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Impact of Intensive Care Unit Nurses' Knowledge on Care of Patients with Central Venous Access Devices

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Abstract: **Central venous access devices (CVADs) are used within a variety of areas in both hospital and community health care settings to administer blood or fluids, to provide long term access for repeat transfusion of blood or blood products, chemotherapy, parenteral nutrition and antibiotic therapy, and to provide immediate access in emergency situations. Nurses who are knowledgeable and competent in the basic aspects of CVADs care able to ensure specific patients' needs are met and prevent further complications. The aim of this study: To study the impact of Intensive Care Unit Nurse's knowledge on Care of Patients with central venous access devices. Subjects and Methods: A descriptive design was utilized at Intensive care unit in Benha University Hospitals and Zagazic University Hospitals. The study included 100 nurses who cared for patients undergoing CVADs insertion were enrolled in this study. Tools of the study involved sheet to collect data related to nurses' demographic data and implantable port catheter care knowledge questionnaire were utilized. Results: the impact of Intensive Care Unit Nurse's knowledge on Care Processes of Patients with central venous access devices the study revealed that two third of nurses received in-service training programs about the CVADs. Also, it revealed two thirds of the studied subjects have got satisfactory knowledge level. The present study showed high significant differences among the nurses' level of knowledge by their age and educational qualifications and total knowledge scores. Conclusion: The majority of the nurses had got satisfactory level and there was significant correlation between the nurses' knowledge level and their demographic characteristics. Recommendations: An educational programs and in-service training courses should be provided to nursing staff working in Intensive Care Unit regarding CVADs implantation care according to the updated standards and guidelines.**

Keywords: **Nurses' knowledge, Central venous access devices, Care.**

1. INTRODUCTION

Central venous access devices (CVADs) are used to deliver a wide range of therapies from lifelong administration of parenteral nutrition to the acute infusion of vesicant inotropic support for the critically ill, and the prolonged delivery of anticancer therapies. Patients requiring these treatments are frequently very old, very young or have chronic health conditions **(Ullman et al., 2015).** The insertion of a CVAD requires the passage of a catheter through the epidermis and stratum corneum, creating a surgical wound that persists for as long as the CVAD is in situ. A CVAD is typically inserted in a sterile percutaneous manner through the skin of the upper chest or upper arm by a specially trained physician or nurse. Once in the vein, the catheter is advanced to the superior vena cava or right atrium **(Infuse Nurse, 2016).** The catheter is secured to the skin via suture, or manufactured securement device, with a transparent dressing **(Ullman et al., 2015).**

The skin breakdown caused by a CVAD provides an entry route for bacteria, increasing the patient's risk for local, systemic, and bloodstream infection. To minimize CVAD-associated infections, evidence-based management strategies have been developed by international organizations such as the Centers for Disease Control and Prevention **(Wall et al.,**

2014). Strategies include the continued application and removal of medical-grade adhesives (eg, dressing products) and decontamination with solvents and detergents (eg, alcohol and chlorhexidine gluconate [CHG]), using a friction-based technique.2 While these strategies reduce the risk of infections, following these recommendations exposes the CVAD site to ongoing irritation and trauma **(Farris et al., 2015).** Effective post insertion management of central venous access devices (CVADs) is important to prevent CVAD-associated complications, including catheter-associated bloodstream infections. Although there is a wealth of evidence-based guidelines available to guide the care of CVADs, applying their recommendations to the clinical setting across variable patient groups, CVAD types and international healthcare settings is challenging. This may result in patients receiving suboptimal care **(Broadhurst et al., 2016).**

The risk of infection can be reduced by adopting cost-effective, evidence-based interventions such as proper education and specific training of the staff, an adequate hand washing policy, proper choices of the type of device and the site of insertion, use of maximal barrier protection during insertion, use of chlorhexidine as antiseptic prior to insertion and for disinfecting the exit site thereafter, appropriate policies for the dressing of the exit site, routine changes of administration sets, and removal of central lines as soon as they are no longer necessary **(Ale et al., 2010) (Wall al., 2014).** Most non-infective complications of central venous access devices can also be prevented by appropriate, standardized protocols for line insertion and maintenance. These too depend on appropriate choice of device, skilled implantation and correct positioning of the catheter, adequate stabilization of the device (preferably avoiding stitches), and the use of infusion pumps, as well as adequate policies for flushing and locking lines which are not in use**(Ullman et al., 2015).**

Nurse requires specific education and training to attain the knowledge, assessment skills and technical tasks required to manage the care for patients who have CVADs. Nurses who are knowledgeable and competent in the basic aspects of CVADs care and maintenance are able to ensure specific patients' needs are met and optimal health outcomes achieved. However, nurses who work in oncology require a higher level of knowledge and skill to manage CVADs **(Khalil et al., 2017).**

Significance of the study:

The use of central venous access devices (CVADs) is now common in a variety of care settings. Technological advances related to CVADs have introduced many of catheter designs that are available to us through numerous manufacturers. To initiate the appropriate procedures for care, nurses involved in the maintenance of CVADs are now challenged with having to be familiar with a large variety of central venous access devices. They must be able to evaluate CVADs and determine its type, size, manufacturer, and specific characteristics as well as to initiate the appropriate management strategies related to that device. The nurse must also be able to recognize the indications, advantages and disadvantages associated with each device, and to assist the patient in making an informed decision regarding the appropriate device for his or her therapy needs. It is essential that care and maintenance procedures be delivered by those whose knowledge base and experience make them competent care providers with the expertise to initiate appropriate prevention and troubleshooting measures, as well as to evaluate and implement nursing actions related to complications.

Aim of the study:

The present study aimed to assess the impact of intensive care unit nurses' knowledge on care of patients with central venous access devices.

Research question:

What do intensive care unit nurses' knowledge about care of patients with central venous access devices?

2. SUBJECTS AND METHODS

Research design:

A descriptive cross sectional design was utilized to meet the aim of this study.

Setting:

The study was conducted at Intensive care unit in Benha University Hospitals and Zagazic University Hospitals.

Sampling:

The sample comprised of 100 males and females nurses who cared for patients undergoing CVADs insertion were recruited randomly, in the above mentioned setting. Purposive sampling technique was used to select the samples. The criteria of the study inclusion; who their age ranges between 20-40 years old, who are ready to participate in study and gave informed consent, with minimum years of experience were at least two years and their educational level were varied. The studied nurses were informed that the study is harmless; all the gathered data were treated confidentially and used for research purpose only.

Research instrument (tools): Two tools were used to collect data relevant to the current study:

Tool 1: Nurses' demographic variables: It was developed by the researchers to collect baseline data which consist of five items namely, age, sex, educational level, area of work, and years of experience in Intensive care units.

Tool 2: Nurses' Knowledge questionnaire:

It was developed by the researchers to assess nurses' knowledge about CVADs. The tools consist of (25 questions) that covered definition of central venous access devices, indication, contraindications, preparation of catheter insertion, complications from CVADs. , infection control measurements, patient education, regulation of catheter and heparinzation care of port a cath. **Scoring system:** The scoring was calculated as each question was scored as one mark for every correct point in answer with total score for the questionnaire was (50 grades) ranked as: Scores less than 37.5 (<75%) was unsatisfactory. Scores equal or more than 37.5 (≥ 75) were satisfactory.

Extensive reviews of literature were carried out about central venous access devices (CVADs) and the appropriate management strategies related to that device.

Validity and reliability:

Content validity was done to recognize the degree to which the used tools measure what was supposed to be measured. Tools developed by the researcher were examined by a panel of five experts in intensive care specialist physician, oncology medicine, critical care and oncology nursing to determine whether the included items are clear and suitable to achieve the aim of the current study. The designed knowledge questionnaire was reliable utilizing inter rater reliability with kappa coefficient =0.79.

Administrative design:

An official permission for conducting the study at intensive care unit in Benha University Hospitals and Zagazic University Hospitals. Was obtained from the hospital administration by the submission of a formal letter from the Dean of the Faculty of Nursing. Meeting and discussion was held between the researcher and the nursing administration to make them aware about aims and objectives of the study, as well as, to get better cooperation during the implementation phase of the study. Nurses were interviewed, explanation of purpose and nature of the study was done, confidentiality and voluntary inclusion was assured.

Ethical Consideration

Human rights must be considered by explaining the aim of the study to each participant to be familiar with importance of his or her participation and assured that the information obtained will be confidential and used only for the purpose of the study. All obtained information was secured and wouldn't affect their annual appraisal. The researcher will assure maintaining anonymity and confidentiality through the coding of data. Consent will be taken from the participants that they agree to be included in the study.

Pilot study:

A pilot study was conducted on 10% of nurses recruited to test the clarity, applicability and validity of the tool. To determine the needed time for filling in application to tools. Based on the results of the pilot study, necessary modifications have been considered. Nurses involved in the pilot study were excluded from the current study.

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Fieldwork:

Once official permissions were obtained, the researcher visited the above mentioned selected setting daily during morning shift. Each nurse was interviewed nearly one hour to fill out the data sheet and the knowledge questionnaire pertinent to CVADs. In the meantime, the researcher is accessible to clarify any unclear questions.

Statistical analysis:

The collected data were tabulated and analyzed using Statistical Package of Social Science (SPSS), version 20. Descriptive and inferential statistics were performed such as mean and standard deviation to estimate the statistical significance difference between variables of the study; frequency; number and percentage distribution and correlation coefficient. The level of significance was considered at the 5% level (P=0.05).

3. RESULT

Results of the present study divided into three parts namely, first part deals with demographic characteristics of the studied subjects. Second part displays general knowledge about insertion and care of port-a-cath among critical care nurses**.** Third section devoted on relationship between demographic characteristics of the critical care nurses and their total knowledge level regarding insertion and care of port-a-cath.

Table 1: Number and percentage distribution of the studied subjects according to their demographic Variables

Variables	**Study sample (n=100)**	
Age in years	**Number (N)**	**Percentage (%)**
< 25	35	35
25-30	51	51
30+	14	14
Mean ± SD	**27.23 ± 3.61**	
Gender		
Male	33	33
Female	67	67
Educational Qualifications		
Bachelor degree	65	65
Diploma	23	23
Technical institute	12	12
Years of Experience in Nursing		
5< 9	18	18
9-12	55	55
13-15	15	15
15+	12	12
Mean ± SD	**10.91 ± 2.76**	
Years of Experience with Port-a-cath		
3< 6	27	27
6-9	34	34
9 +	39	39
Mean ± SD	**10.12 ± 2.31**	
Previous Training Courses		
Yes	62	62
No	38	38

Table 1 shows that, half of studied nurses (50.1%) their age ranged between 25-30 years. the majority of the studied nurses' were females (67.0%) and baccalaureate graduates (65%). Regarding years of experience in nursing field, half of the studied nurses' (55.0%) were having 9-12 years of experience in the nursing field with the mean 10.91 ± 2.76 years, and 39.0% of the studied nurses' were having more than nine years of experience in caring of Port-a-cath with the mean years of 10.12 ± 2.31. In addition, the majority of the studied nurses' attended previous training courses regarding port-A-cath insertion and care (62.0%).

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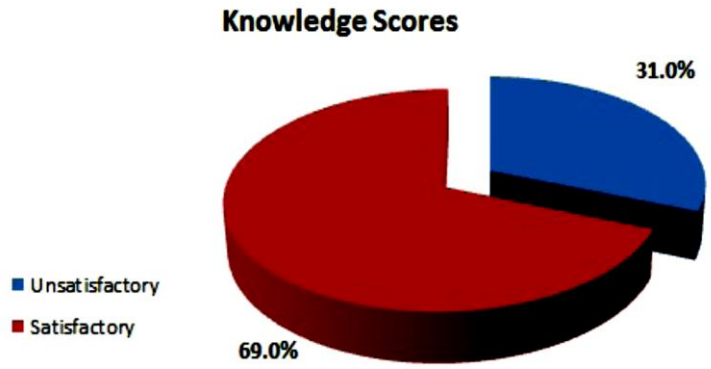

Figure 1: Percentage distribution of the total nurses' knowledge level regarding insertion and care of port-a-cath (N=100).

Figure 1: Illustrates the majority of the studied nurses' (69.0%) have got satisfactory knowledge level.

Table 2: Number and percentage distribution of the studied subjects in relation to general knowledge about insertion and care of port-a-cath (N=100).

Item	Satisfactor		Unsatisfactory	
	Number (N)	Percentage (%)	Number (N)	Percentage (%)
Definition of port-a-cath	68	68.0	32	32.0
Indications of port-a-cath	76	76.0	24	24.0
Contraindications of port-a-cath	68	68.0	32	32.0
Local complications of port-a-cath	69	69.0	31	31.0
General complications of port-a-cath	72	72.0	28	28.0
port-a-cath insertion regulation	62	62.0	38	38.0

Table 2 reveals that percentage distribution of satisfactory and unsatisfactory answers in relation to general knowledge about insertion and care of port-a-cath as can be seen from the Table 2 most of the studied subjects have got the satisfactory responses in the following sub-items and distributed as follows; indication of port-a-cath (76.0%), contraindications of port-a-cath (68%), local complication of porta-cath (69.0%) and the general complications for the port-a-cath (72.0%). On the other hand more than one fourth of the subjects have got unsatisfactory responses regarding port-a-cath insertion regulation (38%).

Table 3: Relationship between demographic characteristics of the studied nurses' and their total knowledge level regarding insertion and care of port-a-cath

Items	Knowledge				Chi-square test	P-value
	Satisfactory		Unsatisfactory			
	Number (N)	Percentage (%)	Number (N)	Percentage (%)		
Age in years 20-24	22	22.0	10	10.0	-	-
25 - 29	37	37.0	14	14.0	13.17	0.001
≥ 30	7	7.0	10	10.0	-	-
Gender Male	27	27.0	6	6.0	2.94	0.08
Female	42	42.0	25	25.0	-	-
Qualification Bachelor	51	51.0	14	14.0	-	-
Diploma	12	12.0	11	11.0	7.79	0.02
Technical institute	6	6.0	6	6.0	-	-

Experience in nursing 5-8		9	9.0	9	9.0	-	-
9-12		47	47.0	8	8.0	20.89	0.0001
12-15		10	10.0	5	5.0	-	-
≥ 15		3	3.0	9	9.0	-	-
Port-a-cath experience 3-5		24	24.0	3	3.0	-	-
6-8		29	29.0	5	5.0	23.48	0.0001
≥ 9		16	16.0	23	23.0	-	-
Training Courses Yes		60	60.0	2	2.0	55.47	0.0001
No		9	9.0	29	29.0	-	-

This table revealed that; there was highly statistically significant correlation between demographic characteristics of the studied nurses and their total knowledge score about port-a-cath such as age, educational level, years of experience in nursing, years of experience in care of port-a-cath and previous training courses. On the other hand, there was no significant correlation between the total knowledge level and gender.

4. DISCUSSION

The present study aimed to assess the impact of intensive care unit nurses' knowledge on care of patients with central venous access devices and to achieve this aim one research question were formulated; what do intensive care unit nurses' knowledge about care of patients with central venous access devices? This discussion of the results will be presented in three sections; First section will high light the demographic characteristics, the second section will conducted the distribution of the studied sample in relation to their knowledge about implantable Port-a-cath care, Third section will concerned with the relationship between nurses' total knowledge level and their demographic characteristics.

I- Demographic characteristics:

Regarding critical nurses' educational qualifications, our study shows that two-thirds of the studied sample had a bachelor degree and the rest of them had a technical institute degree. This analysis is in agreement with previous study by done by **Barnes et al., (2014)** who stated that the majority of the studied sample were had a bachelor degree. Referring to the years of experience in nursing field, half of the studied nurses' were having 9-12 years of experience in the nursing field .This finding in agreement with previous studies by **Anderson et al., (2013) and Khalil et al., (2017)** who reported that half of the studied nurses' regarding years of experience in nursing field, were having 9-12 years. In relation to experience in caring of Port-a-cath the current study shows the studied nurses' were having more than nine years of experience in caring of Port-a-cath with the average years This analysis is in agreement with **Barnes et al., (2014).** Also the study revealed that the majority of the studied nurses' attended previous training courses regarding port-A-cath insertion and care which is in agreement with **Ozden and, Caliskan (2012)** who reported that nearly two thirds of the study subjects received previous in-service training courses regarding port-a-cath care.

II- Distribution of the studied sample in relation to their knowledge about implantable Port-a-cath care:

The study revealed that, nearly two thirds of the study subjects received previous in-service training courses regarding port-a-cath care. This finding is supported by **Ozden et al., (2012)** who reported that the mean knowledge score of the nurses regarding implantable port catheter care was 15.13+4.78 out of 20 .Moreover, the difference between the knowledge scores, based on whether or not the nurses had received in-service training, was found to be statistically significant. Also the present study finding agreed with **Deshmukh and Shinde (2012)** who reported that knowledge of nurses' was increased after structured program and be more effective in increasing knowledge scores of subjects in relation to venous access device care. The current study shows most of the nurses have got satisfactory knowledge regarding indication, contraindication of port-a-cath, nearly a quarter of the studied sample revealed a deficiency in nurses' knowledge regarding the definition of port-a-cath, and port-a-cath insertion regulation, This analysis is partially agreed with **Perez and Vasques (2014)** who mentioned that the nurses' knowledge regarding the implanted port is inadequate for that reason; consequently there is an urgent need for professional training which is in agreement with **Arslan et al., (2014).**

III- Relationship between nurses' total knowledge level and their demographic characteristics:

The present study showed that high statistical significant correlation between nurses' total knowledge and their demographic characteristics except gender. This analysis is partially agreed with **Arslan et al., (2014) and Khalil et al., (2017)** who stated that the age of nurses' had no relationship with their knowledge about port-a catheter and increasing experience in years of practice had a positive relationship with success in testing knowledge. Similarly the current study analysis was consistent with **Anderson et al., (2013) and Ibrahim (2015)** who stated that there was statistically relation between socio-demographic characteristics of the study sample and their total score of knowledge, while no significant correlation between gender of the study sample and their knowledge.

5. CONCLUSION

The study concluded that the majority of critical nurses' had a satisfactory knowledge level regarding care of port a- cath. Furthermore, their total knowledge relates to their demographic characteristics except gender. Nurses' total knowledge affects positively on care of patients with central venous access devices.

6. RECOMMENDATIONS

Recommendations based up on this study, Continuous educational courses to improve nurses' knowledge and practices for Port-a-cath. Periodic supervision should be adopted for nurses whom working in critical units to guarantee adequate performance. Further research on a larger range to validate, support these findings and to determine if nurses' knowledge of port-a-catheters is sufficient to maintain safety and optimal patient care

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