VASCULAR MEDICINE

Vascular Medicine
2018, Vol. 23(4) 411–413

DOI: 10.1177/1358863X18779695
journals.sagepub.com/home/vmj
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Catheter-related venous thrombosis

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Keywords
catheter-related thrombosis, deep vein thrombosis (DVT), line-related thrombosis, superficial vein thrombosis (SVT), thrombosis, upper extremity DVT

What is an intravenous catheter?

Nearly every hospitalized patient and many outpatients undergo placement of some type of intravenous (IV) catheter. This small plastic tube may be for administering medications, fluids, nutrition, or blood transfusions directly into the vein, for drawing blood samples, or for performing dialysis for patients with kidney failure. There are two general categories of IV lines. Peripheral IVs are thin, short catheters that are placed in the superficial or surface veins of the hand, forearm, or in the crease of the elbow. Central venous catheters are longer and larger in diameter. They typically enter the vein at the upper chest wall or the neck and end where the large veins of the neck and arm drain into the heart. They may be tunneled a short distance under the skin before entering the vein. A port is a central venous catheter that is placed entirely underneath the skin and into the vein. A small needle is used to puncture the skin and access the port's reservoir to administer IV medications or to draw blood, and then the needle is removed. Ports (sometimes called a portacath) are commonly used for patients undergoing chemotherapy and are designed to remain in place for an extended period of time. A peripherally inserted central catheter (PICC) is a central catheter frequently used during hospitalization that is inserted in a small vein of the upper arm and ends where the neck and arm veins drain into the heart in a large vein called the superior vena cava (Figure 1).

Both peripheral and central IVs can cause blood clots to form inside the veins, which are the blood vessels that return blood to the heart. These blood clots are divided into two categories: superficial vein thrombosis (SVT) and deep vein thrombosis (DVT). SVT occurs in the smaller surface veins of the upper arm, forearm, and hand. DVT occurs in the deeper veins of the arm, typically above the elbow, and in the large internal jugular vein in the neck.

Superficial vein thrombosis (SVT)

Any time a needle or catheter is put into a vein, the vein wall may become irritated or inflamed, which may lead to the development of small blood clots. Alternatively, the presence of the IV itself can create a spot for blood clots to form. SVT can occur with both peripheral IVs and PICCs. When SVT forms, the patient may experience pain, redness, and tenderness over the affected vein (see Vascular Disease Patient Information Page on superficial vein thrombosis[1]). Sometimes, a hard, tender knot or cord forms under the skin. The skin over the affected vein may be swollen. Occasionally, if the SVT is more extensive, the hand or arm may also be swollen.

SVT is often diagnosed by physical examination by a health care provider alone, although if there is concern that the clot is more extensive, an ultrasound may be performed. Treatment consists of removing the offending IV. If symptoms are bothersome, elevating the arm and applying warm compresses to the area of pain can be effective. Anti-inflammatory medications, such as ibuprofen or diclofenac, may be taken orally or applied to the skin. Patients who have extensive SVT that is close to the junction with the deep veins may be put on blood-thinning medications (anticoagulants) for a short period of time up to several months (discussed below).

Patients with SVT may notice that although the pain and redness resolve fairly quickly, it may take weeks for the hard knot to go away.

Deep vein thrombosis (DVT)

DVT is a more serious complication of central venous catheters. DVT typically starts when a coating of clotted blood and blood proteins forms around the catheter. This is a common occurrence with central catheters and is typically harmless and is no longer an issue once the catheter is removed. However, in some patients, the coating may grow big enough to cause blockage of blood flow out of the vein, resulting in symptoms. The first sign of a catheter-related DVT may be that although medication

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and fluids flow into the catheter, blood cannot be drawn backwards out of the catheter because the clot creates a one-way valve. As the clot enlarges, the patient may have pain, swelling, or redness of the arm and hand, or may notice enlarged veins on the surface of the chest that form to try to bypass the clotted area (Figure 2) (for more information on DVT of the leg, see Vascular Disease Patient Information Page on deep vein thrombosis and pulmonary embolism[2]).

How is catheter-related DVT diagnosed?

Catheter-related DVT is diagnosed with vascular ultrasound, a non-invasive test that uses sound waves to create images of the veins and check flow in the veins. Rarely, if there is strong suspicion for DVT but one is not seen on ultrasound, the patient may undergo a test called venography, in which dye that lights up on X-ray is injected into the vein to identify areas with blood clot. Occasionally, DVT is found on tests like computed tomography (CT) or magnetic resonance imaging (MRI) scans done for other reasons.

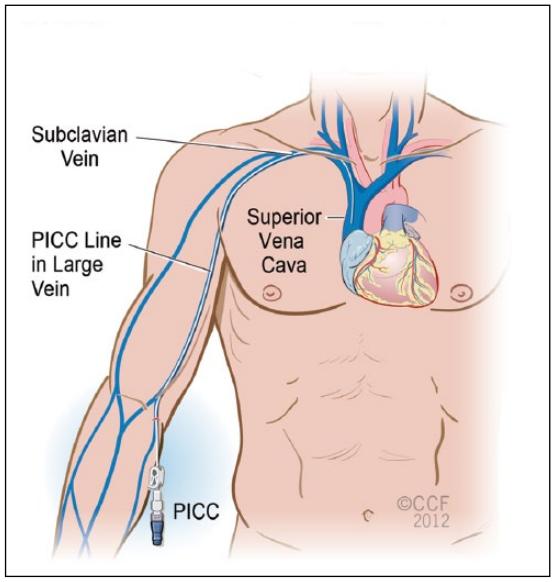

Figure 1. A PICC line. A PICC starts in a small surface vein and ends in a large vein near the heart.
PICC, peripherally inserted central catheter.

Who is at risk for catheter-related DVT?

Anyone with an IV catheter can develop catheter-related thrombosis, but some groups are at higher risk. In particular, patients with cancer are at risk for blood clots, and they often have long-term central venous catheters or ports for administration of chemotherapy. Ports tend to be lower risk for DVT than other types of central catheters. Patients with an inherited or acquired underlying tendency to form clots, called a hypercoagulable state, are at higher risk for catheter-related thrombosis (see Vascular Disease Patient Information Page on thrombophilia[3]). Patients with PICCs are at higher risk of catheter-related thrombosis than patients with other types of central venous catheters because the PICC starts in a small vein. The large IV fills up the inside, or lumen, of the vein, creating stagnant blood flow that can lead to clotting.

How is catheter-related DVT treated?

Treatment of DVT centers on blood-thinning medications, or anticoagulants, to stabilize the clot and to prevent it from growing while the body's own clot-dissolving system can start to break it up. There are a number of options for anticoagulation, which depend on the patient's age, other medical conditions, and the circumstances of hospitalization. Initial treatment may be with medication intravenously or injected under the skin, with eventual transition to a medication taken by mouth. Most patients with catheter-related DVT are treated for a period of 3 months, unless the catheter is to remain in place long-term.

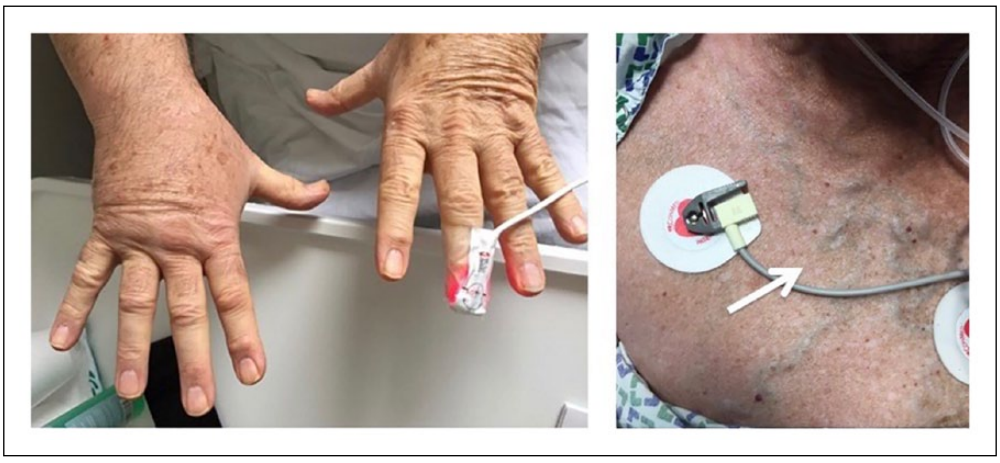

Figure 2. Catheter-related DVT. The left panel shows a patient with acute right arm catheter-related thrombosis; note the puffiness of the right hand compared with the left. The right panel shows a patient with right arm catheter-related thrombosis, where drainage of the arm is entirely blocked, leading to formation of dilated veins on the chest wall (arrow).
DVT, deep vein thrombosis.

At times, when a patient is at high risk for bleeding or has other reasons not to be on an anticoagulant, catheter-related DVT may be monitored with repeated ultrasounds but not treated with anticoagulant medications.

When DVT is identified and the patient is started on treatment, removal of the catheter is not necessary unless it is malfunctioning or no longer needed. In fact, removing the catheter does not remove the need for anticoagulation. Since IV access is often still necessary for the hospitalized patient, the patient may be subjected to having a new catheter placed in a different location, only to run the risk of it clotting as well.

What are the complications of catheter-related thrombosis?

The most feared complication of catheter-related DVT is pulmonary embolism, which occurs when a piece of clot breaks off and travels, or embolizes, through the heart and lodges in the blood vessels of the lungs. This can lead to decreased levels of oxygen in the blood, causing shortness of breath and a racing heartbeat, and can put pressure on the heart, causing low blood pressure and other symptoms. It can also cause chest pain. Upper extremity DVT is much less likely to embolize to the lungs than DVTs that form in the legs, and anticoagulation greatly reduces the risk of embolization.

Patients who have had repeated catheters in the large central veins for dialysis or for other reasons may have narrowing of the veins of the chest or neck due to scar tissue that develops over time (Figure 2). Occasionally this may need to be treated with procedures to open up the veins. Very rarely, some patients with catheter-related DVT go on to develop chronic swelling or color changes in the arm related to injury of the vein.

Summary

Both peripheral and central IV lines can lead to thrombosis (blood clots). Superficial vein thrombosis is treated by removing the IV and managing symptoms. Deep vein thrombosis, which is more serious, is usually treated with anticoagulation.

Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

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