

MRI of the knee revelations

30th September 2014

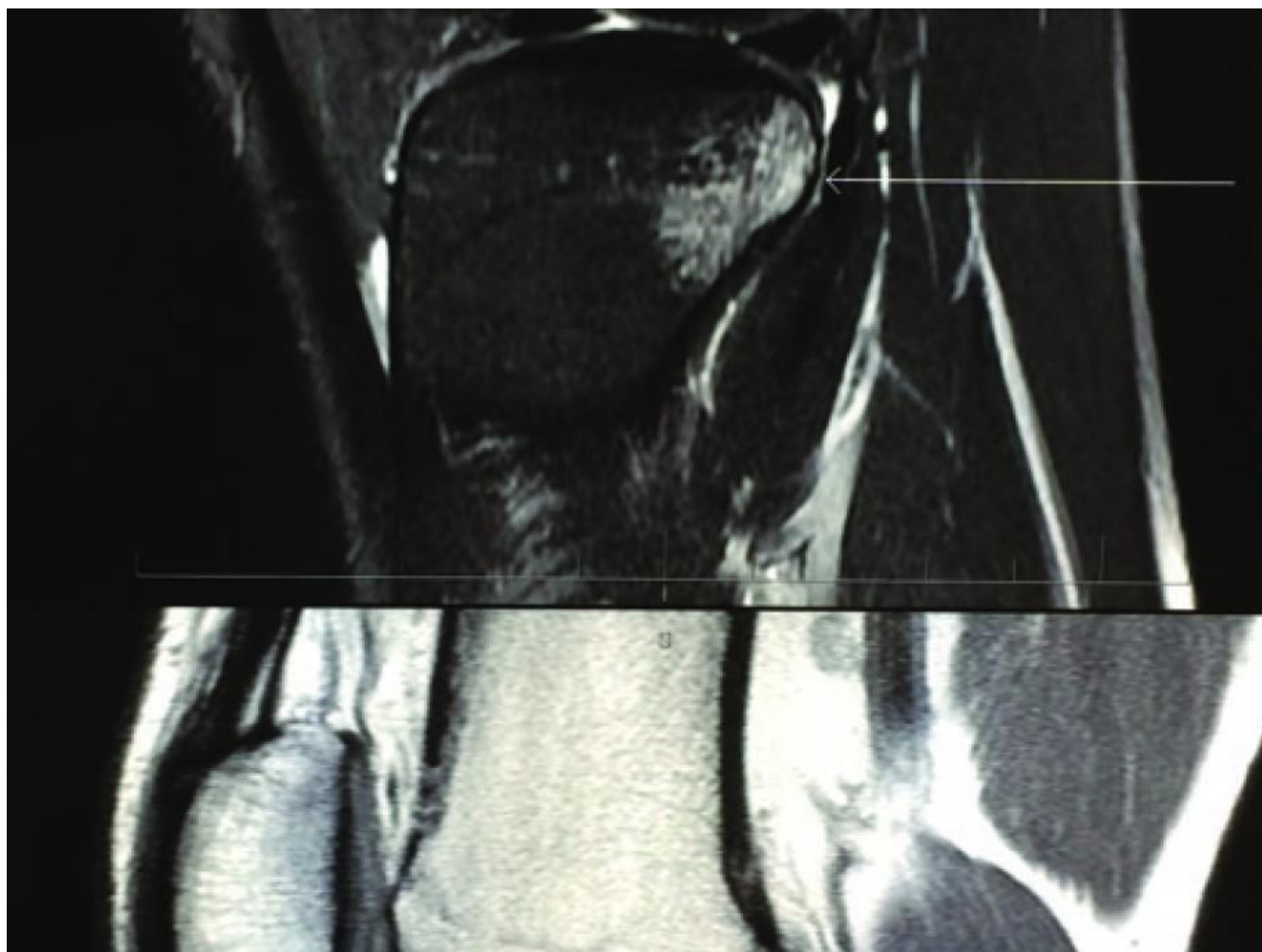
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MRI scanning is an imaging modality that provides detailed images of the knee. It is very good for looking at the soft tissues of the knee but is not always the most appropriate imaging technique. It is currently rare to operate on a knee which is not obviously arthritic without first obtaining a MRI scan.

Technical aspects

MRI does not use ionising radiation but uses powerful magnets to affect water-containing tissues in the body. The magnetic field forces the hydrogen ions to all 'line up' and point in the same direction. This force is then removed which allows the hydrogen ions to go back to a more 'stable' state (precessing). As they do so they release energy which is detected by sensors which use a complicated mathematical algorithm (a Fourier transformation) to turn this information into images.



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The magnetic field can be applied in different ways and for different periods of time to maximise visualisation of different tissues such as fat, muscle or bone. The two most common sequences are T1 and T2 sequences, with T1 showing 'anatomy' and T2 showing 'pathology'. The contrast between different tissues is determined by the rate at which excited atoms return to their equilibrium state. The MRI scanner forms a strong and uniform magnetic field around the area to be imaged.

The field strength of the magnet is measured in tesla and there are various strength magnets: 3, 1.5, 1, 0.7 open, 0.3 open and 1.0 extremity. Generally, the higher the tesla number the more detailed the images. At least three imaging planes are acquired: sagittal, axial and coronal. The orientation of the image is controlled by varying the main magnetic field using gradient coils. As these coils are rapidly switched on and off, they create the characteristic repetitive thumping noises of a MRI scan. Most clinical magnets are superconducting and require liquid helium. Lower field strengths can be achieved with permanent magnets, which are often used in "open" MRI scanners for claustrophobic patients. While these are helpful, they are not as good as a closed scanner.

The findings on MRI depend on the quality of the study, and are influenced by technical factors including magnet strength, imaging planes, use of surface coils and the experience of the reporting radiologist.

When to order an MRI

MRI scans are non-weight-bearing images and therefore do not show limb alignment or the extent of arthritic change well. A careful physical examination combined with plain x-rays can often provide the diagnosis without an MRI scan (and at a substantially lower cost). It is important to keep in mind whether the diagnostic imaging will alter your treatment. Matching the pathology seen on the scan to the patient's complaint is also important, as MRI has been shown to reveal cartilage lesions, osteophytes, and meniscal abnormalities in asymptomatic study volunteers with no history of pain, trauma or knee disease.

MRI scans are not good for diagnosing arthritis because they are non-weight-bearing but they are very good at diagnosing articular cartilage injuries in patients with normal looking x-rays. They can also show other problems with the bone such as osteochondritis dissecans, avascular necrosis, stress fractures and fractures not easily seen on plain x-ray.



Fracture of the medial femoral condyle seen on coronal T1 weighted.

When there has been some internal derangement of the knee, the MRI is very useful to confirm the clinical diagnosis. This includes ACL or PCL injury, meniscal tears and patella instability. A Baker's cyst and tendonitis are also well seen.



Tear of the medial meniscus seen on a sagittal T1 weighted.



Chondral injury of the femoral condyle seen on a sagittal T1 weighted.

How to read the scan

While all three planes are used to make a diagnosis, the sagittal images are particularly good for looking at the ACL and patella tendon. Axial images show the patella-femoral joint, cruciates and popliteal fossa. The coronal images show menisci, ligaments and articular cartilage. In order to diagnose a meniscal tear, the tear must be seen to extend to the meniscal surface on two sequential images.

Included below are examples of common pathology seen on MRI scans. It does not take long to become proficient at diagnosing most common conditions seen on the MRI. The RACGP has produced a very helpful document with clinical guidance for

MRI referral: www.racgp.org.au/your-practice/guidelines/mri-referral/mri-of-the-knee.

Treatment should be targeted towards the patient's symptoms rather than at all the abnormalities seen on the MRI. When combined with a careful clinical examination it is a very powerful diagnostic tool.