PREVENTION OF CENTRAL VENOUS LINE ASSOCIATED BLOODSTREAM INFECTIONS- A LITERATURE REVIEW

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ABSTRACT

Hospital-acquired infections, particularly Central Venous Line-Associated Bloodstream Infections (CLABSIs), are a noteworthy concern in intensive care units (ICUs). CLABSIs not only extend hospital stays but also increase healthcare costs and pose serious threats to patients' well-being. This narrative literature review explores the evidence-based strategies for the prevention of CLABSIs in critical care settings. It emphasizes the importance of proper infection control measures, such as hand hygiene, maximal barrier precautions, and chlorhexidine skin preparation, to reduce the risk of infection. The choice of catheter insertion site, duration of catheter use, and nurse-patient ratios are also discussed as crucial factors in CLABSI prevention. Additionally, post-insertion care, including daily bathing with chlorhexidine, catheter patency maintenance, and dressing changes, is highlighted. The review underscores the need for healthcare workers to adhere to best practices and guidelines to minimize CLABSI rates, ultimately enhancing patient safety and reducing healthcare burdens. The findings emphasize the significance of informed practices in preventing CLABSIs and the potential for improved patient outcomes with their implementation.

Keywords: Central venous catheter, infection control, best practices, guidelines, Antimicrobial-coated catheters

INTRODUCTION

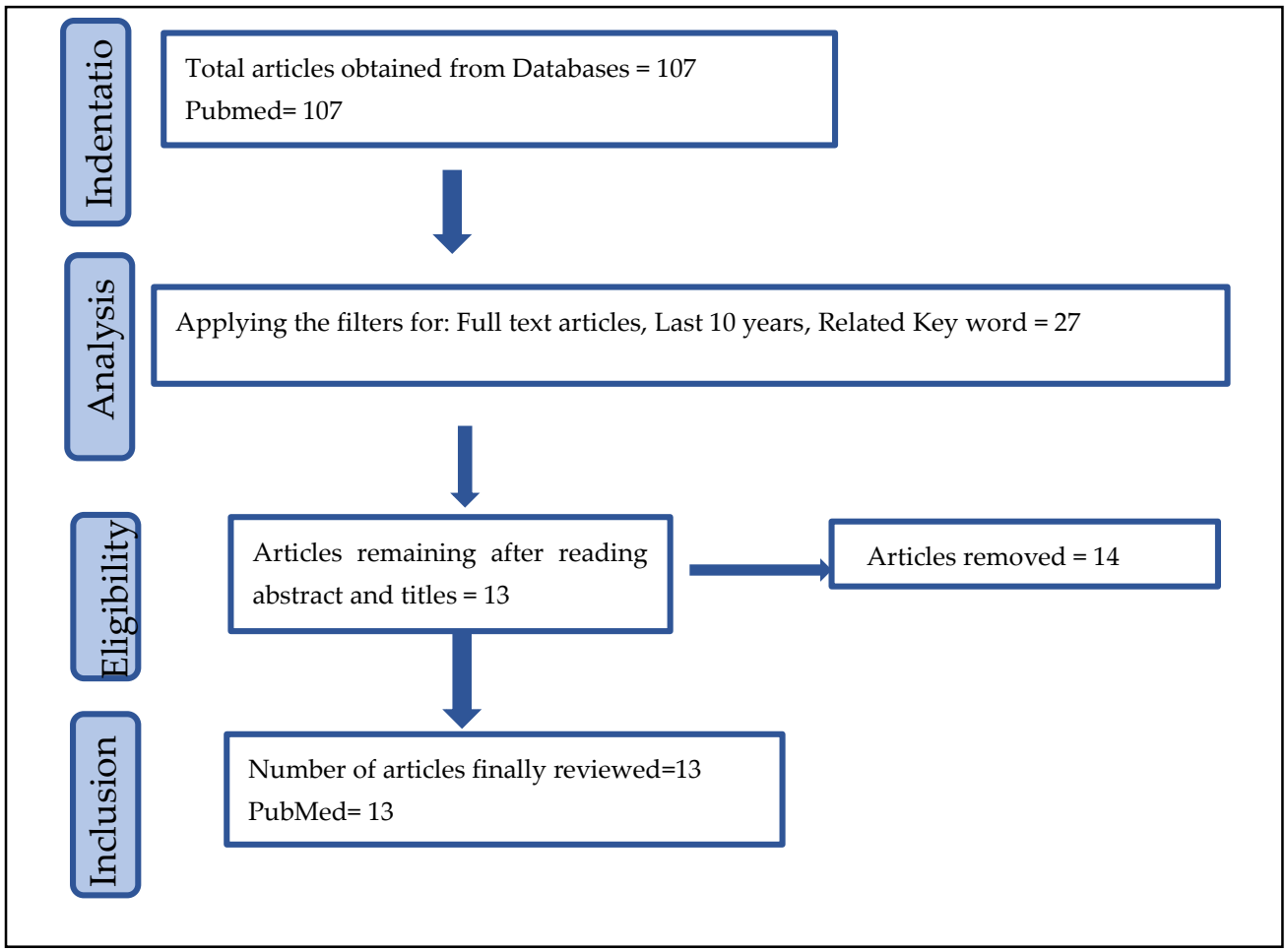
Hospital-acquired infections in intensive care units are a source of prolonged length of stay in the hospital, increased expenses on the patient, and, most importantly, the cause of morbidity and mortality (1). The infectious pathogens are sometimes resistant to multiple drugs and cannot be cured with a common or a single medication, exerting more burden on the patient and the hospitals. These infections contribute to severe health conditions in neonates (2). Similarly, infections can cause life-threatening illnesses in adult patients admitted into critical care units (1). A common source of nosocomial infection and higher incidence rates is improper dealing with a central venous line or central catheter. Infections related to central venous lines significantly contribute to hospital-acquired infections and sometimes sepsis in critical care patients (3. Central venous lines or central venous catheters are frequently used in critical patients to facilitate multiple purposes like administering medications and parenteral nutrition, infusing fluids, transfusion of blood products, performing plasmapheresis and dialysis, and measuring venous pressure. When inserted, the central lines are in place for several days and even weeks (4). Improper care and use without preventive measures of these catheters end up in infection spreading to the bloodstream and leading to sepsis, septic shock, and extra burden on the patient and healthcare system, as discussed above. Infections related to these lines are preventable by consistently incorporating evidence-based guidelines in patient care. The higher rate of bloodstream infections associated with the central line is due to poor compliance with infection control measures.

In addition, the incidence rate is reported to be higher in developing countries than in developed countries and resourceful settings. Several strategies have been revealed to control central line-related infections and make it useable for a maximum duration, including central line bundle of care, duration of the catheter, nurse-patient ratio, insertion site, and care of the catheter after insertion.
This review is taken on to recapitulate the evidence for effective prevention of bloodstream infections related to central venous lines in critical care units to address the question: is the evidence concluded to prevent central line-associated bloodstream infections effectively?

Search Strategy

PubMed data base was used for literature search purposes. The keywords included were, "central venous catheter" AND "infection control" AND " best practices" OR " guidelines" AND "Antimicrobial-coated catheters" AND "CLABSI reduction" OR "Bundle protocols" OR "CLABSI prevention" AND "Hand hygiene" OR "central line infection". The search yielded a total of 107 articles. Two filters were applied those were full text and last ten years. Only 27 articles remained after the application of filters. All 27 articles were reviewed and then 13 articles were included in the literature review. Articles published in high impact factor journals and relevant to the topic of interest were included. Literature search strategy is presented in Figure 1.

Figure 1. PRISMA Flow Chart of Literature Search Strategy



Review of the Literature

Overall improvement in the knowledge and practice regarding evidence-based practices for infection prevention related to central lines is required for healthcare workers. The study described that nurses' knowledge, attitude, and approach toward preventive measures of catheter-related infections can be enahnced with training with evidence-based policies (5). Poor compliance with infection control practices has contributed to higher catheter-related infection rates in ICUs (4).

Updated guidelines have been provided for preventing intravascular catheter-related infections. A study carried out with a project on quality improvement principles shows that a noteworthy reduction in catheter-related infections is possible with improved quality of care in ICUs (2). Adherence to infection control techniques is recommended, especially in patients with compromised immunity levels (6). The evidence-based practices are followed universally for preventing central line-associated bloodstream infections.

Application of Preventive Measures

Hand washing

Proper hand washing is essential to performing any procedure on a patient. Hand washing should be done before and after every procedure performed on a patient. A strong association has been shown between infection related to central line procedures performed without handwashing compared to procedures performed with handwashing (5, 7, 8).

Maximal barrier precautions

These are the personal kits to be worn by the person(s) performing the central line catheterization procedure, including the mask, gown, hat, gloves, and full body drape. Any equipment missing during the process can lead to an increased risk of infection. Lee, Cho (7), showed that the infection rate was lower in patients for whom a minimum of four of the five components were used, while it was considerably high where zero to three components were used.

Chlorhexidine skin preparation

The skin is prepared for the insertion site of the central line. Most commonly, the skin preparation is done with 2% chlorhexidine, which is more effective in preventing catheter-related infection than other solutions (8).

Site for the Catheter Insertion

Three sites are commonly used as insertion sites for central venous line catheters: the internal jugular vein, subclavian vein, and femoral vein (9). The subclavian vein is considered the safest site for the catheter in terms of catheter-related infections as compared to other sites, as catheters inserted peripherally are more susceptible to clotting and dislocating compared to the central venous catheter placed in the internal jugular or subclavian veins . However, the physician sometimes finds it convenient to insert the catheter into the femoral vein, an avoidable site for preventing the infection. So, considering an appropriate site, minimizing patients risk from disease and other complications to ensure the quality care improvement is needed to be preferred over own feasibility.

Duration of the Central Line Catheter

However, the catheter duration is not associated with the infection. Chi, Guo (5), said central venous catheters should be removed and replaced only when a related disorder is considered. Burnham, Rojek

(10), claimed that catheter removal in patients who caught an infection related to the catheter was effective compared to non-removal. Researchers also claim that peripherally inserted catheters must be replaced in 25 days to prevent catheter-related infections (11). The central venous catheter placed in an emergency situation must be replaced immediately (8). As the infection preventive guidelines are less likely to be applied appropriately in emergencies, the catheter must be replaced with infection prevention guidelines. In the light of the evidence provided, there is no specified time for the catheter removal. It should be removed when it is not required any further or in case of infection related to it.

Nurse Patient Ratio

A proper nurse-to-patient ratio is essential to ensure the delivery of holistic care. Aloush and Alsaraireh (12), reported that nurses working with a nurse-to-patient percentage of 1:1 are 6.3 times more likely to conform to infection prevention guidelines than a rate of 1:2 in critical care. Thus, a higher number of patients assigned to a single nurse can cause a failure for a nurse to give proper time to every patient and increase the risk of complications. Therefore, lowering the nurse-to-patient ratio can ensure compliance with preventive measures to prevent the infection.

Post Insertion Care of Catheter

Daily Bathing with Chlorhexidine

During stay in intensive care units, daily bath with chlorhexidine gluconate has been suggested as an effective intervention to control the rate of infections. Daily bathing of the patients admitted to ICUs is reported to overcome approximately 29% of bloodstream infections, 40% of central line-associated bloodstream infections, and 18% of multidrug-resistant organisms' infections (1). Reynolds, Woltz (3), also recommended an implementation program for nurses to change their behavior and improve knowledge and perception by adopting the guidelines based on chlorhexidine bathing, resulting in a significant 27.4% reduction in central line-associated bloodstream infections in the study.

Patency of Central Venous Catheters

Keeping the catheter patent is necessary for its long-term use, and for this purpose, proper flush and lock of the catheter is always essential to reduce the blood influx into the catheter. Using the catheter for a long duration may cause catheter occlusion, which further needs to be replaced, causing threats to the patient's health and the expenditure burden on the hospital and patient (13). Zhong, Wang (13), compared the use of normal saline and heparinized saline for flushing and locking the catheter and found no significant difference in both. Instead, the heparin further exposes the patient to coagulation disorder. So, it is recommended to regularly flush the catheter and lock it properly for its prolonged use.

Dressing Changes

The insertion site needs to be disinfected and applied with dressing and routinely observed for signs of infection and blood oozing. The preferable dressing for the site is transparent dressing and semipermeable rather than sterile gauze for the detection of early infection signs of infection; sterile gauze may be used if the patient is sweating, the site is oozing or bleeding actively (8). The dressing must be changed every seven days or if it becomes opaque, loosened or moist.

CONCLUSION

In conclusion, central venous line catheters are widely used in the hospital for accessing a large vein of the body for multiple purposes, like administration of medicine, parenteral nutrition, blood transfusion and performing procedures like dialysis and plasmapheresis. It must be placed with appropriate

guidelines and infection prevention measures to ensure patient safety from complications and save the hospital and patient from extra burden of prolonged hospitalization.

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