Accessing and Deaccessing Ports: Where Is the Evidence?

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Since the 1980s, tremendous use of intravascular drugs and fluids has increased the need for reliable venous access. Implantable ports have provided reliable access that can be used for IV fluids, medications, and blood products as well as a means to obtain blood samples (see Figure 1). Implanted ports require minimal site care and flushing and permit easy venous, arterial, epidural, or peritoneal access. About five million central venous catheters are placed per year (Putigna & Solenberger, 2009). Many implantable ports of varying size, shape, reservoir size, portal body material, and profile are used in clinical practice. Several types of complications can occur with implantable ports, including occlusion, infection, catheter migration, and catheter separation from portal body. This article focuses on infection.

Background

Although implantable port infections are reported to occur in 2%–40% of patients, the true incidence is difficult to measure (Aldrighetti et al., 2000; Fischer et al., 2008; Jordan et al., 2008; O’Grady et al., 2002; Schiralli et al., 2005). Variations in terms describing port infections and diagnostic tests lead, in part, to indeterminate measures. In general, a steady increase in gram-positive infections has occurred, with most bacteremias caused by gram-positive cocci (Huang, Chen, Su, Yen, & Tsao, 2004). A common source of port infection is contamination of the portal body or within the catheter lumen. Accessing the implantable port also is known to be a means for introducing organisms into the portal body and catheter (Huang et al.). Organisms may adhere to and multiply on the surface of the catheter or the skin, causing a catheter-related infection within the port pocket, exit site, or the bloodstream (see Figure 2). The presence of fibrin or thrombus at the catheter tip, where organisms can colonize and become a constant source of seeding to the bloodstream, also is a source for infection (Vescia et al., 2008).

Clinically, an infection can manifest as local tenderness, pain, erythema, induration, and edema at the port insertion site, at the exit site, or over the port pocket. Purulent or serous drainage may be present at the insertion or exit site. Systemic infections usually present with fever and chills and may or may not include the signs mentioned previously (Camp-Sorrell, 2004). Patients who are immunosuppressed may not exhibit signs of infection, such as swelling, drainage, erythema, or tenderness because of low white blood cell count. Fever may be the only response an immunosuppressed patient has to signify infection.

One way to prevent port infections is using aseptic technique in dressing changes, using accessing and deaccessing procedures, and keeping the exit site clean of potential infectious sources. Although ports have been used for more than 30 years to date, controversy still exists regarding maintenance care. Maintenance care often is based on manufacturer recommendations and institutional tradition instead of research or evidence. A particular area that remains controversial is the procedure used to access and deaccess ports.

To date, only one study (Schulmeister, 1987) has evaluated the use of nonsterile versus sterile gloves for port access.
Forty venous ports were randomly assigned to either the gloved procedure developed by the manufacturer or the nongloved procedure developed by the institution. During the one-year study period, no febrile episodes or infections occurred within either group. The researchers concluded that the nongloved technique was more time efficient and cost effective than the gloved technique.

In the current healthcare environment, universal precautions stipulate the use of gloves prior to all procedures involved in patient care; therefore, using nongloved procedure for port access is not feasible. However, nonsterile gloves are a cost-effective and viable option.

Methods

The setting for the current study was a hematology-oncology clinic located in a rural area. During a one-year period, retrospective data were collected from patient medical records, thus meeting exempt institutional review board criteria. Data were collected from patients who had ports inserted from January 2007 to January 2008. Patients who were undergoing or were about to undergo chemotherapy at the time the port was inserted were included in the chart review. Inclusion criterion was receiving a minimum of two complete cycles of chemotherapy after the port was inserted.

Each port was accessed and deaccessed by the protocols described in Figures 3 and 4. Information collected from the charts included factors that could contribute to infection occurrences, such as hospital admission, neutropenic nadir, disease type, treatment regimen, comorbidities, location of port catheter tip, and the presence of clot or fibrin. The 2006 guidelines from the National Cancer Institute were used to describe neutropenia (see Table 2).

Results

A total of 100 patient charts were reviewed; of the 100, 62 patients were included within the current study. The remaining 38 patients had completed fewer than two cycles of chemotherapy during the study period. Of the 62 patients, six (9.7%) were documented as having some type of port infection, and four of six infected ports required removal. Two infections were at the port exit site, three were systemic, and one was a port pocket infection.

Two port exit site infections were documented with signs of warmth, erythema, and mild edema; however, no type of drainage was documented and blood cultures were negative from both ports. The infections were treated successfully with antibiotics without requiring port removal. One exit site infection was noted after the patient was admitted to the hospital for pancytopenia following a third cycle of chemotherapy. The patient received IV antibiotics, and the infection resolved without port removal. The second exit site infection was attributed to a suture that did not dissolve after port placement. The infection was treated successfully with oral antibiotics and removal of the suture.

Three patients with ports were documented to have systemic blood infection. All three ports were removed because of persistent infection, despite IV antibiotics. One port had a positive blood culture for staphylococcus gram-positive cocci found after the patient was admitted for pneumonia. After 24 hours of IV antibiotics, the patient had persistent fever and chills; subsequently, the port was removed. Before hospitalization, the patient had received treatment with chemotherapy for 10 months, and the port had been in place for 288 catheter days. The patient also had end-stage renal failure and was undergoing dialysis. A yeast infection was documented concurrently with the positive port blood culture at the patient’s Vas-Cath® (Vas-Cath, Inc.), which was used for dialysis. Whether the persistent infection was from the port or Vas-Cath was not determined, but both devices were removed and the patient stabilized.

The second systemic port infection was documented from a positive port blood culture for gram-positive cocci after the patient was admitted to the hospital for febrile neutropenia. After 24 hours of IV antibiotics, the patient’s fever persisted and the port was removed. Documentation showed that the port had issues with obtaining a blood return, and thrombolytic treatment had been used to restore patency before the infection. At the time of port removal, a persistent clot was found at the catheter tip, which was the presumed source of the infection. The port had been in place for 161 catheter days. The third port was found to have a positive port blood culture of gram-positive cocci after the patient was admitted.

### Table 1. Cost of Supplies

<table>
<thead>
<tr>
<th>SUPPLY</th>
<th>COST ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sterile gloves</td>
<td>2.00 per pair</td>
</tr>
<tr>
<td>Nonsterile gloves</td>
<td>0.10 per pair</td>
</tr>
<tr>
<td>Chlorhexidine swab</td>
<td>6.38 per swab</td>
</tr>
<tr>
<td>Transparent dressing</td>
<td>0.87 per dressing</td>
</tr>
<tr>
<td>Gauze and tape</td>
<td>0.10 per roll</td>
</tr>
</tbody>
</table>

Figure 3. Steps for Accessing Ports

1. Wash hands. Assess the port site for erythema, warmth, or drainage.
2. Palpate the outline of the portal body.
3. Wash hands.
5. Spray ethyl chloride.
6. Stabilize portal body with one hand. Insert Huber needle into septum with other hand. Ensure patency by blood return. If no blood return, use interventions to assess port’s patency.
7. Stabilize port with gauze and tape or apply transparent dressing.
with pancytopenia following cycle two of chemotherapy and cellulitis of the lower extremity. The patient’s condition worsened during IV antibiotics, and the port was removed after being in place for 32 days. The patient did not stabilize until she underwent an above-the-knee amputation for her cellulitis. Whether the persistence of infection was from the port or cellulitis was not determined. Additional chemotherapy continued after the patient’s discharge and placement of a tunneled catheter. Of note, the patient had two separate tunneled catheters placed and removed because of infection after the initial port placement and removal.

A port pocket infection was documented after the patient was admitted to the hospital with pancytopenia following a third cycle of chemotherapy. The port pocket was documented as having erythema, warmth, and edema. The port had been in place for 94 days. Cultures from the pocket were positive for streptococcus coagulase. IV antibiotics were initiated without resolution of the infection after 48 hours; subsequently, the port was removed.

Of the six documented infections, five patients were hospitalized before the diagnosis of port infection. Nineteen of 62 patients with ports were admitted to the hospital. In addition, most hospitalized patients had comorbid conditions complicating cancer treatment. Three patients were documented to have grade III neutropenia, and two patients had grade IV. The total number of catheter days for ports to be implanted was 7,277, with a mean of 117 catheter days per patient. Catheter days ranged from 32–288. Of the six documented infections, two port infections (exit site and port pocket) could have been attributed to the accessing and deaccessing procedure.

Other complications were noted during the chart survey. Seven ports had difficulty in blood return. Two were found to have a kink in the catheter requiring surgical revision, whereas the remaining five ports had patency restored after the use of fibrinolytic therapy.

### Discussion

Implantable ports have become an essential type of venous access device used in accessing the vascular system. To date, not enough evidence exists to support the best method to care for ports. The most important aspect in maintenance care is using consistent aseptic technique and strict hand washing. Cleansing the skin for a 30-second count and allowing the solution to dry before access is imperative. Routine flushing every four to eight weeks with 5 ml of heparin is important to prevent clot and fibrin formation; with the presence of a clot and fibrin, infection can seed the catheter and portal body (Camp-Sorrell, 2004).

In the current descriptive study, six infections occurred in 62 patients with ports. To date, no study has compared infection rates of implantable ports using aseptic technique for access and deaccessing procedures. Of the six infections, only two could possibly be attributed to using an aseptic nonsterile glove technique for accessing and deaccessing. In the outpatient setting, maintaining a sterile technique often is a challenge. The patient’s portal site is usually covered by clothing, making the access procedure difficult. The risk for infection can be minimized by strict aseptic technique. Because no significant difference in infections was observed between sterile and nonsterile gloved procedures in the current study, infection seemed to be related more to the type of skin preparation and hand washing than the type of glove used; the finding is in agreement with O’Grady et al.’s (2002) data. Considering current healthcare costs, using the most cost-effective mechanism with a low risk of infection is imperative. Although this descriptive study has the limitation of being retrospective, nonrandomized, and specific to one rural clinic, the port infection rate was relatively low when nonsterile gloves were used to access and deaccess the ports.

### Conclusion

The use of ports to provide access to the venous system for drug delivery is increasing. Patients with cancer who are undergoing chemotherapy are at risk for infection, and some ports in the current study became infected as expected. Whether the infections could have been prevented with the use of sterile rather than nonsterile gloves is unlikely based on the current review. Nurses should be aware of the increased risk for port infections when the patient is neutropenic. Consistent routine care is the best preventive method of complications with ports. Controversy remains on maintenance care for all venous access device types, including accessing and deaccessing ports. Additional research is warranted to provide evidence regarding maintenance care and preventing common complications.

#### References


