

Prostate MRI

Magnetic resonance imaging (MRI) uses a magnetic field, radiofrequency pulses, and a computer to produce detailed pictures of the body. Doctors use Prostate MRI to evaluate the extent of prostate cancer and determine whether it has spread. They may also use it to help diagnose infection, conditions you were born with, or an enlarged prostate. Some exams may use an endorectal coil, a thin wire covered with a latex balloon. The doctor inserts the coil a short distance into the rectum. Prostate MRI does not use radiation. It provides images that are clearer and more detailed than other imaging methods.

Tell your doctor about any health problems, recent surgeries, or allergies. The magnetic field is not harmful. However, it may cause some medical devices to malfunction. Most orthopedic implants pose no risk. 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. Take your regular medications as usual, unless your doctor tells you otherwise. Leave jewelry at home and wear loose, comfortable clothing. You may need to wear a gown. If you have claustrophobia or anxiety, ask your doctor for a mild sedative prior to the exam.

What is MRI of the Prostate?

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.

Multiparametric (Mp-MRI) is an advanced form of imaging. It uses three MRI techniques to provide anatomical pictures and information on the function of the prostate gland.

Mp-MRI assesses water molecule motion (called water diffusion) and blood flow (called perfusion imaging) within the prostate. This helps your doctor tell the difference between diseased and normal prostate tissue.

The prostate is part of the male reproductive system. It sits in front of the rectum, above the base of the penis, and below the bladder. The prostate surrounds the first part of the urethra. It helps make the milky fluid called semen. Semen carries sperm out of the body when a man ejaculates. Your doctor will most commonly use ultrasound or MRI to image the prostate. *See the Prostate Ultrasound page (<https://www.radiologyinfo.org/en/info/us-prostate>) for more information.*

What are some common uses of the procedure?



Your doctor uses MRI to evaluate prostate cancer and see if it is limited to the prostate. Mp-MRI provides information on how water molecules and blood flow through the prostate. This helps determine whether cancer is present and, if so, whether it is aggressive and if it has spread.

Occasionally, MRI of the prostate is used to evaluate other prostate problems, including:

- infection (prostatitis) or prostate abscess.
- an enlarged prostate, called benign prostatic hyperplasia (BPH) (<https://www.radiologyinfo.org/en/info/bph>) .
- abnormal conditions present at birth.
- complications after pelvic surgery.

How should I prepare?

Your MRI exam may use an endorectal coil, a thin wire covered with a latex balloon. The doctor places the coil a short distance into the rectum. The rectum is located immediately behind and up against the prostate. Placing the coil into the rectum so close to the prostate helps generate more detailed images. It also enables your radiologist to perform magnetic resonance (MR) spectroscopy. MR spectroscopy can provide additional information on the chemical makeup of cells in the prostate. Additionally, prostate MRI may examine water molecule motion (water diffusion) and blood flow (perfusion imaging) within the prostate to help differentiate between diseased and normal prostate tissue.

Your doctor will typically use an endorectal coil with low-field (1.5 Tesla) MRI magnets if you have a metal orthopedic implant. Metal implants may interfere with imaging when using a high-field magnet MRI. The doctor will typically not use an endorectal coil with high-field (3 Tesla) MRI units.

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. 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.

If your exam uses an endorectal coil, tell the technologist whether you are allergic to latex. If so, the technologist will cover the endorectal coil with a latex-free condom. To prepare for an MRI with the endorectal coil, eat light meals on the day prior to and on the day of your exam. This will help make it easier to insert the coil. Your doctor may ask you to use an enema before your exam to help clear your bowel. Enema kits or saline laxatives are available over the counter. Prior to your exam, take your usual medications, unless your doctor says otherwise.

If you have claustrophobia (fear of enclosed spaces) or anxiety, 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
- 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
- some types of metal coils placed within blood vessels
- some older cardiac defibrillators and pacemakers
- 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 about them.

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.

Most prostate MRI exams use high-field MRI magnets (3 Tesla) because they provide higher-quality images. However, men with metal implants may undergo low-field prostate MRI (1.5 Tesla) because the implants may otherwise interfere with imaging.

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.

The technologist may place devices that contain coils capable of sending and receiving radio waves around or next to the area of the body under examination.

MRI exams generally include multiple runs (sequences), some of which may last several minutes. Each run will create a different set of noises.

Your exam may use an endorectal coil. If so, a nurse or doctor will place a disposable cover over the coil. They will lubricate the assembly and insert the coil a short distance into your rectum. After insertion, the doctor inflates the circular balloon that sits around the coil and holds it in place during the exam. When the exam is complete, the doctor deflates the balloon and removes the coil.

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.

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 examination usually takes 45 minutes or less.

The doctor may also perform MR spectroscopy during your exam. MR spectroscopy provides additional information on the chemicals present in the body's cells. This may add about 15 minutes to the total exam time.

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.

You may feel pressure while the doctor inserts the endorectal coil into your rectum. This is similar to that experienced during a digital rectal exam.

It is normal for the area of your body being imaged to feel slightly warm. 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. For some types of exams, you may be asked to hold your breath. 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 always be able to see, hear, and speak with you using a two-way intercom. They will give you a “squeeze-ball” that alerts the technologist that you need attention right away. Many MRI centers allow a friend or parent to stay in the room if they are also screened for safety in the magnetic environment.

The technologist may offer (or you may request) earplugs to reduce the noise of the MRI scanner. The scanner produces loud thumping and humming noises during imaging. MRI scanners are air-conditioned and well-lit. Some scanners have music to help you pass the time.

When the contrast material is injected, it is normal to feel coolness and a flushing sensation for a minute or two. The intravenous needle may cause you some discomfort when it is inserted. Once it is removed, you may experience some bruising. There is also a very small chance of skin irritation 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.

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.

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.
- MR images of the body's soft-tissue structures are clearer and more detailed than those of other imaging methods. This detail makes MRI a valuable tool in early diagnosis and evaluation of the extent of tumors, such as prostate cancer.
- MRI has proven valuable in diagnosing a broad range of conditions, including cancer. It is also useful in diagnosing benign conditions such as an enlarged prostate and infection.
- Mp-MRI helps distinguish between low-risk/slow-growing and high-risk/aggressive prostate cancers. It also helps determine if cancer has spread beyond the prostate.
- MRI can detect abnormalities that might be obscured by bone with other imaging methods.

- The MRI gadolinium contrast material is less likely to cause an allergic reaction than the iodine-based contrast materials used for x-rays and CT scanning.

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 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.

What are the limitations of MRI of the Prostate?

High-quality images depend on your ability to remain perfectly still and follow breath-holding instructions 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.

A very irregular heartbeat may affect the quality of images. This is because some techniques time the imaging based on the electrical activity of the heart.

MRI cannot always distinguish between cancer and inflammation or the presence of blood products within the prostate. Blood may sometimes appear due to a prostate biopsy. To avoid confusing any bleeding with cancer, your doctor may wait six to eight weeks after prostate biopsy to perform prostate MRI. This will allow any remnants of bleeding to resolve.

A prostate MRI can detect if a cancer is growing outside the walls of the prostate gland or into nearby structures, such as the seminal vesicles or bladder. This is a sign of possible metastatic disease. However, the exam cannot tell if a cancer has spread distantly into other organs outside the pelvis. If you are a high-risk patient or a patient with biochemical recurrence, your doctor may perform PSMA PET/CT, a test that can accurately detect the spread of prostate cancer to anywhere else in the body.

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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