

## Catheter Angiography

*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 Catheter Angiography?

Angiography is a minimally invasive medical test that helps physicians diagnose and treat medical conditions. Angiography uses one of three imaging technologies and, in some cases, a contrast material to produce pictures of major blood vessels throughout the body.

Angiography is performed using:

- x-rays with catheters
- computed tomography (CT)
- magnetic resonance imaging (MRI)

In catheter angiography, a thin plastic tube, called a catheter, is inserted into an artery through a small incision in the skin. Once the catheter is guided to the area being examined, a contrast material is injected through the tube and images are captured using a small dose of ionizing radiation (x-rays).

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

Catheter angiography is used to examine blood vessels in key areas of the body, including the:

- brain
- kidneys
- pelvis
- legs
- lungs
- heart
- neck
- abdomen

Physicians use the procedure to:

- identify disease and aneurysms in the aorta, both in the chest and abdomen, or in other major blood vessels.
- detect atherosclerotic disease in the carotid artery of the neck, which may limit blood flow to the brain and cause a stroke.
- identify a small aneurysm or arteriovenous malformation inside the brain.
- detect atherosclerotic disease that has narrowed the arteries to the legs and help prepare for endovascular intervention or surgery.
- indicate disease in the arteries to the kidneys or visualize blood flow to help prepare for a kidney transplant.
- guide interventional radiologists and surgeons making repairs to diseased blood vessels, such as implanting stent or evaluating a stent after implantation.
- detect injury to one of more arteries in the neck, chest, abdomen, pelvis or extremities in trauma patients.
- evaluate arteries feeding a tumor prior to surgery or other procedures such as chemoembolization or selective internal radiation therapy.
- identify dissection or splitting in the aorta in the chest or abdomen or its major branches.
- show the extent and severity of atherosclerosis in the coronary arteries and plan for a surgical operation, such as a coronary bypass.
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- sample blood from specific veins in the body to detect any endocrine disease.
- examine pulmonary arteries in the lungs to detect pulmonary embolism (blood clots from leg veins).

## How should I prepare?

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.

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.

If you are breastfeeding at the time of the exam, you should ask your radiologist how to proceed. It may help to pump breast milk ahead of time and keep it on hand for use after contrast material has cleared from your body, about 24 hours after the test.

If you are going to be given a sedative during the procedure, you may be asked not to eat or drink anything for four to eight hours before your exam. Be sure that you have clear instructions from your health care facility.

If you are sedated, you should not drive for 24 hours after for your exam and you should arrange for someone to drive you home. Because an observation period is necessary following the exam, you may be admitted to the hospital for an overnight stay if you live more than an hour away.

## What does the 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.

The catheter used in angiography is a long plastic tube about as thick as a strand of spaghetti.

## How does the procedure work?

Catheter angiography works much the same as a regular x-ray exam.

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.

Different parts of the body absorb the x-rays in varying degrees. Dense bone absorbs much of the radiation while soft tissue, such as 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.

When a contrast material is introduced to the bloodstream during the procedure, it clearly defines the blood vessels being examined by making them appear bright white.

## How is the procedure performed?

This examination is usually done on an outpatient basis. However, some procedures may require admission. Please consult with your physician.

A nurse or technologist will insert an intravenous (IV) line into a small vein in your hand or arm.

A small amount of blood will be drawn before starting the procedure to make sure that your kidneys are working and that your blood will clot normally. A small dose of sedative may be given through the IV line to lessen your anxiety during the procedure.

The area of the groin or arm where the catheter will be inserted is shaved, cleaned, and numbed with local anesthetic. The radiologist will make a small incision (usually a few millimeters) in the skin where the catheter can be inserted into an artery. The catheter is then guided through the arteries to the area to be examined. After the contrast material is injected through the catheter and reaches the blood vessels being studied, several sets of x-rays are taken. Then the catheter is removed and the incision site is closed by placing pressure on the area for approximately 10 to 20 minutes (or by using a special closure device).

When the examination is completed, you will be asked to wait until the technologist or radiologist determines that all the necessary images have been obtained. Your intravenous line will be removed.

A catheter angiogram may be performed in less than an hour; however, it may last several hours.

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

Prior to beginning the procedure, you will be asked to empty your bladder.

You will feel a slight pin prick when the needle is inserted into your vein for the intravenous line (IV).

Injecting a local anesthetic at the site where the catheter is inserted may sting briefly, but it will make the rest of the procedure pain-free.

You will not feel the catheter in your artery, but when the contrast material is injected, you may have a feeling of warmth or a slight burning sensation. The most difficult part of the procedure may be lying flat for several hours. During this time, you should inform the nurse if you notice any bleeding, swelling or pain at the site where the catheter entered the skin.

You may resume your normal diet immediately after the exam. You will be able to resume all other normal activities 8 to 12 hours after the exam.

## Who interprets the results and how will 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

- Angiography may eliminate the need for surgery. If surgery remains necessary, it can be performed more accurately.
- Catheter angiography presents a very detailed, clear and accurate picture of the blood vessels. This is especially helpful when a surgical procedure or some percutaneous intervention is being considered.
- By selecting the arteries through which the catheter passes, it is possible to assess vessels in several specific body sites. In fact, a smaller catheter may be passed through the larger one into a branch artery supplying a small area of tissue or a tumor; this is called superselective angiography.

- Unlike computed tomography (CT) or magnetic resonance (MR) angiography, use of a catheter makes it possible to combine diagnosis and treatment in a single procedure. An example is finding an area of severe arterial narrowing, followed by angioplasty and placement of a stent.
- The degree of detail displayed by catheter angiography may not be available with any other noninvasive procedures.
- No radiation remains in a patient's body after an x-ray examination.
- X-rays usually have no side effects in the diagnostic range.

### Risks

- There is always a slight chance of cancer from exposure to radiation. However, the benefit of an accurate diagnosis far outweighs the risk.
- If you have a history of allergy to x-ray contrast material, your radiologist may advise that you take special medication for 24 hours before catheter angiography to lessen the risk of allergic reaction. Another option is to undergo a different exam that does not call for contrast material injection.
- If a large amount of x-ray contrast material leaks out under the skin where the IV is placed, skin damage can result. If you feel any pain in this area during contrast material injection, you should immediately inform the technologist.
- Women should always inform their physician or x-ray technologist if there is any possibility that they are pregnant.
- Nursing mothers should wait for 24 hours after intravenous contrast material injection before resuming breast-feeding.
- The risk of serious allergic reaction to contrast materials that contain iodine is extremely rare, and radiology departments are well-equipped to deal with them.
- There is a small risk that blood will form a clot around the tip of the catheter, blocking the artery and making it necessary to operate to reopen the vessel.
- If you have diabetes or kidney disease, the kidneys may be injured when contrast material is eliminated through the urine.
- Rarely, the catheter punctures the artery, causing internal bleeding. It also is possible that the catheter tip will separate material from the inner lining of the artery, causing a block downstream in the blood vessel.

# What are the limitations of Catheter Angiography?

Patients with impaired kidney function, especially those who also have diabetes, are not good candidates for this procedure.

Patients who have previously had allergic reactions to x-ray contrast materials are at risk of having a reaction to contrast materials that contain iodine. If angiography is essential, a variety of methods is used to decrease risk of allergy:

- You may be given one or more doses of a steroid medication ahead of time.
- Contrast material without iodine may be used instead of standard x-ray contrast.

Catheter angiography should be done very cautiously—if at all—in patients who have a tendency to bleed.

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