

## Dialysis and Fistula/Graft Declotting Interventions

*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 are Dialysis and Fistula/Graft Declotting Interventions?

Dialysis fistula/graft declotting interventions are minimally invasive procedures performed to improve blood flow in the fistula and grafts placed in the blood vessels of dialysis patients.

Dialysis is a process used to treat patients whose kidneys are not working properly. It involves a special machine and tubing that removes blood from the body, cleanses it of waste and extra fluid and then returns it back to the body.

In order to undergo dialysis, a physician first creates access to a patient's blood vessel using one of three methods:

- a fistula, which is made by joining together an artery and vein to make a bigger high-flow blood vessel.
- a graft, in which a soft plastic tube is placed between an artery and a vein, creating an artificial high-flow blood vessel.
- catheter access, in which a narrow plastic tube is inserted into a large vein in the neck.

When fistulas and grafts become clogged or narrowed, which can prevent a patient from undergoing dialysis, interventional radiologists use two image-guided interventions to fix the problem:

- Catheter-directed thrombolysis, which dissolves blood clots that build up in fistulas and grafts by injecting a medicine.

- Angioplasty and vascular stenting, which uses mechanical devices, such as a balloon, to open fistulas and grafts and helps them remain open with a small implantable wire mesh tube called a stent.

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

These procedures are used to treat:

- narrowing of dialysis fistula or grafts. When there is decreased flow in a graft or fistula, angioplasty or angioplasty with vascular stenting may be performed.
- thrombosis of dialysis fistulas or grafts. When blood does not flow smoothly, it can begin to coagulate, turning from a free-flowing liquid to a semi-solid gel, called a blood clot or thrombus. When blood clots in a fistula or graft prevent dialysis from being performed, catheter-directed thrombolysis with clot-dissolving drugs may be performed.

### 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 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. See the Safety page for more information about pregnancy and x-rays.

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

You will be given a gown to wear during the procedure.

## What does the equipment look like?

In these procedures, x-ray imaging equipment, a balloon catheter, catheter, guide wire, sheath, stent and a medical device that dissolves blood clots may be 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 balloon catheter is a long, thin plastic tube with a tiny balloon at its tip. A stent is a small, wire mesh tube. Balloons and stents come in varying sizes to match the size of the diseased blood vessel.

A catheter is a long, thin, hollow plastic tube, about as thick as a strand of spaghetti. These catheters are designed so that blood dissolving medications can be delivered successfully within the blood clot. There also are medical devices that can be used to dissolve the clots mechanically. Your interventional radiologist will decide which technique is most appropriate for you.

A guide wire is a thin wire used to guide the placement of the diagnostic catheter, angioplasty balloon catheter and the vascular stent. A sheath is a vascular tube placed into the fistula or graft and that allows easy catheter exchanges during these procedures.

Stents are specially designed metal mesh tubes that are collapsed when they are inserted into the body and then expanded inside the vessel to prop the walls open. In some cases the stent may have an artificial fabric covering.

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

## How does the procedure work?

**Angioplasty and vascular stenting:** Using imaging guidance, an inflatable balloon mounted at the tip of a catheter is inserted through the skin into the fistula or graft and advanced to the blockage. There, the balloon is inflated and deflated. In this process, the balloon expands the vein or artery wall, increasing blood flow through the fistula or graft. A stent may be placed to hold the vessel open.

**Catheter-directed thrombolysis:** Using x-ray guidance and a contrast material that helps show the blood vessel, your interventional radiologist will insert a catheter through the skin into a vessel (artery or vein) and direct it to the thrombosis, or blockage. The blood clot will then be dissolved in one of two ways:

- by delivering medication directly to the blood clot.
- by positioning a mechanical device at the site to break up the clot.

## How is the procedure performed?

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

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 sedative 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.

Your physician will numb the area with a local anesthetic.

A very small nick is made in the skin at the site.

**Angioplasty and Vascular Stenting:** A sheath is first inserted into the fistula or graft.

Guided by x-rays, the catheter is then inserted through the sheath and advanced until it reaches the site of the

blockage. Once the catheter is in place, contrast material will be injected into the artery and an angiogram will be taken of the blocked vessel to help identify the site of the blockage.

With x-ray guidance, a guide wire will then be moved to the site, followed by the balloon-tipped catheter. Once it reaches the blockage, the balloon will be inflated for a short period of time. The same site may be repeatedly treated or the balloon may be moved to other sites.

Additional x-rays will be taken to determine how much the blood flow has improved. When your interventional radiologist is satisfied that the vessel has been opened enough, the balloon catheter, guide wire and catheter will be removed.

Many angioplasty procedures also include the placement of a stent, a small, flexible tube made of wire mesh. Stents can be self-expandable (opens up itself upon positioning) or balloon expandable (balloon needed to open the stent). Balloon expandable stents are typically placed over a balloon-tipped catheter so that when the balloon is expanded, it pushes the stent in place against the vessel wall. When the balloon is deflated and removed, the stent remains permanently in place, acting like a scaffold to hold open the vessel. Self-expandable stents are easy to position, but may require additional angioplasty with balloon to obtain satisfactory dilation (opening) of the diseased vessel. Covered stents or stent-grafts have additional advantages over bare stents and are becoming more commonly used.

If a sheath was inserted into your arm or wrist, it will typically be removed at the end of the procedure.

**Catheter Thrombolysis:** Guided by x-rays, your interventional radiologist will insert a catheter through the skin into a blood vessel and advance it to the area of poor circulation.

A contrast material is then injected through the catheter and a series of x-rays is taken to pinpoint the location of the clot. Your interventional radiologist will review the images and determine whether the clot will be best treated by a clot-dissolving medication, by breaking it up with a mechanical device, or both.

To treat the clot with medication, the catheter is left in place and connected to a special machine that delivers the medication at a precise rate. Clot-dissolving medications are delivered through the catheter over several hours to a few days. It may take up to 72 hours for the clot to dissolve (although most clots dissolve within 24 hours), during which time you will be monitored closely by the medical staff.

Removal of the clot from the vessel by a mechanical device is a relatively quick procedure (usually completed in less than one hour) and generally does not require a lengthy hospital stay.

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.

## 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.

**Angioplasty and Vascular Stenting:** It is common for patients to feel some discomfort when the balloon is inflated because the blood vessel is being stretched. Discomfort is more prominent when veins are dilated. Your discomfort should lessen as the balloon is deflated.

The catheter insertion site may be bruised and sore after the procedure.

For several hours, your catheter site will be checked for bleeding or swelling and your blood pressure and heart rate will be monitored. Bleeding risk at the vascular entry site when veins are treated is less likely, therefore, you may be discharged earlier if the procedure is performed for blockage of a vein. Your physician may prescribe medication to relax your arteries, to protect against spasms of the arteries and to prevent blood clots.

If a contrast material was used during the procedure, you may urinate often to rid your body of this material. You may be asked to drink extra fluids.

After you return home, you should rest and drink plenty of fluids. You should avoid lifting heavy objects and strenuous exercise for at least 24 hours. You should

avoid smoking permanently (since this is a major cause of atherosclerosis). If bleeding begins where the catheter was inserted, you should lie down, apply pressure to the site and call your physician. Any change in color in your leg or arm, and any pain or a warm feeling in the area where the catheter was inserted should be promptly reported to your physician.

After an angioplasty or stent placement procedure you may be instructed to take one or more medications (such as aspirin, or blood thinners such as Plavix®, Lovenox® or Coumadin®) for a period of time. These medications can prevent blood clots from forming at the site of arterial treatment during healing. The effect of Coumadin® will be monitored with frequent blood tests.

Magnetic resonance imaging (MRI) may be done following stent placement, but make sure that you notify the MRI department that you have recently had a stent. Although stents used today may be considered safe for MRI, you may need several weeks after stent placement for MRI to be safe. Metal detectors will not affect a stent.

**Catheter-directed Thrombolysis:** Many patients experience some side effects after thrombolysis. Pain is the most common and can readily be controlled by pain medication taken by mouth or given through your IV.

## 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 it is completed.

## What are the benefits vs. risks?

### Benefits

- No surgical incision is needed—only a small nick in the skin that does not have to be stitched closed.
- 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.

### Angioplasty and Vascular Stenting:

- These procedures are performed using local anesthesia; no general anesthetic is required in the majority of patients.

- You will be able to return to your normal activities shortly after the procedure.

### Catheter-directed Thrombolysis

- Catheter-directed thrombolysis can greatly improve blood flow and reduce or eliminate the related symptoms and effects without the need for more invasive surgery.
- Thrombolysis is a safe, highly effective way of re-establishing circulation blocked by a clot.
- Thrombolysis is less invasive than conventional open surgery to remove clots and the hospital stay is relatively brief. Blood loss is less than with traditional surgical treatment and there is no obvious surgical incision.

### Risks

- Any procedure where the skin is penetrated carries a risk of infection. The chance of infection requiring antibiotic treatment appears to be less than one in 1,000.
- 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.

### Angioplasty and Vascular Stenting

- Major complications following angioplasty are uncommon. However, inserting the catheter can lead to injury of the artery. The balloon also poses a risk of blood clots or tearing the artery.
- When angioplasty is performed alone, blockages can recur, although most of these arteries can be opened again successfully. This can also occur when a stent is placed in the artery at the time of the angioplasty.
- Heavy bleeding from the catheter insertion site may require special medication or a blood transfusion.
- A relatively rare complication associated with balloon angioplasty is abrupt vessel closure, or occlusion. This blockage in the area treated by the balloon angioplasty typically occurs within 24 hours of the procedure. If it happens, treatment with medication into the artery to dissolve clots followed by angioplasty or stenting may be appropriate. In some cases, emergency bypass surgery may be needed.
- Other rare complications include heart attack and sudden cardiac death.

- Contrast material used during these procedures may cause renal failure, a decrease in kidney function, particularly if there is already some degree of decreased kidney function. Your physician generally checks your renal function before this procedure in order to lower this risk.

#### **Catheter-directed Thrombolysis**

- There is a risk of infection after thrombolysis, even if an antibiotic has been given.
- Whenever anticoagulant or thrombolytic agents are used, there is a risk that bleeding will occur elsewhere in the body. The most serious complication is intracranial bleeding.
- In some cases the material that is blocking your vessel may move to another part of the vascular system. Usually this can be treated with further thrombolysis but sometimes may require surgery.
- There is a risk of kidney damage in patients with diabetes or other pre-existing kidney disease.

## **What are the limitations of Dialysis and Fistula/Graft Dec clotting and Interventions?**

Some blockages of the veins or arteries are too difficult to open with catheters and balloons. Surgery may be needed to bypass the blockage. If that is the case, a catheter may need to be placed in a neck vein to allow you to receive dialysis temporarily until a surgeon is able to fix your dialysis fistula or graft.

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