Reduction of Erosion Risk in Adult Patients With Implanted Venous Access Ports

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One of the most common venous access devices used in patients with cancer is the implanted venous access port. Although incidences of infection and thrombosis are the most commonly reported complications, erosion rates of venous access ports are estimated at almost 1%. This article describes how evidence-based interdisciplinary interventions decreased port erosions for a regional health center from 3.2% to less than 1%.

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edICATIONS (e.g., chemotherapeutic agents), IV fluids, blood products, and parenteral nutrition solutions are administered via the use of implanted venous access ports (VAPs) in the care of patients with cancer (Silas, Perrich, Hoffer, & McNulty, 2010). VAPs are also used for the injection of contrast media and withdrawal of blood samples. From a patient’s perspective, a VAP is considered a lifeline with minimal impact on body image and interference with daily activities (Dougherty, 2011). The most commonly documented complications associated with VAPs include infection, venous thrombosis, and catheter occlusion (Zawacki et al., 2009). VAP erosion occurs when a portion or all of the port chamber or indwelling venous tubing protrudes through the skin. VAP erosion through the skin is an infrequently reported complication (less than 1%) and has been associated with cachexia and suboptimal device selection (i.e., high-profile ports in patients) (Zawacki et al., 2009). The authors sought to identify the actual organizational VAP erosion rate after the staff perceived an increase in device removal related to erosion. A review of 498 inpatient and outpatient charts from a 20-month period at St. Cloud Hospital revealed a port erosion rate of 3.2%. Analysis of the literature showed erosion rates were uncommon, with rates of less than 1%, and were suspected to be underreported (Almhanna, Pelley, Thomas Budd, Davidson, & Moore, 2008; Camp-Sorrell, 2004; Cil et al., 2006; Fong, Erinjeri, Suncion, Kemeny, & Solomon, 2009; Zawacki et al., 2009). Given higher rates at St. Cloud Hospital, the authors decided that a need existed for multidisciplinary practice change to reduce the existing port erosion rates.

Review of the Evidence

A literature search was performed searching MEDLINE® and CINAHL® to establish what the causes of erosion were. The key search terms included erosions, skin erosions, central venous ports, implanted venous access devices, chemotherapy, wound healing, corticosteroid therapy, and bevacizumab therapy. Articles were written in the English language, dates ranged from January 2000 through March 2011, and populations of adults aged 18 and older were included. Fourteen articles were retained for evaluation, and 11 were used based on the level of evidence (Armola et al., 2009). Protocols for VAPs must be established in accordance with manufacturer’s directions for use (Infusion Nurses Society [INS], 2011). Two manufacturer recommendations were used as well as the INS, bringing the total references to 14.

Many contributing factors are associated with erosions. Research suggests a correlation between the timing of bevacizumab (a vascular endothelial growth factor-specific angiogenesis inhibitor) administration and the actual placement of the port (Almhanna et al., 2008; Erinjeri et al., 2011; Fong et al., 2009; Genetech, Inc., 2013; Grenader, Goldberg, Verstandig, & Shavit, 2010; Muslimani et al., 2010; Zawacki et al., 2009). A potential complication associated with the administration of bevacizumab is delayed or incomplete wound healing (Genetech, Inc., 2013). Angiogenesis likely plays a role in lack of wound healing in repetitive trauma from puncture site wounds and surgical incisions. Long-term corticosteroid use is known to cause thin skin and slower wound healing (Vallerand & Sanoski, 2012). Erosions were correlated with repeated access at the same location (Almhanna et al., 2008; Camp-Sorrell, 2004). VAP erosion has been associated with active patients who use repetitive movements (Almhanna et al., 2008; Camp-Sorrell, 2004). According to manufacturer recommendations, the depth of VAP placement should be from 0.5–2 cm. If the port is placed too shallow or if the tissue layer over the VAP is too thin, it may lead to tissue erosion (Bard Access Systems, 2014). In addition, the port pocket site selection should include an anatomic area that provides good port stability, does not create pressure points, and does not interfere
TABLE 1. Retrospective Chart Review of Reduction of Erosion Risk in Adult Patients With Implanted Ports (N = 15)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>X</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI at placement</td>
<td>27</td>
<td>20–34</td>
</tr>
<tr>
<td>BMI at removal</td>
<td>25.4</td>
<td>21–36</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Stage at insertion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Not applicable</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

BMI—body mass index
Note. Of 498 ports inserted in the charts reviewed, 15 were eroded. The sample is based only on eroded ports. Note. Ports were in place from six weeks to three years at erosion.

with clothing and mobility (Bard Access Systems, 2014).

Findings

Advanced practice nurses (APRNs) conducted retrospective charts reviews of 15 patients with VAP erosion to identify trends specific to port erosions and potential contributing factors (see Table 1). Items evaluated included diagnosis, gender, length of time VAP was in place, BMI at placement and removal, and medications administered through the VAP.

Fourteen of the 15 patients had a malignancy diagnosis, and cancer staging was evaluated. Informal discussion with multidisciplinary team members revealed concerns related to superficial VAP placement and inappropriate anatomic location. Eight of the patients who experienced VAP erosion received bevacizumab therapy, indicating a potential relationship between VAP erosion and administration of bevacizumab. All audited patients received corticosteroids, putting them at increased risk of inadequate wound healing. Direct observation by APRNs of current practice identified techniques that could contribute to VAP erosions. Variation in practice was demonstrated in securement of the VAP access needles and tubing. Current practice did not provide adequate securement to prevent movement at the needle access. Evaluation of VAP sites indicated 12 of the erosions were occurring in the center of the septum. The VAP device was a power port with palpation bumps, and direct observation indicated that staff were repeatedly accessing the same area in the center of the three palpation bumps (set in a triangular pattern) and not rotating the access site because of limited perceived surface area. Interventional radiology insertion technique practices, including depth and skin closure, were observed and indicated a need for practice review.

Practice Changes and Outcomes

The multidisciplinary team made three evidence-based practice recommendations. First, to improve access surface area and prevent use of only one access area, a decision was made to use a power VAP without palpation bumps. The palpation bumps and unique triangular shape were manufacturer features added to the VAP to make it readily recognizable as a power port (Bard Access Systems, 2014). Practice evaluation within the imaging department indicated that palpation bumps were not the only identifiers; use of a scout film, palpation for the triangular shape, and verification of an identification card were needed for accurate power port identification. At least two unique identifiers are necessary at the time of access and prior to power injection, including presence of identification card or key chains provided by the manufacturer, review of the operative document, and palpation of the port (INS, 2011). Therefore, the product change would not change safe practice.

Second, standardization of access needle device and size was incorporated into policy and practice after a successful pilot in the outpatient chemotherapy infusion department. Access needles were changed to only power access, and size was decreased from 19 to 20 gauge. The change in needle size was based on the INS (2011) recommendation to select needle size based on type of infusion therapy. Guidelines

FIGURE 1. Port Erosion Complication Outcomes

Note. Literary benchmark based on information from Almhanna et al., 2008; Camp-Sorrell, 2004; Cil et al., 2006; Fong et al., 2009; Zawacki et al., 2009.
suggest that the use of a 20-gauge needle is appropriate for necessary therapy and imaging services.

Third, as recommended, securement dressings were upgraded to a newer generation of Tegaderm®. The INS (2011) guidelines noted that stabilization will minimize catheter movement and dislodgement. The new transparent dressing had improved ability to consistently secure the access needle and tubing and to prevent tension on the access site and surrounding skin, preventing skin breakdown.

The interventional radiology department evaluated and reviewed insertion techniques to ensure VAPs were placed from 0.5–2 cm deep (Bard Access Systems, 2014). Pre-marking the patient’s bra strap was incorporated into the VAP placement preparation phase; the INS (2011) recommended collaboration with the healthcare team and patient to determine site selection for placement of implanted ports. Postplacement discharge patient education now includes the importance of protecting the skin over the port, particularly from irritation related to seat belts or clothing.

The evaluation of VAP erosions was presented to the medical oncology department related to medication regimen contribution to erosion rates. The manufacturer of bevacizumab recommends suspending treatment for at least 28 days prior to elective surgery, and literature supports delaying treatment within 10–14 days of port placement (Erinjeri et al., 2011; Zawacki et al., 2009). The medical oncologists at the authors’ institution evaluate timing of VAP placement and bevacizumab administration based on the patient’s clinical presentation and prognosis.

Multidisciplinary practice changes took place from March 2011 through April 2012. Within six months of implementation, VAP erosions were reduced from 3.2% to less than 1% (see Figure 1). With implementation of multiple practice changes simultaneously, the change with the greatest impact was unable to be determined.

**Conclusion**

The multidisciplinary team had two assumptions prior to the investigation: VAPs were placed too superficially, and port erosions were only occurring in patients with palpation bump devices. By investigating and evaluating the evidence, the authors found that the assumptions may be contributing factors. Additional practice and equipment factors were noted following review of the literature and INS (2011) guidelines. Recognition of the multiple contributing factors led to evidence-based practice changes rather than uniform or reactive changes. Quality monitoring of port erosions was built into the performance improvement process. Ongoing Plan, Do, Check, Act monitoring provides opportunity for early identification of increased port erosion and additional practice evaluation.

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**References**


