Vascular Access Procedures

What are Vascular Access Procedures?

A vascular access procedure is designed for patients who need intravenous (IV) access for a considerable time, longer than seven to 10 days. A simple IV is effective in the short term but is far from ideal when, for instance, a patient needs a course of chemotherapy, several weeks of IV antibiotic treatment or long-term IV feeding. Some patients have veins that make it difficult to place an IV and those patients may benefit from a vascular access placement. A vascular access catheter is a long, thin tube that is placed in a vein in the arm, in the neck or in the chest just beneath the collarbone. The tube then is threaded into a major vein in the middle of the chest. In many conditions, having this type of tube inserted provides a simple and painless means of drawing blood, or delivering drugs, nutrients or both. This also spares the patient the discomfort and stress of repeated needle sticks. These so-called central catheters can remain in place for weeks, months or even years.

What are some common uses of the procedure?

- A variety of medications, notably antibiotics, may be infused through a central venous access catheter.
- A temporary or long-term answer to malnutrition is to use a central line to provide nutritional support and supplements, such as vitamins and minerals. Patients who are expected to require IV nutrition or frequent blood draws for a prolonged time can benefit from having a tunneled catheter, a more permanent type of device placed partially under the skin that anchors the catheter to the patient's tissues.
- A vascular access catheter may be used temporarily for hemodialysis. In this case, the catheter contains two separate passages (lumens): one that takes venous blood from the body to be cleansed in the dialysis machine, the other that returns this blood to the body through the arterial system. A catheter also is useful if kidney disease progresses rapidly and there is no time to install permanent vascular access before starting hemodialysis.
- An access catheter may serve to deliver blood transfusions.

How should I prepare for the procedure?

You will receive instructions from staff at the interventional radiologist's office at least one day before the procedure. You may have blood drawn for pre-procedure testing at either the hospital or a local clinic. Staff will advise you if changes in your regular medication schedule are necessary. You may have to avoid eating or drinking anything for several hours before the procedure. Make sure that someone will be available to drive you home afterward.
What does the equipment look like?

In contrast to a standard IV, a vascular access catheter is more durable and does not easily get blocked or infected. The tunneled catheter has a cuff that stimulates tissue to grow into the cuff and hold it in place. Small, specially designed instruments are used to insert these catheters. The radiologist typically will perform fluoroscopy (using x-rays to see the catheter in the body) and/or ultrasound imaging to guide catheter insertion and to make sure that the catheter is in the exact desired position. Fluoroscopy done during the procedure can confirm that the catheter is positioned correctly; a post-procedure chest x-ray serves the same purpose.

How does the procedure work?

Several types of vascular access devices are available. There are particular conditions for which they are used. There are many factors that are considered: how long the catheter is needed, what it is being used for and patient preference. The major types are:

- The **midline catheter**, a type of IV line that is in between a routine IV and a central catheter. It is inserted through a vein near the elbow and threaded through a large vein in the upper arm. Though relatively durable, at four to six inches the midline catheter is not long enough to introduce some highly irritating medications. A nurse can insert a midline catheter at the patient's bedside; no imaging guidance is needed.

- The **peripherally inserted central catheter (PICC)** also is introduced through an arm vein but its tip lies in a large central vein. Typically it provides central IV access for as long as four to eight weeks. A PICC may even remain in place for three to six months, as long as it continues to work well and is not infected, but it still is considered to be a temporary catheter. A trained nurse or physician assistant can place a PICC at the bedside as long as the superficial veins are in good shape. However, imaging guidance—by fluoroscopy or ultrasound—is necessary about half the time, in which case the PICC will be placed by a physician in the radiology department. Because a PICC can be well cared for at home, its use often makes early hospital discharge practical. Any trained healthcare worker can easily pull the line out when it is no longer needed.

- The **tunneled catheter** is a permanent catheter that is fixed in place when tissue forms in response to a cuff placed beneath the skin. Examples of the tunneled catheter include HICKMAN® catheters, BROVIAC® catheters and GROSHONG® catheters. Typically the catheter is inserted into the internal jugular vein in the neck or the subclavian vein just below the collarbone, then tunneled from the puncture site down onto the chest wall, emerging from the skin about six inches from where it entered the vein. The tip of the catheter lies in the large vein that returns blood to the heart. The cuff, made of Dacron, is on the tunneled part of the catheter. This type of catheter is the best choice when a patient is likely to need one for longer than three months and when the line will be used many times each day. It is secure and easy to access. The downside of these catheters is that 10 percent to 15 percent of tunneled catheters have to be removed because of infection.

- The **subcutaneous port** is a permanent vascular access device consisting of a catheter attached to a small reservoir implanted beneath the skin. The entire device is under the skin—nothing is visible on the outside of the skin except for a small bulge where the reservoir is located. The catheter itself, which passes from an access site in a vein of the arm, shoulder or neck, ends in a large central vein in the chest. The reservoir has a silicone covering that can be punctured with a special needle. The port is used mainly when IV access is needed only intermittently over a long period, as in patients who require chemotherapy. Its only disadvantage is the need for a needle stick whenever treatment is given, but discomfort usually is not marked and it tends to decrease over time.

**Note:** HICKMAN®, BROVIAC® and/or GROSHONG® are registered trademarks of C. R. Bard, Inc. and its related company, BCR, Inc.

How is the procedure performed?

Apart from a midline catheter or PICC line, which may be inserted at the bedside, vascular access devices are inserted in an interventional radiology suite (a special room for procedures) or occasionally the operating room. If imaging guidance is not used during placement, a chest x-ray is taken afterwards to confirm that the device is correctly located. At the outset, a sedative medication will be given through a conventional IV line to help you relax. You will feel sleepy but will remain awake for most or all of the procedure. After an area of the upper chest, neck or arm is swabbed with a disinfectant and covered with sterile drapes, a local anesthetic is injected to numb the venous puncture site. Using ultrasound or fluoroscopy to identify the vein, the radiologist passes a small needle into the subclavian vein, neck vein or arm vein. Through this a small, thin wire called a guidewire...

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is passed into the superior vena cava. The catheter itself is placed over the guidewire, which is then removed.

For a tunneled catheter, the physician will make two incisions usually smaller than one inch long—one over the vein where the catheter is inserted and the other where the catheter emerges from the skin. The catheter is placed beneath the skin between the two incisions. Finally, the radiologist will place two small stitches, one at each end of the tunnel, which remain in place for about one to two weeks and help keep the catheter firmly in place. A small bandage is placed over the sites and the catheter soon is ready for use. Implanting a port also requires two incisions (except in the arm where a single incision may suffice). The port reservoir is placed under the skin close to the lower incision. The incision for the port is a little longer than for the catheter, usually about two inches long. A small, elevated area remains on the body at the site of the reservoir; you will be able to feel it. The incisions are held together by stitches, surgical glue or a special tape.

What will I experience during the procedure?

You will lie on your back during the procedure. The local anesthetic may burn for a short time before it takes effect. You may feel some pressure or brief discomfort when the needle is placed into the vein. The same is the case when a tunnel is created. You will have to lay flat and hold your arm still for about 30 to 45 minutes during catheter placement. From time to time you may be asked to move your arm or wrist to help the catheter pass through the vein.

About one hour or less is needed in the recovery room after a vascular access procedure. When discharged, you should rest at home for the remainder of the day and may resume your usual activities the following day, but should avoid lifting heavy objects. After having a tunneled catheter or subcutaneous port placed, you should expect some bruising, swelling and tenderness in the chest, neck or shoulder, but these symptoms resolve over about five days. Pain medicine may help during this time. The incisions will heal in seven to 10 days, and the stitches may be removed after that time according to your physician's instructions. For the first week, it is especially important to keep the catheter site clean and dry. Some but not all physicians will recommend sponge bathing around the catheter site, then cleaning the area with peroxide, applying an anesthetic ointment that contains an antibiotic and bandaging the area. It is important to closely follow the instructions given you about how to care for the incision and the device. You may be told that it is all right to shower after a week, using a piece of plastic wrap over the catheter insertion site, but not to swim or soak in a tub with the incision under water. Flushing the catheter at a stated interval with a heparin solution may help keep blood clots from forming and obstructing the catheter. However, instructions will vary according to the type of device used. Your healthcare team will make sure that you know what to do.

It is a good idea to call the physician or nurse if you have any questions about your vascular access device. You must notify them if problems develop with your catheter. Problems calling for medical attention include malfunction of the device, bleeding at the insertion site or signs of infection. Infection may be present if you develop fever or notice redness, increased swelling or tenderness, warmth at the catheter insertion site or fluid drainage from the site.

Who interprets the results and how do I get them?

Fluoroscopy during the placement procedure or a chest x-ray taken immediately after catheter placement will confirm its correct position. How well the catheter functions may be determined by the radiologist, using a needle and syringe to inject fluid through the catheter.

What are the benefits vs. risks?

Benefits

- The vascular access device is an extremely useful solution for patients who—for any reason—require repeated entry into the venous circulation over a long period. A number of different designs are available that are suitable for different circumstances.
- Placement of a vascular access device is a great boon for those requiring prolonged treatment such as chemotherapy. They will not need to have an IV line placed for each treatment and their arm veins will not become badly scarred.
- A PICC is very helpful when medicines or fluids that are irritating to the wall of the vein are needed. A wide range of products may be given by this route, including antibiotics and blood products, and the catheter also may be used for IV feeding and frequent blood sampling.
- A vascular access device may be used immediately after placement. Some types will continue functioning well for a year or longer. The devices are easily removed when no longer needed.
• A catheter sometimes is the only way of getting access to the circulatory system for hemodialysis in patients with serious kidney disease.

Risks

Two types of risk are associated with vascular access devices: those occurring during or shortly after placement and delayed risks that occur simply because the device is in your body.

Risks associated with placement of a vascular access device

• **Bleeding**—Any surgical procedure carries a risk of bleeding. The risk can be minimized through a blood test in advance to be sure that your blood clots normally. If it does not, the procedure may be postponed or you may receive medication to improve blood clotting.

• **Infection**—An infection may develop at an incision site shortly after catheter placement. The risk is less if you carefully follow instructions about caring for the incisions as they heal.

• **Pneumothorax**—Very rarely a patient may develop a condition called a pneumothorax, a collection of air in the chest that may cause one of the lungs to collapse. This may occur during placement of a catheter or port using a vein in the chest or neck, but not when an arm vein is used. The risk is lessened when catheter placement is guided by ultrasound or fluoroscopy. If your physician is concerned that pneumothorax may have occurred, taking a chest x-ray just after catheter placement will rule out this problem.

• **Abnormal heart rhythm**—The normal heart rhythm may be disturbed while the catheter is inserted, but this is usually only temporary. The problem is easily recognized during the procedure and eliminated by adjusting the catheter position.

• **Arterial puncture**—Rarely, the catheter will enter an artery rather than a vein. If this happens, the catheter will have to be removed. Most often the artery then heals by itself, but occasionally it has to be surgically repaired.

Delayed Risks

• **Delayed infection**—Two types of delayed infection may develop: skin infection at the catheter or port insertion site or bloodstream infection. Infections are least common after placing a port. The risk of delayed infection can be minimized if you and anyone else who will be handling the device wash hands before flushing it or cleaning the insertion site. The site should be carefully inspected each time the dressing is changed.

• **Catheter fracture**—A hole or break in the catheter may lead to leakage of fluid. This problem may be seen with use of a PICC or tunneled catheter. Breaks may be avoided by not always clamping the catheter in the same spot and by never using too much force when flushing it. Two important first aid measures: 1) clamp the catheter between the damaged part and the skin insertion site; 2) tape a sterile gauze pad to the skin to cover the break. Catheters rarely fracture inside the body. A chest x-ray will show a fracture and allow removal of the broken fragment without surgery.

• **Accidental dislodgment of the catheter**—This also may occur with a PICC or tunneled catheter. If the catheter is not looped and taped firmly to the skin at all times, it may come out. If this happens, you should apply pressure to the incision site using a sterile dressing and call your physician immediately.

• **Air in the catheter**—This is an emergency that may cause chest pain or shortness of breath. You should clamp the catheter right away, lie (or place the patient) on the left side, and call 9-1-1. This problem can be avoided by always clamping the catheter before and after inserting a syringe, and by making sure that the catheter cap is screwed on tightly.

• **Catheter occlusion (closing)**—Any type of vascular access catheter may become obstructed by clotted blood. You can minimize the risk by carefully following instructions about flushing the catheter. Once a catheter occludes, it sometimes can be cleared by injecting medication but at other times must be removed or exchanged for a new catheter.

• **Vein occlusion**—If the vein in which the catheter lies becomes occluded, the arm, shoulder, neck or head may develop swelling. Should this occur, call your physician immediately. The clot may be treated by a blood-thinning medication, but occasionally will have to be removed.

What are the limitations of Vascular Access Procedures?

Although some types of central venous catheter may remain in place for months or even years, eventually they may need to be replaced if they are still required. The procedure of inserting a vascular access device is invasive because incisions are necessary, and the risk of infection must always be kept in mind. The reservoir
The septum of most types of implanted ports has a useful lifetime of about 1,000 punctures and so is not suitable for patients who require IV access on a daily basis.

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