

Magnetic Resonance Imaging (MRI)

What is MRI of the Body?

Magnetic resonance imaging (MRI) uses radio frequency waves and a strong magnetic field rather than x-rays to provide remarkably clear and detailed pictures of internal organs and tissues. MRI requires specialized equipment and expertise and allows evaluation of some body structures that may not be as visible with other imaging methods.

What are some common uses of the MRI procedure?

Because MRI can give such clear pictures of soft-tissue structures near and around bones, it is the most sensitive exam for spinal and joint problems. MRI is widely used to diagnose sports-related injuries, especially those affecting the knee, shoulder, hip, elbow, and wrist. The images allow the physician to see even very small tears and injuries to ligaments and muscles.

Organs of the chest and abdomen—including the lungs, liver, kidney, spleen, pancreas, and abdominal vessels—can also be examined in high detail with MRI, enabling the diagnosis and evaluation of tumors and functional disorders.

How should I prepare for the procedure?

Because of the strong magnetic field used for MRI, you will be screened for metal objects and implantable devices (such as, prosthetic hip, pacemaker, artificial heart valve, implantable port, infusion catheter, IUD) multiple times for your safety. In most cases surgical staples, plates, pins, and screws pose no risk during MRI if they have been in place for more than four to six weeks. Tattoos and permanent eyeliner may also create a problem. You will be asked if you have ever had a bullet or shrapnel in your body, or ever worked with metal. If there is any question of metal fragments, you may be asked to have a x-ray that will detect any such metal objects. You will be asked to remove anything that might degrade MRI images of the head, including hairpins, jewelry, eyeglasses, hearing aids, and any removable dental work.

What does the MRI equipment look like?

The conventional MRI unit is a cylindrical tube with openings on each end in which the patient must lie totally still for several seconds at a time. The “short-bore” systems are wider and shorter and do not fully enclose the patient.

How does the procedure work?

MRI is a unique imaging method because, unlike the usual x-rays or CT, it does not rely on ionizing radiation. Instead, radio frequency waves are directed at protons, the nuclei of hydrogen atoms, in a strong magnetic field. The protons are first “excited” and then “relaxed” emitting radio signals that can be computer-processed to form an image. In the body, protons are most abundant in the hydrogen atoms of water—the “H” of H₂O—so that an MRI image shows differences in the water content and distribution in various body tissues. Even different types of tissue within the same organ, such as the gray and white matter of the brain, can easily be distinguished. Typically an MRI examination consists of two to six imaging sequences, each lasting two to 15 minutes. Each sequence has its own degree of contrast and shows a cross-section of the body in one of several planes (right to left, front to back, upper to lower).

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How is the procedure performed?

The patient is placed on a sliding table and positioned comfortably for the MRI examination. Then the technologist leaves the room and the individual MRI sequences are performed. The patient is able to communicate with the technologist at any time using an intercom. Also, many MRI centers allow a friend or, if a child is being examined, a parent to stay in the room. Depending on how many images are needed, the exam will generally take 15 to 45 minutes, although a very detailed study may take longer. You will be asked not to move during the actual imaging process, but between sequences some movement is allowed. Patients are generally required to remain still for only a few seconds to a few minutes at a time.

Depending on the part of the body being examined, a contrast material may be used to enhance the visibility of certain tissues or blood vessels. A small needle connected to an intravenous line is placed in an arm or hand vein. A saline solution will drip through the intravenous line to prevent clotting until the contrast material is injected, about two-thirds of the way through the exam.

When the exam is over the patient is asked to wait until the images are examined to determine if more images are needed. A radiologist experienced in MRI will analyze the images and send a report with his or her interpretation to the patient's personal physician. This should take only a few days or less.

What will I experience during the procedure?

MRI causes no pain, but some patients can find it uncomfortable to remain still during the examination. Others experience a sense of being "closed in" though the more open construction of newer MRI systems has done much to reduce that reaction. You may notice a warm feeling in the area under examination; this is normal, but if it bothers you the technologist should be notified.

If a contrast injection is needed, there may be discomfort at the injection site, and you may have a cool sensation at the site during injection. Most bothersome to many patients are the loud tapping or knocking noises heard at certain phases of imaging. Earplugs may help and are provided.

Who interprets the results and how do I get them?

A radiologist, who is a physician experienced in MRI and other radiology examinations, will analyze the images and send a signed report with his or her interpretation to the patient's personal physician. The patient receives MRI results from the referring physician who ordered the test. New technology also allows for distribution of diagnostic reports and referral images over the Internet at many facilities.

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