

Magnetic Resonance Imaging



North American Spine Society
Public Education Series

What Is Magnetic Resonance Imaging (MRI)?

Magnetic resonance imaging (MRI) is a valuable diagnostic study that has been used by health care providers since the 1980s. MRI is a noninvasive, nonradioactive and pain-free method of evaluating the human body. An MRI typically is ordered as part of a medical evaluation and uses strong magnets and radio waves that are evaluated using computer technology to view three-dimensional images of the body.

During MRI, radio waves are released in pulses through your body, causing movement or “excitement” in hydrogen atoms in your cells. When the radio waves stop, the hydrogen atoms relax and release energy. Different parts of the body, such as soft tissue and bones, have characteristic patterns of how they are affected by the radio waves; these patterns are displayed on a computer monitor as pictures of the anatomy of the body. A specially trained radiologist reads these images, which are presented in visual sections or slices, to help determine the cause of your pain.

MRIs are easily obtained, risk-free to most people and can usually be performed without any special preparation (such as having to drink or be injected with contrast materials or radioactive dye.) Occasionally, your doctor will order a study that requires the injection of a special drug that provides greater detail in the images.

Do I Need an MRI?

When you go to your health care provider for neck or back pain or radicular pain (pain that radiates from the neck into the arm or lower spine into the leg), it is important to determine the source of your pain. There are many possible causes.

In many cases, neck, back and radicular pain may subside in a month or two with proper treatment. However, if the pain continues more than six or seven weeks, gets worse before that time, or if significant weakness or numbness develops, MRI is a tool that can be used by your health care provider to help pinpoint the cause and assist in choosing an appropriate treatment plan.

In some cases, neck, back or radicular pain may indicate a serious medical condition. Therefore, it is very important that the cause is identified and addressed early.

Which Spine Problems Can Be Detected By MRI?

The usual causes of low back and radicular pain is degeneration of the spine or a disc herniation. These can also be factors in neck pain. MRI can provide information on the condition of the vertebrae, the spinal canal and the intervertebral discs (the shock-absorbing connective tissue between the vertebrae.) Scientific studies have shown that MRI is a good examination tool to provide this type of information, usually in a noninvasive manner. (Myelogram can also be an accurate test, but requires an injection.) However, keep in mind that abnormalities that show up on MRI can also be found in patients without any symptoms. Therefore, it is essential that the findings on MRI are considered together with a detailed history and physical examination.

Disc Degeneration and Herniation

MRI can determine the physical changes that occur in a disc, including the development of a herniation or bulge that can lead to neck or back pain or the development of radicular pain and tingling or numbness. Your health care provider can use the information from the MRI to determine the location and type of disc damage or herniation that may have occurred and prescribe the proper treatment. (See the NASS Patient Education brochure on Lumbar or Cervical Herniated Disc for more information.)

Sometimes disc degeneration can cause pain by allowing normal everyday forces (stress and strain) to be transferred to other areas of the spine, such as to the facet joints that connect the vertebrae. MRI can reveal when these stresses have been strong enough to cause changes in the facet joints or a narrowing of the spinal canal.

Recurrent Disc Herniation

For certain tests, MRI can be used in conjunction with intravenous contrast materials to determine the cause of radiating back pain, especially following spinal surgery. MRI enhanced with gadolinium can be very effective for determining whether back pain following spine surgery is the result of a buildup of scar tissue or a reherniation of the disc—a problem that was once very difficult to verify.

Gadolinium-enhanced MRI is a technology in which the patient is injected with gadolinium, a naturally occurring metallic element that has special magnetic properties, during the procedure. This procedure usually involves two MRIs. The first is performed

Spine Problems Diagnosed by MRI Continued...

before the injection of gadolinium. After the initial, or baseline, MRI, the patient is injected with gadolinium. Within 10 minutes of the injection, a second MRI is taken of the same area. The gadolinium will enter the scar tissue faster than the disc material or bone because scar tissue often has a greater blood supply than normal tissue. The special magnetic properties of gadolinium make scar tissue easier for the radiologist to detect, enabling him or her to tell if scar tissue or disc reherniation may be causing pain.

Spinal Stenosis

The spinal canal runs through the vertebrae from top (base of the skull) to bottom (the tailbone) and provides a passageway for the nerves running to the lower extremities. A narrowing of the spinal canal is called spinal stenosis, which can cause neck or leg pain, weakness of the arm or leg muscles and/or numbness in the arms or legs. MRI can be very effective in viewing the spinal canal from different angles, called planes, which gives your health care provider valuable structural information to confirm the diagnosis as well as aid in planning operative or nonoperative treatment. (See the NASS Patient Education brochure on Spinal Stenosis for more information.)

Compression Fractures

Compression fractures are fractures of the vertebrae in which the anterior (front) part of the vertebrae compresses or wedges under the posterior (back) part. This fracture causes the vertebrae to become taller in back than in front. In some situations, it is difficult for the health care provider

to determine whether a compression fracture of the vertebrae is new and if it has been caused by osteoporosis, tumor, infection or other reason. MRI can be helpful in determining the cause of these fractures, which can be very important since the recommended treatment will be different depending upon the source of the fracture.

Other Uses

MRI is a also sensitive tool for the detection of spinal infection. Studies have found MRI to be 94% accurate in the detection of osteomyelitis (infection of the bones, including those of the spine.) The results of MRI for the detection of bone infection are similar to other studies such as bone scans and gallium studies. The benefit of the MRI over those two types of studies is that you do not have to undergo the injection of radioactive isotopes.

How is MRI Performed?

MRI can also show evidence of infection of the intervertebral discs and other soft tissue structures of the spine, and can be used to detect tumors.

An MRI evaluation usually takes from 15 minutes to 1 hour to complete. It requires little effort from you, except to be as motionless as possible for the duration of the examination. This requirement, however, does make it difficult for those in serious pain and those who are disoriented or mentally impaired.

Technologic advances have led to many changes in the size and structure of MRI diagnostic machines. Older MRI machines consist of an elongated tube, which the patient passes through while laying on his or her back on a sliding platform. With this type of machine, there are limitations for people who are very overweight (over 350 lbs.), very young or with claustrophobia.

Newer, “open” MRI machines have more space between the magnets to allow the patient to lay flat on a table without passing through a narrow tube and provide the patient with a less constricted environment. These machines are better suited to handle patients up to 500 lbs., young children (especially children with special needs) and people with a fear of tight spaces. However, there is some debate about the effectiveness of the open MRI. Because these types of machines use a lower strength magnetic field, the images may not be as detailed as the traditional, tube-type MRI.

After the Procedure

One of the advantages of an MRI is there is usually not much preparation needed before the test. Unless you are undergoing a test that requires the injection of a contrast (such as gadolinium), there is no need to fast or restrict fluid intake prior to an MRI.

You may want to wear loose-fitting, comfortable clothing that has no metal buttons or zippers. You will be asked about any metal-containing devices in your body and will also be asked to remove any eyeglasses, jewelry, coins from your pocket, or clothing containing metallic zippers before the procedure.

Who Should Not Get an MRI?

Since the MRI is magnetically generated, they are not indicated for use in the presence of certain medical implants. People with ferromagnetic cerebral aneurysm clips, cardiac pacemakers, metal foreign bodies in their eyes and metal cochlear implants are not suggested to have MRI. Likewise, women who are pregnant (especially those in the first trimester), people with electrical nerve stimulators and those with severe claustrophobia are also advised against MRI.

Titanium implants are MRI compatible. People with nontitanium implants should inform the radiologist or technician prior to the procedure; however, most joint implants are firmly attached inside bone and will not pose a serious problem. People with internal metallic surgical staples from healed surgeries should also inform the radiologist or technician prior to the procedure.

People with long bone or pelvic external fixation devices or with retained bullet fragments should consult a medical expert on the use of MRI.

Although metallic instrumentation in the spine, such as pedicle screw instrumentation for spinal fusion, is not specified as a contraindication to MRI evaluation, it can obscure the results of the evaluation and therefore sometimes are not used in this group of patients who require further diagnostic testing.

Notes





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DISCLAIMER

The information in this pamphlet is selective and does not cover all possible symptoms, diagnostic methods and treatments for acute low back pain. If you have any questions, contact your health care provider for more information. This brochure is for general information and understanding only and is not intended to represent official policy of the North American Spine Society. Please consult your health care provider for specific information about your condition.

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