

## Myelography

*This information is reviewed by a physician with expertise in the area presented and is further reviewed by committees from the American College of Radiology (ACR) and the Radiological Society of North America (RSNA), comprising physicians with expertise in several radiologic areas.*

### What is Myelography?

Myelography is an imaging examination that involves the introduction of a spinal needle into the spinal canal and the injection of contrast material in the space around the spinal cord (the subarachnoid space) and nerve roots using a real-time form of x-ray called fluoroscopy.

An x-ray (radiograph) is a noninvasive medical test that helps physicians diagnose and treat medical conditions. Imaging with x-rays involves exposing a part of the body to a small dose of ionizing radiation to produce pictures of the inside of the body. X-rays are the oldest and most frequently used form of medical imaging.

### What are some common uses of the procedure?

Magnetic resonance imaging (MRI) is often the first imaging exam done to evaluate the spinal cord and nerve roots. However, on occasion, a patient has medical devices, such as a cardiac pacemaker, that may prevent him or her from undergoing MRI. Sometimes, myelography and/or a CT scan is performed in conjunction with MRI to better define abnormalities.

Myelography is most commonly used to detect abnormalities affecting the spinal cord, the spinal canal, the spinal nerve roots and the blood vessels that supply the spinal cord, including:

- to show whether herniations, or protrusion, of the material between the vertebral bodies, termed the intervertebral disks, are pushing on nerve roots or the spinal cord.
- to depict a condition that often accompanies degeneration of the bones and soft tissues surrounding the spinal canal, termed spinal stenosis. In this condition, the spinal canal narrows as the surrounding tissues enlarge due to the development of bony spurs (osteophytes) and the adjacent ligaments.

Myelography can also be used to assess the following conditions when MR imaging cannot be performed, or in addition to MRI:

- tumors
- infection
- inflammation of the arachnoid membrane that covers the spinal cord
- spinal lesions caused by disease or trauma

A myelogram can show whether surgical treatment is promising in a given case and, if it is, can help in planning surgery.

### How should I prepare?

Your physician will give you detailed instructions on how to prepare for your myelogram

You should inform your physician of any medications you are taking and if you have any allergies, especially to barium or iodinated contrast materials. Also inform your doctor about recent illnesses or other medical conditions.

Specifically, the physician needs to know if (1) you are taking medications that need to be stopped a few days before the procedure and (2) whether you have a history of reaction to the contrast material used for the myelogram.

Some drugs should be stopped one or two days before myelography. These include certain antipsychotic medications, antidepressants, blood thinners, and drugs—especially metformin—that are used to treat diabetes. The most important type of medication that must be stopped is blood thinners (anticoagulants). If you are taking blood thinners, you should speak with your physician about alternative methods of maintaining anticoagulation while you are undergoing a myelogram. For example, intravenous blood thinners such as heparin can be used after stopping the conventional, more long-acting blood thinners.

Many drugs used to treat seizures are not indicated before a myelogram. Therefore, it is also important that medical staff know in advance if you have a seizure disorder and they can help you plan to stop taking the seizure medications a few days before the myelogram.

Although reactions to the iodinated contrast material used in the myelogram are extremely uncommon, you should inform your physician if you have previously had a severe allergic reaction to contrast material or other medication.

In addition, please mention if you have any allergies to other non-medical substances or have a history of asthma. If this is the case, you will be watched especially carefully to check for a reaction when injecting the contrast material. Allergy to iodine-containing substances can be especially risky.

Usually patients are advised to increase their fluid intake the day before a scheduled myelogram, as it is important to be well hydrated. Solid foods should be avoided for several hours before the exam, but fluids may be continued.

You may be asked to remove some or all of your clothes and to wear a gown during the exam. You may also be asked to remove jewelry, eye glasses and any metal objects or clothing that might interfere with the x-ray images.

Women should always inform their physician or x-ray technologist if there is any possibility that they are pregnant. Many imaging tests are not performed during pregnancy so as not to expose the fetus to radiation.

If an x-ray is necessary, precautions will be taken to minimize radiation exposure to the baby.

At the conclusion of the myelogram, the patient usually remains in an observation area for 1-2 hours and is discharged. Unless you are to spend the night in hospital, you should arrange to have a relative or friend take you home.

## What does the myelography equipment look like?

The equipment typically used for this examination consists of a radiographic table, an x-ray tube and a television-like monitor that is located in the examining room or in a nearby room. When used for viewing images in real time, the image intensifier (which converts x-rays into a video image) is suspended over a table on which the patient lies. When used for taking still pictures, the image is captured either electronically or on film.



## How does the procedure work?

X-rays are a form of radiation like light or radio waves. X-rays pass through most objects, including the body. Once it is carefully aimed at the part of the body being examined, an x-ray machine produces a small burst of radiation that passes through the body, recording an image on photographic film or a special digital image recording plate.

Fluoroscopy uses a continuous x-ray beam to create a sequence of images that are projected onto a fluorescent screen, or television-like monitor. When used with a contrast material, which clearly defines the area being examined by making it appear bright white, this special x-ray technique makes it possible for the physician to view internal organs in motion. Still images are also captured and stored either on film or electronically on a computer.

Until recently, x-ray images were maintained as hard film copy (much like a photographic negative). Today, most images are digital files that are stored electronically. These stored images are easily accessible and are sometimes compared to current x-ray images for diagnosis and disease management.

## How is the procedure performed?

This examination is usually done on an outpatient basis.

As the patient lies face-down on the examination table, the radiologist will use the fluoroscope, which projects radiographic images in a movie-like sequence onto the monitor, to visualize the spine and determine the best place to inject the contrast material.

The contrast material usually is injected into the lower lumbar spine, because it is considered easier and safer.

Occasionally, if it is deemed safer or more useful, the contrast material will be injected into the upper cervical spine.

At the site of the injection, the skin will be cleaned and then numbed with a local anesthetic. Depending on the location of the puncture, the patient will be positioned on their side or abdomen or in a sitting position as the needle is inserted. In some cases, patients will be placed in a sitting position. The needle is advanced, usually under fluoroscopic guidance, until its tip is positioned within the subarachnoid space within the spinal canal, at which time a free slow flow of fluid is obtained. If requested by the referring physician, a small amount of cerebrospinal fluid may be withdrawn for laboratory studies. The contrast material is then injected through the needle, the needle is removed and the skin at the puncture site is again cleaned. The patient is then positioned on the table, usually lying on their abdomen.

Again using the fluoroscope for guidance, the radiologist then slowly tilts the x-ray table allowing the contrast material to flow up or down within the subarachnoid space and to surround the nerve roots or the spinal cord. As the table is tilted, the radiologist monitors the flow of contrast material with fluoroscopy, focusing on the area that correlates with the patient's symptoms. At this point, the patient may be repositioned on their side, and additional x-ray images may be obtained by the radiologist and technologist; while such images are being obtained, it is important for the patient to remain still to reduce the possibility of blurred images. When these images have been completed, the table is returned to the horizontal position, and the patient is allowed to roll onto their back and assume a position of greater comfort while the images are checked by the radiologist.

A computed tomography (CT) scan is frequently performed immediately following the conclusion of the myelography while contrast material is still present within the spinal canal. This combination of imaging studies is known as CT myelography.

A myelography examination is usually completed within 30 to 60 minutes. A CT scan will add another 15 to 30 minutes to the total examination time.

## What will I experience during and after the procedure?

You will feel a brief sting when local anesthetic is injected under the skin and you will feel slight pressure on your back as the spinal needle is inserted. Positioning the needle can occasionally cause a sharp pain.

During the exam, you will be asked to lay as still as possible while the table is tilted at different angles.

A foot rest and straps or supports for your feet and ankles will keep you from sliding out of position. You may find the face-down position uncomfortable, however, you should not have to maintain this position for very long. Rarely, a patient may experience difficulty breathing deeply or swallowing when the table is tilted face down. If this should occur, please tell the radiologist or technologists and the table will be raised to a more comfortable position.

Headaches, flushing, or nausea may follow contrast injection, though this is rare. Seizures are also possible, but are very rare when the newer contrast materials are used.

Following the conclusion of the myelogram, the patient will be escorted to a recovery area where vital signs and general patient conditions are observed for one to two hours. Some facilities have patients stay in the recovery area resting with the head elevated at a 30° to 45° angle for as long as four hours. You may be encouraged to take fluids at this time to help eliminate the contrast material from your body and to prevent headache.

Following your myelogram, you should refrain from strenuous physical activity and from bending over for one to two days.

You should notify your health professional if you experience fever higher than 100.4°F, excessive nausea or vomiting, severe headache for more than 24 hours, neck stiffness or numbness in your legs. You should also report if you have trouble urinating or moving your bowels.

## Who interprets the results and how do I get them?

A radiologist, a physician specifically trained to supervise and interpret radiology examinations, will analyze the images and send a signed report to your primary care or referring physician, who will discuss the results with you.

## What are the benefits vs. risks?

### Benefits

- Myelography is relatively safe and painless.
- When a contrast material is injected into the subarachnoid space surrounding the spinal nerve roots and spinal cord, it allows the radiologist to view outlines of the different areas of the spine that usually are not visible or distinguishable on x-rays.

- No radiation remains in a patient's body after an x-ray examination.
- X-rays usually have no side effects when used in the diagnostic range necessary for this procedure.

## Risks

- There is always a slight chance of cancer from exposure to radiation. However, the benefit of an accurate diagnosis far outweighs the risk.
- The effective radiation dose from this procedure is about 4 mSv, which is about the same as the average person receives from background radiation in 16 months.
- Although it is uncommon, headaches following myelography associated with the needle puncture is a risk. The headache, when it occurs, usually begins when the patient begins to sit upright or stand. One of the common features of this type of headache is that it is improved when the patient lays flat. When present, the headache usually begins within 2-3 days after the procedure. Rest while laying on one's back and increased fluid intake readily relieve mild headaches, but more severe headaches may call for medication.. In rare circumstances some patients may continue to experience spinal headaches, which may necessitate a special, but simple, procedure to stop leakage of cerebrospinal fluid from the puncture site.
- Adverse reactions to the injection of contrast material during a myelogram are infrequent and usually mild in nature, including itching, rash, sneezing, nausea, or anxiety. The development of hives or wheezing is rare, but may require treatment with medication. More severe reactions involving the heart or lungs are rare.
- Other rare complications of myelography include nerve injury from the spinal needle and bleeding around the nerve roots as they enter or exit the spinal canal. In addition, the meninges covering the spinal cord may become inflamed or infected. Seizures are a very uncommon complication of myelography.
- There is a very small risk that pressure changes within the spinal canal caused by the introduction of a needle below the site of an obstruction will block the flow of fluid within the subarachnoid space of the spinal canal, which can make urgent surgery necessary.
- Women should always inform their physician or x-ray technologist if there is any possibility that they are pregnant.

## A Word About Minimizing Radiation Exposure

Special care is taken during x-ray examinations to use the lowest radiation dose possible while producing the best images for evaluation. National and international radiology protection councils continually review and update the technique standards used by radiology professionals.

State-of-the-art x-ray systems have tightly controlled x-ray beams with significant filtration and dose control methods to minimize stray or scatter radiation. This ensures that those parts of a patient's body not being imaged receive minimal radiation exposure.

## What are the limitations of Myelography?

- The most significant limitation of myelography is that it only sees inside the spinal canal and the very adjacent spinal nerve roots. Abnormalities outside these areas may be better imaged with MRI or CT.
- Myelography usually is avoided during pregnancy because of the potential risk to the baby.
- The findings may not be accurate if the patient cannot hold still and moves a great deal during the exam.
- It may be difficult to inject contrast material in patients with structural defects of the spine or following some forms of spinal injury.
- Myelography cannot be performed if the injection site is infected.

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