# Direct Arthrography

Arthrography is a type of medical imaging used in the evaluation and diagnosis of joint conditions and unexplained pain. It is very effective at detecting disease within the ligaments, tendons and cartilage. Arthrography may be indirect, where contrast material is injected into the bloodstream, or direct, where contrast material is injected into the joint. Computed tomography (CT) scanning, magnetic resonance imaging (MRI) or fluoroscopy – a form of real-time x-ray may be performed after arthrography to image the joint.

Your preparation may vary depending on which imaging method your exam will use. Tell your doctor if there's a possibility that you are pregnant and discuss any recent illnesses, medical conditions, medications you're taking, and allergies – especially any allergies to contrast materials. Leave jewelry at home and wear loose, comfortable clothing. You may be asked to wear a gown.

## What is Direct Arthrography?

Arthrography is medical imaging used in the evaluation and diagnosis of joints conditions. It can either be direct or indirect. Both direct and indirect arthrography enhance visualization of the joint space after imaging of the joint is performed.

Indirect arthrography is a technique in which contrast material is injected into the blood stream and eventually absorbs into the joint.

With direct arthrography, however, the contrast material is injected directly into the joint by a radiologist. Direct arthrography is preferred over indirect arthrography because it distends or enlarges the joint thus allowing for enhanced visualization of small internal structures. This leads to improved evaluation of diseases or conditions within the joint. It is often performed only if a non-arthrographic exam is felt to be inadequate in assessing a joint abnormality.

There are several methods to perform direct arthrography.

Conventional direct arthrography of a joint often uses a special form of x-ray called fluoroscopy (http://www.radiologyinfo.org) to guide and evaluate the injection of iodine (http://www.radiologyinfo.org) contrast material directly into the joint. In some cases, ultrasound may be used to guide the procedure. Alternate methods of direct arthrography examinations may also use magnetic resonance imaging (MRI) or computed tomography (CT) following contrast material injection into the joint.

An x-ray exam helps doctors diagnose and treat medical conditions. It exposes you to a small dose of ionizing radiation (http://www.radiologyinfo.org) to produce pictures of the inside of the body. X-rays are the oldest and most often used form of medical imaging.

Fluoroscopy makes it possible to see bones, joints and internal organs in real time as opposed to a single point in time, which is the case with regular x-rays. When iodine contrast is injected into the joint, it fills the entire joint which becomes clearly visible during fluoroscopy, allowing the radiologist (http://www.radiologyinfo.org) to assess the anatomy and function of the joint. Although the

injection is typically monitored by fluoroscopy, the examination also commonly involves taking radiographs for documentation. These images are most often stored and viewed electronically.

Similarly, direct MR arthrography also involves the injection of a contrast material into the joint. The contrast material used for MR evaluation is different from that used for x-ray; it contains gadolinium, which affects the local magnetic field within the joint and appears on the MR images. As in conventional direct arthrography, the contrast material outlines the structures within the joint, such as cartilage, labrum, ligaments and bones, and allows them to be evaluated by the radiologist after the MR images are produced.

MRI uses a powerful magnetic field, radiofrequency pulses and a computer to produce detailed pictures of organs, soft tissues, bone and virtually all other internal body structures. The images can then be examined on a computer monitor connected to an image archive (PACS system) or printed or copied to CD. MRI does not use ionizing radiation (x-rays).

CT direct arthrography uses the same type of contrast material as conventional direct arthrography and may be supplemented by air to produce a double contrast CT arthrogram. CT makes cross sectional images processed by a computer using x-rays.

## What are some common uses of the procedure?

Arthrographic images help physicians evaluate alterations in structure and function of a joint and help to determine the possible need for treatment, including arthroscopy, open surgery or joint replacement.

The procedure is most often used to identify abnormalities within the:

- shoulder
- elbow
- wrist
- hip
- knee
- ankle

The procedure is often used to help diagnose persistent, unexplained joint pain or discomfort. In some cases, local anesthetic medications or steroids may be injected into the joint along with the contrast material. These medications may temporarily decrease joint-related pain or inflammation and provide physicians additional information about possible sources of pain.

## How should I prepare?

No special preparation is necessary before direct arthrography. Food and fluid intake do not need to be restricted, unless a sedative will be given.

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

Some MRI examinations may require you to receive an injection of contrast into the bloodstream. Some of this contrast material is absorbed into the joint resulting in an indirect arthrogram. The radiologist or technologist may ask if you have asthma, or allergies of any kind, such as an allergy to iodine or x-ray contrast material, drugs, food, or environmental agents. However, the contrast material used for an MRI exam, called gadolinium, does not contain iodine and is much less likely to cause side effects or an allergic reaction.

Tell the radiologist if you have any serious health problems or if you have recently had surgery. Some conditions, such as severe kidney disease, may prevent you from being given MRI or CT arthrogram contrast material.

If you are scheduled to have MR or CT arthrography and have claustrophobia (fear of enclosed spaces) or anxiety, you may want to ask your physician about being sedated prior to the scheduled examination.

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.

You may need to remove some clothing and/or change into a gown for the exam. Remove jewelry, removable dental appliances, eyeglasses, and any metal objects or clothing that might interfere with the x-ray images.

Women should always tell their doctor and technologist (http://www.radiologyinfo.org) if they are pregnant. Doctors will not perform many tests during pregnancy to avoid exposing the fetus (http://www.radiologyinfo.org) to radiation. If an x-ray is necessary, the doctor will take precautions to minimize radiation exposure to the baby. *See the Radiation Safety (https://www.radiologyinfo.org/en/info/safety-radiation) page for more information about pregnancy and x-rays.*

Though MRI does not use ionizing radiation, women should still inform their physician and technologist if they may be pregnant.

Children younger than 13 may need to be sedated in order to hold still for the procedure. Parents should ask about sedation before

the procedure and realize that there are food and drink restrictions that may be required prior to sedation.

Plan to have someone drive you home after your procedure.

## What does the equipment look like?

This exam typically uses a radiographic table, one or two x-ray tubes, and a video monitor. Fluoroscopy converts x-rays into video images. Doctors use it to watch and guide procedures. The x-ray machine and a detector suspended over the exam table produce the video.

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.

Other equipment necessary for performing arthrography include a variety of needles, syringes and a water-soluble contrast material.

## 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. The technologist carefully aims the x-ray beam at the area of interest. The machine produces a small burst of radiation that passes through your body. The radiation records an image on photographic film or a special detector.

Different parts of the body absorb the x-rays in varying degrees. Dense bone absorbs much of the radiation while soft tissue (muscle, fat, and organs) allow more of the x-rays to pass through them. As a result, bones appear white on the x-ray, soft tissue shows up in shades of gray, and air appears black.

Most x-ray images are electronically stored digital files. Your doctor can easily access these stored images to diagnose and manage your condition.

Fluoroscopy uses a continuous or pulsed x-ray beam to create images and project them onto a video monitor. Your exam may use a contrast material to clearly define the area of interest. Fluoroscopy allows your doctor to view joints or internal organs in motion. The exam also captures still images or movies and stores them electronically on a computer.

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?

Your doctor will likely do this exam on an outpatient basis.

The patient is positioned on the examination table. X-rays of the joint may be taken prior to the procedure to help in guiding the injection and also to provide a baseline exam to be compared later with the arthrogram images. If recent x-rays are available, the physician may choose to use these for reference.

Next, the skin around the joint is cleansed with antiseptic and is often covered with a sterile surgical drape. Using a small needle, the physician injects local anesthetic into the area. You may feel a minor sting that will usually subside after 15 to 20 seconds.

After the local anesthetic has taken effect, a longer needle is then inserted into the joint. The radiologist, a physician specially trained to supervise and interpret radiology examinations, will often use fluoroscopy or ultrasound to guide the needle into the correct position. The physician will sometimes use a syringe to drain (or aspirate) the joint fluid, which may be sent to a laboratory for analysis. Aspiration is typically performed when an infection is suspected.

The contrast material and sometimes air are injected into the joint space while the radiologist observes with fluoroscopy or ultrasound. In some cases, additional medications, such as anti-inflammatory steroids, may be injected into the joint along with the contrast material. After the needle is removed, the patient will be asked to move the affected joint to distribute the contrast material throughout the space. The radiologist may move the joint while evaluating the joint motion under fluoroscopy.

A conventional direct arthrography exam is usually completed within 30 minutes. Exams involving MRI may take more than one hour.

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

You will experience a slight pinprick and may feel a momentary burning if a local anesthesia is used to numb the joint area. You may feel pressure or even pain when the needle is advanced into the joint. Inform the radiologist performing the procedure if you have pain so more local anesthetic can be injected into the area.

You may feel fullness in the joint as it is filled and possibly hear gurgling when the joint is moved.

**If your arthrography exam involves MR imaging:**

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 seconds to a few minutes at a time. You will know when images are being recorded because you will hear and feel loud tapping or thumping sounds. The coils that generate the radio waves make these sounds when they are activated. You will be provided with earplugs or headphones to reduce the noise made by the scanner. 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 needle 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.

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After the examination, you may experience swelling and discomfort. You may apply ice to the joint to reduce swelling if it is bothersome. A mild over-the-counter analgesic (http://www.radiologyinfo.org) can be taken for pain. These symptoms usually disappear after 48 hours. Contact your doctor if they persist after two days.

Vigorous exercise is not recommended for at least 24 hours after the exam as there is a slight increased risk of dislocation after your procedure. Typically, if an arthrogram is performed on a joint, you will be asked to minimize activity using that joint for about 24 hours after the procedure to allow your body to eliminate the injected fluid from the joint.

If steroids or anesthetic medications are injected into the joint during the arthrogram, you may be asked to keep a log of your level of joint discomfort over the following days or weeks. This information may help your physician determine the cause of chronic joint pain and what therapies may be effective. It is also recommended that you refrain from vigorous exercise of the joint for about two weeks.

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

A radiologist (https://www.radiologyinfo.org/en/info/article-your-radiologist) , a doctor trained to supervise and interpret radiology examinations, will analyze the images. The radiologist will send a signed report to your primary care or referring physician (http://www.radiologyinfo.org) who will discuss the results (https://www.radiologyinfo.org/en/info/all-about-your-radiology-report) 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

- Direct arthrography is particularly effective for detecting disease of the structures within the joints such as ligaments, labrum, tendons and cartilage. This is particularly true for the shoulder in the setting of shoulder dislocation and in the hip, wrist and elbow.

**Exams involving x-ray imaging:**

- No radiation stays in your body after an x-ray exam.
- X-rays usually have no side effects in the typical diagnostic range for this exam.

**Exams involving MR imaging:**

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

- Any procedure that penetrates the skin carries a risk of infection. The chance of infection requiring antibiotic treatment appears to be less than one in 1,000.
- There is always the possibility of injuring a vessel or a nerve adjacent to the joint. Injury to these structures, however, is minimal particularly when the procedure is performed under ultrasound guidance.

**Exams involving x-ray imaging:**

- There is always a slight chance of cancer from excessive exposure to radiation. However, given the small amount of radiation used in medical imaging, the benefit of an accurate diagnosis far outweighs the associated risk.
- Patients who have known allergies to iodine may have an adverse reaction to the contrast material. Because the contrast material is put in a joint and not a vein, allergic reactions are very rare, although in some cases, mild nausea to severe cardiovascular complications may result.
- Women should always tell their doctor and x-ray technologist if they are pregnant. *See the Radiation Safety (https://www.radiologyinfo.org/en/info/safety-radiation) page for more information about pregnancy and x-rays.*
- The radiation dose for this procedure varies. *See the Radiation Dose (https://www.radiologyinfo.org/en/info/safety-xray) page for more information.*

**Exams involving MR imaging:**

- 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.

## A Word About Minimizing Radiation Exposure

Doctors take special care during x-ray exams to use the lowest radiation dose possible while producing the best images for evaluation. National and international radiology protection organizations continually review and update the technique standards radiology professionals use.

Modern x-ray systems minimize stray (scatter) radiation by using controlled x-ray beams and dose control methods. This ensures that the areas of your body not being imaged receive minimal radiation exposure.

# What are the limitations of arthrography?

The limitations of arthrography include:

- Partial tears of the rotator cuff may not be detected with conventional direct arthrography.
- Some joint injuries cannot be detected with conventional direct arthrography, including defects of the cartilage, which can be found inside and along the edges of some joints, bruising of neighboring bones and injuries to ligaments outside the joint.

## Disclaimer



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