What is MRI and How Does It Work?

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MRI is an advanced medical imaging technique used in radiology to produce detailed images of structures inside the body. Modern 3T MRI platforms are particularly useful in evaluating the soft and connective tissues of the body, including the brain, spine, muscles, joints and nearly all internal organs.

Unlike X-rays and CT scans, MRI does not use ionising radiation. Instead, it uses a strong magnetic field, and radio-waves and a powerful computer to process the data and create detailed images that can help doctors investigate symptoms, diagnose medical conditions and plan treatment.

What does MRI stand for?

MRI stands for Magnetic Resonance Imaging.

The name refers to the way the technology uses magnetic fields to generate signals from tissues within the body. These signals called “resonance”, are detected by the MRI scanner equipment and processed by a computer to create detailed images.

How does an MRI work?

The human body contains a large amount of water, which contains hydrogen atoms. When a patient enters an MRI scanner, the strong magnetic field influences the alignment of these hydrogen atoms (also known as protons). The scanner then applies radio-waves pulses that temporarily change this alignment. As the hydrogen atoms return to their previous state, they produce signals (known as resonance) that can be detected by the scanner.

Different tissues produce different signal characteristics. By changing the MRI sequences used during an examination, the radiographer can produce images that highlight different types or aspects of tissue and abnormalities. An abnormality may appear differently from one sequence to another, and this combination of information helps the radiologist determine what it may represent.

For example, fluid and fat often appears bright on a type of MRI image called a T2-weighted sequence. The MRI radiographer can then use additional sequences that suppress the appearance of fat, helping certain areas of fluid or abnormal tissue stand out more clearly. Other specialised sequences, such as diffusion imaging, can provide further information about the nature of a finding. Think of it as looking at the same area through several different lenses. Each provides different information, and together they help build a more complete picture for the reporting radiologist.

What does an MRI show?

MRI provides excellent contrast between different types of soft tissue. MRI can provide detailed images of:

- the brain and spinal cord
- the spine and intervertebral discs
- muscles
- tendons and ligaments
- cartilage and joints
- bone marrow
- nerves (e.g. MBR Health NerveVIEW)

- blood vessels
- abdominal and pelvic organs
- soft tissue masses and other abnormalities

Due to the physics of MRI (which require hydrogen molecules present in water), imaging air-filled organs such as the lungs is challenging, and MRI can have reduced sensitivity for small lesions in this area. This is why CT is commonly used for lung examinations.

However, what an MRI can show primarily depends on which the part of the body being examined, the sequences used (e.g. inclusion of IV contrast sequences or diffusion) and the clinical question being investigated.

What is MRI used for?

Doctors may request an MRI to investigate symptoms, assess an injury, clarify findings from another imaging examination, monitor a known condition (e.g. high-risk pancreatic cysts, cancer staging) or help plan treatment (e.g. laparoscopy for endometriosis).
Modern 3T MRI platforms are highly versatile and can provide detailed imaging across many areas of the body. In musculoskeletal imaging, MRI can provide detailed assessment of tendons, ligaments, spinal discs, cartilage, muscles, joints and bone marrow.

This can be useful when investigating:

- sporting injuries such as a possible ACL rupture
- potential infectious process
- areas of inflammation
- cancer or metastatic spread
- ongoing post-surgical pain
- causes of back and neck pain, such as slipped or ruptured disc or
- causes of joint pain such as osteoarthritis,
- and other musculoskeletal conditions.

MRI is also used extensively in to diagnose conditions of other organs of the body including the brain, abdominal, pelvic, vascular and cancer imaging. MRI is also being studies as a potential screening and surveillance tool for individuals at high-risk of breast cancer, prostate cancer, and as a whole-body cancer screening tool for people with genetic predisposition for developing cancer.

While it is highly versatile, MRI is not always the best imaging test for every condition. Depending on the clinical question, CT, ultrasound, X-ray or another imaging technique may be more appropriate. However, often times conditions may ultimately require multiple "cameras" for a comprehensive evaluation and diagnostic confidence.

Does an MRI use radiation?

No. MRI does not use harmful ionising radiation. However, because of the powerful magnetic field, MRI has its own safety requirements. Patients are screened before their examination for medical devices, implants, previous surgery and metal that may be present in or on the body.

Who performs an MRI?

MRI examinations are performed by radiographers (also called MRI technologists) with specialised training and experience in magnetic resonance imaging.

In radiology clinics in Australia, most MRI radiographers do the following:

- Protocols requested imaging for appropriate sequence choice based on clinical indications (along side the radiologist, of course).
- Completes the required safety screening
- Prepares and positions the patient
- Inserts a cannula and administers IV contrast when recommended by the radiologist
- Performs the imaging examination
- Monitors the patient for signs of reactions

The images are then interpreted by a radiologist, who is a specialist medical doctor trained in diagnostic imaging. The radiologist reviews the examination and prepares a diagnostic radiology report for the referring healthcare practitioner.

3T MRI at MBR Health – Radiology on the Gold Coast

MBR Health provides advanced 3T MRI at our specialist radiology, precision imaging and regenerative medicine centre in Mermaid Beach on the Gold Coast.

Through an exclusive industry collaboration with our imaging technology manufacturer, MBR Health has access to next-generation imaging capabilities that are not yet commercially available in routine clinical practice. For patients and referrers, this means access to emerging imaging technology combined with the expertise of our specialist radiologists and experienced radiographers — all within a clinical environment focused on precision diagnostics.

If you have an MRI referral, you can upload your referral and MBR Health's friendly reception team will contact you to arrange your appointment.

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Written by: A Forbes, PhD.

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