

Vascular Access for Hemodialysis

What is a vascular access?

A vascular access is a hemodialysis patient's lifeline. A vascular access makes life-saving hemodialysis treatments possible. Hemodialysis is a treatment for kidney failure that uses a machine to send the patient's blood through a filter, called a dialyzer, outside the body. The access is a surgically created vein used to remove and return blood during hemodialysis. The blood goes through a needle, a few ounces at a time. The blood then travels through a tube that takes it to the dialyzer. Inside the dialyzer, the blood flows through thin fibers that filter out wastes and extra fluid. The machine returns the filtered blood to the body through a different tube. A vascular access lets large amounts of blood flow continuously during hemodialysis treatments to filter as much blood as possible per treatment. About a pint of blood flows through the machine every minute. A vascular access should be in place weeks or months before the first hemodialysis treatment.

Two types of vascular access designed for long-term use include the arteriovenous (AV) fistula and the AV graft. A third type of vascular access—the venous catheter—is for short-term use.

What is an arteriovenous fistula?

An AV fistula is a connection, made by a vascular surgeon, of an artery to a vein. Arteries carry blood from the heart to the body, while veins carry blood from the body back to the heart. Vascular surgeons specialize in blood vessel surgery. The surgeon usually places an AV fistula in the forearm or upper arm. An AV fistula causes extra pressure and extra blood to flow into the vein, making it grow large and strong. The larger vein provides easy, reliable access to blood vessels. Without this kind of access, regular hemodialysis sessions would not be possible. Untreated veins cannot withstand repeated needle insertions. They would collapse the way a straw collapses under strong suction.



National Institute of
Diabetes and Digestive
and Kidney Diseases

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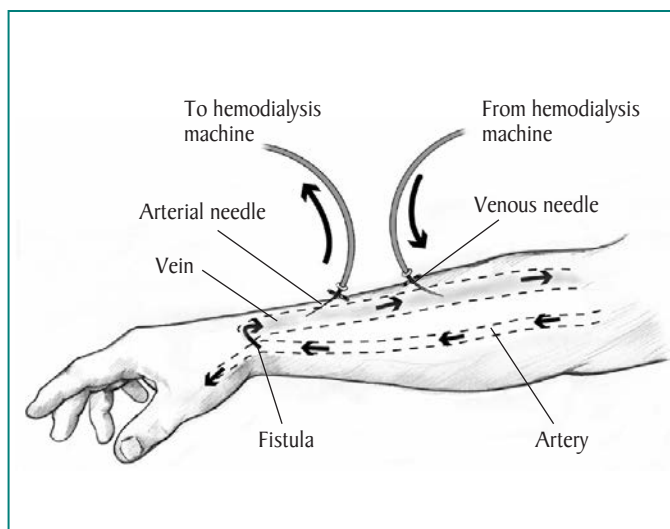
Health care providers recommend an AV fistula over the other types of access because it

- provides good blood flow for dialysis
- lasts longer than other types of access
- is less likely to get infected or cause blood clots than other types of access

Before AV fistula surgery, the surgeon may perform a vessel mapping test. Vessel mapping uses Doppler ultrasound to evaluate blood vessels that the surgeon may use to make the AV fistula. Ultrasound uses a device, called a transducer, that bounces safe, painless sound waves off organs to create an image of their structure. A specially trained technician performs the procedure in a health care provider's office, an outpatient center, or a hospital. A radiologist—a doctor who specializes in medical imaging—interprets the images. A patient does not need anesthesia. A Doppler ultrasound shows how much and how quickly blood flows through arteries and veins so the surgeon can select the best blood vessels to use.

A surgeon performs AV fistula surgery in an outpatient center or a hospital. The vascular access procedure may require an overnight stay in the hospital; however, many patients go home afterward. A health care provider uses local anesthesia to numb the area where the surgeon creates the AV fistula.

An AV fistula frequently requires 2 to 3 months to develop, or mature, before the patient can use it for hemodialysis. If an AV fistula fails to mature after surgery, a surgeon must repeat the procedure.



AV fistula in forearm

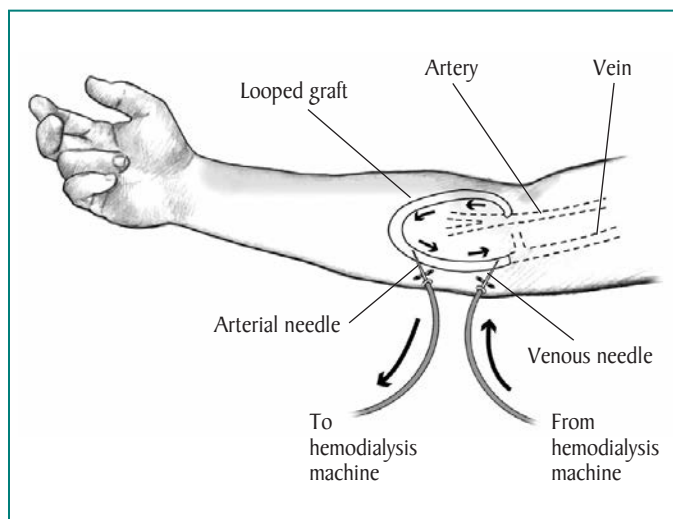
At the start of a hemodialysis session, a health care provider or the patient inserts two needles into the vascular access. One needle carries blood from the body to the dialyzer. The other carries filtered blood back to the body. To tell the needles apart, the needle that carries blood away from the body is called the arterial needle. The needle that carries blood back to the body is called the venous needle. Some patients prefer to insert their own needles into the vascular access, which requires training to learn how to prevent infection and protect the vascular access. No matter who inserts the needles, the patient should know how to take care of the needle insertion area to prevent infection.

If an AV fistula does not mature, an AV graft is the second choice for a long-lasting vascular access.

What is an arteriovenous graft?

An AV graft is a looped, plastic tube that connects an artery to a vein. A vascular surgeon performs AV graft surgery, much like AV fistula surgery, in an outpatient center or a hospital. As with AV fistula surgery, the patient may need to stay overnight in the hospital, although many patients can go home after the procedure. A health care provider uses local anesthesia to numb the area where the surgeon creates the AV graft.

A patient can usually use an AV graft 2 to 3 weeks after the surgery. An AV graft is more likely than an AV fistula to have problems with infection and clotting. Repeated blood clots can block the flow of blood through the graft. However, a well-cared-for graft can last several years.



AV graft in forearm

Set Up the Vascular Access Well before Starting Hemodialysis

Patients should set up a vascular access well before starting hemodialysis, as AV fistulas and AV grafts both need time to mature before they are ready for use. A health care provider can help schedule an appointment with a vascular surgeon well before the patient starts hemodialysis, even if the patient is feeling fine. Giving a vascular access time to mature can help prevent problems with narrow veins, low blood flow, and blood clots.

Before the procedure, health care providers should use the back of the patient's hand for drawing blood to preserve the blood vessels in the arm. A health care provider can teach the patient simple exercises that help the blood vessels grow larger for the surgeon's use. The same exercises help the AV fistula grow larger after the procedure.

What is a venous catheter?

A venous catheter is a tube inserted into a vein in the neck, chest, or leg near the groin, usually only for short-term hemodialysis. The tube splits in two after the tube exits the body. The two tubes have caps designed to connect to the line that carries blood to the dialyzer and the line that carries blood from the dialyzer back to the body. A person must close the clamps on each line when connecting and disconnecting the catheter from the tubes.

If kidney disease has progressed quickly, a patient may not have time for placement of an AV fistula or AV graft before starting hemodialysis treatments.

A nephrologist—a doctor who specializes in kidney problems—or an interventional radiologist—a doctor who uses medical imaging equipment to perform operations—performs the venous catheter placement procedure in a hospital or an outpatient center. The patient receives local anesthesia and sedation to stay calm and relaxed during the procedure.

Venous catheters are not ideal for long-term use. With a venous catheter, a patient may develop a blood clot, an infection, or a scarred vein, causing the vein to narrow. However, if a patient needs to start hemodialysis right away, a venous catheter will work for several weeks or months until a surgeon can perform a long-term access surgery and the AV fistula or AV graft has time to mature.

If fistula or graft surgery is unsuccessful, then a patient will need a long-term venous catheter access. When a patient needs a venous catheter for more than 3 weeks, the surgeon will “tunnel” the catheter under the skin, rather than insert it directly into the vein. A tunneled catheter is more comfortable and has fewer problems. Even tunneled catheters, however, may become infected.

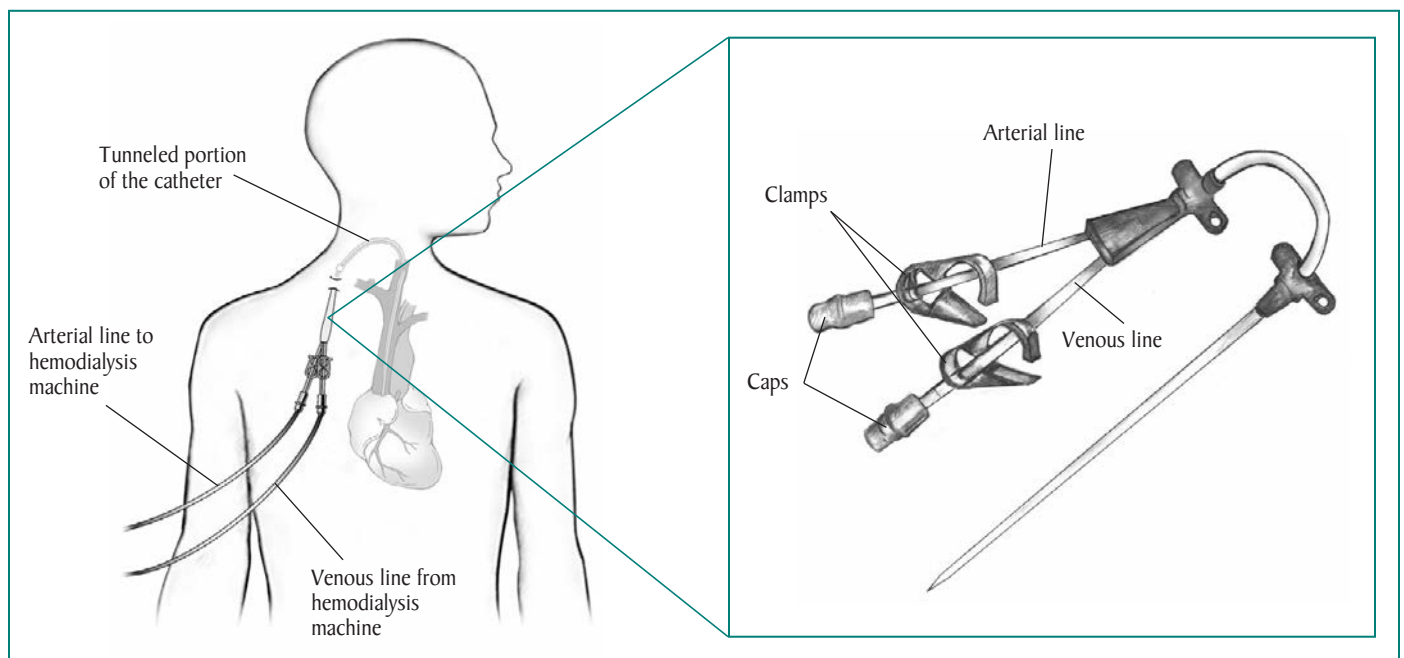
What problems could a vascular access cause?

All three types of vascular access—AV fistula, AV graft, and venous catheter—can cause problems that require further treatment or surgery. The most common problems include access infection and low blood flow due to blood clotting in the access.

Infection and low blood flow happen less frequently in properly formed AV fistulas than in AV grafts and venous catheters. Still, having an AV fistula does not guarantee the access will be problem-free.

AV grafts more often develop low blood flow, an indication of clotting or narrowing of the access. The AV graft may then require angioplasty, a procedure to widen the narrow part. Another option involves surgery on the AV graft to replace the narrow part.

Venous catheters are the most likely to cause infection and clotting problems. If these problems develop, medication may help. Antibiotics are medications that fight bacteria that can cause infection. Blood thinners such as warfarin keep blood from clotting. If these treatments fail, a nephrologist or an interventional radiologist will need to replace the catheter.



Tunneled venous catheter

How does a patient care for and protect a vascular access?

A patient can care for and protect a vascular access by

- ensuring that the health care provider checks the access for signs of infection or problems with blood flow before each hemodialysis treatment, even if the patient is inserting the needles.
- keeping the access clean at all times.
- using the access site only for dialysis.
- being careful not to bump or cut the access.
- checking the thrill in the access every day. The thrill is the rhythmic vibration a person can feel over the vascular access.
- watching for and reporting signs of infection, including redness, tenderness, or pus.
- not letting anyone put a blood pressure cuff on the access arm.
- not wearing jewelry or tight clothes over the access site.
- not sleeping with the access arm under the head or body.
- not lifting heavy objects or putting pressure on the access arm.

Eating, Diet, and Nutrition

Researchers have not found that eating, diet, and nutrition play a role in causing or preventing problems with a vascular access.

Read more about eating well during hemodialysis in *Eat Right to Feel Right on Hemodialysis* at www.kidney.niddk.nih.gov.

Points to Remember

- A vascular access is a surgically created vein used to remove and return blood during hemodialysis.
- An arteriovenous (AV) fistula is a connection, made by a vascular surgeon, of an artery to a vein.
- Health care providers recommend an AV fistula over the other types of access because it
 - provides good blood flow for dialysis
 - lasts longer than other types of access
 - is less likely to get infected or cause blood clots than other types of access
- An AV graft is a looped, plastic tube that connects an artery to a vein.
- A venous catheter is a tube inserted into a vein in the neck, chest, or leg near the groin, usually only for short-term use.
- Venous catheters are not ideal for long-term hemodialysis. With a venous catheter, a patient may develop a blood clot, an infection, or a scarred vein, causing the vein to narrow.
- All three types of vascular access can cause problems that require further treatment or surgery. The most common problems include access infection and low blood flow due to blood clotting in the access.

Hope through Research

The National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) has many research programs aimed at improving the treatment of kidney failure. One research program aimed at better understanding fistula maturation is the Hemodialysis Fistula Maturation Study. This multicenter study enrolled approximately 600 study participants with newly placed fistulas to study the influence of vascular anatomy, vascular biology, patient factors, and process of care on the fistulas' usefulness for maintenance hemodialysis. The results of this study will become available in 2015.

Clinical trials are research studies involving people. Clinical trials look at safe and effective new ways to prevent, detect, or treat disease. Researchers also use clinical trials to look at other aspects of care, such as improving the quality of life for people with chronic illnesses. To learn more about clinical trials, why they matter, and how to participate, visit the NIH Clinical Research Trials and You website at www.nih.gov/health/clinicaltrials. For information about current studies, visit www.ClinicalTrials.gov.

For More Information

People on hemodialysis can learn more about how to care for an access site from their health care provider. For a copy of the booklet *Hemodialysis Access: What You Need to Know*, contact

National Kidney Foundation

30 East 33rd Street
New York, NY 10016-5337
Phone: 1-800-622-9010 or 212-889-2210
Fax: 212-689-9261
Internet: www.kidney.org

For a copy of the booklet *Understanding Your Hemodialysis Access Options*, contact

American Association of Kidney Patients

2701 North Rocky Point Drive, Suite 150
Tampa, FL 33607
Phone: 1-800-749-2257 or 813-636-8100
Fax: 813-636-8122
Email: info@aakp.org
Internet: www.aakp.org

Life Options has developed an interactive patient education website called Kidney School. Module 8 of this program addresses vascular access for hemodialysis. To view this module, go to www.kidneyschool.org or contact

Life Options

c/o Medical Education Institute, Inc.
414 D'Onofrio Drive, Suite 200
Madison, WI 53719
Phone: 1-800-468-7777 or 608-833-8033
Fax: 608-833-8366
Internet: www.lifeoptions.org

The Centers for Medicare & Medicaid Services, the End-stage Renal Disease Networks, and the Institute for Healthcare Improvement launched the National Vascular Access Improvement Initiative in 2003. Materials from the Fistula First Change Package are available by contacting

Fistula First Breakthrough Initiative

IPRO ESRD Network Coordinating Center

1979 Marcus Avenue, Suite 105

Lake Success, NY 11042

Phone: 516-209-5306

Fax: 516-326-7805

Email: FFBI@ncc.esrd.net

Internet: www.fistulafirst.org

Acknowledgments

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About the Kidney Failure Series

The NIDDK Kidney Failure Series includes booklets and fact sheets that can help the reader learn more about treatment methods for kidney failure, complications of dialysis, financial help for the treatment of kidney failure, and eating right on hemodialysis. Free single printed copies of this series can be obtained by contacting the National Kidney and Urologic Diseases Information Clearinghouse.

National Kidney Disease Education Program

3 Kidney Information Way

Bethesda, MD 20892

Phone: 1-866-4-KIDNEY (1-866-454-3639)

TTY: 1-866-569-1162

Fax: 301-402-8182

Email: nkdep@info.niddk.nih.gov

Internet: www.nkdep.nih.gov

The National Kidney Disease Education Program (NKDEP) is an initiative of the National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, U.S. Department of Health and Human Services. The NKDEP aims to raise awareness of the seriousness of kidney disease, the importance of testing those at high risk, and the availability of treatment to prevent or slow kidney disease.

National Kidney and Urologic Diseases Information Clearinghouse

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Internet: www.kidney.niddk.nih.gov

The National Kidney and Urologic Diseases Information Clearinghouse (NKUDIC) is a service of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). The NIDDK is part of the National Institutes of Health of the U.S. Department of Health and Human Services. Established in 1987, the Clearinghouse provides information about diseases of the kidneys and urologic system to people with kidney and urologic disorders and to their families, health care professionals, and the public. The NKUDIC answers inquiries, develops and distributes publications, and works closely with professional and patient organizations and Government agencies to coordinate resources about kidney and urologic diseases.

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This publication is available at www.kidney.niddk.nih.gov.

You may also find additional information about this topic by visiting MedlinePlus at www.medlineplus.gov.

This publication may contain information about medications and, when taken as prescribed, the conditions they treat. When prepared, this publication included the most current information available. For updates or for questions about any medications, contact the U.S. Food and Drug Administration toll-free at 1-888-INFO-FDA (1-888-463-6332) or visit www.fda.gov. Consult your health care provider for more information.



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