

# Providing optimal care for patients with central catheters

By Ann Earhart, MSN, RN, ACNS-BC, CRNI

**WHEN REGISTERED NURSE** *Andrea arrives on shift for report, she learns that her patient, a 62-year-old male, has a peripherally inserted central catheter (PICC). As she starts to assess him, she sees a double-lumen catheter in his chest. When she asks a coworker how to identify and care for this line, she hears baffling instructions about tip placement, along with some terms she's not sure of, such as power injection, valved, and tunneled.*

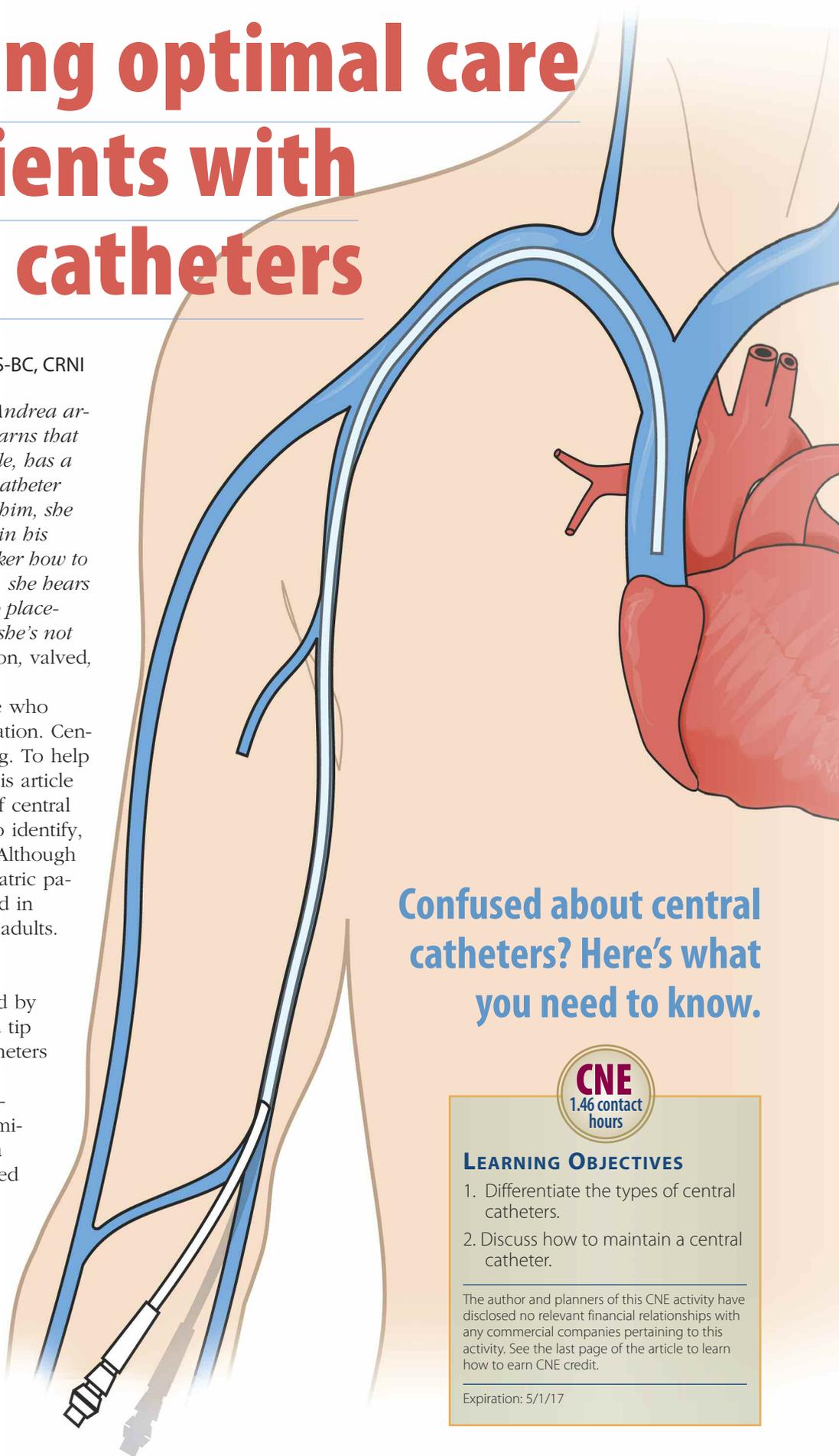
Andrea isn't the only nurse who might be at a loss in this situation. Central catheters can be confusing. To help clarify this important topic, this article compares the various types of central catheters and explains how to identify, care for, and maintain them. Although central catheters used in pediatric patients are similar to those used in adults, this article focuses on adults.

## Types of central catheters

Central catheters are identified by location, type, indication, and tip location. Types of central catheters include:

- PICCs; inserted into the patient's arm with the tip terminating in the superior vena cava, these may be indicated for both short- and long-term therapies (up to 1 year or so)
- nontunneled catheters
- tunneled catheters
- implantable ports
- dialysis catheters.

Also, a central catheter may be open-ended



**Confused about central catheters? Here's what you need to know.**



### LEARNING OBJECTIVES

1. Differentiate the types of central catheters.
2. Discuss how to maintain a central catheter.

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or valved, and it may or may not be power injectable. Catheters also vary in number of lumens (from one to four) and in French size (4 to 14 Fr), with either a straight or reverse taper on the distal portion. Tapered catheters are wider at the insertion site, in essence plugging the larger-insertion puncture site to lessen bleeding. Some clinicians prefer a tapered catheter, using the catheter or a dressing technique to stop bleeding at the insertion site.

The type of catheter used depends on the therapy required (such as total parenteral nutrition, lipids, or multiple antibiotics) and patient characteristics (for instance, the need for a central catheter versus a less invasive peripheral line). Each catheter type has risks and benefits, which clinicians must discuss with patients when planning care.

Once the clinician determines the patient needs a central catheter, the next decision is how many lumens the catheter should have. Central catheter placement using ultrasound allows measurement of the patient's vein size, which ensures an appropriate-size catheter to allow blood to flow around it. A catheter that's too large can cause arm swelling and deep vein thrombosis.

### **Nontunneled catheter**

A nontunneled catheter typically is inserted in the neck, chest, or groin using the internal jugular or subclavian vein or, in emergencies, the femoral vein. If the patient is chronically ill or other veins are hard to access, the catheter may be placed in another vein, such as the translumbar vein.

Indicated for acute short-term conditions, nontunneled catheters come with single, double, triple, or quadruple lumens and in multiple sizes (14 to 22 G). The Centers for Disease Control and Prevention (CDC) doesn't recommend their routine replacement. Patients should be assessed daily to deter-



## **Organizations with central-catheter care guidelines**

The Infusion Nurses Society (INS), Oncology Nursing Society, Association for Vascular Access, Institute for Health Care Improvement (IHI), and Centers for Disease Control and Prevention (CDC) provide recommendations on central-catheter care based on research, evidence, and expert opinions. These guidelines include the INS Standards of Practice, CDC Guidelines, SAVE the Line Campaign, and the Healthcare-Associated Infections (HAI) Prevention Compendium.

In 2008, the Society for Healthcare Epidemiology of America and the Infectious Diseases Society of America sponsored and authored a compendium of practice recommendations to prevent HAIs in acute-care hospitals, in partnership with the Association for Professionals in Infection Control and Epidemiology, The Joint Commission, and the American Hospital Association. These organizations work together to review and rank the evidence on how to insert and maintain vascular access devices. An update to this compendium is expected in 2014.

mine if they still need the catheter; it should be removed as soon as it's no longer needed.

### **Tunneled catheter**

A tunneled catheter must be inserted invasively to help secure it and promote longevity. It has a cuff that stimulates tissue growth and helps hold the catheter in place; the catheter is positioned with the cuff 2 to 4 cm from the insertion site. A retention suture sometimes is used to hold the catheter until the tissue grows around this cuff, which takes 1 to 4 weeks. The remaining catheter portion is exposed but provides external access to eliminate needle sticks. The exposed portion requires daily to weekly maintenance and must be protected from being pulled or getting wet.

### **Implantable port**

An implantable port (also called a portacath or subcutaneous implanted port) is attached to a reservoir. The entire catheter and reservoir are placed surgically or locally beneath the skin, allowing the patient

to shower and bathe without restrictions. Implantable ports come with single and dual lumens. To access the catheter, the skin is pierced with a special noncoring needle.

### **Dialysis catheter**

Not used routinely for access, a dialysis catheter may be used in a life-threatening emergency if no other access is available. It's inserted in the neck or chest through the internal jugular or subclavian vein (or in some cases, the femoral vein). It may be tunneled or nontunneled, depending on urgency of need, patient's diagnosis, and expected duration of use. Nontunneled dialysis catheters are used for short-term acute treatment or until a more permanent tunneled catheter can be placed. Some manufacturers have added an extra lumen to allow I.V. medication administration; this lumen requires the same maintenance as any central-catheter lumen.

A dialysis catheter is accessed, cleaned, and flushed differently than other catheters; this article

doesn't address those topics. If your patient has a dialysis catheter, assess the site carefully to check whether the dressing is clean, dry, and intact. Be aware that in some facilities, a dialysis catheter is packed with a solution, such as normal saline solution, citric acid, alteplase, or large heparin doses. When the catheter is accessed, the packing solution must be removed first; afterward, the dialysis team (or other specialty team) must be called to repack the catheter.

### Care and maintenance

Care and maintenance of a central catheter requires vigilance and attention to detail to prevent complications and maintain patency. More than 80% of bloodstream infections are linked to vascular access devices, and 50% of these infections are preventable. Various organizations provide guidelines on central-catheter care. (See *Organizations with central-catheter care guidelines.*)

The Institute for Health Care Improvement (IHI) recommends bundling multiple practices to improve patient outcomes and prevent central line-associated bloodstream infections (CLABSIs). Components of the IHI central-line insertion bundle include:

- hand hygiene
- maximal barrier precautions, including a large sterile drape covering the patient head to toe (with a small opening at the insertion site) and head covers, masks, sterile gowns, and gloves for all personnel directly involved in line insertion
- chlorhexidine skin antisepsis at the insertion site
- optimal site selection; the inserting clinician reviews risks and benefits of line placement in the various veins
- daily review of the need to continue the central catheter.

Central catheter maintenance involves some of the same compo-

nents as the insertion bundle but includes additional components.

### Hand hygiene

Perform hand hygiene before and after every patient contact. If you enter the patient's room to care for the catheter or administer drugs through it but will perform other activities beforehand (such as changing the dressing or providing indwelling urinary catheter care), rewash your hands before you touch the catheter. Recommendations for achieving National Patient

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Safety Goals for infection prevention include proper hand hygiene, setting goals for improving hand hygiene, and using proven guidelines to prevent CLABSIs.

### Skin antisepsis

Skin antisepsis at the insertion site is crucial to CLABSI prevention. Disinfect the skin with an appropriate antiseptic at each dressing change. The CDC recommends a chlorhexidine preparation stronger than 0.5% in 70% isopropyl alcohol. Scrub back

and forth for 30 seconds and let the site dry completely (which may take 30 seconds to 3 minutes). Don't apply the dressing until the preparation has dried, to avoid skin irritation and redness under the dressing. If the patient can't tolerate chlorhexidine, clean the skin with tincture of iodine, an iodophor preparation, or 70% isopropyl alcohol.

### Dressing changes

The dressing at the insertion site helps protect the catheter. Frequency of dressing changes depends on dressing type and integrity. Change a transparent dressing every 7 days; change a gauze dressing every 48 hours.

If the dressing is no longer intact, is oozing, or has become bloody or contaminated, change it as soon as possible. Apply an impermeable cover before the patient takes a shower or bath to protect it from direct contact with water. Manufacturers make covers specifically for central catheters to keep dressings dry in the shower. If the dressing gets wet and is no longer intact, change it to prevent infection.

Chlorhexidine sponges or dressings and silver patches provide continued antisepsis under the dressing. If your facility's central catheter infection rate hasn't decreased despite adherence to basic prevention measures, use a chlorhexidine-impregnated sponge for temporary short-term catheters in patients older than 2 months, per CDC recommendations.

### Securement-device changes

A central catheter must be stabilized to prevent dislodgment, migration, damage, and pistoning (back-and-forth motion within the vein, which can damage the intima and cause phlebitis and infection). Many physicians suture catheters in place to stabilize them and prevent malpositioning. Clean the sutures when changing the dressing, noting



## Cleaning the hub

Usually, the hub is defined as the hub of the catheter, the surface of the injectable cap, and the injection port on the I.V. tubing. Cleaning the hub takes time and friction. The hub should be cleaned each time it's accessed. For instance, when a patient receives an I.V. medication, the hub should be cleaned three times—before the initial saline flush, before medication administration, and before the final saline flush.

Many healthcare facilities are using new devices to scrub and soak catheter hubs.

- An alcohol-impregnated hub cap (a needleless I.V. and port protector that provides passive disinfection) can be screwed on to soak the hub clean.
- A needleless cap on an I.V. port and female Luer-loc hub provides a more efficient friction scrub using an active disinfection cleanser.

The Association for Vascular Access introduced the concept of scrubbing the hub as part of its "I SAVE That Line!" campaign. Opinions differ on scrub time needed; recommended times vary from 3 to 30 seconds. Setting a specific scrub time is challenging because of the different types of caps. Smooth-surface caps can be cleaned more quickly than those with deep crevices.

skin redness around them. Reddening may warrant suture replacement with a sutureless-securement device, which can help prevent catheter malpositioning and pistoning. Replace securement devices during dressing changes.

### Tubing changes

Be sure to prime the administration set and maintain infusate sterility. Know that nonvented administration sets are used for I.V. bags; vented administration sets, for solutions in glass bottles (such as propofol).

Frequency of tubing changes depends on whether the infusion is intermittent or continuous. For continuous medication or fluid infusions, don't disconnect the tubing from the patient; change it every 72 to 96 hours. If the patient's receiving intermittent infusions (such as one or two daily doses of an antibiotic), the tubing can be disconnected. Tubing that's disconnected from the patient or the main I.V. tubing is considered intermittent and should be changed every 24 hours

to decrease contamination risk.

Blood, parenteral nutrition, and fat emulsion fluids have separate requirements for tubing changes. According to the American Association for Blood Banks, red blood cell components expire 4 hours after the catheter is accessed when transfused through a 170- to 260-micron filter. If one unit of blood takes 4 hours to infuse, change the tubing before starting the second unit. Follow your facility's policy for tubing changes with blood products.

The Association for Parenteral and Enteral Nutrition provides guidelines for tubing changes through a catheter used to administer lipids and parenteral nutrition. It recommends changing the tubing:

- every 12 hours for lipid products
- every 24 hours for parenteral nutrition products with lipids or that have a Y-connection for lipids
- every 72 to 96 hours for parenteral nutrition without lipids.

### Changing and cleaning the cap

An almost-forgotten component of

central-catheter care is changing the I.V. cap. CDC recommends changing the cap with a tubing change no more often than every 72 hours. The Infusion Nurses Society recommends changing the cap every 7 days with a dressing change. Both organizations recommend changing a cap that is clogged or contaminated.

Cap changes can be confusing when the tubing is changed every 12 to 24 hours. No evidence exists on the practice of changing caps with each tubing change; check your facility's policy and procedures. Some facilities may require cap changes every 12 to 24 hours, others every 72 to 96 hours, and some with each dressing change. Also, check the manufacturer's guidelines; some manufacturers recommend changing the cap after blood withdrawals.

When changing the cap, be sure to prime the new cap with saline solution and clean the catheter hub. Despite the minimal flush volume of I.V. caps, introducing air into the line puts the patient at risk for air embolism. (See *Cleaning the hub*.)

### Flushing the catheter

The catheter must be flushed to maintain patency. Otherwise, it becomes sluggish, blood return is impeded, and blood and medication build up on the inside of the catheter, forming fibrin. Fibrin can act as a barrier inside and around the catheter, leading to occlusion. Also, pathogens cause development of biofilm, which can lead to catheter malfunction and infection.

All central catheters should be flushed with normal saline solution before and after medication administration. Flushing frequency varies with catheter type. Nonvalved catheters require more frequent flushing, with recommendations varying from every shift to every day. Follow your facility's guidelines on flushing frequency. Valved catheters require once-weekly



## Heparin versus saline flush

Debate continues over whether to use a heparin flush or a normal saline solution flush to maintain central-catheter patency. Injectable caps with the latest technology can be flushed only with saline solution and remain patent without increased clotting. No empirical evidence exists to support heparin flushes to maintain patency; in fact, routine heparin use is linked to heparin-induced thrombocytopenia. Clinicians should be vigilant about flushing with saline solution and using the least amount of heparin possible. For adults, Infusion Nurses Society (INS) guidelines recommend flushing with up to 5 mL of 10 units/mL heparin daily. In facilities that use heparin rather than saline flushes, INS recommends using the smallest amount of heparin possible for acute nontunneled catheters; for adults, INS recommends flushing with 10 units/mL heparin.

With an open-ended implantable port, use a heparin flush, not a saline flush, to maintain patency. A port that isn't accessed should be flushed once a month. If the port is accessed with a noncoring Huber needle and medication is being administered, flush with heparin when the needle is removed and the port is deaccessed. Otherwise, flush and maintain an accessed port as you would any central line. INS guidelines recommend flushing implantable ports with 5 mL/100 units heparin.

flushing when not being used to administer fluids or medications. Failure to flush between medications can cause catheter occlusion from precipitate formation.

For routine flushing, use 10 mL normal saline solution. When withdrawing blood specimens through the catheter, flush with 20 mL. If your patient's receiving viscous solutions (such as lipids or parenteral nutrition), flush with 20 mL normal saline solution. Check your facility's policy and procedure on the amount and frequency of saline flush to use for these therapies. (See *Heparin versus saline flush*.)

The flushing method depends on the type of catheter cap (positive-pressure, neutral, or negative-pressure) and certain other features. For instance, some catheters lack clamps. Negative-pressure caps require clamping before syringe removal. Neutral caps may or may not require clamping but should be clamped before syringe removal. Positive-pressure caps don't require clamping; if your facility recom-

mends clamping the catheter, clamp it after syringe removal. Follow the manufacturer's recommendations for flushing and clamping.

If you meet resistance during flushing or don't see a blood return, assess catheter patency before administering medications and fluids. Don't flush the catheter forcibly. Aspirate for a blood return to confirm patency before administering medication and solutions and during every shift. If blood return is absent, assume the catheter is malpositioned or an occlusion has formed, which calls for declotting medication. Either complication requires assessment and intervention.

### Competent catheter care

Competent, confident central-catheter care and maintenance can help prevent dangerous complications that imperil a patient's life. Make sure to follow catheter-care recommendations from relevant organizations and catheter manufacturers. For information about complications of central catheters, read

“Recognizing, preventing, and troubleshooting central-line complications” in the November 2013 issue of *American Nurse Today*. ★

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**Ann Earhart is a vascular and infusion clinical nurse specialist at Banner Good Samaritan Medical Center in Phoenix, Arizona.**

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**PURPOSE/GOAL**

To provide nurses with information that will help them better care for patients with central lines.

**LEARNING OBJECTIVES**

1. Differentiate the types of central catheters.
2. Discuss how to maintain a central catheter.

**Please mark the correct answer online.****1. Which type of central catheter is most appropriate for a patient with an acute short-term condition?**

- a. Nontunneled
- b. Dialysis
- c. Implantable port
- d. Tunneled

**2. Which type of central catheter typically is inserted in the neck, chest, or groin using the internal jugular or subclavian vein?**

- a. Nontunneled
- b. Dialysis
- c. Implantable port
- d. Tunneled

**3. Which type of catheter is attached to a reservoir?**

- a. Nontunneled
- b. Dialysis
- c. Implantable port
- d. Tunneled

**4. Which type of catheter may be packed with a solution that must be removed before it is accessed?**

- a. Nontunneled
- b. Dialysis
- c. Implantable port
- d. Tunneled

**5. Which statement about skin antisepsis at the central-catheter insertion site is correct?**

- a. Scrub the site for 10 seconds and let dry.
- b. Gently wipe the antiseptic onto the insertion site.
- c. Apply the dressing before the antiseptic has dried.
- d. Disinfect the skin with an antiseptic at each dressing change.

**6. The Centers for Disease Control and Prevention recommend which product as the first choice for disinfecting the skin?**

- a. A chlorhexidine preparation stronger than 0.5% in 70% isopropyl alcohol
- b. A chlorhexidine preparation weaker than 0.5% in 70% isopropyl alcohol
- c. Tincture of iodine
- d. An iodophor preparation

**7. A transparent dressing on a central catheter should be changed every:**

- a. 2 days.
- b. 4 days.
- c. 7 days.
- d. 10 days.

**8. Your patient with a central catheter is receiving a continuous fluid infusion. How often should you change the tubing?**

- a. Every 12 to 24 hours
- b. Every 24 to 48 hours
- c. Every 48 to 72 hours
- d. Every 72 to 96 hours

**9. According to the American Association for Blood Banks (AABB), red blood cell components expire how many hours after the catheter is accessed when transfused through a 170- to 260-micron filter?**

- a. 2 hours
- b. 4 hours
- c. 6 hours
- d. 8 hours

**10. Your patient is receiving parenteral nutrition with lipids through a central catheter. How often should the tubing be changed?**

- a. Every 12 hours
- b. Every 24 hours
- c. Every 72 hours
- d. Every 96 hours

**11. Which statement about cleaning the hub of the catheter, the surface of the injectable cap, and the injection port on the I.V. tubing is correct?**

- a. The hub should be cleaned before the initial saline flush only.
- b. The hub should be cleaned before medication administration only.
- c. The hub should be cleaned each time it is accessed.
- d. The hub should be cleaned after the final saline flush.

**12. Which statement about flushing a central catheter to maintain patency is correct?**

- a. For routine flushing, use 40 mL of normal saline solution.
- b. Nonvalved catheters require less frequent flushing.
- c. Use the least amount of heparin possible for flushing.
- d. Evidence shows that heparin flushes maintain patency of the catheter.

**13. Which statement about flushing an open-ended implantable port is correct?**

- a. Use a heparin flush, not a saline flush, to maintain patency.
- b. Use a saline flush, not a heparin flush, to maintain patency.
- c. If the port isn't accessed, flush it every 2 months.
- d. If the port isn't accessed, flush it every 3 months.

**14. When you try to flush your patient's central catheter, you meet resistance. You should:**

- a. assess catheter patency before administering medications or fluids.
- b. obtain an order to discontinue the central catheter.
- c. push harder to overcome resistance and complete the flush.
- d. assess for blood return; if not present, administer the flush.