Nurses' Knowledge and Practice Regarding Care of Central Venous Line in Intensive Care Units

Amal Karem Abd Azem[1*], Amany Mohammed shebl[2], Mona Abed El-Rahman[3]

[1]*PhD student, Assistant Lecturer at Department of Medical Surgical Nursing, Faculty of Nursing, Port Said University;* [2]*Professor of Medical Surgical Nursing, Faculty of Nursing, Port said University;* [3]*Assistant Professor of Medical Surgical Nursing, Faculty of Nursing, Port said University.*

ABSTRACT

Background: Critical care patients typically need a central venous line (CVL) for blood and fluid delivery and pressure monitoring. Nurses must understand CVL maintenance to avoid catheter issues and identify issues. Safety and improved patient outcomes derive from this expertise. **Aim of the study**: to evaluate nurses' knowledge and practice concerning care of CVL in intensive care unit. **Subjects and method:** The descriptive research was conducted at the critical care units of El Salam Hospital, El-Zohour Hospital, and El Hayat Hospital, all affiliated with the Egypt Health Care Authority and situated in the Port Said Governorate of Egypt. A convenience sample of sixty-five nurses was utilised, comprising those available from the specified locations. **Tools:** Data was collected utilizing two tools: a knowledge assessment questionnaire with demographic information, nurses' comprehension of central lines, blood stream infections (BSI), and care components. Nursing Practice Observational Checklist. **Results:** The study found that most intensive care units staff nurses lack center venous line management skills and practices. A substantial positive association was found between nurses' center venous line care knowledge and practices. **Conclusion**: intensive care units nurses lack of center venous line care knowledge and practice. **Recommendations:** The study suggests continued center venous line education and training for intensive care units staff.

Keywords: Central Venous Line; Intensive Care Unit; Nurses' Knowledge; Nurses' Practice.

INTRODUCTION

The Central Venous Line is a critical factor in hemodynamic monitoring. The CVL was initially executed in experimental animals at the onset of the 20th century. In humans, it did not become a regular technique for severely ill patients until after World War II. Central Venous Pressure monitoring is a prevalent method for the direct assessment of right atrial pressure. It denotes the filling pressure of the right ventricle and reflects the capacity of the right side of the heart to handle a fluid load. Nurses' responsibilities in the Central Venous Pressure Catheterization process start with the preparation and extend through to the removal of the Central Venous Catheter. The resolution of the patient's condition is contingent upon the precise care given by the nursing staff (Hassan, 2024)

CVLs may cause infection. Complications can cause significant morbidity or death. A nurse who understands Central Venous Access Devices' pros and cons may minimize and recognize catheter-related difficulties, improving patient outcomes. Possible complications including catheter-related bacteremia must be addressed. Nurses are the primary defenders against infections. Nurses managing central line devices must adhere to infection control protocols (Sham et al., 2023).

Nurses in intensive care units (ICUs) are essential in managing CVLs due to the fragile condition of their patients and the significant risk of complications, such as catheter-related bloodstream infections (CRBSIs). Ensuring patient safety necessitates a comprehensive understanding of CVL procedures, including proper insertion techniques, maintenance protocols, and compliance with infection control standards. Research indicates that the probability of errors, including inadequate hand hygiene, failure to uphold sterile conditions, and unfamiliarity with best practice standards that elevate infection risks, is associated with nurses' insufficient understanding or training (Aloush & Alsaraireh, 2023).

In order to minimize complications, nurses must possess both theoretical comprehension and practical experience in the management of CVLs. In order to

maintain line integrity and prevent infections, it is imperative to rigorously adhere to evidence-based guidelines, including the use of chlorhexidine as an antisepsis, the routine inspection of insertion sites, the prompt replacement of dressings, and the accurate documentation of care activities. The evidence indicates that educational programs that incorporate theory and practice significantly improve the ability of ICU nurses to perform CVL-related procedures (Ahmed et al., 2023). In order to ensure that cases who require central venous access receive safe and high-quality treatment, nurses must adhere to strict infection prevention protocols, partake in ongoing education programs, and have the support of healthcare administrators.

Significance of the study:

The CVLs are important pieces of equipment used in ICUs to give drugs, keep an eye on blood flow, and check fluid levels. Catheter-related bloodstream infections (CRBSIs) are one of the most serious problems that can happen when CVLs are not properly managed and maintained. These infections make it much more likely that a patient will get sick or die and that medical care will cost more.

The ICUs worldwide continue to be plagued by central line-associated bloodstream infections (CLABSIs), which are predominantly CVL infections. The reason for this is that the surgery is highly intrusive, and the patients' health is already precarious. Healthcare costs are elevated, hospital stays are prolonged, and the morbidity rate is significantly elevated as a consequence of these maladies. A recent study has estimated that the incidence of CLABSI in ICUs ranges from 1.2 to 7.6 infections per 1,000 central line days. Factors that are specific to each location, as well as the extent to which hospital regulations are adhered to, contribute to these rates **(CDC, 2023).**

Developing countries, particularly those in the Middle East and Africa, may see an exceptionally high prevalence due to a lack of resources and the difficulties in applying practices supported by research. Long catheter dwell periods, improper management, and

staff training all contribute to a significantly higher risk of infection. Monitoring, education, and strict adherence to treatment standards are thus essential strategies for reducing CVL infections and improving outcomes for patients in the ICU.

This study is significant as it highlights the current level of nurses' knowledge and practice regarding CVL care, identifying potential gaps that may compromise patient safety. By evaluating both theoretical understanding and practical application, the findings can guide the development of targeted educational programs, policy updates, and clinical training interventions. Enhancing nurses' competencies in CVL care will contribute to safer patient outcomes, improved quality of care, and more efficient infection control in ICU settings. This research aims to evaluate the knowledge and skills of critical care unit nurses about CVL administration.

AIM OF THE STUDY

The objective of this investigation is to evaluate the knowledge and practice of nurses in the field of CVL care in ICUs by:

1. Evaluate ICU nurses knowledge concerning evidence-based guidelines for CVL care.
2. Determine the level at which nurses practise care for those with CVLs in the ICU.

Research question

1. What is the level of nurses' knowledge concerning the care of CVLs in the ICU?
2. What are the current practices of nurses related to CVL care in the ICU?

SUBJECTS AND METHOD

Technical Design

In terms of the technical design of this study, it comprised a description of the setting, subjects, data collection tools and design of research.

Study design

A descriptive study approach was utilized. A descriptive research design is a research approach used to describe characteristics of a population or phenomenon in a systematic and accurate way, without influencing it. It focuses on answering questions like what is happening, who is involved, and where or when it occurs (Sileyew, 2019).

Study Settings

The commencement of present study took place in three hospital affiliated to Egypt health care authority namely; As-Sallam (consists of 294 nursing staff, 120 beds, 3rd floors), El-Zohour (consists of 220 nursing staff, 61 beds, 4th floors), and El-Nasr specialized children's hospital (consists of 177 beds, 85 nursing staff, 3rd floors) in Port-Said city.

Study subject

Convenient sample of available nurses worked in critical care units in the aforementioned hospitals agreed to take part in the current study and their numbers are 65 nurses.

Tools of data collection:

In this research, two tools were employed:

TOOL (1): Knowledge assessment Questionnaire:

The researcher designed the questionnaire based on relevant literature. It comprised four parts:

Part (1): Nurses' demographic and work related data:

This includes information such as gender, years of experience, age, CVL care training, and CLABSI preventive training.

Part (2): Nurses' Knowledge Regarding Central Line

This part aimed to assess nurses' knowledge concerning the care of central venous catheters, it was developed by (O'Grady et al., 2011), It consisted of 13-question English-language questionnaire. The questions covered catheter insertion sites, indications, complications, and types of central lines. An official bilingual translator who also translated backwards into English used the conventional 'forward-backward' process to translate the questionnaire from English to Arabic. Next, the original questionnaire was compared to the back-translation.

Part (3): Nurses' Knowledge Regarding Blood Stream Infection (BSI).

This part aimed to assess nurses' knowledge concerning Blood Stream Infection, it was developed by researcher based on (CDC, 2012), It consisted of 15-question English-language questionnaire. The questions covered the origin of the infection, the factors that lead to hospital-acquired infections, the origins of the illness, the microorganisms that are associated with bloodstream infections, the signs and symptoms of bloodstream infections, the risk factors for bloodstream infections, and the repercussions of bloodstream infections.

Part (4): Nurses' Knowledge Regarding Components of Care:

This part aimed to assess nurses' knowledge of CLABSI prevention and care practices, it was developed by Kadium (2015). It consisted of 49-question divided into six

subscales (central line care, dressing changes, site selection, hand hygiene, use of chlorhexidine, and barrier precautions.

TOOL (2): An Observational Checklist:

The 23-item tool, based on Bindler and Ball (2012), covers routine CVC changes, frequency of IVF set changes, TPN and blood set changes, use of a dedicated port for TPN administration, and hand hygiene. Central venous catheters with antibiotics. Comparing transparent and gauze bandages. Apply antibiotic ointment to the insertion site or access port and take precautions. Recommended insertion site: subclavian; flush with normal saline 0.9%; provide antibiotics systemically; commence nursing interventions for oozing.

Scoring system

A knowledge scoring system was established, assigning one (1) point for each valid answer and zero (0) points for wrong answers. Scoring for practice was conducted so that completed steps received one point, while uncompleted steps were assigned a score of zero. Knowledge was satisfactory when it equaled or exceeded 60%, and unsatisfactory when it fell below 60%   (Kadium, 2015). Practice levels were Done satisfactory in ICU not less than 80% and more (Kadium,2015).

Operational Design:

The phase of preparatory, reliability and validity, field work and pilot study are the components of the operational design.

Preparatory phase

Reviewing recent national and international relevant literature, articles, periodicals, journals, books, the Egyptian Knowledge Bank collection, and the internet on a variety of topics pertaining to Nurses' Knowledge and Practice Regarding Care of CVL in ICUs marked the beginning of the preparatory phase. The tools were revised, modified in addition to testing of the reliability and validity. At this point, the process of obtaining

the initial approve of the nursing and medical directors of the chosen hospitals also began.

Content validity

The study English tools were evaluated by nine specialists, five of whom were experts in the fields of anesthesia and ICU medicine and medical surgical nursing. These specialists included a professor in medical surgical at Port Said University, two assistant professors at Port Said University, two lecturers at Port Said University, and a lecturer in the faculty of medicine at Port Said University. A total of nine experts were involved in the evaluation process. Following that, the enhancements that were required were implemented into these tools.

Reliability

In order to evaluate the reliability of the research instruments, the Cronbach's Alpha test was implemented. Cronbach's Alpha values for the knowledge assessment questionnaire and the observational inventory were 0.84 and 0.86, respectively. The questionnaire was assessed utilizing both of these items.

In order to assess the feasibility, objectivity, and applicability of the instruments as well as the time required to complete each, seven nurses (representing 10% of the total sample) took part in the pilot study. The nurses were then removed from the sample. Before starting the study's fieldwork, it was carried out for two weeks in the aforementioned settings. Following receipt of the pilot study data, the appropriate adjustments were made (in area of prescription drugs), and the final form was created.

Field Work

The collection of data took place from the start of February 2023 to the end of June 2023. The researcher was present at the study settings three days a week, from 9 a.m. to 3 p.m. In the hospitals mentioned earlier, the researcher conducted individual interviews with each nurse. The researcher gave an overview of the project and

introduced herself. Patients who met the inclusion criteria for the study and gave their verbal consent to participate were subsequently enrolled. The researcher then used study instruments to assess the needs of critical care unit nurses and their knowledge and behaviors regarding the management of CVLs. The researcher needed around 20 minutes to complete these instruments with each subject.

Administrative design

An official letter was issued by the dean of the Port Said University Faculty of Nursing explaining the research's title and purpose to the director of the Egypt Health Care Authority Port-Said branch and the selected study region. The purpose of the letter was to obtain consent for data collecting in the study settings.

Ethical considerations

In accordance with committee standards, the university of Nursing at Port Said University, and the principles outlined in the Declaration of Helsinki, the study received approval from the Research Ethics Committee (REC) of the university. Subsequently, following the elucidation of the study's goal, authorization to proceed was obtained from the directors of the specified institutions. Furthermore, subsequent to presenting the study to each patient, verbal agreement was obtained for their participation.

Statistical Design

The IBM SPSS 20.0 software application was utilizing to enter and evaluate data. Qualitative data was characterized using quantitative measures and proportions. The Kolmogorov-Smirnov test confirmed distribution normality. The range, mean, and standard deviation were used to describe the quantitative data. Two quantitative variables with proper distributions were connected via the Pearson correlation coefficient. We analyzed the results significant at the 5% level.

RESULTS

Table (1): shows that the mean age of the nurses was 23.93 years (± 2.99), with 78.5% being female. Additionally, 64.6% of the nurses held a Bachelor of Nursing degree, and they had an average work experience of 3.24 years (± 2.12). Furthermore, 61.5% of the nurses worked 12-hour shifts. Lastly, 76.9% attended training courses related to infection control, including those specifically for central venous catheter care.

Table (2): illustrates the overall knowledge of nurses about the management of CVLs, indicating that the majority of nurses had inadequate understanding in this area.

Table (3): illustrates the overall nursing practices for the management of CVLs, indicating that the majority of nurses exhibited inadequate practices in this area.

Table (4): presents that there were significant statistical positive correlations between nurses' total knowledge score with total practice about central venous catheter.

Table (1): Nurses' knowledge and practice concerning care of CVL in ICU.

Personnel Characteristics	(N)	(%)
Age (year)		
Mean ± SD	23.93 ± 2.994	
Gender		
Male	14	21.5
Female	51	78.5
Level of education		
Nursing technical institute	23	35.4
Bachelor of Nursing	42	64.6
Years of Experience		
Mean ± SD	3.24 ± 2.12	
The number of working hours per day in intensive care		
8hours	25	38.5
12 hours	40	61.5
Did you attend training courses about infection control?		
Yes	50	76.9
No	15	23.1
Number of course (Mean ± SD)	**3.38±2.54**	
Attend training courses about infection control related central venous catheter ?		
Yes	37	56.9
No	28	43.1
Number of course (Mean ± SD)	**1.35±0.483**	

Table (2): Total nurses' knowledge concerning care of CVL in ICU.

Total nurses' knowledge	Items	
	N	**%**
Satisfactory knowledge (60 ≥)	**13**	**20**
Unsatisfactory knowledge (<60)	**52**	**80**

**A statistically significant P value, P < 0.001

Table (3): Total nurses' practice regarding care of CVL in ICU.

Total nurses' practice	Items	
	N	**%**
Satisfactory practice (75 ≥)	17	26.2
Unsatisfactory practice (<75)	48	73.8

Table (4): Correlation between the total score of nurses' knowledge and the total score of their practice for central venous catheter treatment.

Variable		Total practice
Total knowledge score	**R**	0.840
	P	0.000**

****Correlation is significant at the 0.01 level.**

DISCUSSION

The effective CVL care relies on nurses' adherence to sterile techniques and standardized protocols. Maintaining high practice standards is crucial to minimizing complications and ensuring optimal patient safety in ICUs. The study found that the majority of them were female. Furthermore, bachelor degree of Nursing with Mean experience, worked for 12 hours, and the majority of participants had attended training courses for infection control and infection control related central venous catheter. This result due to a predominance of women in the nursing profession. Additionally, over two-thirds of the participants held a Bachelor's degree in Nursing, suggesting a relatively high level of academic preparation among the study sample. The average clinical experience reported further indicates that the participants were not novice nurses but had gained sufficient time in practice to engage in central line care.

Regarding demographic characteristics of studied samples. This result in the same line with Elaziz and Bakr (2022) found that the majority of nurses working in ICUs were female and held a bachelor's degree in nursing. This reflects broader national and international trends where nursing continues to be a female-dominated profession with increasing educational qualifications. Also, on similarity with Ali and Mahmoud (2021), it was reported that most ICU nurses worked 12-hour shifts and had several years of clinical experience. The authors discussed how prolonged working hours could affect performance, especially in high-risk procedures like central venous catheter care. This result on the same line with Gad and Abdelaziz (2023) found that a majority of ICU nurses had attended infection control training programs, including sessions focused on central venous catheter care. Nevertheless, the study observed that, despite training, practice levels remained inadequate, indicating deficiencies in training content or subsequent reinforcing.

The study's findings indicate that most nurses lack the requisite skills to safely administer CVLs. The exigencies of critical care units may occasionally hinder opportunities for professional advancement, whereas inadequate knowledge may stem from insufficient continuous education.

The results of this study support those of Sakshi et al. (2019), who discovered that nurses lack the necessary training to correctly insert CVLs. Similarly, Mohamed and Mohamed (2022) discovered that keeping up with the latest knowledge and best practices for CVL administration was difficult due to staffing shortages in the ICU, long patient wait times, and high workloads.

The care that nurses provide for CVLs is second to none. The study found that the majority of the nurses who participated in it handled CVLs improperly. Inadequate supervision, lack of hands-on training, and disregard for infection control measures are all factors that could contribute to this problem.

Our findings are in line with those of Raghep and Elgazar (2020), who also discovered that the majority of nurses lacked adequate practice with central line methods prior to receiving instructional assistance. However, according to Almahmoud et al. (2020), nearly two-thirds of the participants showed that they adequately maintained CVLs. Contrary to what Dyk et al. (2021) discovered, more than half of the nurses surveyed reported having sufficient expertise to competently manage CVLs.

The current study demonstrates that general knowledge and general practice are positively correlated, which is important for the correct management of CVLs.

This result is possible in high-risk operations where knowledge is crucial for effective practice, such as central line care. Assuming they have a firm grasp on the material, nurses will be better equipped to incorporate infection control protocols, catheter care, and complication management into their daily work. Lennon et al. (2020) also found a strong association between nurses' knowledge and conduct about CVLs, therefore these findings are consistent with their. Findings from this study corroborate those from earlier studies showing a relationship between the total domains of knowledge and total domains of practice for the nurses evaluated (Zeyada et al., 2021).

Limitations Of The Study

Not applicable.

CONCLUSION

Most of the nurses who took part in this study clearly lacked the necessary expertise and practice when it came to inserting CVLs, according to the results. In ICUs, there is a positive link between nurses' total practices and their statistically significant knowledge of CVL administration.

RECOMMENDATIONS

The present study's conclusions lead to the following recommendations being put forth: Conducting periodic in-service training sessions to update nurses on new techniques and infection prevention strategies regarding central lines.

Declaration of conflicting interests:

There are no competing interests.

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معلومات وممارسات الممرضين تجاه العناية بالقسطرة الوريدية المركزية في وحدة العناية المركزة

أمل كارم عبد العظيم [1] ؛أمانى محمد شبل [2] ؛ منى عبد الرحمن[3]

[1]مدرس مساعد التمريض الباطني والجراحي بكلية التمريض , جامعة بورسعيد؛ [2]أستاذ التمريض الباطني والجراحي بكلية التمريض , جامعة بورسعيد؛ [3]أستاذ مساعد التمريض الباطني والجراحي بكلية التمريض , جامعة بورسعيد

الخـــلاصـــــــة

تستخدم القسطرة الوريدية المركزية بشكل واسع لدى المرضى ذوي الحالات الحرجة لمراقبة الجهاز القلبي الوعائي بشكل مستمر. وتُعد معلومات الممرضين عن كيفيه العناية بالقسطرة الوريدية المركزية أمرًا حيويًا لتقليل المضاعفات والتعرف بدقة على المشاكل المتعلقة بالقسطرة، مما يضمن نتائج أفضل وأكثر أمانًا للمريض . هدفت هذه الدراسة إلى تقييم معلومات وممارسات الممرضين فيما يتعلق بالعناية بالقسطرة الوريدية المركزية في وحدة العناية المركزة و اعتمدت الدراسة على تصميم وصفي، وتم تنفيذها في وحدة العناية المركزة بمستشفى بورسعيد العام، مستشفى الزهور المركزي، ومستشفى بورفؤاد، التابعة لهيئة الرعاية الصحية بمحافظة بورسعيد، مصر. تكونت العينة من 65 المتاحين فى هذه المستشفيات أثناء جمع المعلومات و تم استخدام أداتين لجمع البيانات، هما:استمارة تقييم وشملت: البيانات الديموغرافية للممرضين، معلومات الممرضين بالقسطرة الوريدية المركزية، معلومات الممرضين بعدوى مجرى الدم، معلومات الممرضين بمكونات الرعاية السريريه والاداة الثانية ملاحظة لممارسات الممرضين عن كيفيه العناية بالقسطرة الوريدية المركزية و أظهرت نتائج الدراسة أن غالبية الممرضين كان لديهن مستوى غير مرضٍ من المعلومات والممارسات المتعلقة بالعناية بالقسطرة الوريدية المركزية في وحدة العناية المركزة. كما ان هناك علاقة إيجابية ذات دلالة إحصائية بين مستوى المعلومات والممارسات المتعلقة بالعناية بالقسطرة الوريدية المركزية. وأوصت الدراسة بضرورة إنشاء نظام للرصد والتقييم لمتابعة مدى التزام الممرضات بمعايير العناية بالقسطرة الوريدية المركزية.

الكلمات المرشدة : القسطرة الوريدية المركزية, وحدة العناية المركزة, الممرضين، المعلومات، الممارسات.