In delivering safe care to their patients, oncology nurses should be familiar with the proper use and maintenance of implanted ports. Yet, despite the ubiquitous presence of implanted ports, accessing techniques and patency maintenance remain controversial. Additional research is needed to establish practices based on evidence.

Implanted ports have become invaluable for treating patients with cancer. Central venous access devices are used for obtaining blood samples and administering chemotherapy and other supportive medications. Implanted ports have advantages over tunneled central venous catheters, as they are concealed beneath the skin as opposed to tunneled catheters or peripherally inserted central venous catheters, and often are preferred by patients requiring therapy because they require less maintenance (Sansivero, 2010).

Oncology nurses increasingly are aware of the need to use sound, scientific-based research to support clinical practice. The value of evidence-based practice is summed up by Eaton and Tipton (2009): “The ability to provide evidence for nursing interventions is critical to all aspects of patient care” (p. 2). But what do oncology nurses do when no evidence exists or the effectiveness of a particular practice has yet to be established?

The controversy surrounding the sterile versus clean techniques for accessing ports has been a source of discussion for a number of years. The Infusion Nurses Society advocated the use of the sterile technique in 2006 standards, and continued that recommendation in the current 2011 Standard of Practice (Infusion Nurses Society, 2006). Camp-Sorrell and Cope (2010) do not require the sterile technique.

Further confusion at the bedside arose when Arch (2007) wrote an article advocating the sterile technique. Citing the lack of evidence to support the practice, the recommendation was refuted in a letter to the editor by Camp-Sorrell (2008). In her response, Arch raised concerns that placing an occlusive dressing on a non-sterile site could lead to bacterial growth beneath the dressing (Camp-Sorrell, 2008). In the author’s experience, institutions have adopted the use of sterile procedure because of that assertion, yet published studies have not substantiated that claim.

Infections

A number of articles examining infection rates associated with implanted ports have been published (Beckers, Ruven, Seldenrijk, Prins, & Biesma, 2010; Camp-Sorrell, 2009; Kefeli et al., 2009; Nakazawa, 2010; Schulmeister, 1987; Vallés et al., 2008). Unfortunately, these studies were relatively small in size, ranging from 28–89 patients, and did not specifically compare whether using sterile versus nonsterile gloves during accessing significantly affected infection rates. Therefore, meaningful conclusions cannot be drawn with either approach, particularly because a relationship also exists between thrombus formation and infection (Nakazawa, 2010). In addition, unrelated risk factors such as patient age, gender, catheter type, and placement technique have been identified as contributing to implanted port-related infections (Galloway, 2010; Heibl et al., 2010; Hsieh et al., 2009; Jan et al., 2010; Vandoni et al., 2009). The use of sterile bundles, incorporating a sterile mask, head covering, gown, gloves, and oversized drape, has reduced the introduction of pathogens during central venous catheter insertion (Camp-Sorrell, 2010; Galloway, 2010; Raad, Hanna, & Maki, 2007). The rationale for the sterile technique during insertion also may be responsible for advocating the use of the sterile technique for accessing.

Research

In 1987, Schulmeister compared the use of a manufacturer-supplied sterile access kit to ungloved accessing and found no difference in infection rates, but no recent studies have compared the sterile and nonsterile techniques. In 2008, a retrospective
study reviewed the charts of 68 patients whose implanted ports were accessed using a nonsterile technique (Camp-Sorrell, 2008). Their skin was cleaned using chlorhexidine gluconate. Six patients developed port-related infections; however, only two potentially were related to the accessing technique and may have been because of other patient-related variables. The author concluded that aseptic nonsterile technique did not increase the risk of access-related infections.

The use of chlorhexidine gluconate has had a dramatic effect on skin antisepsis when compared to povidone-iodine. Chlorhexidine gluconate has several benefits, including the ability to provide protection for several hours after its use with a 50% reduction in infections noted in three studies of more than 4,500 catheters (Balamongkhon & Thamlifikul, 2007; Chaiyakanapruk, Veenstra, Lipsky, & Saint, 2002; Frasca, Dahyot-Fizelier, & Mimoz, 2010; Mimoz et al., 2007). Like povidone-iodine, chlorhexidine gluconate must dry to be effective. Although friction is a necessary part of the cleaning process, no study has proven that the manufacturer-recommended back-and-forth cleaning procedure is superior to traditional concentric circles (Camp-Sorrell, 2010).

### Pathogens

As a whole, implanted ports tend to result in fewer infections than tunneled central venous catheters (Galloway, 2010). Infections typically are caused by the resident epidermal flora coagulase-negative *Staphylococcus* and *Staphylococcus aureus*, although gram-negative bacilli and *Candida* species also can play a role (Nakazawa, 2010).

The primary source of central venous catheter-related infections is contamination at the needleless connector, which often is in contact with skin, or thrombus formation (Mermel et al., 2009; Moureau & Dawson, 2010; Nakazawa, 2010). Needleless connectors have been scrutinized as a potential source of bacteria since their development in the 1990s. Proper disinfection of the hub’s exterior with alcohol or chlorhexidine gluconate in conjunction with friction (Kaler & Chinn, 2007) is essential to reduce pathogen inoculation. Some manufacturers are beginning to produce antimicrobial caps to further reduce pathogen inoculation.

### The Role of Thrombi and Flushing

Within hours of insertion, all central venous catheters begin to produce an intraluminal thrombus. Bacteria adhering to a thrombus can form an exopolymer saccharide called biofilm, which provides a fertile medium for additional bacterial growth (Chernecky, Macklin, Casella, & Jarvis, 2009; Nakazawa, 2010). Preventing or minimizing thrombi results in reduced infections. When scrutinizing central venous access infection rates, the incidence of clot formation, prevention, and treatment also must be reviewed.

Flushing central venous catheters—including implanted ports—also is controversial, and practices vary widely (Camp-Sorrell, 2010; Heibl et al., 2010; Jauch et al., 2009; Pittiruti, Hamilton, Biffi, MacFie, & Pertkiewicz, 2009). General recommendations suggest flushing with at least twice the intraluminal volume using normal saline followed by heparin—although not all researchers agree heparin is needed (Green et al., 2008; Infusion Nurses Society, 2011). When heparin is used, the concentration varies from 10–1,000 u/ml. The choice of flush often is determined more by institutional policy than by data because manufacturer recommendations typically refer nurses to their own institution’s policies. Some clinicians use various antibiotic locks in place of heparin, although the efficacy of this practice still is uncertain (Camp-Sorrell, 2010; Frasca et al., 2010; Pittiruti et al., 2009).

How often an implanted port should be flushed when not in use varies. One published study randomized 89 patients into two groups; the first received 500 units in 3.5 ml of heparinized saline every four weeks, the second received 1,000 units in 3 ml of heparinized saline every six weeks. The researchers reported no occlusions or infections in either cohort during the 12-month study period and concluded that the flushing interval can be safely lengthened to eight weeks without risk of occlusion (Kefeli et al., 2009). Weaknesses in the study include a retrospective nonrandomized design and the absence of clinical measurements (e.g., dye studies, cultures) that may preclude drawing a broad conclusion. However, the study suggests that alternate flushing schedules (with or without volume and heparin concentration changes) should be investigated further.

### Future Directions

Based on current evidence, implanted port-associated infections may be multifactorial. The current scrutiny by the U.S. Centers for Medicare and Medicaid Services regarding hospital-acquired infections has pushed catheter-related bloodstream infections to the forefront (Harnage, 2008; Heibden, 2009). As a result, institutions might be unwilling to give up the sterile access dogma, fearing infection rates could worsen. In the absence of evidence, they may elect to err on the side of caution. A large, well-controlled multicenter study could put this controversy to rest.

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