Central venous catheters (CVCs) are used commonly for venous access during treatment, and catheter-related bloodstream infection (CRBSI) is a frequent, yet highly preventable, hospital-acquired infection. One of the performance elements of the Joint Commission’s 2012 National Patient Safety Goals addresses the education of patients and family members on CVC care and management, as well as CRBSI prevention before a central catheter is inserted. This article presents the history and roles of the Infusion Therapy Team at the University of Texas MD Anderson Cancer Center in CVC care and describes an organized patient education program that plays a key part in the institution’s strategy to reduce and prevent CRBSI. Institutional standard policies and procedures for patient care should be in compliance with guidelines of the Centers for Disease Control and Prevention and the Joint Commission before any patient educational initiative is implemented. Such standards will serve as a guide to set up, organize, and implement an effective program.

Background

The ITT of the University of Texas MD Anderson Cancer Center is believed to be the first and longest continuously operating IV access team in the United States (Richardson & Caillouet, 2004). The clinic began in 1975, with the world’s first peripherally inserted central catheter (PICC) being placed by a nurse, Millie Lawson, RN. The team currently operates with 58 RNs, 2 licensed vocational nurses, 2 certified nursing assistants, 7 clerical support staff, 1 mid-level provider, and a surgical fellow rotating in the department on a daily basis. The unit is responsible for the management and care of percutaneous CVC and PICC insertions, over-wire catheter exchanges, and removal of implanted ports. Most of the catheters have dwell times ranging from months to years. For the MD Anderson Cancer Center, the longest continuous use is seven years for a silicone PICC and 10 years for a silicone subclavian CVC. The ITT clinic includes the implanted port clinic, which comprises a dedicated surgeon, physician assistants, an

Strategic Patient Education Program to Prevent Catheter-Related Bloodstream Infection

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RN, and clerical staff; that team performs most implanted port insertions at the institution. The ITT clinic places an average of 600 percutaneous CVCs and PICCs and 100 implanted ports every month.

The ITT nurses function in a variety of roles, including insertion of PICCs; assisting surgeons and mid-level providers with percutaneous, nontunneled central catheter insertions; and removal of implanted ports. Specialty-trained and -competent ITT nurses also perform overwire exchanges to reposition malpositioned catheters or when an existing catheter needs to be salvaged because of rupture, lumen occlusion, or need for a different type of catheter for treatment or suspected infection. In addition, the ITT team educates patients and family members on CVC preventative care and maintenance before and after a catheter is placed. The role of the ITT nurse as educator is invaluable and critical to reducing the incidence of complications. Patient safety and caregiver education has been included in ITT practice since the 1970s, long before the emergence of published literature demonstrating that patient education helps prevent CRBSI.

In the mid-1970s, options for health care at home were scarce. Few home healthcare agencies existed for referral that had the equipment or knowledge to care for patients with CVCs. To ensure patient safety at home, the ITT team at MD Anderson Cancer Center created a CVC care kit and taught patients and family members to perform ongoing maintenance and care. The program originally used one-on-one teaching (Richardson & Caillouet, 2004). Later, a more formal education program was developed to assist and promote self-reliance among patients and their family members in maintaining CVCs. Classes were held weekly and later daily; to date, they are held twice each weekday and once on Saturdays and Sundays.

In 1981, a video on catheter care was developed to facilitate the educational process and maximize the efficiency of ITT nursing staff (Richardson & Caillouet, 2004). The CVC care video has been revised numerous times to reflect changes in practice as set forth by the professional and national regulatory standards of the Centers for Disease Control and Prevention (2010), Infusion Nurses Society (Gorski, Perucca, & Hunter, 2010; Infusion Nurses Society, 2011), and Oncology Nursing Society (Camp-Sorrell, 2011); the latest revision was completed in 2009. Changes in CVC care have included the conversion to chlorhexidine-based antiseptic solution and dressings, adaptation of zero reflux connector caps, and educational emphasis on aseptic techniques geared toward preventing CRBSI. In 2010, the film won the National Health Information Merit Award for Patient Education (National Health Information Awards, 2010).

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Catheter-Related Bloodstream Infection

Because the use of CVCs for venous access is essential in treating patients with cancer, the risk of CRBSI is imminent. In the United States, an estimated 80,000 cases of CRBSI occur in intensive care units and 250,000 cases occur in all hospitals (O’Grady et al., 2011); 12%–25% of those cases result in death (Harnage, 2008; O’Grady et al., 2002). Although CRBSI is highly avoidable, it is the most common type of hospital-acquired infection (Stone et al., 2010) and can cost more than $1.4 billion per year to treat (Ryder, 2010). In 2008, the Centers for Medicare and Medicaid Services issued a regulation on nonpayment for conditions such as hospital-acquired infections, including CRBSIs that occur during the hospital stay and are not present on admission (Stone et al., 2010). Because of the high medical costs and mortality, the Centers for Disease Control and Prevention recommend the use of standardized practices to decrease the occurrence of CRBSI (O’Grady et al., 2002).

CRBSI has four common sources (Haday, 2006; O’Grady, 2002; Richardson, 2007). A break in the skin during catheter insertion allows microorganisms normally present on the skin to gain access to the circulatory system and potentially cause infection. For catheters used long term, the frequent manipulation of catheter connector end caps and their potential for contamination is the usual cause of CRBSI (Haday, 2006). Another source is contaminated infusates, which permit pathogens to enter the catheter and bloodstream. Finally, hematogenous seeding, which occurs when microorganisms from another infectious site travels to and invades the CVC (e.g., bladder infection), also can lead to CRBSI.

Literature Review

Limited published information is available about detailed educational programs geared toward patients and caregivers in the care of CVCs. The authors conducted a literature review using the electronic databases PubMed, CINAHL®, and Scopus and the keywords patient education, central venous catheter care, home care, and CRBSI. Cole (1999) asserted that initiatives to involve patients and family members in CVC care promote patient satisfaction and reduce the incidence of CRBSI. In addition, three articles were identified that focused on the benefit of patient education in preventing and reducing CRBSI (Møller & Adamsen, 2010; Møller, Borregaard, Tvede, & Adamsen, 2005; Santarpia et al., 2002).

The study by Santarpia et al. (2002) showed that formal and detailed instruction on the use and care of CVCs, with meticulous attention to aseptic techniques given by a specially trained team to patients and caregivers, reduced the incidence of CRBSI. Santarpia et al. (2002) compared group A, which received written and oral instructions on CVC care, to group B, which received more detailed instructions and training sessions on CVC care with central focus on aseptic technique and identification of complications. Results showed that group A had a CRBSI incidence of 6 per 1,000 catheter days, whereas group B had 3 per 1,000 catheter days (p < 0.001) (Santarpia et al., 2002).

Møller et al. (2005) showed that “systematic individualized, supervised patient education is able to reduce catheter-related infections” (p. 330). A control group that received inpatient and outpatient CVC care coordinated by nurses was compared to the intervention group, which was taught to perform self CVC care. In that study, the education program provided to the intervention group was focused on the theory and practice of CVC care, such
as cleanliness, sterile techniques in performing the procedure, uses for the catheter, and the risks involved. The result showed the incidence of CRBSI was 4.22 per 1,000 catheter days in the control group and 1.92 per 1,000 catheter days in the intervention group (p < 0.05) (Møller et al., 2005).

Finally, Møller and Adamsen (2010) found that patients who received an in-depth, individualized instructional CVC care program felt more self-reliant and accountable for their own care compared with patients who received nursing care. The self-care group also believed that their self-confidence increased their autonomy and decreased their reliance on nurses. Although Møller and Adamsen's (2010) study explored patients' clinical and psychological responses to CVC care, it also showed that patients' feeling of efficiency in performing CVC care and their knowledge of aseptic techniques possibly helped prevent CRBSI, based on the results of a previous study that showed a decrease of CRBSI by 50% (Møller et al., 2005).

Historically, patients and their caregivers did not commonly participate in CVC care (Cole, 1999). MD Anderson Cancer Center is an exception in that the patient education program has been in place since the 1970s. Because of the time span, reviewing patient outcomes and determining whether the education has been an effective means of preventing CRBSI would be difficult, as creating a control group would require withholding the complete educational program from some patients. However, the authors presumed that the evolving education program has contributed to the historically low CRBSI rate at the institution in inpatient and outpatient areas, which also was supported by the other published study results in the literature review. To date, the institution's annual infection control report shows a steady decline in its CRBSI rate per 1,000 catheter days (0.42 in 2006, 0.28 in 2007, 0.28 in 2008, 0.18 in 2009, and 0.12 in 2010).

Developing a Patient Education Program

In developing a patient education program, comprehension level, language barriers, literacy, communication disabilities, and preferred learning methods must be considered. Nurses should be attentive to signs of those issues. According to Vandevuur (2009), “Adults are not content oriented; adults are self-directed and problem centered, and they need and want information that can be readily adapted” (p. 207). According to the National Work Group on Literacy and Health (1998) report, education materials for patients with inadequate literacy should be written at the fifth-grade level. The average reading level of an adult is between eighth and ninth grade, and one of every five individuals can read only at the fifth-grade level (Doak, Doak, & Root, 1996). Because most illiterate people will not acknowledge that they are unable to read, write, or comprehend information beyond a fourth-grade level (Bastable, 2008; Cole, 1999), literacy must be considered in the presentation of the instruction. Adult learners, particularly those with hearing and visual deficits, tend to opt for printed instruction (Hainsworth, 2008). The use of audiovisual technology increases retention because the learners are able to relate printed information and the actual performance of a task (Hainsworth, 2008). In consideration of the patient population at MD Anderson Cancer Center, the patient education department chose a sixth-to-eighth-grade reading level to develop patient education materials that would be readable and understandable by most patients.

At MD Anderson Cancer Center, all patients needing CVC care are required to receive specific education on their catheter before the central line is placed. Patients and their at-home caregivers receive the written information handout Prevention of Central Venous Catheter–Related Infections (see Figure 1). The full hand-out provides an overall review of CRBSI and its prevention, as well as information regarding the risks, preventive measures, and signs of CRBSI; changing the CVC dressing; and the change procedures for the connector injection cap. If a patient or caregiver expresses that he or she is not ready to assume this responsibility, their

The purpose of this document is to point out certain steps in the care of your central venous catheter that are important in decreasing your risk of getting a catheter infection.

What is a catheter-related bloodstream infection (CRBSI)?
- A CRBSI happens when bacteria gets in the catheter and then enters your blood stream.
- The two most common sites that often contribute to the development of a CRBSI are the catheter insertion site and the catheter hub.
- Cleaning the catheter site and hub as you have been taught is very important.

What puts me at risk for getting a CRBSI?
- Low white blood cell counts, as white blood cells help fight infection
- Not washing your hands before and after changing your dressing
- Improper changing of your catheter dressing and cleaning of your catheter
- Not changing your dressing routinely or when it is wet or soiled
- Not cleaning the injection caps with alcohol before flushing your catheter

What can I do to decrease my chance of getting a catheter infection?
- Wash your hands thoroughly with soap and warm running water for at least 15 seconds using friction. Do this before and after changing your dressing.
- Change your dressing if it is wet or dirty.
- Always cover your dressing and all catheter parts with plastic and tape to protect them while showering.
- Clean the injection cap with an alcohol prep pad just before flushing your catheter.
- Flush your catheter at least three times a week up to once a day when you are not getting medicines.
- Don’t change your dressing in the bathroom or kitchen. Use a clean and quiet place, such as the dining table or bedroom.

FIGURE 1. Prevention of Central Venous Catheter–Related Infections

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Patients or their caregivers are required to attend the CVC care class, which addresses catheter flushing, connector cap change, and the sterile dressing change competency. The class requirement was added to the written consent form for the catheter insertion procedure. The standard is to attend the outpatient ITT clinic for routine care or use as a resource (see Figure 2). The video Care of Your Central Venous Catheter describes a systematic process for safely caring for a CVC. The video presents information on the different types of catheters, sites of insertion, parts of the catheter, and uses for the catheters. Weekly connector cap change, routine flushing of the CVC, and changing CVC sterile dressing are highlighted. Emphasis is placed on proper hand-washing technique before and after the care procedures, the importance of maintaining sterile technique, and the difference between clean and sterile. In addition, frequently asked questions, signs and symptoms of complications, protection of the catheter during showering, when and how to report problems or issues, and the hours and contact telephone numbers of the ITT clinic are reviewed. A voiceover verbalizing the step-by-step instructions and written text added to still shots also draw attention to salient points and details.

The remainder of the CVC care class consists of a 30-minute didactic lecture, nurse demonstration of caring for a locking flush and implementing a connector cap change, hands-on practice by the learners, and instructions about the return demonstration requirements. Information is given on the availability of the MD Anderson Patient Learning Center, where patients can go to view the CVC care class video, access it online via myMDAnderson (a secure Web site), or purchase a copy of the video in DVD format for home reference. The film also is available on demand on all hospital network televisions at MD Anderson Cancer Center.

Class attendance is documented, with about 750 students attending the CVC care class each month. Patients and caregivers can choose to repeat classes as often as they like. After fulfillment of the class requirements and when a patient or caregiver feels confident about performing CVC care, a one-on-one return demonstration is scheduled with an ITT nurse to validate the knowledge and skills learned. During the demonstration, the ITT nurse evaluates for readiness and competence in CVC care. A certificate of completion is awarded when the return demonstration is performed.

FIGURE 2. Preparation for Central Venous Catheter Dressing Change

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Implications for Practice

- An organized and systematic patient educational program on central venous catheter care that focuses on sterile technique is a significant strategy to prevent catheter-related bloodstream infection.
- The role of nurses as educators is essential to achieve safe and high-quality standards of patient care.
- An educational program using detailed written instructions, audiovisual presentation, instructor-led discussion, hands-on practice, and one-on-one return demonstration to validate knowledge and skills learned can empower patients and caregivers to participate in their own care.

Conclusions

Complying with the Joint Commission’s national safety goal to use evidence-based practices that prevent CRBSI and implementing those measures requires a strategic and organized education program to directly target and reduce the incidence of CRBSI, a highly preventable adverse event. The use and incorporation of evidence-based products and the implementation of best practices to improve health care and promote safety can be accomplished most effectively through the development of educational initiatives and standard guidelines. In addition, nurses and their institutions should keep abreast of current available healthcare trends and evidence-based medicine.

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References


**For Exploration on the Go**

Learn more about catheter-related infections in *Access Device Guidelines: Recommendations for Nursing Practice and Education* by Dawn Camp-Sorrell by opening a barcode scanner on your smartphone. Point your phone at the code and take a photo. Your phone will link to the content automatically. Or, access this content at http://esource.ons.org/ProductDetails.aspx?SKU=INPU0600.

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