Central venous access plays an important role in modern medical patient assessment and treatment. The use of central venous access devices has become routine in the oncology setting. Clinical oncology nurses need to know how the devices function, how to provide proper care, and how to manage potential side effects. The focus of this article will be on the navigation of implanted, skin-tunneled ports.

In the oncology setting, central venous access devices (CVADs) most often are used to administer chemotherapy. CVADs also are used for blood draws; hydration; administration of blood products, total parenteral nutrition (TPN), or medications (long-term, intermittent, and continuous); peripheral access; hemodynamic monitoring; and simultaneous administration of multiple complex fluids.

Types of Devices and Their Usage

**Nontunneled CVADs** are made of polyurethane, have three to five lumens, and come in various diameters and lengths (Hamilton, 2006). Typical use is for short periods of time (5–10 days), and the internal jugular, subclavian, or femoral veins are used as insertion sites.

**Skin-tunneled CVADs** also are placed in the jugular and subclavian veins. The femoral vein is used less frequently. The catheters come in varying diameters and have multiple lumens. A Dacron® (Invista, Inc.) cuff stabilizes the catheter by creating fibrosis with the subcutaneous tissues. The cuff also provides an antimicrobial barrier between the skin and the vascular system, allowing the catheter to remain in place for months or even years.

**Peripherally inserted central catheters (PICCs)** have peripheral insertion sites in the basilic, median, cubital, or cephalic veins. The catheters are considered CVADs because their tips terminate in the lower third of the superior vena cava (Hamilton, 2006). PICCs may be used for months.

For long-term oncology use, skin-tunneled, implanted, subcutaneous CVADs are recommended. The devices are placed surgically in the subcutaneous tissue of the chest, arm, or abdominal wall (see Figure 1). They should be considered only for patients requiring long-term IV therapy. The implanted port consists of a self-sealing septum covering a metal or plastic reservoir (the body) and a catheter feeding into the superior vena cava over a guidewire.

**Figure 1. Surgeons Placing an Implanted Port**

*Note. Surgeons are placing a port chamber for chemotherapy infusion. The port chamber is placed in a subcutaneous pocket, which is closed with sutures. The white silastic (silicone) catheter attached to the port chamber will feed into the superior vena cava over a guidewire.*

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Digital Object Identifier: 10.1188/07.CJON.485-488
Complications during the use of CVADs include (Hamilton, 2006):

- Pneumothorax
- Cardiac tamponade
- Arterial rupture
- Hemorrhage
- Hemothorax
- Hydrothorax
- Air embolus
- Brachial nerve plexus injury
- Thoracic duct injury
- Misplacement
- Infection

Complications associated with the insertion of CVADs are (Hamilton, 2006):

- Implantation site infection or sepsis
- Thrombosis or deep vein thrombosis
- Hydrothorax
- Hemothorax
- Hemothorax
- Air embolus
- Brachial nerve plexus injury
- Thoracic duct injury
- Misplacement
- Infection

Figure 2. Port Access Procedure

Note. Based on information from Hadaway, 2002; Larovere, 1999a, 1999b; Masoorli, 2005; O’Grady et al., 2002.

Figure 3. Port Deaccess Procedure

Note. Based on information from Hadaway, 2002; Larovere, 1999a, 1999b; Masoorli, 2005; O’Grady et al., 2002.
<table>
<thead>
<tr>
<th>Type of Port Complication</th>
<th>Signs and Symptoms</th>
<th>Possible Cause(s)</th>
<th>Intervention</th>
<th>Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infection or sepsis</td>
<td>Fever, redness, pain, or edema</td>
<td>Contamination of insertion site</td>
<td>Draw aerobic and anaerobic blood cultures; culture any site drainage, and treat with antibiotics. Port may need to be removed.</td>
<td>Good sterile technique; timely dressing, needle, and tubing changes</td>
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<tr>
<td>Thrombus or deep vein thrombosis</td>
<td>Catheter occlusion, lack of blood return, resistance present when flushing line, swelling, or symptoms of superior vena cava syndrome</td>
<td>Long dwell times; precipitate buildup from blood, lipids, or drugs; or lack of proper line flush</td>
<td>Check to see if tubing is kinked or clamped. When flushing, do not force if resistance is met; notify the physician because fibrinolytic drug instillation may be needed.</td>
<td>Flush regularly; flush catheter between IV medications with normal saline. If an open-ended catheter is being used, flush with 20 ml normal saline and then 5 ml 100 unit/ml heparin (only once), clamping as the last few milliliters are pushed.</td>
</tr>
<tr>
<td>Skin breakdown</td>
<td>Compromised skin over septum site</td>
<td>Insertion incision directly over the port that does not heal, port accessed in same place each time, or substantial patient weight loss</td>
<td>Port may need to be removed.</td>
<td>Good skin care, improved patient nutrition</td>
</tr>
<tr>
<td>Infiltration or extravasation</td>
<td>Pain or burning at port site, with or without use; leaking; skin color changes; edema; induration at site</td>
<td>Needle dislodgement; improper needle length, especially in a patient who is obese; catheter separation, fracture, or rupture; fibrin sheath formation; thrombus; vein pressure from lymphedema or enlarged axillary nodes; or vessel narrowing from scarring caused by surgery or radiation</td>
<td>Stop infusion immediately. Notify the physician, and follow facility protocol for infiltration or extravasation care. A cathetergram may be ordered to evaluate whether fluid flows properly.</td>
<td>Provide patient education, monitor the site frequently, and check for blood return.</td>
</tr>
<tr>
<td>180º rotation of implanted port</td>
<td>Resistance met when accessing port</td>
<td>Port not adequately sutured to fascia during insertion, substantial patient weight loss, or persistent vomiting or coughing breaks sutures</td>
<td>Try to access again with a new sterile needle. Do not turn port back over because it may cause a twisted catheter, separate the catheter from the port, or rupture the catheter. Notify the physician immediately. Port repositioning is performed in interventional radiology or the operating room.</td>
<td>–</td>
</tr>
<tr>
<td>Catheter migration or fracture</td>
<td>Symptoms of fracture are shoulder pain, burning at site, and inability to obtain good blood return; right atrium migration symptoms are arrhythmias, chest pain, and dyspnea; and symptoms of jugular vein migration are an earache on the port side and bubbling heard when the catheter is flushed.</td>
<td>The catheter was flushed with high gradient pressure or it severed from the port.</td>
<td>Stop and notify the physician. Fluoroscopy is used to verify catheter tip position.</td>
<td>Do not flush port with a syringe smaller than 10 ml.</td>
</tr>
<tr>
<td>Fibrin sheath formation</td>
<td>Lack of blood return with aspiration; resistance may be met with flushing.</td>
<td>Long dwell times or precipitate buildup from blood, lipids, or drugs</td>
<td>Check to see if tubing is kinked or clamped. When flushing, do not force flush if resistance is met; if line flushes easily without blood return, have the patient change position, raise his or her arms, or turn his or her head to the other side and cough. Notify the physician because fibrinolytic drug instillation may be needed.</td>
<td>Flush regularly; flush catheter between IV medications with normal saline. Clamp tubing as the last 0.5 ml is instilled to create a positive pressure; positive pressure prevents back flow of blood into the catheter.</td>
</tr>
</tbody>
</table>

• Skin breakdown at the site
• Infiltration or chemotherapy extravasation
• 180° rotation of an implanted port
• Catheter migration or fracture
• Fibrin sheath formation.

Implanted port access is a sterile procedure. Topical analgesics can be used to decrease patient discomfort. Each lumen should be accessed and flushed at least once a month if used intermittently. See Figure 2 for the port access procedure and Figure 3 for the deaccess procedure. During continuous use, access needles should be changed every seven days, with caps and tubing changed every two days, except with TPN. When TPN is infused, tubing is changed every 24 hours because of the high glucose content and potential for bacterial growth (Mattlow et al., 1999).

Complications

Some complications from CVAD are rare, whereas others are more common. See Table 1 for a summary of port complications and how oncology nurses navigate them through prevention, identification, and intervention.

Proper care and maintenance of ports decrease the potential for complications. Routine flushing is important to reduce fibrin sheath or clot formation. The mnemonic device “SASH” can help when flushing most catheters: saline, administer the medication, saline, and heparin (Hadaway, 2003). Routine port flushing with heparinized saline is the most common practice to maintain patency. However, flushing with heparinized saline is inadequate to prevent blood vessel thrombus. Systemic prophylaxis using anticoagulation has been evaluated. The benefit of systemic prophylaxis with low-molecular-weight heparin or warfarin has not been well established; therefore, it is not recommended for routine practice (Kuter, 2004).

Because catheter occlusions can affect patient care, the staff nurses in the James Care Dublin Unit at Ohio State University questioned whether the use of a single-lumen or dual-lumen port affected the rate of catheter occlusion. The nurses underwent a quality control project to evaluate the question. During a two-month period, all patients with implanted ports that presented to the chemotherapy unit for treatment were monitored. All patients received the same maintenance care. Maintenance care consisted of a monthly port flush with normal saline followed by heparinized saline. A total of 43 visits were recorded. Of those seen, 17 patients had double-lumen ports and 26 had single-lumen ports. Nine occlusions were identified during the two-month period, all in patients with double-lumen ports.

Based on these results, single-lumen ports now are requested unless otherwise medically indicated. Further evaluation is indicated to validate the results of this limited, quality-assurance project.

Patient Education

Nursing knowledge of port types and proper care are only a part of successful port navigation. Patient education is vital for the success of all ports. Initially, nurses should explain the placement procedure and recovery process. Postoperatively, education should be provided pertaining to site care and the importance of routine flushing using only a noncoring needle with sterile technique during access. Patients with ports must be aware of potential complications and should understand when they should notify their healthcare providers. Arming patients with this knowledge helps to ensure a successful and uncomplicated port experience.

Use of implanted ports in the oncology setting makes long-term, intermittent IV treatments more patient friendly by helping to maintain patients’ quality of daily living. Oncology nurses knowledgeable in port navigation can ensure that patients in their care have clear sailing.

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References


Spot on implanted ports and airport security . . .

Implanted medical devices may set off airport security alarms. Patients should carry the identification card they received with the port and inform security personnel about their need for a port and its potential for setting off alarms. A letter from a physician also may be useful. For more information, visit www.portadvantage.com/patient/faqs.html.