



Central Line–Associated Bloodstream Infection: Not Just an Intensive Care Unit Problem

Alyssa Whited, RN, MSN, AOCNP®, and Janell M. Lowe, MSN, ARNP, AOCNP®

Central line–associated bloodstream infection (CLABSI) is an ongoing issue in health care, causing increased mortality and billions of dollars in healthcare costs. The majority of research and implementation has been done in the intensive care unit (ICU) setting. Although thousands of non-ICU patients are known to have CLABSI, adequate research has not been conducted in this population. This article explores the current literature on CLABSI and recommends additional research to focus on the non-ICU population and setting.

Alyssa Whited, RN, MSN, AOCNP®, is an inpatient nurse and Janell M. Lowe, MSN, ARNP, AOCNP®, is an inpatient advanced RN practitioner at Moffitt Cancer Center in Tampa, FL. The authors take full responsibility for the content of the article. The authors did not receive honoraria for this work. No financial relationships relevant to the content of this article have been disclosed by the authors or editorial staff. Whited can be reached at alyssa.whited@moffitt.org, with copy to editor at CJONEditor@ons.org.

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Healthcare-associated infections can cause substantial harm or even death. Central line-associated bloodstream infections (CLABSIs) are frequent healthcare-related infections that have a high mortality rate of 12%–25% (Centers for Disease Control and Prevention [CDC], 2011). Those infections are preventable problems. Since 2001, a vast reduction of CLABSIs has occurred in intensive care unit (ICU) patients (CDC, 2011). Many hospitals nationwide have had excellent success in implementing programs to reduce or eradicate ICU CLABSI rates, saving billions of dollars and thousands of lives (CDC, 2011). From 2001–2009, the number of CLABSIs in U.S. ICUs dropped substantially from 49,000 to 18,000 (CDC, 2011). That dramatic decrease is attributed to large-scale projects that have focused on implementing best practices to reduce CLABSI in ICUs. Some of the strategies implemented in those projects included adhering to guidelines for best insertion practices, implementation of care bundles, education programs for staff, and an improved culture of safety (CDC, 2011).

Despite the successful reduction of CLABSI rates in ICUs, thousands of patients outside of the ICU continue to contract those infections. The CDC (2011) estimated that 37,000 outpatient hemodialysis recipients and 23,000 hospitalized patients in non-ICUs developed CLABSIs in 2008 and 2009, respectively, representing a potential 60,000 lives at risk and billions in extra healthcare costs. The purpose of this article is to explore the current literature on CLABSI and show that research is needed urgently for non-ICU patients.

Literature Review

A literature review was conducted to identify current research studies involving CLABSI. In 2002, guidelines on preventing CLABSI (CDC, 2002) led to multiple research studies looking at CLABSI rates in ICUs. A pioneer study included all adult ICU patients in Michigan (Pronovost et al., 2006). The ICUs implemented five evidence-based procedures recommended by the CDC that have been found to significantly reduce

CLABSIs: “hand washing, using full-barrier precautions during the insertion of central venous catheters, cleaning the skin with chlorhexidine, avoiding the femoral site if possible, and removing unnecessary catheters” (Pronovost et al., 2006, p. 2726). Central line removal was discussed daily at rounds, a cart was created with all the supplies needed for central lines, a checklist was created to ensure adherence to policy, and CLABSI rates were provided at monthly and quarterly meetings. The result was a significant decrease in the number of CLABSIs; in the first three months after the changes were initiated, “the median rate of infection decreased from 2.7 per 1,000 catheter-days at baseline to 0” (Pronovost et al., 2006, p. 2729). Lasting benefits of the changes also were seen with a 66% decline in CLABSIs 18 months postintervention (Pronovost et al., 2006). The study showed that change in practice can have a significant impact on CLABSI rates in ICUs.

A study that included all 23 ICUs in Rhode Island provided education for clinicians and again incorporated the five evidence-based behaviors recommended by the CDC for reducing CLABSI (DePalo et al., 2010). The intervention resulted in lower CLABSI rates in January 2006 and a further decline to zero CLABSIs reported by any of the ICUs in June 2008 (DePalo et al., 2010).

Similarly, other studies have examined the remaining CLABSIs present in an ICU after implementation of a central line bundle that included education of the nurses and physicians, using carts with all supplies for central line insertions, using a checklist during insertion, stopping procedures if any guidelines have been violated, and doing a daily

assessment of central line need (Shuman et al., 2010). A large percentage of the CLABSIs occurred in both peripherally inserted central catheter (PICC) lines and nontunneled hemodialysis catheters (Shuman et al., 2010). Vancomycin-resistant enterococci were the most common cause of CLABSI, as well as the most common bacteria associated with the contaminated specimens (Shuman et al., 2010). Even with a small sample size, the study helped to identify ways to reduce CLABSI in the ICU setting and reported a significant number of contaminated blood cultures resulting in a higher rate of CLABSIs (Shuman et al., 2010).

A similar study also was done in adult ICUs that had already implemented a central line insertion bundle and looked at the remaining CLABSIs present in the unit (Guerin, Wagner, Rains, & Besse- sen, 2010). A postinsertion bundle was implemented involving daily inspection of the line; changing the dressing when wet, soiled, or every seven days; using chlorhexidine gluconate-impregnated sponges at the site of insertion; scrubbing the hub prior to accessing the line; and always using proper hand hygiene. Guerin et al.'s (2010) study resulted in a significant decrease in the number of CLABSIs and supported the need for additional management of the line in combination with a central line inser- tion bundle.

Assessment of Education Programs

A variety of intervention studies imple- menting an educational program for staff to improve CLABSI rates was reviewed. Each study developed a pre- and post-test and used different education programs to highlight best practices. Santana, Furtado, Wey, and Medeiros (2008) used one-hour lectures by infection control experts, sup- plemented with fact sheets and monthly data reporting on the CLABSI rates. Another study by East and Jacoby (2005) focused on compliance to the central line policy in the cardiac ICU. An education module was used along with fact sheets and posters discussing prevention of CLABSIs (East & Jacoby, 2005). Finally, Pérez Parra et al. (2010) presented the main points from the CDC's (2002) guidelines on CLABSI pre- vention to all staff in the ICU (see Figure 1). The only interventions in those stud-

ies were education programs for the staff directly involved in the care and insertion of central lines. All three studies found a significant decrease in the incidence of CLABSI and better compliance with cen- tral line policies at their institutions (East & Jacoby, 2005; Pérez Parra et al., 2010; Santana et al., 2008).

Staff education may reduce the inci- dence of CLABSIs (Bizzarro et al., 2010; Horvath et al., 2009; Wylie et al., 2010). Horvath et al. (2009) looked at implement- ing an education program to improve compliance with the central line policy. An IV audit tool was created along with an education program for all nurses and physicians; the intervention resulted in better staff compliance with central line care protocols (Horvath et al., 2009). Other programs have provided education on central line placement, dressing changes, access and use of a closed medication system, limiting placement, and prompt removal; information about CLABSI rates also was given to staff (Bizzarro et al., 2010). Wylie et al. (2010) found that length of access of the central line (time not specified) and receiving paternal nutrition and blood products during hospitalization were risk factors for CLABSIs in a pediatric ICU. Having the central lined placed in the ICU also increased patients' risk of devel- oping CLABSI (Wylie et al., 2010).

Comparison of Infection Rates in Other Populations

CLABSI rates in non-ICU patients may be similar to the rates of infection in the ICU setting (Climo et al., 2003; Marschall et al., 2007). Marschall et al. (2007) looked at patients admitted over 13 months and found that, although the rate of usage for central lines was lower, 42 CLABSIs occurred during the study period, which was similar to rates found in ICUs across the United States. In addition, a study by Climo et al. (2003) compared the incidence of central lines between the ICU and general medical floors by implementing one day of sur- veillance in all inpatient units and ICUs. Although the usage and prevalence of central lines were higher in the ICU, the overall number of central lines in the hospital was higher outside of the ICU, with 70% of the central lines located on general wards (Climo et al., 2003). Both Climo et al. (2003) and Marschall et al.

(2007) looked at the number of central lines that exist outside the ICU and described the need for more research involving those patients because of the large number of central lines found on non-ICU floors.

Research focusing on patients with cancer and central lines has primarily in- volved the pediatric population. The aim of those studies was to collect data about the demographics of patients who devel- op CLABSI and identify common risk fac- tors. Findings demonstrated an increased risk in patients with nontunneled central lines and Hickman catheters compared to those with implantable ports and PICC lines (Adler et al., 2006; Mollee et al., 2011; Worth, Black, Seymour, Thursky, & Slavin, 2008).

Implications for Practice

CLABSIs contribute to additional hos- pital costs of more than \$36,000 per infection, extend hospital stays, and raise mortality rates (U.S. Department of Health and Human Services, 2011). Prevention of CLABSI in ICU patients has saved billions of dollars, and bil- lions more can be saved by preventing those infections in non-ICU patients. Providers who care for patients with central lines outside of the ICU must be diligent in their practice to prevent

- ✓ Use full sterile sheet when inserting a central line.
- ✓ Use the subclavian vein, when possible.
- ✓ Use a needleless system.
- ✓ Clean skin with 2% chlorhexidine gluco- nate prior to insertion.
- ✓ Establish and follow a dressing protocol.
- ✓ Wash hands.
- ✓ Adhere to the best possible frequency of dressing changes.
- ✓ Use a multilumen central line for the ad- ministration of parenteral nutrition.
- ✓ Properly manage suspected CLABSI.
- ✓ Establish a protocol for tubing changes.

CLABSI—central line—associated blood- stream infections

FIGURE 1. Key Points for CLABSI Prevention

Note. Based on information from Centers for Disease Control and Prevention, 2002; Pérez Parra et al., 2010.

- ▶ Centers for Disease Control and Prevention Guidelines for Prevention of Intravascular Catheter-Related Infections
www.cdc.gov/hicpac/BSI/BSI-guidelines-2011.html
- ▶ Healthcare-Associated Infections Resources and Frequently Asked Questions
www.cdc.gov/HAI/bsi/bsi.html
- ▶ National Healthcare Safety Network
www.cdc.gov/NHSN
- ▶ On the Cusp: Stop Health Care-Associated Infections
www.onthecuspstophai.org

FIGURE 2. Resources on Central Line-Associated Bloodstream Infections

CLABSI. Until evidence is sufficient to determine best practice to prevent CLABSI in the non-ICU patient, healthcare providers should implement practices that have had success in the ICU in reducing CLABSI rates. Implementation of care bundles, educational programs for staff on central lines and prevention of infection, recognizing risk factors for infection, and implementation of CDC guidelines for maintaining central lines should be common practice.

Care bundles are a group of best practices implemented together to have an impact on the number of CLABSIs. Those bundles have been shown to greatly reduce the incidence of CLABSIs (Pronovost et al., 2006). The bundles included using carts with all supplies for central line insertions, using a checklist during insertion, stopping procedures if any guidelines have been violated, daily assessment and documentation of the need for having a central line, daily inspection of the insertion site, site care as needed and every seven days, hand hygiene before handling the IV system and for 15 seconds before each use, and scrubbing the infusion hub with alcohol (Guerin et al., 2010; Shuman et al., 2010). Care bundles need to be individualized to every setting, as some practices used in care bundles in the ICU may not be applicable in a non-ICU setting. Many non-ICU settings infrequently insert but often maintain, use, and care for central lines. When creating care bundles for the non-ICU setting, healthcare providers can look to the CDC guidelines for best practices.

One recommendation for reducing CLABSI is performing a daily evaluation of the clinical need for a central line (Pronovost et al., 2006). Central lines should be evaluated by the physician or advanced practice professional, as well as the bedside nurse who most frequently uses and maintains the central line.

Education on central lines and CLABSI prevention is an easy but effective way to reduce the incidence of CLABSI. Staff education can be implemented in any healthcare setting, including non-ICU areas. Education programs that have demonstrated effectiveness in the ICU setting included education on central line best practices, lectures by infection control experts, distribution of fact sheets and easily visible posters, and providing monthly data on CLABSI rates. All staff members can be engaged in education interventions (East & Jacoby, 2005; Pérez Parra et al., 2010; Santana et al., 2008).

Conclusions

Although evidence showing similar outcomes in the ICU and non-ICU settings is insufficient at this time, healthcare providers should look at the current literature and guidelines and work within their own institutions to develop programs and policies to guide and assist them in preventing CLABSI (see Figure 2). The need for additional research is evident, and those who provide direct patient care, such as nurses and advance practice providers, must be directly involved.

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