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# Knowledge and Practice of Nurses Regarding Central Venous Catheter (CVC) Associated Infection Prevention

**Wasim Sajjad[1*], Humaira Siddique[1], Rubina Jabeen[1] and Syeda Tasneem[1]**

[1]Department of Nursing, Superior University, Lahore, Pakistan

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***Corresponding Author:***
Wasim Sajjad
Department of Nursing, Superior University, Lahore, Pakistan
wasimsajjad2060@gmail.com

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## ABSTRACT

Central venous catheters (CVCs) are frequently utilized in intensive care units (ICUs) for the administration of fluids, medications, nutrition, and intravascular monitoring. A central venous catheter (CVC) is inserted into a major central vein, typically the internal jugular, subclavian, or femoral vein, with its lumen positioned within the inferior vena cava, superior vena cava, or right atrium. **Objective:** This study aimed to evaluate nurses' knowledge and practices concerning the prevention of infections associated with central venous catheters (CVCs). **Methods:** A descriptive cross- sectional research study was conducted from March 2023 to December 2023 at Jinnah Hospital, Lahore. Purposive sampling was done to recruit the participating nurses. A well-designed questionnaire was used for data collection after the validation. **Results:** The study was descriptive cross-sectional, so descriptive statistics were applied, frequency distribution was calculated, data normality was checked. The study reported that the knowledge participants with poor knowledge were 61(41.2%), the participant with low practice were 53(35.8 %). **Conclusion:** The study concluded that many nurses have poor knowledge, and bad practices regarding central venous catheter (CVC) associated infection prevention. Future research should focus on providing education to nurses regarding the standard protocol and precaution for maintaining central venous catheter.

## INTRODUCTION

A central venous catheter (CVC) is pushed into a major, central vein (usually the internal jugular, subclavian, or femoral) and its lumen is situated within the inferior vena cava, superior vena cava, or right atrium [1]. The placement of a central venous catheter (CVC) is among the most prevalent invasive procedures in critical care, emergency medicine, and cancer treatment. These devices are everywhere, and prolonged use may make people forget about the side effects over time. However, significant morbidity and mortality can be attributed to the device or the insertion procedure, and the overall complication rate for CVCs is approximately 20% [2]. Central line-associated bloodstream infections (CLABSIs) occur at a rate of 4.1 per 1000 central line days, making them the most prevalent complications associated with central venous catheters (CVCs)[3]. Higher rates of morbidity, mortality, and medical expenses are linked to CLABSIs. Patients with CLABSI are 2.75 times more likely to die in the hospital than those without the condition, according to a meta-analysis [4]. Central venous puncture complications are estimated to occur at 15%. These complications fall into two categories: infectious and mechanical. Pneumothorax, blood vessel cut, and hematoma are the most well-known mechanical problems [5]. A hematoma, a cardiac tamponade, a guidewire embolism, an air embolism, an arrhythmia, a thoracic duct injury, or an air embolism are less common but may be more serious. If the procedure is done correctly, some of these problems can be avoided [6]. Knowledge is

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considered a crucial element in the prevention of central line-associated bloodstream. It has been observed that nurses in the intensive care unit care for and spend most time with CVC-infected patients [7]. Implementing evidence-based best practices also contributes significantly to primary infection prevention. [8]. In addition to possessing sufficient knowledge and training in the prevention of CVC-BSI, health professionals are required to adhere to up-to-date CVC care guidelines, as per Centers for Disease Control and Prevention-CDC [9]. The literature emphasizes that nurses can avoid CVC-associated infections if they possess a thorough understanding of CVC-BSI and are mindful of evidence-based protocols and procedures [10, 11]. The proper practice of nurses is increasing the recovery of patients quickly. Several international organizations have published clinical practice guidelines for the prevention of CLABSIs. These guidelines typically include specific steps that healthcare workers who insert and handle CVCs should take [12]. The research studies investigate the fact that the infection rate is still high, and the nurses have limited knowledge regarding CVC-associated infection prevention [13, 14]. The central venous catheter CVC-associated infection is the ultimate cause of nosocomial infection and is responsible for high mortality and increased hospital stay.That ultimately burdens the healthcare system, so there is an intense need to highlight these issues. The established Central Venous Catheter (CVC) care and infection prevention guidelines fail to prevent nurses from keeping up with the protocols, which results in high Central Line-Associated Bloodstream Infection (CLABSI) rates. The lack of region-specific research about CVC-associated infections stands out since Pakistan specifically requires study because its healthcare infrastructure presents distinct differences compared to other countries regarding nursing practices, available resources, and institutional policies. Research has previously concentrated on generic infection control measures instead of investigating CVC-associated infection prevention methods in critical care areas. A tertiary care hospital needs this research because it will evaluate the existing knowledge processes of nurses about preventing infections related to central venous catheters. The assessment of such gaps allows healthcare professionals to develop specific training approaches that enhance both patient security and minimize hospital-acquired infections.

This study aimed to evaluate nurses' practices and knowledge in preventing infections linked to central venous catheterization.

## METHODS

A descriptive cross-sectional study was carried out at Jinnah Hospital Lahore from March 2023 to December 2023. The purposive sampling technique was used in the study. The study population was staff nurses in the surgical ward and ICU of Jinnah Hospital Lahore. At least six months of clinical experience in handling CVCs was the requirement for registered nurses. The study did not include nurses on leave or worked in outpatient departments. The sample size of 147 was determined using Slovin's formula, assuming a total population of 233 and a 95% confidence level and a 5% margin of error. Data were obtained from all staff nurses working in the surgical ward, medical ward, and ICU. An adopted questionnaire of knowledge and practice was used to gather the information from the study sample. The survey comprised various multiple-choice and closed-ended questions that addressed essential elements of CVC management, including sterilization procedures, personal hygiene, and catheter treatment processes. The questionnaire maintained English language usage to achieve maximum understanding by participants in the study. The instrument achieved validity through the expert review conducted by professionals who specialize in both infection control and nursing practice. The instrument obtained validity confirmation from panels of nursing professionals. A small nurse sample participated in the questionnaire reliability test, which produced a Cronbach's alpha value of 0.82, demonstrating adequate internal consistency. The survey examined nurse responses regarding both their understanding of catheter care frequency and their actual procedures. All participants received the questionnaire as a paper document with guarantees of anonymous response collection for confidentiality purposes. After collecting data, the data were computed using SPSS version 23.0, and frequency was determined. Ethical consideration was followed, which was organized by the superior university department of nursing. All confidentiality was ensured. Any participant who was not willing to participate was withdrawn from the study at any time, and there would be no potential harm or potential benefits for the study.

## RESULTS

This demographic table shows that majority of age group with 26-30 years as depicted in Table 1. Majority population were female. The Majority with married marital status. Majority of nurses with 10-15 years' experience. Majority with Post RN in Nursing. Majority of nurses working were in ICUs.

**Table 1:** Demographic Characteristics of participants

| Variables | Category | Frequency (%) |
|---|---|---|
| Age | 21-25 Years | 30 (20.3%) |
| | 26-30 Years | 55 (37.2%) |
| | 31-35 Years | 51 (34.5%) |
| | 36-40 Years | 12 (8.1%) |

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| | | |
|---|---|---|
| Gender | Male | 71 (48.0%) |
| | Female | 77 (52.0%) |
| Marital Status | Single | 73 (49.3%) |
| | Married | 75 (50.7%) |
| Experience | 1-5 Years | 19 (12.8%) |
| | 6-10 Years | 56 (37.8%) |
| | 10-15 Years | 69 (46.6%) |
| Qualification | Diploma in Nursing | 25 (16.9%) |
| | Post RN | 80 (54.1%) |
| | BSN (Generic) | 43 (29.9%) |
| Department | ICU | 67 (45.3%) |
| | Medical Wards | 48 (32.4%) |
| | Surgical Wards | 33 (22.3%) |

Most of the nurses have good knowledge regarding "Is changing the bandage at the catheter insertion site advised?" Majority of the Participants have average knowledge regarding "Routine replacement of Central Venous Catheters is advised?". The majority of participants possess mediocre levels of knowledge. regarding "It is advisable to disinfect the catheter insertion site with?" Majority of the Participants have average knowledge regarding "It is advisable to position the administration set while administering blood, blood products, or lipid emulsions via a Central Venous Catheter?'. The responses are shown in Table 2.

**Table 2:** Knowledge Questionnaires

| Questions | Respond | Frequency (%) |
|---|---|---|
| Is changing the bandage at the catheter insertion site advised? | Every 2 Days | 100 (67.6%) |
| | Every 7 Days | 39 (26.4%) |
| | No, Because..... | 9 (6.1%) |
| Is Routine replacement of Central Venous Catheters is advised? | Every 7 Days | 30 (20.3%) |
| | Yes, Every 3 Weeks | 21 (14.2%) |
| | No, Only When Indicated | 97 (65.5%) |
| Is it advisable to disinfect the catheter insertion site with? | 70% Alcohol | 35 (23.6%) |
| | 2% Chlorhexidine Gluconates with Alcohol | 84 (56.8%) |
| | Povidone-Iodine | 28 (18.9%) |
| | I Do Not Know | 1 (7%) |
| Is it advisable to position the administration set while administering blood, blood products, or lipid emulsions via a Central Venous Catheter? | Within 24 H | 25 (16.9%) |
| | Every 72 H | 38 (25.7) |
| | Every 96 H | 81 (54.7&) |
| | I Don't Know | 4 (2.7&) |

The response regarding practice questionnaires is presented in Table 3. Majority of the participants were high practice regarding "Do you provide the patient with information about the surgery when communication is possible?'. Majority of the participants were good practice regarding "Do you obtain consent from the patient and/or their relatives?' Majority of the participants were moderate practice regarding, "Do you place the patient in the proper anatomical position?'. Majority of the participants were poor practice regarding "Do you use gloves, a cap, a mask, a gown, and a field as part of sterile technique?'.

**Table 3:** Practice Questionnaires

| Questions | Respond | Frequency (%) |
|---|---|---|
| Do you provide the patient with information about the surgery when communication is possible? | Never | 26 (17.6%) |
| | Seldom | 20 (13.5%) |
| | Always | 102 (98.9%) |
| Do you obtain consent from the patient and/or their relatives? | Never | 21 (14.2%) |
| | Seldom | 25 (16.9%) |
| | Always | 102 (98.9%) |
| Do You Place the Patient in The Proper Anatomical Position? | Never | 16 (10.8%) |
| | Seldom | 49 (33.1%) |
| | Always | 83 (56.1%) |
| Do you use gloves, a cap, a mask, a gown, and a field as part of sterile technique? | Never | 37 (25.0%) |
| | Seldom | 52 (35.1%) |
| | Always | 59 (39.3%) |

## DISCUSSION

Majority of Participants respond to every 2-day option to the question that the "Is changing the bandage at the catheter insertion site advised?" were 100(67.6%). Majority of Participants respond to No when indicted option to the question that is the routine replacement of Central Venous Catheters advised? Were 97(65.5%). Majority of Participants responded to 2% chlorhexidine gluconate with alcohol option to the question that it is advisable to disinfect the catheter insertion site with? was 84(56.8%). Majority of Participants respond to every 96-h option to the question that the When blood, blood derivatives, or lipid emulsions are infused by a Central Venous Catheter, it is recommended to place the administration set?'. were 81(54.7%). Majority of Participants respond to always option to the question that Do you provide the patient with information about the surgery when communication is possible? Were 102(98.9%). Majority of the nurses were Always 102(98.9%) to the question "Do you obtain consent from the patient and/or their relatives? Majority of the nurses were strongly always 83(56.1%) to the question Do you place the patient in the proper anatomical position?". Majority of the nurses were always 59(39.3%), to the question "Do you use gloves, a cap, a mask, a gown, and a field as part of sterile technique? Findings were compared to the existing literature on infection prevention associated with the CVC.The studies highlight the importance of knowledge and adherence to infection protocols to minimize the risk of infections, like the findings of this study [15, 16]. Furthermore, as in the current study, it was observed that ICU nurses' knowledge of infection prevention protocols was suboptimal just like current research [17]. However, the study suggests that education programs can increase nurses' knowledge and practice toward the prevention of CVC-associated

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infection and suggests different types of interventions. For improving the skills of nurses in a critical care setting, workshops, simulation training for correct sterile techniques, and interactive case studies are some of the types that will be effective strategies, for instance. Previous studies have demonstrated that simulation-based training leads to significant improvements in healthcare workers following infection control protocols [18]. A more detailed comparison with previous studies has been made. For instance, it has been found to be a similar lag in nursing knowledge as in this study, but this study accounts for the additional gap inventory via the nursing practice's part. In line with these recommendations, studies agree with the need for increased training and protocol compliance, which is supported by these studies [19, 20]. The majority of participants have mediocre knowledge.The current investigation identified inadequate knowledge and practice for the prevention of infections associated with central venous catheters using a cross-sectional study methodology. The present study examines the degree of central venous catheter-related infection prevention knowledge and practice. The future research can work on enhancement of knowledge and practice by conducting experimental studies through which they can assess knowledge and practice to give the intervention for improving the expertise and conduct by nurses related to central venous catheter associated infection prevention .Future research can provide education to nurses regarding the standard protocol and precaution for maintaining central venous catheter.

## CONCLUSIONS

The current study concluded that the knowledge and practice regarding central venous catheter-associated infection prevention is poor. This is the need for time to work on nurses' knowledge and practice regarding infection prevention of central venous catheters. This can reduce the infection, which is related to central venous catheters, and improve the patient's condition. There is a high need to better nurse knowledge and practice through conducting education programs regarding central venous catheters.

## Authors Contribution

Conceptualization: WS, HS
Methodology: WS, HS
Formal analysis: WS, RJ, ST
Writing review and editing: WS, HS, RJ
All authors have read and agreed to the published version of the manuscript.

## Conflicts of Interest

All the authors declare no conflict of interest.

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