

Brain MRI

A brain MRI, *also called a head MRI*, uses a powerful magnetic field, radio waves and a computer to produce pictures of the brain. The pictures produced are clearer and more detailed than other imaging methods. Magnetic resonance imaging (MRI) does not use ionizing radiation and may require an injection of a contrast material called gadolinium.

Tell your doctor about any health problems, recent surgeries or allergies and whether there's a possibility you are pregnant. The magnetic field is not harmful, but it may cause some medical devices to malfunction. Most orthopedic implants pose no risk, but you should always tell the technologist if you have any devices or metal in your body. Guidelines about eating and drinking before your exam vary between facilities. Unless you are told otherwise, take your regular medications as usual.

Leave jewelry at home and wear loose, comfortable clothing. You may be asked to wear a gown. If you have claustrophobia or anxiety, you may want to ask your doctor for a mild sedative prior to the exam.



What is a brain MRI?

Magnetic resonance imaging (MRI) uses a powerful magnetic field, radiofrequency pulses, and a computer to produce detailed pictures of internal body structures. MRI does not use radiation (x-rays).

Detailed MR images allow doctors to examine the body and detect disease. Currently, MRI is the best imaging test for many brain disorders.

What are some common uses of brain MRI?

Doctors use Brain MRI to investigate sudden onset or long-standing symptoms. It can help diagnose conditions such as:

- stroke and stroke damage
- changes associated with aging (brain volume loss or signal changes in brain tissue)
- brain damage or bleeding from traumatic injury
- loss of body movement control (ataxia)
- brain tumors
- developmental anomalies
- hydrocephalus — dilatation of fluid spaces within the brain (ventricles)
- causes of epilepsy (seizure)
- infections
- certain chronic conditions, such as multiple sclerosis
- eye and inner ear disorders
- pituitary gland disorders

How should I prepare for the brain MRI?

You will need to change into a hospital gown. This is to prevent artifacts appearing on the final images and to prevent you from wearing clothes inside the MRI machine that can heat up.

Guidelines about eating and drinking before an MRI vary between specific exams and facilities. Ask your imaging center for instructions. Take medications as usual unless your doctor tells you otherwise.

Some MRI exams use an IV injection of contrast material. The imaging center will always ask if you have allergies to contrast material. Most MRI exams use a contrast material that contains gadolinium, which is extremely safe. Doctors can use gadolinium contrast in patients who have had allergic reactions to iodine contrast.

Tell the technologist if you have any serious health problems (such as kidney disease) or recent surgeries.

Women should always tell their doctor and technologist if they are pregnant. MRI has been used since the 1980s with no reports of any ill effects on pregnant women or their unborn babies. However, the baby will be in a strong magnetic field. Therefore, pregnant women should not have an MRI in the first trimester unless the benefit of the exam clearly outweighs any potential risks. Pregnant women will usually not receive gadolinium contrast material unless absolutely necessary. *See the MRI Safety During Pregnancy (<https://www.radiologyinfo.org/en/info/safety-mri-pregnancy>) page for more information about pregnancy and MRI.*

If you have claustrophobia (fear of enclosed spaces) or anxiety, you may want to ask your doctor to prescribe a mild sedative prior to the date of your exam.

Leave all jewelry and other accessories at home or remove them prior to the MRI scan. Metal and electronic items are not allowed in the exam room. They can interfere with the magnetic field of the MRI unit, cause burns, or become harmful projectiles. These items include:

- jewelry, watches, credit cards, and hearing aids, all of which can be damaged
- pins, hairpins, metal zippers, and similar metallic items, which can distort MRI images and damage the machine
- removable dental work
- pens, pocketknives, and eyeglasses
- body piercings
- magnetic false eyelashes
- mobile phones, electronic watches, and tracking devices.

In most cases, an MRI exam is safe for patients with metal implants, except for a few types. People with the following implants may not be scanned and should not enter the MRI scanning area without first being evaluated for safety:

- some cochlear (ear) implants
- some types of clips used for brain aneurysms
- some older cardiac defibrillators and pacemakers
- some nerve stimulators

Tell the technologist if you have medical or electronic devices in your body. These devices may interfere with the exam or pose a risk. Many implanted devices will have an ID card and also a pamphlet explaining the MRI risks for that device. If you have these items, bring them to the attention of the scheduler before the exam. MRI cannot be performed without confirmation and documentation of the type of implant and MRI compatibility. You should also bring the items to your exam in case the radiologist or technologist has any questions.

If there is any question, an x-ray can detect and identify any metal objects. Metal objects used in orthopedic surgery generally pose no risk during MRI. However, a recently placed artificial joint may require the use of a different imaging exam.

Tell the technologist or radiologist about any shrapnel, bullets, or other metal that may be in your body. Foreign bodies near and especially lodged in the eyes are very important because they may move or heat up during the scan and cause blindness. Dyes used in tattoos may contain iron and could heat up during an MRI scan. This is rare. The magnetic field will usually not affect tooth fillings, braces, eyeshadows, and other cosmetics. However, these items may distort images of the facial area or brain. Tell the radiologist about them.

Anyone accompanying a patient into the exam room must also undergo screening for metal objects and implanted devices.

What does the equipment look like?

The traditional MRI unit is a large cylinder-shaped tube surrounded by a circular magnet. You will lie on a table that slides into a tunnel towards the center of the magnet.

Some MRI units, called short-bore systems, are designed so that the magnet does not completely surround you. Some newer MRI machines have a larger diameter bore, which can be more comfortable for larger patients or those with claustrophobia. "Open" MRI units are open on the sides. They are especially helpful for examining larger patients or those with claustrophobia. Open MRI units can provide high quality images for many types of exams. Open MRI may not be used for certain exams. For more information, consult your radiologist.

How does the procedure work?

Unlike x-ray and computed tomography (CT) exams, MRI does not use radiation. Instead, MRI uses a powerful magnet to re-align hydrogen atoms that naturally exist within the body. MRI pictures are created by sending small bursts of radiofrequency energy into your body as a computer measures the signal that comes back. That information can be used to create images of your body.

The MRI magnet is ALWAYS on, which is why it is critical that you fill out your MR safety form accurately and listen to the MRI technologist.

MRI is often able to tell the difference between diseased tissue and normal tissue better than x-ray, CT, and ultrasound.

How is the procedure performed?

The technologist will position you on the moveable exam table. They may use straps and bolsters to help you stay still and maintain your position.

The technologist will place a helmet-like device around your head called a brain MRI coil. The brain coil helps the technologist to obtain very detailed images of your brain.

If your exam uses a contrast material, a doctor, nurse, or technologist will insert an intravenous catheter (IV line) into a vein in your hand or arm. They will use this IV to inject the contrast material.

You will be placed into the magnet of the MRI unit. The technologist will perform the exam while working at a computer outside of the room. You will be able to talk to the technologist via an intercom. MRI exams create multiple different types of images that the radiologist uses to diagnose different conditions. As the exam proceeds, you will hear some loud noises that many people describe as a clanking, banging, or a laser gun sound.

When the exam is complete, the technologist may ask you to wait while the radiologist checks the images in case more are needed.

The technologist will remove your IV line after the exam is over and place a small dressing over the insertion site.

The entire examination is usually completed within 30-60 minutes.

What will I experience during and after the procedure?

Most MRI exams are painless. However, some patients find it uncomfortable to remain still. Others may feel closed-in (claustrophobic) while in the MRI scanner. The scanner is noisy so you will be given ear plugs to wear.

It is normal for the area of your body being imaged to feel slightly warm. If it bothers you, tell the radiologist or technologist. It is important that you remain perfectly still while the images are being taken. This is typically only a few minutes at a time. You may be able to relax between imaging sequences. However, you will need to keep the same position as much as possible without moving.

You will usually be alone in the exam room. However, the technologist will be able to see, hear, and speak with you at all times using a two-way intercom. They will give you a “squeeze-ball” that alerts the technologist that you need attention right away. Many facilities allow a friend or parent to stay in the room if they have also been screened for safety.

Children will be given appropriately sized earplugs or headphones during the exam. Music may be played through the headphones to help pass the time. MRI scanners are air-conditioned and well-lit.

In some cases, IV injection of contrast material may be given before the images are obtained. The IV may cause you some discomfort and you may experience some bruising. There is also a very small chance of skin irritation at the site of the IV tube insertion. Some patients may have a temporary metallic taste in their mouth after the contrast injection.

If you do not require sedation, no recovery period is necessary. You may resume your usual activities and normal diet immediately after the exam. On very rare occasions, a few patients experience side effects from the contrast material. These may include nausea, headache, and pain at the site of injection. It is very rare that patients experience hives, itchy eyes, or other allergic reactions to the contrast material. If you have allergic symptoms, tell the technologist. A radiologist or other doctor will be available for immediate assistance.

Who interprets the results and how do I get them?

A radiologist, a doctor trained to supervise and interpret radiology exams, will analyze the images. The radiologist will send a signed report to your ordering provider, who will share the results with you.

You may need a follow-up exam. If so, your doctor will explain why. Sometimes a follow-up exam further evaluates a potential issue with more views or a special imaging technique. It may also see if there has been any change in an issue over time. Follow-up exams are often the best way to see if treatment is working or if a problem needs attention.

What are the benefits vs. risks?

Benefits

- MRI is a noninvasive imaging technique that does not involve exposure to radiation.
- MRI can help physicians evaluate the structures of the brain and can also provide functional information in selected cases.
- MR images of the brain and other cranial structures are clearer and more detailed than with other imaging methods. This detail makes MRI an invaluable tool in early diagnosis and evaluation of many conditions, including tumors.
- MRI can detect abnormalities that might be obscured by bone with other imaging methods.
- A variant called MR angiography (MRA) provides detailed images of blood vessels in the brain—often without the need for contrast material. *See the MRA page (<https://www.radiologyinfo.org/en/info/angiomr>) for more information.*

- MRI can detect stroke at a very early stage by mapping the motion of water molecules in the tissue. This water motion, known as diffusion, is impaired by most strokes, often within less than 30 minutes from the onset of symptoms.

Risks

- The MRI exam poses almost no risk to the average patient when appropriate safety guidelines are followed.
- The strong magnetic field is not harmful to you. However, it may cause implanted medical devices to malfunction or distort the images.
- Nephrogenic systemic fibrosis is a recognized complication related to injection of gadolinium contrast. It is exceptionally rare with the use of newer gadolinium contrast agents. It usually occurs in patients with serious kidney disease. Your doctor will carefully assess your kidney function before considering a contrast injection.
- There is a very slight risk of an allergic reaction if your exam uses contrast material. Such reactions are usually mild and controlled by medication. If you have an allergic reaction, a doctor will be available for immediate assistance.
- Although there are no known health effects, evidence has shown that very small amounts of gadolinium can remain in the body, after multiple MRI exams. This is most likely to occur in patients receiving multiple MRI exams over their lifetime for monitoring chronic or high-risk health conditions.
- If you are breast feeding, current American College of Radiology (ACR) guidelines suggest there is no need to stop breast feeding if you received IV contrast during your MRI. Some women still prefer to “pump and dump” for 24 hours after their test. If you have questions, please ask to speak to a radiologist.

What are the limitations of a brain MRI?

High-quality images depend on your ability to remain perfectly still while the images are being recorded. If you are anxious, confused or in severe pain, you may find it difficult to lie still during imaging.

A person who is very large may not fit into certain types of MRI machines. There are weight limits on the scanners.

Implants and other metallic objects can make it difficult to obtain clear images. Patient movement can have the same effect.

Present data show no convincing evidence that non-contrast MRI harms the fetus of a pregnant woman. However, if the need for the exam is not time sensitive your doctor may delay the exam until after delivery. Your doctor will discuss the benefits and risks of any MRI procedure with you. Doctors may perform non-contrast MRI after the first trimester to assess the fetus for findings that are not fully evaluated by ultrasound. MRI gadolinium contrast agents are generally avoided during pregnancy except in very specific circumstances.

Brain MRI may not always distinguish between cancer tissue and fluid, known as edema.

An MRI exam typically costs more and may take more time than other imaging exams. Talk to your insurance provider if you have concerns about the cost of MRI.

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