

# Diagnostic Imaging Pathways - Common Procedures

## Magnetic Resonance Imaging (MRI)

### MRI Principles

MRI is based on the interaction between nuclei of hydrogen atoms occurring abundantly in all biological tissues and the magnetic fields generated and controlled by the MRI system's instrumentation. Hydrogen nuclei have a non-zero magnetic moment. When a body tissue is placed in the magnetic field of the MR scanner, the magnetic moments of the protons tend to align themselves with the main magnetic field of the scanner. Having aligned the hydrogen protons in a known direction, a pulsed radiofrequency field is applied to the body tissues, causing a number of hydrogen protons to flip or absorb energy. When the RF field is turned off, the protons gradually return to their previous positions, and in the process release the energy they absorbed in the form of a RF signal. It is this signal that is used to develop the MR images by the computer.

### Main Indications

The most frequent indications for MRI are for diseases of the neurological and musculo-skeletal systems. Other indications include tumour staging (for example rectal, prostatic and gynaecological malignancies), hepatobiliary disease, assessment of the breast in patients of high-risk for cancer, and of breast implants. Increasingly, MRI is substituting for CT scans particularly in children and young adults because of the lack of ionizing radiation. However, in Australia the indications that attract a Medicare rebate are limited, especially when the request is initiated by a primary care physician.

### MRI in the Paediatric Population

MRI is becoming an increasingly used imaging modality in the paediatric population due to its broad application in a wide variety of clinical situations as well as growing concerns about the effects of ionising radiation in the radiosensitive paediatric population. Given the logistical considerations of imaging patients with MRI, imaging in the paediatric population presents unique challenges that should be considered when referring a child for a MRI imaging procedure. Some factors that should be considered in paediatric MRI referrals can include:

- **Time factor for MRI:** The use of MRI can be time consuming and will often require the patient to remain still for up to an hour; failure to do so may compromise the quality of imaging achieved and reduce or negate the diagnostic information provided by imaging. Assessment needs to be made of a child's cognitive ability to be able to follow instruction and comply with the requirements for achieving a successful MRI examination
- **Environment:** MRI facilities can be physically intimidating for a child, given factors like gantry size, noise and the generally foreign environment
- **Invasiveness:** Some MRI examinations may require the administration of intravenous contrast which can require further procedures like peripheral intravenous cannulation which can be distressing for a child
- **Safety considerations:** The usual safety considerations and contraindications associated with MRI are applicable in the paediatric population. However additional considerations need to be taken into account, particularly in neonates and infants, and include factors like the immature thermoregulatory mechanisms and potential consequent problems in physiologically responding radiofrequency heating which occurs with MRI examinations



The use of general anaesthesia or sedation may be required for children who are referred for MRI examination in addition to other strategies like mock MRI scanners or play therapy. For more information on MRI imaging in the paediatric population please access the following link. [Paediatric, Magnetic Resonance Imaging](#)

Access the following link for the source of this information. [Techniques in Pediatric MRI - Tips for Imaging Children](#)

## Main Contra-indications

The main contra-indications to MRI examinations include cardiac pacemakers, cochlear implants, epidural electrodes and ferromagnetic aneurysm clips. Relative contra-indications include first trimester pregnancy and claustrophobia.

## Use of Contrast Media

Gadolinium-DTPA is the most commonly used contrast agent in MRI. Its main use is to increase lesion conspicuity in situations where contrast uptake may be expected as in the case of break down in the blood brain barrier or in neovascularity in tumours. IV Gadolinium can also be used to increase vessel conspicuity in MR Angiography but should be used with caution in patients with renal failure pending further study due to its association with Nephrogenic Systemic Fibrosis (NSF). For more information, please access the following: [Gadolinium](#)

More specialised contrast agents are also available, for example hepatobiliary agents that have a delayed liver parenchymal phase of uptake.

## Information for Consumers

For information published at this website, please access the following: [Magnetic Resonance Imaging](#)

For information published by the Royal Australian and New Zealand College of Radiologists, please access InsideRadiology at: [www.insideradiology.com.au](http://www.insideradiology.com.au)

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