

## Knee MRI

Magnetic resonance imaging (MRI) of the knee uses a powerful magnetic field, radio waves and a computer to produce detailed pictures of the structures within the knee joint. It is typically used to help diagnose or evaluate pain, weakness, swelling or bleeding in and around the joint. Knee MRI does not use ionizing radiation, and it can help determine whether you require surgery.

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 such as shrapnel in your body, especially in or near your brain, spinal cord, heart or eyes. 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 remove any metal piercings. 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 Knee MRI?

MRI of the knee provides detailed images of structures within the knee joint, including bones, cartilage, tendons, ligaments, muscles and blood vessels, from many angles.

Magnetic resonance imaging (MRI) is a noninvasive test doctors use to diagnose medical conditions.

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.

## What are some common uses of the procedure?

In combination with conventional x-rays, MRI is usually the best choice for examining the body's major joints like the knee.

The examination is typically performed to diagnose or evaluate:

- knee pain, weakness, swelling or bleeding in the tissues in and around the joint
- damaged cartilage, meniscus, ligaments or tendons
- sports-related knee injuries, such as sprains and torn ligaments, cartilage, or tendons
- bone fractures that may not be visible on x-rays and other imaging tests
- damage from arthritis (<http://www.radiologyinfo.org>)
- build-up of fluid in the knee joint
- infections (such as osteomyelitis (<http://www.radiologyinfo.org>) )
- tumors (<http://www.radiologyinfo.org>) (primary tumors and metastases (<http://www.radiologyinfo.org>) ) involving bones

- and joints
- dead bone
- a feeling that your knee is giving away at the joint
- decreased motion of the knee joint
- knee cap injury or pain
- complications related to implanted surgical devices
- pain or trauma following knee surgery

Your doctor may also order an MRI to determine if knee arthroscopy or another surgical procedure is needed, and to monitor your progress after knee surgery.

A special form of MRI called an MR arthrogram injects contrast material into the joint so that the radiologist can get a better look at the knee's structures.

## How should I prepare?

You will need to change into a hospital gown. This is to prevent artifacts appearing on the final images and to comply with safety regulations related to the strong magnetic field.

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

Some MRI exams use an injection of contrast material. The doctor may ask if you have asthma or allergies to contrast material, drugs, food, or the environment. MRI exams commonly use a contrast material called gadolinium (<http://www.radiologyinfo.org>) . Doctors can use gadolinium in patients who are allergic to iodine contrast. A patient is much less likely to be allergic to gadolinium than to iodine contrast. However, even if the patient has a known allergy to gadolinium, it may be possible to use it after appropriate pre-medication. *For more information on allergic reactions to gadolinium contrast, please consult the ACR Manual on Contrast Media (<https://www.acr.org/Clinical-Resources/Contrast-Manual>) .*

Tell the technologist or radiologist if you have any serious health problems or recent surgeries. Some conditions, such as severe kidney disease, may mean that you cannot safely receive gadolinium. You may need a blood test to confirm your kidneys are functioning normally.

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 should not receive gadolinium contrast 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 (<http://www.radiologyinfo.org>) (fear of enclosed spaces) or anxiety, ask your doctor to prescribe a mild sedative prior to the date of your exam.

Infants and young children often require sedation or anesthesia to complete an MRI exam without moving. This depends on the child's age, intellectual development, and the type of exam. Sedation can be provided at many facilities. A specialist in pediatric sedation or anesthesia should be available during the exam for your child's safety. You will be told how to prepare your child. Some facilities may have personnel who work with children to help avoid the need for sedation or anesthesia. They may prepare children by showing them a model MRI scanner and playing the noises they might hear during the exam. They also answer any questions and explain the procedure to relieve anxiety. Some facilities also provide goggles or headsets so the child can watch a movie during the exam. This helps the child stay still and allows for good quality images.

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
- removable dental work
- pens, pocketknives, and eyeglasses
- body piercings
- 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 (<http://www.radiologyinfo.org>)
- some types of metal coils placed within blood vessels
- some older cardiac defibrillators (<http://www.radiologyinfo.org>) and pacemakers (<http://www.radiologyinfo.org>)
- vagal 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 a pamphlet explaining the MRI risks for that device. If you have the pamphlet, bring it 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 any pamphlet 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 (<http://www.radiologyinfo.org>) 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 (<http://www.radiologyinfo.org>), 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.

Some facilities use smaller extremity scanners to image the joints of the arms or legs. With this type of system, you may recline or

sit next to the MRI unit, while only the body part being scanned is placed inside the machine. Although these are smaller systems, they usually produce high quality images due to the unit's powerful magnet.

## How does the procedure work?

Unlike x-ray and computed tomography (CT) exams, MRI does not use radiation. Instead, radio waves re-align hydrogen atoms that naturally exist within the body. This does not cause any chemical changes in the tissues. As the hydrogen atoms return to their usual alignment, they emit different amounts of energy depending on the type of tissue they are in. The scanner captures this energy and creates a picture using this information.

In most MRI units, the magnetic field is produced by passing an electric current through wire coils. Other coils are inside the machine and, in some cases, are placed around the part of the body being imaged. These coils send and receive radio waves, producing signals that are detected by the machine. The electric current does not come into contact with the patient.

A computer processes the signals and creates a series of images, each of which shows a thin slice of the body. The radiologist can study these images from different angles.

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?

MRI exams may be done on an outpatient basis.

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.

Small devices that contain coils that send and receive radiofrequency pulses may be placed around your knee to help improve image quality.

If your exam uses a contrast material, a doctor, nurse, or technologist (<http://www.radiologyinfo.org>) will insert an intravenous (<http://www.radiologyinfo.org>) 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.

If your exam uses a contrast material, the technologist will inject it into the intravenous line (IV) after an initial series of scans. They will take more images during or following the injection.

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 exam is usually completed in 45 minutes.

If your child requires sedation to complete the MRI, you may be asked to come early for the exam in order for your child to be evaluated prior to sedation. Sedation may add 15 to 30 minutes to the procedure. Your child may need to stay additional time to be monitored as the sedation wears off.

In selected patients, arthrography will be performed first. During that procedure, contrast material may be injected into the knee joint space before MRI in order to image the joint structures in more detail. Arthrography may require imaging guidance to place a needle into the knee joint. For MR arthrographic examinations, you will experience a slight pinprick and may feel a momentary

burning if a local anesthesia is used to numb the skin over the joint area before the contrast is injected. When the contrast material is injected, it is normal to feel coolness and a flushing sensation for a moment. You may hear gurgling when the joint is moved.

The needle may cause you some discomfort when it is inserted and you may experience some bruising once it is removed. There is also a very small chance of irritation of your skin at the site of the needle insertion. You may experience some mild discomfort and swelling that should last not more than a few days following the procedure. If you develop a fever, which may indicate an infection, contact your doctor or seek medical attention. Arrange for someone to drive you home after the procedure.

See the *Direct Arthrography* (<https://www.radiologyinfo.org/en/info/arthrog>) page for more information.

## 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 can be noisy.

It is normal for the area of your body being imaged to feel slightly warm, but if it bothers you, notify the radiologist or technologist. It is important that you remain perfectly still while the images are being recorded, which is typically only a few seconds to a few minutes at a time. You will know when images are being recorded because you will hear tapping or thumping sounds when the coils that generate the radiofrequency pulses are activated. You will be able to relax between imaging sequences, but will be asked to maintain your position as much as possible.

You will usually be alone in the exam room during the MRI procedure. However, the technologist will be able to see, hear and speak with you at all times using a two-way intercom. Many MRI centers allow a friend or parent to stay in the room as long as they are also screened for safety in the magnetic environment.

You may be offered or you may request earplugs to reduce the noise of the MRI scanner, which produces loud thumping and humming noises during imaging. Children will be given appropriately sized earplugs or headphones during the exam. MRI scanners are air-conditioned and well-lit. Some scanners have music to help you pass the time.

If you have an exam that requires an injection of intravenous contrast material, it is normal to feel coolness and a flushing sensation for a minute or two following the injection. The intravenous needle may cause you some discomfort when it is inserted and once it is removed, you may experience some bruising. There is also a very small chance of irritation of your skin at the site of the IV tube insertion.

If you have not been sedated, no recovery period is necessary. You may resume your usual activities and normal diet immediately after the exam. A few patients experience side effects from the contrast material, including nausea and local pain. Very rarely, patients are allergic to the contrast material and experience hives, itchy eyes or other reactions. If you experience allergic symptoms, a radiologist or other physician will be available for immediate assistance.

There is no recovery time from an MRI scan, unless you need sedation. After the scan, you can resume your normal diet, activity and medications.

## 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 primary care or referring physician, who will share the results with you.

## What are the benefits vs. risks?

### Benefits

- MRI is a noninvasive imaging technique that does not involve exposure to radiation.

- MRI has proven valuable in diagnosing a broad range of conditions, including tendon, ligament, muscle, cartilage and bone abnormalities that are not as visible on x-rays or CT scans.
- MRI can help determine which patients with knee injuries require surgery.
- MRI may help diagnose a bone fracture when x-rays and other tests are inconclusive.
- MRI can detect abnormalities that might be obscured by bone with other imaging methods.
- MRI provides a noninvasive (<http://www.radiologyinfo.org>) alternative to x-ray, angiography (<http://www.radiologyinfo.org>) and CT for diagnosing problems of the blood vessels.

## Risks

- The MRI exam poses almost no risk to the average patient when appropriate safety guidelines are followed.
- If sedation is used, there is a risk of using too much. However, your vital signs will be monitored to minimize this risk.
- 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 (<http://www.radiologyinfo.org>) 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, particularly the brain, 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. The contrast agent is mostly eliminated from the body through the kidneys. If you are a patient in this category, consult with your doctor about the possibility of gadolinium retention, as this effect varies from patient to patient.
- IV contrast manufacturers indicate mothers should not breastfeed their babies for 24-48 hours after contrast material is given. However, the most recent American College of Radiology (ACR) Manual on Contrast Media reports that studies show the amount of contrast absorbed by the infant during breastfeeding is extremely low. *For further information please consult the ACR Manual on Contrast Media (<https://www.acr.org/Clinical-Resources/Contrast-Manual>) and its references.*

## What are the limitations of a knee MRI?

High-quality images are assured only if you are able 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. Constant coughing and shaking might also interfere with the scan. A bent knee that cannot be extended is also difficult to image.

A person who is very large may not fit into the opening of a conventional MRI machine.

The presence of an implant or other metallic object sometimes makes it difficult to obtain clear images and patient movement can have the same effect. In some cases, metal artifact reduction imaging is performed in patients who have metallic surgical implants at the knee and require MR imaging.

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. MRI gadolinium contrast agents are generally avoided during pregnancy except in very specific circumstances. Your doctor will discuss the benefits and risks of any MRI procedure with you. Doctors may perform MRI after the first trimester to assess the fetus for findings that are not fully evaluated by ultrasound.

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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