

Knowledge and Practice of the Critical Care Nurses on Vascular Access Devices Related Infection

Shereen Abd El-Moneam Ahmed¹, Rehab Hassan Kaf1²

Lecturer of Medical-Surgical Nursing, Faculty of Nursing, Suez Canal University, Egypt^{1,*}

Lecturer of Pediatric Nursing, Faculty of Nursing, Suez Canal University, Egypt²

Corresponding Author: Shereen Abd El-Moneam Ahmed

Abstract: Background: Vascular access devices can cause bloodstream infections (BSIs) which lead to long hospital stay, morbidity, and high mortality. The catheter-BSIs can largely be preventable through efficient nurses' level of knowledge and practice.

Aim: to assess the Critical Care nurses' knowledge and practice on vascular access devices related infection.

Subject and Methods: A quantitative descriptive research design was utilized in this study on a purposeful sample of (74) critical care nurse whose work experience is more than six months, and working at the Critical Care Units affiliated to Suez-Canal University Hospitals, Ismailia city, from February to May 2017. The study instruments were a Knowledge questionnaire to assess the level of nurses' knowledge, and an observational checklist to assess level of nurses' practice regarding VADs related infection.

Results: (40.54%) of the studied critical care nurses have good level of knowledge, and only (6.75%) have excellent level of knowledge, with mean total level of knowledge (8.6078 ± 1.9908). According to level of practice, (43.24%) of the critical care nurses need improvement, and only (12.16%) proficiently perform the procedures, with mean total level of practice (2.1400 ± 1.4287).

Conclusion: The findings of the current research concluded the presence of a significant relation between the studied critical care nurses' mean total knowledge and mean total practice on vascular access devices related infections as the mean level of knowledge is higher than the mean level of practice.

Recommendations: Implementing structured training programs on the VADs related infection preventive guidelines at the hospitals and increase the in-service training for nurses.

Keywords: Vascular access devices, Infection Control, critical care nurses

Date of Submission: 26-02-2019

Date of acceptance:12-03-2019

I. Introduction

The use of any type of the vascular access devices (VADs) either peripheral or central is vital through all health specialties. The VADs frequently need administration sets which replaced routinely each three to four days in order to reduce infectious hazards as they cause about 60% of all hospital acquired bloodstream infections (BSIs) if in place for more than four days (Akbari & Kjellerup, 2015).

The VADs used frequently for all ages either adults or pediatric patients, although their use makes patients risky for infectious hazards "local and systemic" which include: specific site infection, osteomyelitis, septic thrombophlebitis, endocarditis, lung /brain abscess, and ophthalmitis which have a major impact on the health care due to its high recurrence, morbidity, and mortality (Radonić et al., 2014)

The incidence of vascular access devices related infections varies with the type and number of catheter use, the patient-related factors, the type of disease, the presence of comorbidity, and severity of illness according to the Association of Anesthetists of Great Britain and Ireland, (2016). The incidence of infection at the Intensive Care Units (ICUs) is higher than its incidence at the ambulatory or inpatient settings; as the vascular access devices may be in place for prolonged period, patients colonized, and multiple manipulation of the catheter during the day for administering fluids, drugs, blood products, parenteral nutrition, in addition to monitor the hemodynamic status of the patients. Moreover, the catheters can inserted during urgent or emergent situations in which the use of the aseptic technique may not followed (Adegboye et al., 2018)

The rate of catheter-related infections either local or systemic is difficult to determine since most surveillance systems identify only catheter-related BSIs and do not estimate local infections (Hadaway, 2012). In the United States, it is estimated that about 250,000 cases occurs each year (Gyanes & Band, 2018).

Conditions that suggest the presence of hospital acquired vascular access device-related bacteremia or fungemia include: having a catheter in place; the patient appears septic without having obvious reason to suggest predisposition to sepsis; no other infection anywhere at the body; the site of insertion is red, swollen, and painful; in addition to tenderness around the catheter exit site with 2 cm; drainage; fever, chills, and

hypotension; moreover the patient still septic if the vascular access device stay in place without removal even have the appropriate therapy (Hinkle & Cheever, 2014)

Currently, most hospitals use automated systems to detect growth in incubating blood cultures. A few hospitals follow blood culture systems which quantify the colonies of growth present in each blood culture specimen. At least 2 blood cultures should be implemented when catheter infection is suspected, in addition to the culture of the catheter tip (Shah et al., 2013).

In order to minimize the occurrence of VADs related infection; specific knowledge should be presented to the critical health care professionals. The critical Healthcare professionals can choose devices that appropriate to the patients' needs through using Technology (Chernecky et al., 2015). Prevention guidelines for VADs related infections help the healthcare professionals minimize or prevent its occurrence. However, the nurses not always follow the prevention guidelines (Cicolini et al., 2014).

The critical care nurses have a crucial role in the prevention and management of bloodstream infections as they evaluate patients for the presence of infection; make daily VADs site inspections; and monitor the interval of line changes; changing infusion sets, caps, and solutions; practice the infection Transmission-Based Precautions and Standard Precautions (Hinkle & Cheever, 2014).

The recent preventive strategies include the use of chlorhexidine-impregnated dressing, topical anti-infective cream or ointment dressing to the site of insertion, alcohol, antimicrobial lock therapy, chelating agents, biofilm disruptors' pathogens, and catheters with an anti-infective surface, or catheters with contamination resistant hub (Akbari & Kjellerup, 2015).

II. Aim

This study aimed to assess the critical care nurses' knowledge and practice on vascular access devices related infection.

Research questions:

1. What is the critical care nurses' level of knowledge on vascular access devices related infection?
2. What is the critical care nurses' level of practice on vascular access devices related infection?
3. What are factors that promote occurrence of VADs related infection?

Significance of the study:

Patients at the Critical Care Units either being an adult or a child can acquire VADs related infection because they are vascular accessed. Nurses level of knowledge and practice control their adherence to the infection prevention guidelines. The current study will give baseline data to design an educational program for nurses to increase adherence to the identified VADs related infection guidelines and modify them according to the nature of their work place, in addition to improve the patients' outcome. Also, the study will identify factors that promote occurrence of VADs related infection, which help identification and planning strategies to overcome these factors.

III. Subjects and Method

Research Design:

This study used a descriptive research design to assess the critical care nurses' knowledge and practice on vascular access devices related infection.

Setting:

This study implemented at the Critical Care Units (CCUs) affiliated to Suez Canal University Hospitals, Ismailia City, Egypt. They include: Intensive Care Unit (ICU), Pediatric care unit (PICU), Neonatal intensive care unit (NICU), Cardio-Thoracic Intensive unit (CTIU), Coronary Care Unit (CCU), and the Hepatic Intensive care Unit (HICU).

Target population and sampling:

The study comprised a purposeful sample composed of (74) nurses working at the CCUs affiliated to Suez-Canal University Hospital, , Ismailia city, Egypt, from February to May 2017 with the following inclusion criteria:

- Being male or female nurse
- Nurse's ages ranged from 18-45 years old.
- Work experience for more than six months.
- Agree to participate in this study

The sample size at this study calculated using this Equation.

$$\text{Sample size (ss)} = \frac{Z^2 * (p) * (1-p)}{c^2}$$

Where:

Z = value (e.g. 1.96 for 95% confidence level), p = percentage picking a choice, expressed as decimal (.5 used for sample size needed), and c = confidence interval, expressed as decimal (e.g., .04 = ±4)

Tools for data collection:

Two tools used in the present study to collect data as follow:

A- Knowledge questionnaire which is a self-administered questionnaire designed by the researchers after reviewing the recent related literatures and translated into Arabic. It is composed of three parts:

Part I: Composed of six questions that expressed the demographic characteristics of the nurses such as age, sex, years of experience, qualification, place of work at the CCUs, and any training programs on VADs related infection prevention.

Part II: Composed of 7 questions asking about factors that promote occurrence of VADs related infection such as: duration of the VAD placement, experience of the nurse, ratio of nurse to patient in the CCUs, inefficient sterile techniques, improper choice of the insertion site, the insertion site colonization, in addition to catheter hub contamination (Deshmukh & Shinde, 2014).

Part III: Concerned with the assessment of nurses' knowledge on vascular access devices related infections. It included 30 questions adopted from (O'Grady et al., 2011) & (Hinkle & Cheever, 2014). The questions translated into Arabic language which ask about: definition of VADs, types of VADs, indications, duration of use, causes of VADs related infections, sources of infection, mode of transmission, risk factors for infections, clinical manifestations, conditions that suggest presence of infection, complications, prevention of complications, management of complications, health care team and patient related factors, environmental related factors, burden of infection, diagnosis of infection, treatment, and nurses' role in infection prevention and management measures.

B- An observational checklist: It was adopted by the researchers from (Smeltzer et al., 2010) & (Ignatavicius & Workman, 2013) for assessing nurses' level of practice regarding vascular access devices related infection with 2 degrees for each accurately done item, one degree for the incomplete or inefficient step, and zero for the not done step. The observational checklists covered the nurses' role (before, during, and after) insertion of the vascular access devices, in addition to changing dressing and maintenance care. Each nurse was observed by one of the researchers for three consecutive times and data presented using the mean of the three practices to avoid subjectivity and maintain consistency of the tabulated data.

Scoring system:

Regarding the knowledge questionnaire each correct answer given a score of one and incorrect or missed answer a score of zero. And scoring of the checklist was implemented by giving score of two to each correctly done step, score of one for incorrectly or incomplete done step, and zero for each not done step. Grades of the nurses' total knowledge were as the following: fair = ≥50%, Good = 51%- 64%, very good = 65% <85 %, and excellent = ≥ 85%.

Grades of the total nurses level of practice performance were as the following: Not done or bad (≤30%), Needs improvement (>30%-65%) which mean that the step is performed incorrectly or out of sequence or the sequence is completely not followed, competently performed (>65% -<80%) which mean that the step is performed correctly and in proper sequence but the ICU nurses does not progress from step to step efficiently, and proficiently performed (≥ 80%) which means that the step performed efficiently and in proper sequence.

Validity and Reliability:

The content validity of the knowledge questionnaire was revised by five experts at the Medical-Surgical Nursing and the Pediatric Nursing specialty, then modifications accordingly done.

An Alpha Coefficient was used to check the reliability of the tools. The reliability of the knowledge questionnaire is established at 0.90, and the observational checklist at 0.93.

Pilot study

A pilot study was implemented on seven nurses to assess clarity, feasibility, and the time needed to complete the study tools. It is implemented at January 2017. Modifications were made based on the results of the pilot study. The nurses participated in the pilot study were omitted from the data collection for the current study sample.

Procedure and work description

The preparatory phase started prior to the development of the study. It is composed of reviewing of the recent literature related to the research problem and the theories of the all aspects of the problem using articles, books, net, and periodicals to develop tools of data collection.

The first phase of the work was implemented by taking permission from the hospital administrative personnel to apply the study, then the researchers met every nurse separately and explained the aim of the study and what is needed from nurses, and what is the effect of the present study on the nurses as well as the patient. An oral consent was obtained from the CCUs nurses to participate in the study. The researchers met three nurses each visit as the self-administered Arabic questionnaire given to the nurses at the beginning of the shift to allow nurses fill it while they are in break with the presence of the researchers.

With regard to the observational checklist, the researchers assessed each nurse of the study sample three times during providing care on three different visits or different three patients. The nurses observed for four hours during the evening shift; as during this time they expected to implement all the procedures included in the checklist for the same patient or for different ones. The selected participants were aware that they are observed. The data collected from February to May 2017 by visiting the previously mentioned settings two times a week at the evening shift as the stress of work at the CCUs at this time is less than the morning shift, and no crowdedness by the trainees.

Ethical considerations:

Ethical considerations followed for the entire subject through the whole work. An oral consent was obtained from the participants after clarification of the aim and nature of the study. Ethical issues were ensured to all the nurses participated in the study including anonymity, confidentiality and the right to withdraw from the study at any time. Telephone numbers of the researchers are available for the participants for any clarifications. Permission was taken from the faculty of nursing, Suez Canal University prior embarking in the study.

Statistical Design

Statistical analysis implemented using SPSS version 20 statistical software package. Data were presented using percentage, frequency, and Mean ± SD for the descriptive data such as demographic characteristics. The relation between variables was done by using T- test/ F-test according to type of the manipulated data. Significant level was set at *P* <0.05.

IV. Results

Table (1): Demographic data of the studied critical care nurses (n=74).

Demographic data	No	%
Age:		
< 25 Years	46	62.16
25 up to 35 Years	15	20.27
>35 Years.	13	17.56
X ±SD	25.38 ± 0.5	
Sex:		
Female	45	60.81
Male	29	39.19
Educational level:		
Technical health institute diploma.	32	43.24
Nursing schools diploma.	28	37.84
Bachelor degree.	14	18.92
Place of work in CCUs:		
Intensive Care Unit(ICU)	30	40.54
Pediatric care unit (PICU)	13	17.57
Neonatal intensive care unit (NICU)	10	13.51
Cardio-Thoracic Surgery unit (CTIU)	9	12.16
Coronary Care Unit (CCU)	6	8.11
Hepatic Intensive care Unit (HICU)	6	8.11
Years of Experience in ICUs:		
6 months < 1 year	14	18.91
1 year to < 5 years	35	47.30
5 years to < 10 years.	13	17.57
> 10 years.	12	16.22

Attending training programs or workshop on preventing VADs related infection:		
1 or 2 seminars	20	27.03
>2 seminars	13	17.56
Don't attend any seminars	41	55.41

Table 1 shows the demographic data of the studied nurses, and represents that the mean age of the studied nurses was (25.38 ± 0.5) years with higher percentages of female nurses than males (60.81% versus 39.19%) respectively. With regard to the studied nurses' educational level, less than half (43.24%) of the studied nurses had technical health institute diploma, while only (18.92%) of the nurses had Bachelor degree in nursing. Around two-fifths of the studied nurses (40.54%) working at the main ICU. Slightly less than half of the nurses (47.3%) had from 1 to less than 5 years of experience in ICUs. Slightly more than half (55.41%) of the nurses didn't attend any seminars or training programs on VADs related infection prevention.

Table (2): Knowledge and practice of the studied critical care nurses on vascular access devices related infection (n= 74).

Level of scores	Numbers	%
Knowledge :		
Fair	27	36.49
Good	30	40.54
Very good	12	16.22
Excellent	5	6.75
Practice:		
Not done or bad	20	27.03
Needs improvement	32	43.24
competently performed	13	17.57
proficiently performed	9	12.16

Table 2 shows the distribution of the studied nurses' level of knowledge and practice regarding VADs related infection. It expresses that around two-fifths (40.54%) of the studied nurses have good level of knowledge, slightly more than one-third (36.49%) have fair level of knowledge, and minority (6.75%) have excellent level of knowledge, with the mean level of knowledge is (8.6078± 1.9908).

Regarding level of the studied nurses' practice according to the VADs related infection, slightly more than two-fifths (43.24%) need improvement, followed with slightly more than one-quarter (27.03%) some of their procedures' steps are not done or badly implemented, and minority (12.16%) proficiently perform the procedures, with mean total practice (2.1400±1.4287).

Table (3): Relation between the mean critical care nurses' levels of knowledge and practice (n= 74)

Means		t-test	P-value
Knowledge	Practice		
X± SD	X± SD		
8.6078± 1.9908	2.1400±1.4287	2.253	0.000**

Table 3 shows a significant relationship between mean levels of nurses' knowledge and practice regarding vascular access devices related infection $P < 0.001$. As the mean level of knowledge is higher than the mean level of practice

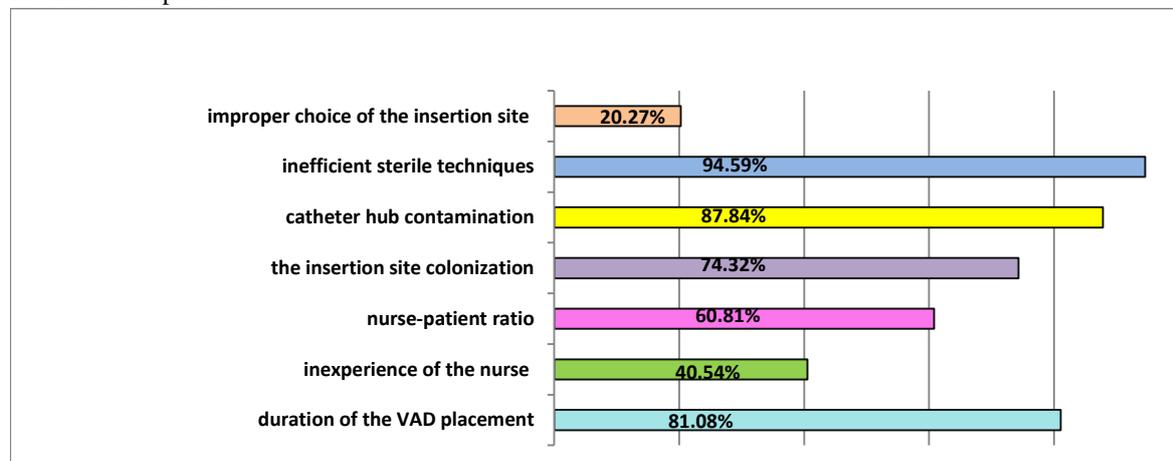


Figure (1): Factors that promote occurrence of vascular access devices related infection (n=74)

Figure 1 shows factors that promote occurrence of VADs related infection. It shows that around the entire nurses (94.59%) stated that inefficient sterile techniques is the most common factor, followed with the catheter hub contamination, and duration of the VADs placement by the majority of the nurses (87.84%, 81.08%) respectively, the insertion site colonization by slightly less than three-quarters of the nurses (74.32%), nurse-patient ratio in the CCU by three-fifths of the nurses (60.81%), and inexperience of the nurse by two-fifths (40.54%) of the nurses, in addition to improper choice of the insertion site by one-fifth (20.27%) of the studied nurses.

Table (4) Relation between demographic data of the studied critical care nurses and mean level of knowledge scores (n = 74).

Demographic data	Mean level of Knowledge Scores	Test	p-value
Age:			
< 25 Years	115.2 ± 16.0	F= 2.526	0.014*
25 up to 35 Years	103.5 ± 19.5		
>35 Years.	113.8±19.0		
Sex:			
Female	113.8±19.0	t=0.545	0.587
Male	111.7±16.1		
Educational level:			
Technical health institute diploma.	103.3 ± 15.9	F=3.408	0.018*
Nursing schools diploma.	109.5 ± 18.6		
Bachelor degree.	115.3 ± 15.6		
Place of work in ICUs:			
Intensive Care Unit(ICU)	111.1±17.7	F=3.271	0.010*
Pediatric care unit (PICU)	103.5 ± 19.5		
Neonatal intensive care unit (NICU)	115.2±16.7		
Cardio-Thoracic Surgery unit (CTIU)	118.8±13.5		
Coronary Care Unit (CCU)	103.5 ± 19.5		
Hepatic Intensive care Unit (HICU)	104.8 ± 20.0		
Years of Experience in ICUs:			
6 months < 1 year	104.3±19.3	F=4.673	0.012*
1 year to < 5 years	119.8±12.5		
5 years to < 10 years.	115.3 ± 15.6		
> 10 years.	114.2±16.4		
Attending training programs or workshop on preventing VADs related infection:			
1 or 2 seminars	113.2±16.4	F=4.343	0.011*
>2 seminars	117.8±13.5		
Don't attend any seminars	102.3±19.3		

Table 4 shows that the high mean level of knowledge scores is among the critical care nurses aged less than 25 Years, Bachelor educated, work at the Cardio-Thoracic Intensive unit, with experience years in CCUs ranged from 1 to less than 5 years, and attend more than 2 training programs or workshops on preventing VADs related infection with mean (115.2 ± 16.0, 115.3 ± 15.6, 118.8±13.5, 119.8±12.5, and 117.8±13.5) respectively. There is a statistical significant relationship among the same listed demographic data and mean level of knowledge scores at $p < (0.014, 0.018, 0.010, 0.012, \text{ and } 0.011)$ respectively. The same table shows no statistical significant relation between sex and the mean level of knowledge scores.

Table (5) Relation between demographic data of the studied critical care nurses and mean level of practice scores (n= 74).

Demographic data	Mean level of practice Scores	Test	p-value
Age:			
< 25 Years	65.9 ± 10.5	F=7.422	0.001*
25 up to 35 Years	73.4 ± 7.9		
>35 Years.	70.4±9.7		
Sex:			
Female	72.8±8.5	t= -1.134	0.260
Male	73.8 ± 6.7		
Educational level:			
Technical health institute diploma.	69.4 ± 10.7	F=5.478	0.006*
Nursing schools diploma.	66.8 ± 20.0		
Bachelor degree.	73.5 ± 8.0		
Place of work in ICUs:			
Intensive Care Unit(ICU)	76.0±5.5	F=4.826	0.011*

Pediatric care unit (PICU)	71.3±9.3		
Neonatal intensive care unit (NICU)	72.6±8.7		
Cardio-Thoracic Surgery unit (CTIU)	67.7±9.2		
Coronary Care Unit (CCU)	71.6±9.8		
Hepatic Intensive care Unit (HICU)	66.8 ± 20.0		
Years of Experience in ICUs:			
6 months < 1 year	67.7±9.2	F=3.970	0.023*
1 year to < 5 years	71.3±9.3		
5 years to < 10 years.	78.0±3.5		
> 10 years.	65.7±7.2		
Attending training programs or workshop on preventing VADs related infection:			
1 or 2 seminars	68.4 ± 11.7	F=6.083	0.004*
>2 seminars	74.5 ± 9.0		
Don't attend any seminars	62.8 ± 21.0		

Table 5 shows that the high mean level of practice scores is among the studied nurses aged from 25 up to 35 Years, Bachelor education, work at the Intensive Care Unit, with experience years ranged from 5 years to less than 10 years, and attend more than 2 training programs or workshops on preventing VADs related infection with mean (73.4 ± 7.9, 73.5 ± 8.0, 76.0±5.5, 78.0±3.5, and 74.5 ± 9.0) respectively. There is a statistical significant relationship among the same listed demographic data and mean level of practice scores at $p < (0.001, 0.006, 0.011, 0.023, \text{ and } 0.004)$ respectively. The same table shows no statistical significant relation between sex and the mean level of practice scores.

V. Discussion

Nowadays with the great advance in technology, up-to-date Knowledge, and the use of evidence-based practices the nurses' role has altered dramatically. Using these innovations help the nurses in selection of the VADs, insertion, maintenance, and removal. The routine maintenance of VADs is a shared responsibility between the health professionals and the patient (Sandoval et al., 2018).

Ten percent of patients on general hospital departments will have different types of infection during their length of hospital stay and around 30% of ICUs patients are attacked by nosocomial infection at least once Louis, (2011). These infections are more complicated and may cause acute infections in which the causative microorganisms are resistant to antimicrobial medications (Zhang et al., 2013). The critical care patients who require aggressive diagnostic and treatment procedures are more risk for these infections (Macher et al., 2010). This is considered as a warning alarm that raises the importance of assessing, updating and qualifying health care providers' level of knowledge to practice optimal quality patients' clinical care (Currie et al., 2011). Therefore, the aim of the present study is to assess the Critical Care nurses' knowledge and practice on vascular access devices related infection.

The current study clarified that the mean age of the studied nurses was (25.38 ± 0.5) years with higher percentages are female as they represented three-fifths from the total study sample. Less than half of the studied nurses had technical health institute diploma, and less than one-fifth of the nurses had Bachelor degree. Around two-fifths of the studied nurses work at the main ICU. Slightly less than half of the studied nurses had from 1 to less than 5 years of experience. Slightly more than half of the nurses didn't attend any seminars or training programs on VADs related infection prevention.

A study by El Nemr et al., (2013) implemented at the ICUs of Zagazig University Hospital using an interventional program to decrease central venous catheter related Blood Stream Infection; stated that in the surgical ICU, the mean age of studied sample was (26.28 ± 3.9) years, more than half of nurses had general diploma while only minority had Bachelor (BSC) degree in Nursing. The experience duration of nearly half of healthcare providers ranged from 5-10 years. Training courses on infection control was received by slightly more than one-third of the health care providers.

In the same study, at the emergency ICU; the mean age of studied sample was (28.063±5.2) years, slightly less than half of nurses had general diploma and one-fifth had BSC in Nursing, nearly half of studied health care providers had less than 5 years of work experience. Training courses on infection control was received by slightly less than two-fifths of the health care providers.

The present study clarified that around two-fifths of the nurses have good level of knowledge, slightly more than one-third have fair level of knowledge, and minority have excellent level of knowledge about the VADs related infection. From the researchers' view, this is could be caused by the recurrent use of (VADs) at the predetermined settings to the entire patients which make nurses aware of the devices and their uses, in addition to the in-service training at the hospital .

This result is in the same line with Paolucci et al., (2011) who studied the RN Knowledge of Vascular Access Devices Management and found that nurses working in the colorectal unit were generally knowledgeable about VADs management. Also, El-Sayed et al., (2015) whom studied the nurses knowledge and practice for infection prevention in the burn unit; stated that most of their sample consume in general satisfactory knowledge on nosocomial infections, and infection control measures.

Moreover, a study by Cicolini et al., (2014) who studied the nurses' knowledge of evidence-based guidelines on prevention of the peripheral venous catheter-related infections stated that the nurses' knowledge is low in some recommendations of peripheral venous catheter-related infections' prevention. These results contradict with Deshmukh & Shinde, (2014) whom studied the impact of education among nurses on knowledge and practice in care of venous access device, and stated that slightly less than half of the subjects have poor knowledge regarding venous access device care.

Regarding the studied CCUs nurses' level of practice on the VADs related infection, the current study showed that slightly more than two-fifths of the nurses need improvement, followed with slightly more than one-quarter some of their procedures and steps are not done or badly implemented, and minority proficiently perform the procedures. From the researcher's point of view, inadequate practices of nurses could be explained by limited experience of nurses, the absence of supervision and constant feedback, unavailability of procedure books and absence of training program prior to work in C.C.U.s, and follow-up boosters programs that aim to quality improvement.

Results of the current study agreed with a study implemented in Egypt by El-Sayed et al., (2015) who studied the Nurses' Knowledge and Practice for Prevention of Infection in Burn Unit, and stated that the level of practice for starting and maintaining IV infusion, following aseptic technique principles, object's handling and its disposal were low in the studied nurses. Also, Eskander et al., (2013) who studied the intensive care nurses' knowledge and practices of infection control standard precautions at a selected cancer hospital; found unsatisfactory performance in changing the administration sets, as well as the central line site care.

This result disagrees with Deshmukh & Shinde, (2014) whom stated that three-quarters of the studied subjects have average practice regarding venous access device care. Also, Fashafsheh et al., (2015) in Palestine studied the knowledge and practice of nursing towards infection control measures and found that the majority of the nurses had good level of practice on infection control preventive measures.

This study revealed that there is a significant relation between the nurses' mean level of knowledge and mean level of practice regarding vascular access devices related infection. From the researchers' point of view the level of nursing practice to achieve the goal of infection prevention is greatly influenced by their level of knowledge, the organizational factors, the nurse-patient ratio, and sufficient supplies, lack of training, and lack of facilities in the work unit.

In the same line a study by Gijare, (2012) who studied the effectiveness of teaching on infection control measures among the health professionals and Hamid et al., (2010) who studied knowledge about blood-borne infectious diseases and universal precautions practice among the health professionals, as they found significant statistical positive correlation between practice and knowledge of infection control precautions among the studied nurses .

Regarding factors that promote occurrence of VADs related infection, the current study shows that around the entire nurses stated that inefficient sterile techniques is the most common factor, followed with the catheter hub contamination and duration of the VAD placement by the majority of the nurses, the insertion site colonization by slightly less than three-quarters of the nurses, nurse-patient ratio by three-fifths of the nurses, and inexperience of the nurse by two-fifths of the nurses, in addition to improper choice of the insertion site by one-fifth of the studied nurses.

In the same line a study evaluated the Central Venous Catheter Associated Blood Stream Infections by (Khanna et al., 2013) found that duration of catheter in situ, and site of venous cannulation are predisposing risk factors for the catheter-related infections' development.

The current study shows that the high mean level of knowledge scores is among the nurses aged less than 25 Years, Bachelor education, work at the Cardio-Thoracic Intensive unit, with years of experience in CCUs ranged from 1 to less than 5 years, and attend more than 2 training programs or workshops on preventing VADs related infection with a statistical significance among the same demographic data and mean level of knowledge scores. But there is no statistical significant relation between sex and the mean level of knowledge scores.

In the same line Khalil et al., (2017) in Egypt studied the Oncology Critical Care Nurse's level of Knowledge about the insertion, care and complications of venous port catheters; found a high statistical significant relation between demographic data of the studied nurses such as: age, educational level, years of experience in nursing, previous training courses and their level of knowledge regarding the catheter port infection. But there was no significant relation between the level of knowledge and the sex.

Also, a study by El-Sol & Badawy (2017) who studied "The Effect of Teaching Module about Prevention of Central-Line Associated Blood Stream Infection on ICU Nurses' Knowledge and Practice", illustrated that nurses aged more than 34 years old, with more than 10 years of experience, and had bachelorette degree in nursing; had significant high level of knowledge.

The current study shows that the high mean level of practice scores is among the CCUs nurses aged from 25 up to 35 Years, Bachelor education, work at the Intensive Care Unit, with Years of Experience in CCUs ranged from 5 years to less than 10 years, and attend more than 2 training programs or workshops on preventing VADs related infection with statistical significance among the same demographic data and mean level of practice scores, but there is no statistical significant relation between sex and the mean level of practice scores.

The results of the current study are consistent with Deshmukh & Shinde, (2014) whose results showed no significant association between sex of the nurses and the pre-test practice' score on venous access device care. But the same study is not consistent with the results of the current study as it some points as it shows no significant association between age, qualification, and years of experience of the nurses and the pre-test practices' score regarding venous access device care.

VI. Conclusion and Recommendations

The present study concluded that two-fifths of the studied nurses have good level of knowledge, and slightly more than two-fifths need improvement in practice with statistical significant relation between the nurses' mean level of knowledge and mean level of practice scores on vascular access devices' related infection. So, the current study recommended the implementation of structured training programs on the VADs related infection preventive guidelines at the hospitals and increase the in-service training for nurses. Also, the current study recommended that the Infection Control team should follow the critical care staff to assure the application of infection control methods, availability of equipment, and screen for prevalence of VADs related infection with accurate recording. Moreover, guidelines to prevent and manage VADs related infection should be implemented by all the nurses.

References

- [1]. Adegboye, M.B., Zakari, S., Ahmed, B.A., Olufemi, G.H. (2018). Knowledge, awareness and practice of infection control by health care workers in the intensive care units of a tertiary hospital in Nigeria. *Afri Health Sci J*; 18(1): 72-78.
- [2]. Akbari, F. and Kjellerup, B.V. (2015): Elimination of Bloodstream Infections Associated with *Candida albicans* Biofilm in Intravascular Catheters, *Pathogens Journal*; 4(3):457-69.
- [3]. Association of Anaesthetists of Great Britain and Ireland. (2016). Safe vascular access. *Anaesthesia*, May 2016; 71: 573-585. Available at: <http://onlinelibrary.wiley.com/doi/10.1111/anae.13360/full>
- [4]. Chernecky, C., Macklin, D., and Blackburn, P. (2015): Catheter-Related Blood stream Infections (CR-BSI) in Geriatric Patients in Intensive Care Units, *Crit Care Nurs Q J*;38(3):280-92.
- [5]. Cicolini, G., Simonetti, V., Comparcini, D., Labeau, S., Blot, S., Pelusi, G., Di Giovanni, P.J. (2014): Nurses' knowledge of evidence-based guidelines on the prevention of peripheral venous catheter-related infections: a multicenter survey, *Clin Nurs J*; 23(17-18)
- [6]. Currie, L., Lecko, C., Gallagher, R., and Sunley, K. (2011): Safety: principle of nursing practice C, *Nursing Standard*, 25 (30):35-37
- [7]. Deshmukh, M. , and Shinde, M. (2014): Impact of Structured Education On Knowledge And Practice Regarding Venous Access Device Care Among Nurses, *International Journal of Science and Research (IJSR) online*; 3 (5). Available at: www.ijsr.net. Retrieved on May,25, 2016.
- [8]. El Nemr, W.A., Fahmy, H.H., Abd El Razek, G.M., and Abd El Salam, N.M. (2013). An Interventional Study To Decrease Central Venous Catheter Related Blood Stream Infection In Intensive Care Units At Zagazig University Hospital. *Z.U.M.J*; 19(6): 492-505
- [9]. El-Sayed, Z.M., Gomaa, A., and Abdel-Aziz, M. (2015): Nurses' Knowledge and Practice for Prevention of Infection in Burn Unit at a University Hospital: Suggested Nursing Guidelines, *IOSR Journal of Nursing and Health Science*; 4 (4): 62-69.
- [10]. El-Sol, A., & Badawy, A.I. (2017). The Effect of a Designed Teaching Module Regarding Prevention of Central-Line Associated Blood Stream Infection on ICU Nurses' Knowledge and Practice. *American Journal of Nursing Science*; 6(1):11-18.
- [11]. Eskander, H.G., Morsy, W.Y.M., and Elfeky, H.A.A. (2013): Intensive Care Nurses' Knowledge and Practices Regarding Infection Control Standard Precautions At A Selected Egyptian Cancer Hospital, *Education and Practice Journal*; 4(19): 160-174.
- [12]. Fashafsheh, I., Ayed A., Eqtait, F., and Harazneh, L. (2015): Knowledge and Practice of Nursing Staff towards Infection Control Measures in the Palestinian Hospitals, *Journal of Education and Practice*; 6 (4): 79-90.
- [13]. Gaynes, R., & Band, J, D.(2018): Intravascular catheter infection: Epidemiology, pathogenesis, and microbiology,
- [14]. Gijare, M. (2012): Effectiveness of Teaching On Infection Control Practices Among Healthcare Professionals, *Sinhgad e Journal of Nursing*; 2(2): 5-9.
- [15]. Hadaway, L. (2012): Short Peripheral Intravenous Catheters and Infections, *Journal of Infusion Nursing*; 35(4): 230–240
- [16]. Hamid, M.Z.A., Aziz, N.A., Anita, A.R., Norlijah, O., (2010). Knowledge of Blood borne Infectious Diseases And The Practice Of Universal Precautions Amongst Healthcare Workers In A Tertiary Hospital In Malaysia. *Southeast Asian Journal, Trop Med Public Health*, 41(5): 1192-1199.
- [17]. Hinkle, J. L., & Cheever, K. H. (2014). *Brunner & Suddarth's Textbook of Medical-Surgical Nursing* (13th ed.). Philadelphia: Wolters Kluwer Health | Lippincott Williams & Wilkins.
- [18]. Ignatavicius, D.D., and Workman, M.L. (2013): *Medical- Surgical Nursing: patient- Centered Collaborative Care*. 7th ed, United States of America, Elsevier CO.PP: 519, 533-534.
- [19]. Khalil, N.S., Youssef, W., Moustafa, Z. (2017). Oncology Critical Care Nurse's Knowledge about Insertion, Care and Complications of Venous Port Catheters in Egypt. *Adv Practice Nurs J*; 2(2): 137

- [20]. Khanna, V., Mukhopadhyay, C., Vandana, K. E., Verma, M., and Dabke, p. (2013). Evaluation of Central Venous Catheter Associated Blood Stream Infections: A Microbiological Observational Study. *Journal of Pathogens*; June 2013, <http://dx.doi.org/10.1155/2013/936864>
- [21]. Macher, E., Dubos, F., Garnier, N., Delebarre, M., Berranger, E., Thebaud, E., Mazingue, F., Leblond, P., and Martinot, A. (2010): Predicting Risk of Severe Bacterial Infection in Children With Chemotherapy-Induced Febrile Neutropenia. *Pediatric Blood Cancer J*; 55:662–667.
- [22]. O'Grady NP, Alexander M, Burns LA, et al. (2011). Guidelines for the prevention of intravascular catheter-related infections. *Clin Infect Dis*. 2011; 52(9):e162–e193.
- [23]. Paolucci, H., Nutter, B., and Albert, N.M. (2011): RN Knowledge of Vascular Access Devices Management, *The journal of the association for vascular access*; 16(4): 221-225
- [24]. Radonić, J., Mihaljević, L., Radonić, R., Rogić, D., Sekulić, A., Katancić-Holjevac, J., Murselović, T., Stambolija, V. (2014): Peripheral arterial catheter related infections in the neurosurgical intensive care unit, *Coll Antropol J*; 38(2):665-9.
- [25]. Sandoval, L.J.S., Sandoval, R.N.C., and Emily Sugey Castillo Cieza, E.S.C. (2018). Nursing care for a person with invasive devices, intensive care unit, of hospital of Chiclayo. *Hospice & Palliative Medicine International Journal*; 2(3):178–181.
- [26]. Shah, H., Bosch, W., Thompson, K.M., and Hellinger, W.C. (2013). Intravascular Catheter-Related Bloodstream Infection, *Neurohospitalist J*; 3(3): 144–151.
- [27]. Smeltzer, S.C., Bare, B.J., Hinkle, J.L., and Cheever, K.H. (2010): *Brunner and Suddarth's Textbook of Medical-Surgical Nursing*. 13th ed, North American Edition, Williams and Wilkins Co. Vol. 1. Unit 16
- [28]. Zhang, L., Keogh S., and Rickard C.M. (2013). Reducing the risk of infection associated with vascular access devices through nanotechnology: a perspective, *International Journal of Nanomedicine*; 8: 4453–4466

Shereen Abd El-Moneam Ahmed. " Knowledge and Practice of the Critical Care Nurses on Vascular Access Devices Related Infection" .IOSR Journal of Nursing and Health Science (IOSR-JNHS), vol. 8, no.02 , 2019, pp. 13-22.