

## Catheter Embolization

*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 Embolization?

Embolization is a minimally invasive treatment that occludes, or blocks, one or more blood vessels or vascular channels of malformations (abnormalities).

In a catheter embolization procedure, medications or synthetic materials called embolic agents are placed through a catheter into a blood vessel to prevent blood flow to the area.

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

Catheter embolization is performed to:

- control or prevent abnormal bleeding, including:
  - bleeding that results from an injury, tumor or gastrointestinal tract lesions such as ulcer or diverticular disease. Embolization is commonly the first line of treatment in gastrointestinal bleeding of any cause. Controlling bleeding into the abdomen or pelvis from injuries caused in a motor vehicle crash is especially suitable for this treatment.
  - long menstrual periods or heavy menstrual bleeding that results from fibroid tumors of the uterus. Embolization may prove to be an excellent alternative to a hysterectomy, the surgical removal of the uterus. Because fibroids have a large blood supply, they will tend to shrink and control heavy menstrual bleeding if this blood supply is interrupted.
- occlude or close off the vessels that are supplying blood to a tumor, especially when the tumor is difficult or impossible to remove. After embolization a tumor may shrink or it may continue to grow but more slowly, making chemotherapy or surgery a more effective option.

- eliminate an arteriovenous malformation (AVM) or arteriovenous fistula (AVF) (abnormal connection or connections between arteries and veins). These passageways, which may occur anywhere in the body including the brain or spinal cord, act like a short circuit diverting blood from fully circulating and delivering oxygen where it is needed.
- treat aneurysms (a bulge or sac formed in a weak artery wall) by either blocking an artery supplying the aneurysm or closing the aneurysmal sac itself as an alternative to surgery.
- treat varicoceles (enlarged veins) in the scrotum that may be a cause of infertility.

Catheter embolization may be used alone or combined with other treatments such as surgery or radiation.

### How should I prepare?

Prior to your procedure, your blood may be tested to determine how well your liver and kidneys are functioning and whether your blood clots normally.

You should report to your doctor all medications that you are taking, including herbal supplements, and if you have any allergies, especially to local anesthetic medications, general anesthesia, or to contrast materials (also known as “dye” or “x-ray dye”). Your physician may advise you to stop taking aspirin, nonsteroidal anti-inflammatory drugs (NSAIDs) or a blood thinner for a specified period of time days before your procedure. Also inform your doctor about recent illnesses or other medical conditions.

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.

You will receive specific instructions on how to prepare, including any changes that need to be made to your regular medication schedule.

You may be instructed not to eat or drink anything after midnight before your procedure. Your doctor will tell you which medications you may take in the morning.

You will be admitted to the hospital on the morning of your procedure and be assessed by the interventional radiologist before the procedure begins.

You should plan to stay overnight at the hospital for one or more days. You will be given a gown to wear during the procedure.

## What does the equipment look like?

In this procedure, x-ray equipment, a catheter and a variety of synthetic materials and medications called embolic agents are used.

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.

A catheter is a long, thin plastic tube, about as thick as a strand of spaghetti.

Your physician will select an embolic agent depending on the size of the blood vessel or malformation and whether the treatment is intended to be permanent or temporary. These include:

- Gelfoam™, a gelatin sponge material, which is cut into small pieces that are injected into an artery and float downstream until they can go no further. After a period ranging from a few days to two weeks, the material dissolves.
- particulate agents, including Polyvinyl alcohol (PVA) and gelatin-impregnated acrylic polymer spheres, which are suspended in liquid and injected into the bloodstream to block small vessels. These agents are used to block or occlude vessels permanently, including the treatment of uterine fibroid tumors.
- various sized metallic coils made of stainless steel or platinum are used to block or occlude large arteries. They can be positioned very precisely to stop bleeding from an injured artery or halt arterial blood flow into an aneurysm.

- liquid sclerosing agents such as alcohols, which are used to destroy blood vessels and vessel malformations. Filling a vessel or a vascular malformation with this liquid agent causes blood clots to form, closing up the abnormal vascular channels.
- liquid glue. When injected into the target channel that needs to be closed off, it hardens quickly.

Other equipment used during the procedure includes an intravenous line (IV) and equipment that monitors your heart beat and blood pressure.

## How does the procedure work?

Using x-ray imaging and a contrast material to visualize the blood vessel, the interventional radiologist inserts a catheter through the skin into a blood vessel and advances it to the treatment site. A synthetic material or medication called an embolic agent is then inserted through the catheter and positioned within the blood vessel or malformation where it will remain permanently.



*Catheter embolization Image: Coronal MR pelvis, large fibroid*

## How is the procedure performed?

Image-guided, minimally invasive procedures such as catheter embolizations should be performed by a specially trained interventional radiologist in an interventional radiology suite or occasionally in the operating room.

Prior to your procedure, ultrasound, computed tomography (CT) or magnetic resonance imaging (MRI) may be performed.

You will be positioned on the examining table. You will be connected to monitors that track your heart rate, blood pressure and pulse during the procedure.

A nurse or technologist will insert an intravenous (IV) line into a vein in your hand or arm so that sedation medication can be given intravenously. You may also receive general anesthesia.

The area of your body where the catheter is to be inserted will be shaved, sterilized and covered with a surgical drape. A very small nick is made in the skin at the site.

Using image-guidance, a catheter (a long, thin, hollow plastic tube) is inserted through the skin into a blood vessel and maneuvered to the treatment site.

A contrast material then is injected through the catheter and a series of x-rays are taken to locate the exact site of bleeding or abnormality. The medication or embolic agent is then injected through the catheter. Additional x-rays are taken to ensure the loss of blood flow in the target vessel or malformation.

At the end of the procedure, the catheter will be removed and pressure will be applied to stop any bleeding. The opening in the skin is then covered with a dressing. No sutures are needed.

Your intravenous line will be removed.

If you are being treated for an intracranial arteriovenous malformation (AVM), a small test injection of embolic agent is done first and neurological function will be tested to ensure no important brain area will be affected by the embolization. Then, vessels feeding the AVM will be injected with the embolic material. Large AVMs may require multiple embolization procedures on separate days for complete treatment. For example, two or three treatments may be given at intervals of two to six weeks.

You can expect to stay in bed for six to eight hours after your procedure. The length of the procedure varies from 30 minutes to several hours depending on the complexity of the condition.

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

Devices to monitor your heart rate and blood pressure will be attached to your body. You will feel a slight pin prick when the needle is inserted into your vein for the intravenous line (IV) and when the local anesthetic is injected. The intravenous (IV) sedative will make you feel relaxed and sleepy. You may or may not remain awake, depending on how deeply you are sedated.

You may feel slight pressure when the catheter is inserted, but no serious discomfort. As the contrast material passes through your body, you may get a warm feeling.

Most patients experience some side effects after embolization. Pain is the most common and can be controlled by medication given by mouth or through your IV.

Women who have embolization of fibroid tumors may have severe pain or cramps shortly after the procedure and for eight to 12 hours afterward. Pain for as long as three to five days after the procedure is not uncommon and may require appropriate pain medications.

Mild headache may follow embolization of an intracranial arteriovenous malformation (AVM). Most patients leave the hospital within 24 hours of the procedure, but those who have considerable pain may have to stay longer. You should be able to resume your normal activities within a week.

About one in five patients treated for fibroids will develop post-embolization syndrome, which consists of fever (up to 102° F) that may be accompanied by loss of appetite and nausea or vomiting. The syndrome may occur after any embolization procedure, but is more prone to develop when a solid tumor is embolized. The symptoms usually clear up within three days, though they sometimes last longer and require medication to improve. These symptoms are the body's reaction to breakdown products from the tumors and are most common when very large tumors are embolized.

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

The interventional radiologist can advise you as to whether the procedure was a technical success when the procedure is completed.

In cases of bleeding, it may take 24 hours to know whether it has stopped. After embolization of a tumor, uterine fibroids or a vascular malformation, one to three months may have to pass before it is clear whether symptoms have been controlled or eliminated.

## What are the benefits vs. risks?

### Benefits

- Embolization is a highly effective way of controlling bleeding, especially in an emergency situation.

- Worldwide success rates of 85 percent and higher have been reported in women treated with embolization for uterine fibroids.
- Embolization is much less invasive than conventional open surgery. As a result, there are fewer complications and the hospital stay is relatively brief—often only the night after the procedure. Blood loss is less than with traditional surgical treatment, and there is no obvious surgical incision.
- This method can be used to treat tumors and vascular malformations that either cannot be removed surgically or would involve great risk if surgery was attempted.
- No surgical incision is needed—only a small nick in the skin that does not have to be stitched closed.

## Risks

- There is a very slight risk of an allergic reaction if contrast material is injected.
- Any procedure that involves placement of a catheter inside a blood vessel carries certain risks. These risks include damage to the blood vessel, bruising or bleeding at the puncture site and infection.
- There is always a chance that an embolic agent can lodge in the wrong place and deprive normal tissue of its oxygen supply.
- There is a risk of infection after embolization, even if an antibiotic has been given.
- A small percent of women have uterine injury from embolization of fibroid tumors and this may make it necessary to remove the uterus. In a few cases in women over age 45, menopause has begun within one year of embolization of fibroids. The effect of fibroid embolization on fertility is not clearly understood; patients who wish future fertility should consult carefully with their interventional radiologist prior to pursuing fibroid embolization as a treatment option.
- Because the use of the contrast material is part of the procedure, there is a risk of an allergic reaction to the contrast material.
- There is also a risk of kidney damage due to the contrast material, particularly in patients with diabetes or other pre-existing kidney disease.

## What are the limitations of Catheter Embolization?

Technically, successful embolization without injuring normal tissue requires that the catheter be placed in a precise position. This means that the catheter tip is situated so that embolic material can be deposited only in vessels serving the abnormal area. In a small percentage of cases, the procedure is not technically possible because the catheter cannot be positioned appropriately. Whether clinical success is achieved depends on many factors, including the size of a tumor, the location of an arteriovenous malformation (AVM), and how the patient views the outcome. Several sessions of embolization may be needed to reduce symptoms from an AVM. Uterine fibroids respond well in a large majority of cases, but perhaps 10 percent of women fail to improve.

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