the popliteus tendon and muscle, the PCL, the lateral collateral ligament (LCL) and several smaller structures making up the arcuate complex, namely the arcuate, fabellofibular and popliteofibular ligaments. Of these three structures the popliteofibular ligament is the only one seen consistently on MRI.
- The diagnosis in the acute phase should be suspected when disruption of more than one of these structures is encountered. Rupture of the PCL, LCL, popliteal tendon and muscle and fibular avulsion by the arcuate complex can be accurately assessed on MRI.



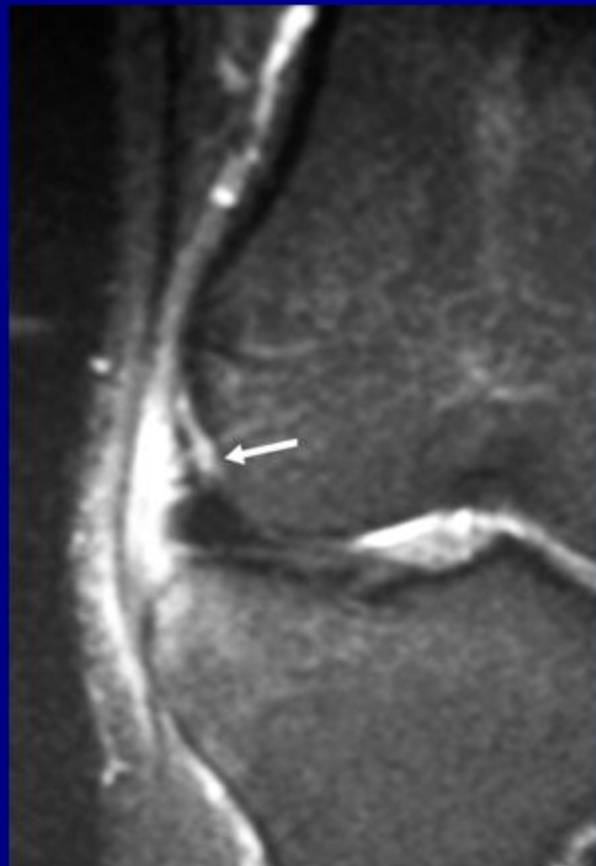
Chronic Meniscal tear

- The most common lesion encountered on the non-acute scan is the horizontal oblique degenerative type tear.
- This lesion can affect any part of either meniscus but the posterior third of the medial meniscus is the most common site.
- A typical lesion is seen as linear horizontal oblique high signal extending to the inferior, or less commonly the superior, articular surface of the meniscus
- There are often accompanying signs of early degenerative disease such as articular cartilage defects, subchondral edema and cysts and small osteophytes.
- Signal that does not extend to an articular surface represents intrameniscal degeneration.
- Degenerative type tears may be associated with a perimeniscal cyst which is formed by fluid being pumped into the perimeniscal tissues through the tear. These cysts can in themselves be painful and may need arthroscopic decompression.



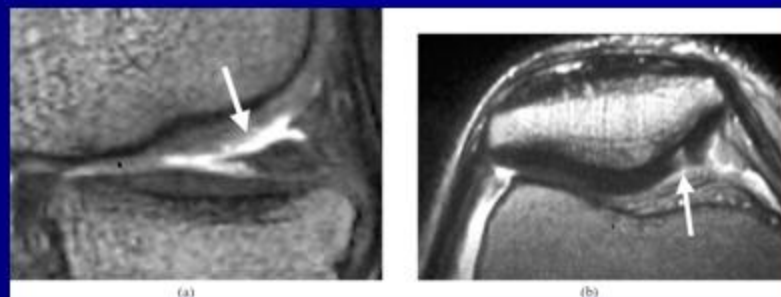
Iliotibial band friction syndrome

- The iliotibial band inserts on the anteromedial aspect of the medial tibial condyle.
- Iliotibial band friction syndrome is a specific condition usually seen in downhill runners and cyclists and is caused by repetitive flexion and impingement of the band against the lateral femoral condyle when the knee is flexed at around 30 degrees.
- There is focal tenderness over the band and sometime a palpable "creak" as the knee flexes
- On MRI ill-defined edema or less commonly a well-defined cyst, is seen seated deep to the band



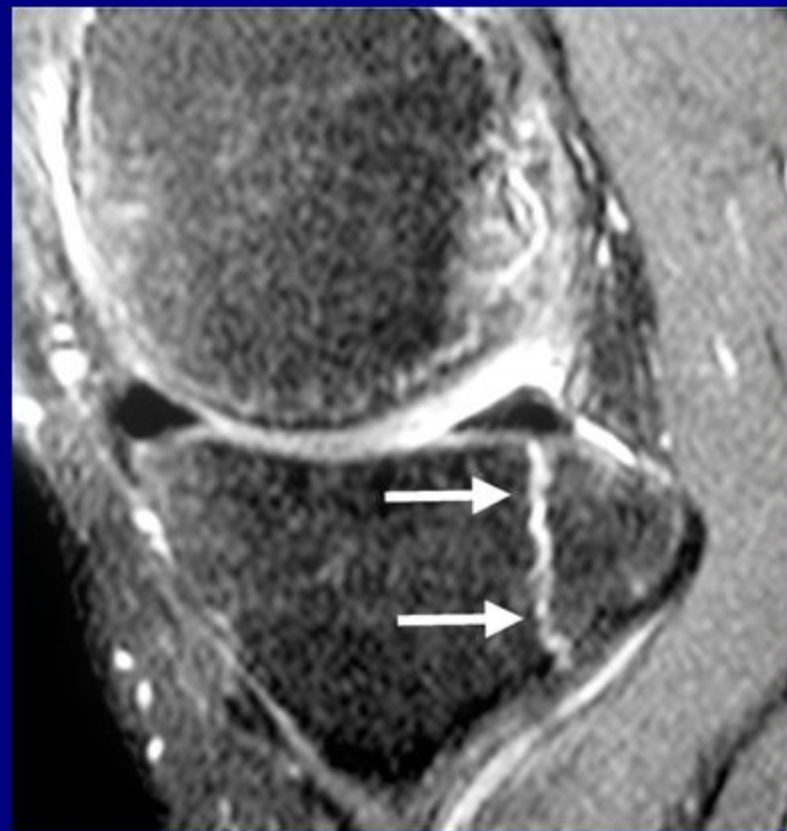
Articular Cartilage Defect

- Articular cartilage defects can painful and arthroscopic treatment by removing unstable fragments is beneficial in some cases.
- On MRI full thickness defects are best seen on sequences that have high contrast between fluid and articular cartilage on the water weighted sequences (such as STIR, T2 fast spin echo and some more specialized gradient echo techniques)



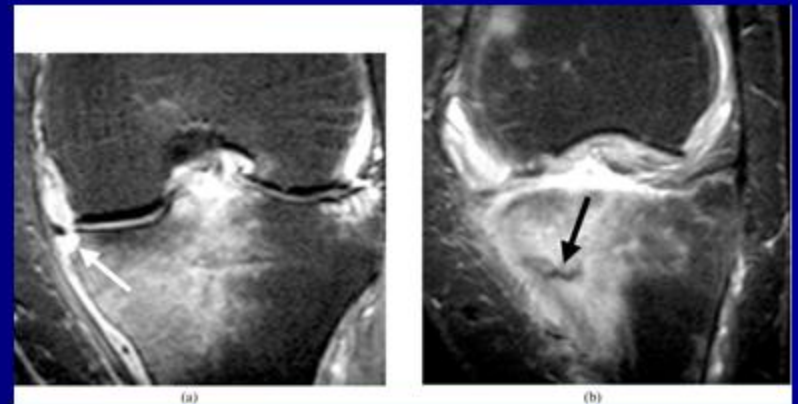
Bony abnormalities

- The most common occult fractures are of the lateral tibial plateau and avulsion fractures at the distal end of the ACL or PCL.



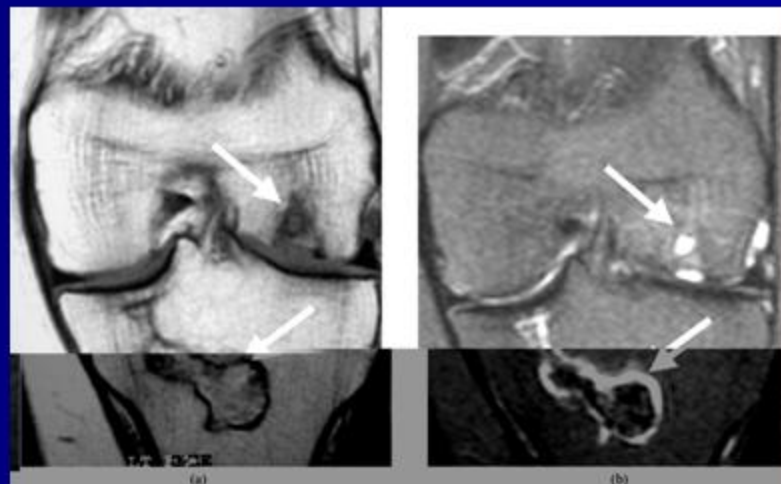
Bony abnormalities

- MRI is sensitive in identifying insufficiency or stress fracture which are seen as low signal lines surrounded by edema. The most common lesion seen around the knee is an insufficiency fracture of the medial tibial plateau. This lesion is usually associated with osteoporosis and is therefore seen in the older age group



Osteonecrosis

- Sometimes encountered in the femur or tibia usually in patients with known risk factors (steroid, sickle cell, etc...).
- These lesions are not symptomatic unless they involve the subarticular bone when the articular surface may collapse.
- MRI will show the typical geographic lesion containing fat and bordered by a low signal intensity line.
- The border may show the typical double line sign (parallel high and low signal intensity lines) on T2 weighted images

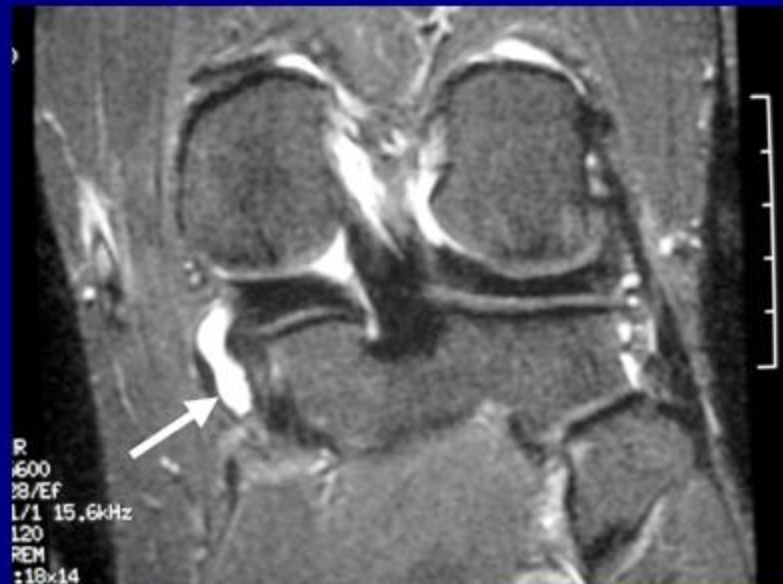


Cystic lesions

- Common cystic lesions encountered are bursa, synovial cysts, ganglions or meniscal cysts.

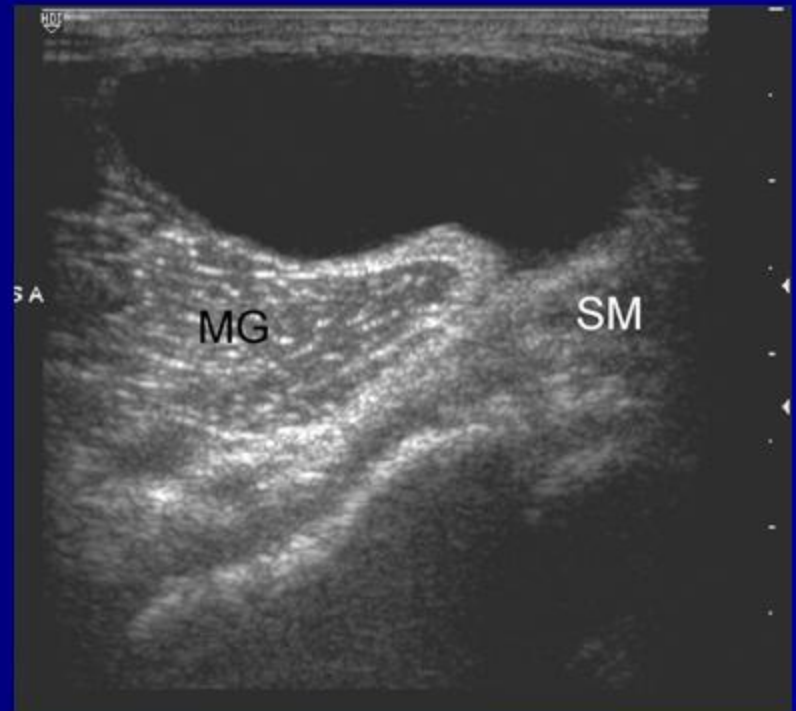
Bursa

- Bursa are normal synovial lined structures that can be affected by the same conditions as synovial lined joints.
- Bursa may also be developmental, forming within the soft tissues where there is abnormal repetitive pressure. Normal bursas are found in predictable places.
- Bursa becomes visible on imaging when they develop an effusion due to inflammatory synovitis or trauma.
- The common symptomatic bursas are those of the pre-patellar bursa, infrapatellar bursa, pes anserinus and semimembranosus bursa.
- A small bursa is sometimes seen between the deep and superficial fibers of the MCL. Bursas can also be involved in other synovial conditions such as synovial osteochondromatosis.



Synovial cysts

- Synovial cysts communicate with the joint.
- By far the most common encountered at the knee is the popliteal (Baker's) cyst. This is a normal extension of the synovium which can become distended due to any chronic condition of the joint.
- The cyst has a typical diagnostic configuration on ultrasound and MRI with the neck emerging from between the tendons of the medial head of gastrocnemius and semimembranosus

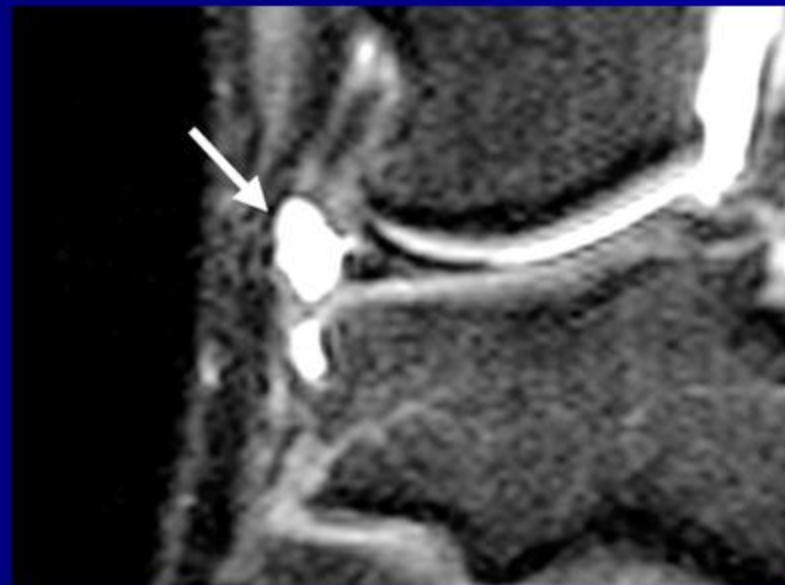


Imaging

- Useful in the acutely injured knee as clinical assessment may be difficult on account of pain and the presence of a hemarthrosis.
- A locked knee with restricted extension may be due to muscle spasm associated with ligamentous injury (pseudolocking) or a true block secondary to a displaced meniscal, or occasionally osteochondral fragment.
- MRI is useful in differentiating these two entities and allows the early implementation of appropriate therapy, which is usually either arthroscopic removal of the cause of a physical block or early intensive physiotherapy

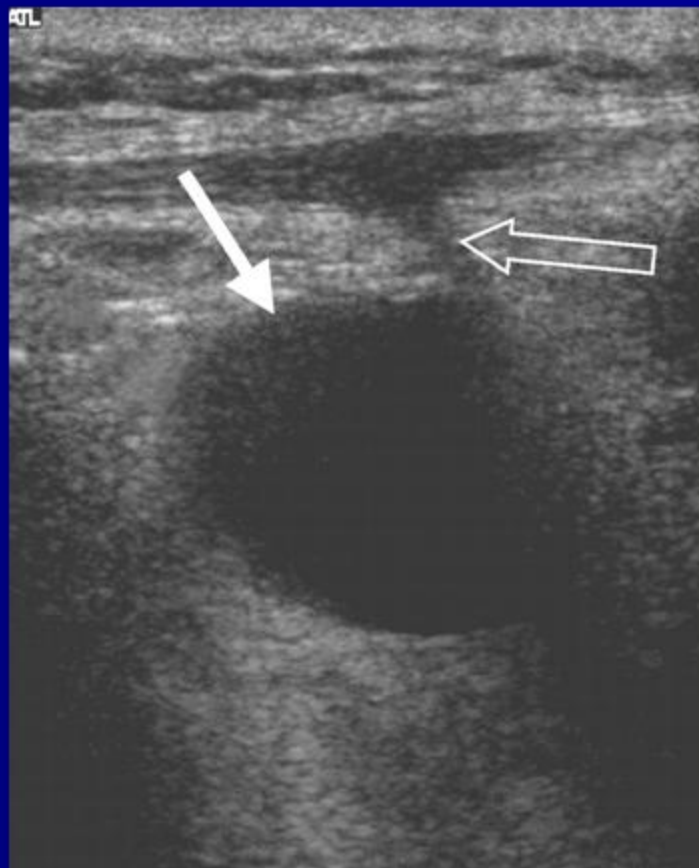
Perimeniscal cysts

- formed by fluid being pumped through a meniscal tear into the perimeniscal tissue
- They occur in both lateral and medial menisci and may be painful.
- On the lateral side they tend to form a mass at the site of the meniscal tear as the overlying LCL is not bound to the meniscus.
- On the medial side the cyst has a tendency to migrate along the tightly bound tissue planes and emerge as palpable masses some distance from its origin
- On ultrasound the cyst can sometimes be traced to a meniscal tear but MRI is usually required to establish the diagnosis. Even on MRI it may occasionally be difficult to demonstrate the communication as the connecting stalk may be tenuous.



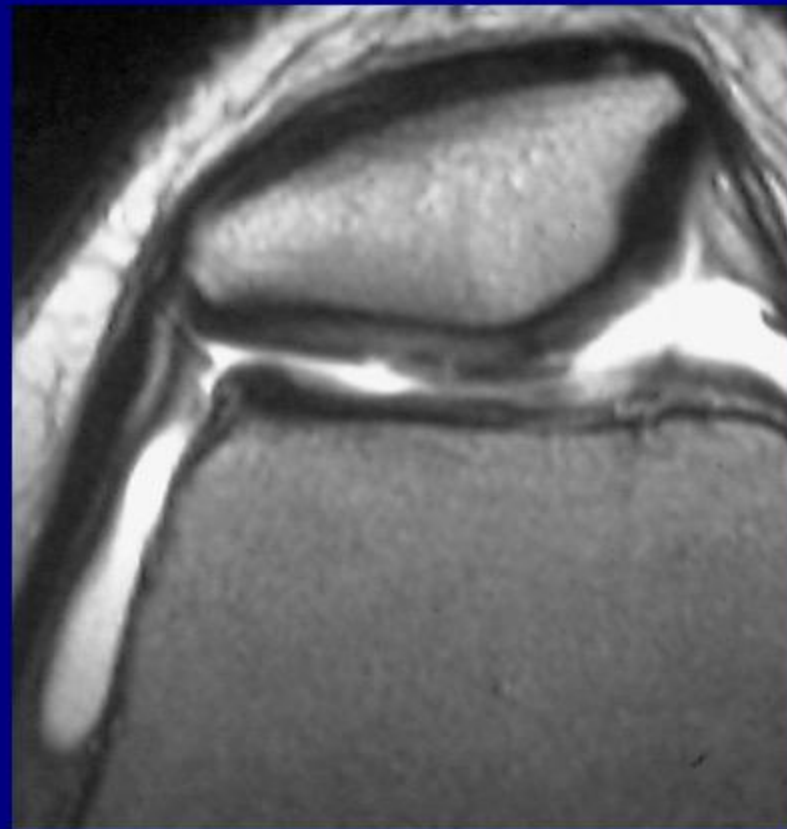
Ganglion

- A cyst that does not fall into one of above categories is usually labeled a ganglion.
- A ganglion is due to myxoid degeneration of a structure such as a tendon, ligament or joint capsule.
- They differ histologically from synovial cysts but a small proportion will communicate with the joint.
- The main body of the lesion is often connected to its origin by a stalk which may be demonstrated on imaging
- Ganglions may cause symptoms other than swelling.
- Lesions arising from the cruciate ligaments prevent full knee flexion
- They may be successfully treated by ultrasound or CT guided aspiration.
- A ganglion involving of the common peroneal nerve is a well recognized condition. The cyst, which is thought to arise from the proximal tibiofibular joint, dissects along the nerve resulting in foot drop



Chondromalacia patellae

- This term refers to degeneration of the articular cartilage and is associated with anterior knee pain in the young.
- The grading spans from softening of the cartilage to full thickness defects.
- Can be associated with anterior knee pain on going up and down stairs

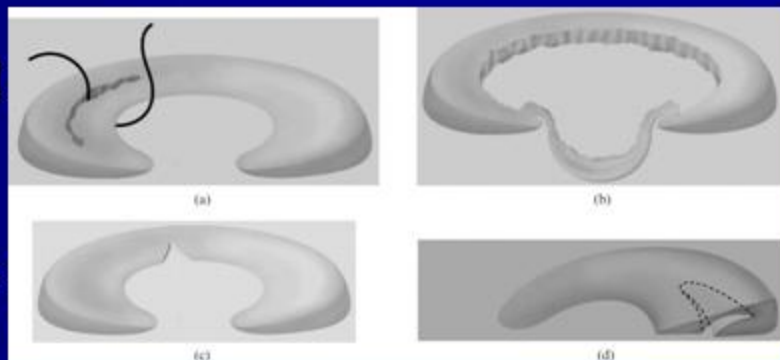


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Acute Meniscal Tear

- broadly divided into vertical, circumferential, vertical radial and horizontal types
- In general, vertical tears are traumatic and horizontal tears are degenerative.
- Unstable menisci and displace meniscal fragments cause mechanical problems.
- **Clinical correlation is essential as the incidence of tears in the asymptomatic population is high.**



Locked Knee

- Most common meniscal lesion in the locked knee is the bucket handle type tear which predominately involves the medial meniscus.
- This lesion is a large circumferential vertical tear of the meniscus with displacement of the free internal portion into the intercondylar region.
- The MRI signs are a low signal intensity mass lying in the intercondylar region. The posterior portion of the fragment usually lies under the posterior cruciate ligament (PCL) giving the double PCL sign.
- The peripheral meniscal remnant will have an irregular edge and will appear abnormally small



Lateral compartment Locked Knee

- In the lateral compartment a typical lesion causing locking is a displacement of the posterior third of the meniscus into the anterior part of the compartment.
- The fragment may rest adjacent to the intact anterior third giving the appearance of an enlarged meniscal segment ("pseudohypertrophy") on some slices



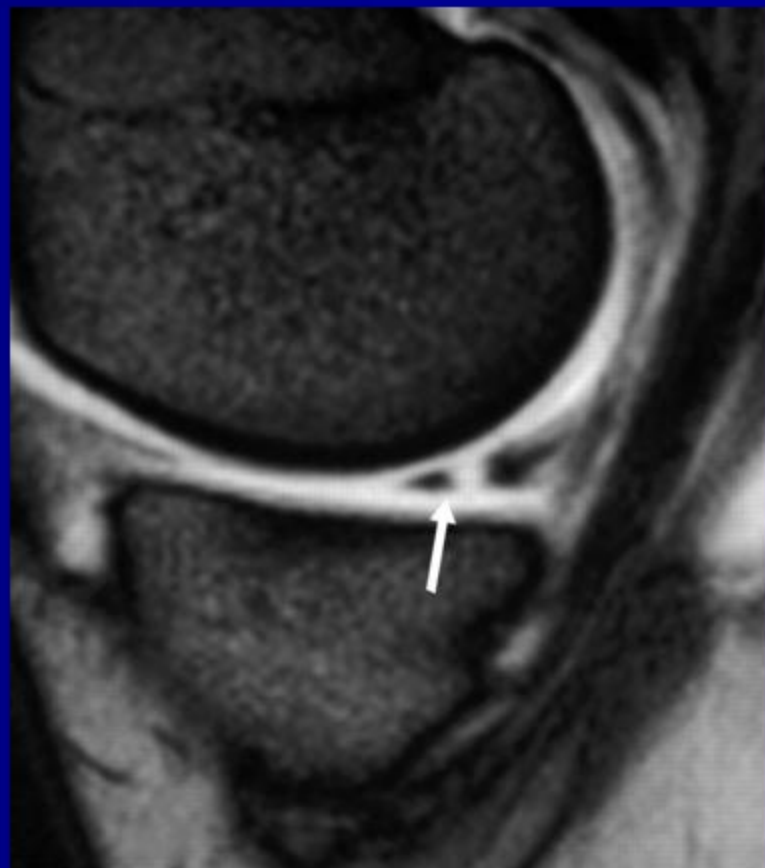
Flap tear

- A flap tear is when a fragment is displaced from the superior or inferior surface of the meniscus. The displaced portion is usually easy to see on MRI.
- Sometimes fragment of the mid portion of the medial meniscus may be found lying on the medial aspect of the medial tibial condyle giving a characteristic appearance



Vertical Meniscal tear

- Vertical circumferential tears
 - unstable when of sufficient length.
 - are seen as linear high signal traversing the entire width of the meniscus
 - can be associated with an anterior cruciate ligament injury



Radial tear

- Radial vertical tears extend from the free edge of the meniscus and are oriented in the radial plane
- They usually involve the lateral meniscus often anterior horn-body junction or posterior horn-body junction.
- On sagittal images the tear commonly lies perpendicular to the scan plane and is seen as a break in the normal bow tie configuration of the meniscus

