



Prevention and Nursing Management for Central Line Associated Blood Stream Infection

**Sheetal Sakharkar ^{a*}, Ranjana Sharma ^a, Dinesh V. Mude ^b, Pooja Kasturkar ^c,
Pratibha Wankhede ^d, Kavita Gomase ^e, Prerna Sakharwade ^f
and Kanchan Bokade ^f**

^a Department Medical Surgical Nursing, Smt. Radhikabai Meghe Memorial College of Nursing, Datta Meghe Institute of Medical Sciences Sawangi (Meghe), Wardha, Maharashtra, India.

^b Department Pharmaceutics Chemistry, Dr. R.G. Bhojar Institute of Pharmacy, Wardha, Maharashtra, India.

^c Department Mental Health Nursing, Smt. Radhikabai Meghe Memorial College of Nursing, Datta Meghe Institute of Medical Sciences Sawangi (Meghe), Wardha, Maharashtra, India.

^d Department Community Health Nursing, Smt. Radhikabai Meghe Memorial College of Nursing, Datta Meghe Institute of Medical Sciences Sawangi (Meghe), Wardha, Maharashtra, India.

^e Department Obstetrics and Gynaecology, Smt. Radhikabai Meghe Memorial College of Nursing, Datta Meghe Institute of Medical Sciences Sawangi (Meghe), Wardha, Maharashtra, India.

^f Department Child Health Nursing, Smt. Radhikabai Meghe Memorial College of Nursing, Datta Meghe Institute of Medical Sciences Sawangi (Meghe), Wardha, Maharashtra, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JPRI/2021/v33i52A33555

Editor(s):

(1) Dr. Mohamed Salem Nasr Allah, Weill Cornell Medical College, Qatar.

Reviewers:

(1) Durvanei Augusto Maria, São Paulo University, Brazil.

(2) Fesih Aktar, Dicle University, Turkey.

Complete Peer review History, details of the editor(s), Reviewers and additional Reviewers are available here:
<https://www.sdiarticle5.com/review-history/75195>

Short Communication

Received 11 September 2021

Accepted 23 October 2021

Published 27 November 2021

ABSTRACT

Central line associated blood stream infection (CLABSI), is a substantial contributor to in-hospital morbidity and death, as well as increased cost and length of stay in the intensive care unit (ICU). CLABSIs are one of the most deadly for each infection is expected to have a mortality rate of 12-25 percent. CLABSI prevention is important, and nurses play a vital role. Nurses are required to complete initial training as well as annual competence tests for central venous catheter protocol

*Corresponding author: E-mail: sheetalmude14@gmail.com;

and other skills to ensure that they are delivering direct care to patients using the most up-to-date evidence-based practices.

Conclusion: CLABSI prevention bundles are the best method for implementing many interventions at once in addition to standardizing practice. Standard prevention bundles in addition to routine CLABSI education for staff are the most effective methods for preventing infection; it is inevitable that compliance with bundles will vary across healthcare institutions.

Keywords: Prevention; nursing care; central line related blood stream infection.

1. INTRODUCTION

Central line is referred to as an “intravascular catheter at or near to the heart, or in one of the major arteries that is utilized for blood infusions, blood withdrawals, and hemodynamic monitoring.” (CDC, 2020a). Common vessels utilized for central line placement include: Pulmonary artery, Aorta Superior vena cava, inferior vena cava, brachiocephalic veins, internal jugular veins, subclavian veins, external iliac veins, common iliac veins, and femoral veins [1].

CVCs are widely utilized in critically sick patients and have a number of advantages over peripheral intravenous access. Indwelling CVCs, on the other hand, have the potential to cause bloodstream infections, with the risk increasing as a result of a variety of factors including catheter selection, catheter placement, insertion method, and catheter care. The incidence of blood stream infections linked with CVCs has decreased significantly according to evidence-based recommendations. The use of improved technology in conjunction with the adoption of guidelines has the potential to minimize morbidity and mortality from infections caused by CVCs [2].

Central venous catheters allow for the safe administration of intravenous medications that cannot be given peripherally, as well as the administration of intravenous fluid resuscitation and the monitoring of hemodynamic parameters in patients suffering from septic shock, cardiogenic shock, decompensated heart failure, and pulmonary hypertension [3].

Despite its advantages, CVCs can act as entry points for localized and systemic bloodstream infections. As a result, a lot of work has gone towards lowering the number of bloodstream infections caused by CVCs [3].

CVCs are frequent intravenous catheters that are required for the treatment of some hospitalized

patients, particularly those who are severely sick. A CVC is implanted in around 5 million patients in the United States each year, resulting in over 15 million CVC days. Tunneled catheters and non-tunneled catheters are the two kinds of CVCs. Tunnel catheters are intended for long-term usage in chemotherapy or hemodialysis patients. Non-tunneled catheters are the most widely used CVC and are intended for short-term usage [4].

One of the most frequent hospital acquired infections, central line associated blood stream infection (CLABSI), is a substantial contributor to in-hospital morbidity and death, as well as increased cost and length of stay in the intensive care unit (ICU) [5].

Central line-associated bloodstream infections are defined by the CDC as “a laboratory confirmed bloodstream infection where an eligible primary bloodstream infection (BSI) organism is identified and an eligible central line is present on the laboratory confirmed bloodstream infection (LCBI) date of event (DOE) or the day before” (CDC, 2020a) [6].

The various kinds of hospital acquired infections; CLABSIs are one of the most deadly for each infection is expected to have a mortality rate of 12-25 percent. (CDC, 2002) [7].

In the critical care units in underdeveloped nations, central line associated bloodstream infections (CLABSI) are more common [5].

CLABSI is more common in ICUs because of emergency catheter placement, longer duration, and medication administration, and fluid administration; other confounding variables include chronic disease, elderly age, sepsis, and immune suppression. In the United States, CLABSI rates in ICUs and patient wards are 1.6 and 1.1 per 1000 catheter days, respectively [3].

Thousands of people in the United States are affected by CLABSI, resulting in billions of dollars in additional healthcare expenses. CLABSI cases

range from 250,000 to 500,000 each year in the United States, with each case costing an estimated \$46,000. CLABSI is considered to arise when there is a lapse in technique during CVC catheter placement or maintenance. Infection occurs When germs enter the circulation through the CVC, which is situated in a major vein in the patient's neck, chest, or groin area. With non-tunneled catheters, the catheter is placed inside of the body exposing only the hub – the access point of the catheter. Due to the percutaneous insertion approach that goes directly into the bloodstream, non-tunneled catheters have a greater incidence of CLABSI than tunneled catheters [8].

According to the Centers for Disease Control and Prevention (CDC), the two most prevalent causes of bacterial contamination of a CVC are a break in normal aseptic measures after insertion or a break in procedures during CVC care and maintenance by healthcare personnel. CLABSI must be verified by a test result indicating that the infection was caused by a particular source at the central line site at the time of catheter placement or within 48 hours after CVC removal [9].

Despite the fact that central lines are necessary for patient care, they are linked to an increased risk of infection. CLABSIs are caused by the colonization of microorganisms on the catheter's external surface or in the fluid route when the device is placed or used. A variety of species have a role in the formation of healthcare-associated infections (HAIs) and CLABSI [7].

Researcher showed that the frequency of each type of infection may vary in a hospital setting. In patients with MRSA infection, Madani TA identified surgical site infection (31.1%) as the most common type followed by pneumonia (27%), central venous catheter infection (13.5%), peripheral venous line infection (6.8%), and bacteraemia in 27% cases [10].

1.1 Risk Factors for CLABSI

CLABSIs can develop for a variety of reasons however; the qualities of the central line, its installation, as well as its after-installation care have a significant influence on total risk of infection development. CLABSI has a number of risk factors broken down into two varieties: *intrinsic* and *extrinsic* factors. Intrinsic risk factors are those that are non-modifiable features of the patient, including: patient age, underlying

illnesses or disorders, and gender of the patient. Extrinsic risk factors are variables linked with central line placement or maintenance that are possibly controllable. These include: prolonged hospitalization before central line insertion, parenteral nutrition, mill lumen central lines, lack of maximal barriers for central line insertion, femoral or internal jugular access site, multiple central lines, heavy microbial colonization at the insertion site, and central line insertion in an intensive care unit or emergency department [11].

1.2 Catheterization Site Selection

The internal jugular vein, the subclavian vein, and the femoral vein are the three most common locations for central venous catheterization. Each is linked to infectious, thrombotic, and mechanical problems, with the risks varying depending on the insertion location. For the sole aim of decreasing CLABSI, the subclavian location is recommended [12].

CLABSI prevention is important, and nurses play a vital role in this. Nurses are required to complete initial training as well as annual competence tests for CVC protocol and other skills to ensure that they are delivering direct care to patients using the most up-to-date evidence-based practices [13].

Nurses are critical in the correct management of central lines and, as a result, in the prevention or development of CLABSIs. Nursing staff use central lines on a regular basis for a variety of purposes, including medicine administration, blood draws, and parenteral feeding supply. Nurses must be informed of current, effective, and evidence-based treatments in order to maximize central line management and avoid CLABSIs. CLABSI incidence will decrease when effective evidence-based treatments are implemented into nursing care, lowering the cost of care and length of stay for hospitalized patients while also improving patient outcomes [14].

2. DRESSING AND TAKING CARE OF CATHETERS

2.1 Chlorhexidine-Impregnated Dressings

There are two types of chlorhexidine gluconate-impregnated dressings on the market: Biopatch)

and the Tegaderm™ Chlorhexidine Gluconate (CHG) IV Securement Dressing. Both are considered to be members of the same product class because they contain chlorhexidine as the active ingredient, have the same anatomic site of action (skin around the catheter insertion site), deliver chlorhexidine locally to the catheter insertion site and surrounding skin, and have a similar delivery time span. (E.g. while dressing is present). Both have been demonstrated to help prevent catheter colonization and infections. A Cochrane review found moderate-quality evidence showing that chlorhexidine impregnated dressings reduce the frequency of catheter-related BSI per 1000 patient days compared with standard polyurethane dressings (RR 0.51, 95% CI 0.33 to 0.78) and reduce catheter tip colonization compared to standard dressings (RR 0.58, 95% CI 0.47 to 0.73) [15].

2.2 Disinfection Caps

Catheter manipulation for medication delivery poses a risk of contamination, thus precautions should be made to avoid the spread of harmful organisms. When manipulating access ports, use an antiseptic solution such as chlorhexidine, povidone iodine, an iodophor, or 70% alcohol to clean them. It's impossible to say how long cleaning should last. A research comparing scrub periods of 3, 10, and 15 seconds with 70% alcohol on catheters contaminated with a solution comprising *Staphylococcus aureus*, *Staphylococcus*, *Escherichia coli*, and *Pseudomonas aeruginosa* species found a roughly 20-fold reduction in CFUs/mL between the 3 and 15 second intervals. Although the study was likely under-powered, this difference did not approach statistical significance ($p = 0.09$). Human variables are included into successful decontamination operations due to the variation in efficacy between scrub periods. Passive hub decontamination, on the other hand, relies on hub and port coverings to keep the catheter hubs in touch with the cleaning solution [16].

Several disinfection cap products are available and have been shown to be effective in reducing hub colonization and CLABSI. In a retrospective study investigating the introduction of disinfection cap, CLABSI rates dropped from 1.682/1000 catheter days to 0.6461/1000 catheter days after implementing disinfection caps, achieving statistical significance. In an observational study in an oncology unit, a total of 3,005 catheter-days

and 1 CLABSI (0.3 infections/1,000 catheter-days) were documented during an intervention period where alcohol-impregnated port-protectors were introduced, compared with 6,851 catheter-days and 16 CLABSIs (2.3 infections/1,000 catheter-days) during the control period (RR, 0.14; 95% CI, 0.02–1.07; $p = .03$). As an effective antiseptic method that does not rely on active human intervention, disinfection caps are an attractive way to complement a comprehensive CLABSI reduction strategy [17].

The insertion, maintenance, and removal of central lines, according to the CDC's checklist for the prevention of central line-associated bloodstream infections (CLABSIs), are the three primary components of avoiding CLABSIs. To begin, correct insertion procedures must be followed. Preparing the insertion site with >0.5 percent chlorhexidine with alcohol, placing a sterile gauze or dressing over the insertion site, and using a chlorhexidine impregnate (CDC, 2011) [18].

Second, proper central line maintenance requires adhering to hand hygiene requirements, bathing intensive care unit (ICU) patients with a chlorhexidine preparation daily, thoroughly scrubbing the access port, using sterile devices to access catheters, replacing soiled dressings as soon as possible, performing routine dressing changes using aseptic technique, and changing administrators (CDC, 2011). Finally, the continued necessity for central lines must be assessed on a regular basis. Daily audits are recommended to determine whether each central line is still needed, and unnecessary central lines should be removed as soon as possible. CLABSI prevention bundles, educational strategies and training for healthcare personnel, daily chlorhexidine bathing, central line dressing changes, and catheter hub disinfection are all recommended [19].

2.3 Nurses' Prevention Strategies

The term "central line bundle" should be familiar to all nurses. The phrase refers to a set of five evidence-based central line insertion and management techniques (detailed below). When the bundled techniques are executed together, they produce better results than when each approach is done separately. Furthermore, the bundle method encourages multidisciplinary care team members to work together and collaborate [20].

Many case studies have shown that the central line bundle is effective [21].

The five main components of the central line bundle are:

- **Maintaining good hand hygiene.** Wash hands before and after palpating insertion sites or accessing, changing, or dressing a catheter. Include hand hygiene on the central line checklist, keep alcohol-based hygiene dispensers prominently displayed, and put signage in patient rooms as reminders to staff to enhance compliance in area. The most practical and cost-effective way to prevent hospital-acquired illnesses is to wash hands [18].
Maximal barrier precautions. One study found that when the line was inserted without the maximum barrier measures, the risk of CLABSI was six times greater. These precautions for the patient include draping the patient in a wide sterile drape with a tiny hole at the insertion site. For clinicians, this includes wearing a mask, cap, sterile gown, and sterile gloves, just as they would during surgery. To minimize the trouble of seeking out supplies, the easiest approach to assure compliance with this precaution is to have all required items stored together [7].
- **Chlorhexidine skin antisepsis.** According to studies, chlorhexidine protects against infection better than other antiseptics. It should be applied to the insertion site with a back-and-forth friction scrub for at least 30 seconds before the line is placed and allowed to dry fully. It's simple to improve compliance by adding this step on the central line checklist and keeping chlorhexidine solution available where central line equipment is kept — [18].
- **Choosing the best catheter location.** In adult patients, evidence-based guidelines advocate avoiding the femoral vein for catheter placement since studies have linked this location to increased infection risks. According to certain studies, using the subclavian site corresponds with lower infection rates than using the jugular location. The bundle method, on the other hand, is entirely focused on reducing the risk of CLABSI, and understands that other medical concerns should be addressed when determining where the line should be placed.
- (A physician should do a risk/benefit analysis as to which insertion site is most appropriate

for the individual patient, with input from care team members [4].

Daily evaluation of the need for a central line -

The objective here is to quickly remove lines that are no longer obviously needed for the patient's best care - not to leave them in place for easy access. As the line is left in place, the chance of infection grows. (Weekly reviews of need may be required when central lines are inserted for long-term usage, such as in chemotherapy.) [22]. Poor people belonging to the lower strata of society face more difficulties because of infection [23].

3. CONCLUSION

CLABSI prevention bundles are the best method for implementing many interventions at once in addition to standardizing practice. Standard prevention bundles in addition to routine CLABSI education for staff are the most effective methods for preventing infection; it is inevitable that compliance with bundles will vary across healthcare institutions. Staff nurses had complied with standard practice training 23.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
<https://www.sdiarticle5.com/review-history/75195>