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Research Article

Impact of Mini Structured Education Program on ICU Nurses Knowledge and Practice Regarding Prevention of Central Venous Line Associated Blood Stream Infection in Alshaab Teaching Hospital-Khartoum City – 2020

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Abstract: ***Background:*** Central venous catheters (CVC) are known to be associated with risk of complications such as infection and hemorrhage thus good knowledge and practices of care are crucial in limiting these risks also nurses be supposed to integrate evidence-based practice into their care to improve patient outcomes. This study aimed to evaluate impact of mini structured education program on ICU nurses knowledge and practice regarding prevention of central venous line associated blood stream infection. ***Methodology:*** This is an interventional pre –posttest study conducted in Alshaab Teaching Hospital, full coverage sampling method was used incorporated 32 ICU nurses working in ICU and met selection criteria, Information and skill were collected by researchers from ICU nurse's using standardized self-administer questionnaire and direct observation check list . Mini structured education program was applied and post-test with final assessment were conducted after 2 weeks using same questionnaire and check list then the collected data pre and post analyzed analyzed and interpreted using both descriptive and inferential statistics based on the objective and hypothesis of the study. A two-tailed p value at 0.05 was taken as the level of significance using SPSS version 20. ***Results:*** Among 32 nurses included; mean age of participant was 25 years, almost of participants were female 87.5% while(29) 90,6% had BSc level of qualification and84,4% more than 1year duration of work. The overall mean of pre-test knowledge scores regarding prevention of central venous line associated blood stream infection was found to be 5.8 with statically significant difference (p=0.000<0.05) and in post-test found to be increased to 8,2with statically significant difference (p=0.000<0.05) . Regarding practice the overall mean of pre-test scores toward care of CVL in order to prevent central venous line associated blood stream infection was found to be 11.8with statically significant difference (p=0.000<0.05) and posttest increased to 15.7 with statically significant difference (p=0.000<0.05). ***Conclusion:*** Study concluded that there was highly statistical significant improvement in ICU nurses' knowledge and practice regarding care of CVL in order to prevent central venous line associated blood stream infection.
Keywords: Central venous line, mini structured education program, blood stream infection, ICU Nurses.

INTRODUCTION

Background

The use of CVCs has risen over the past decade due to their relative ease in placement and necessity for many lifesaving treatments for the administration of fluids, medications, blood products, parenteral nutrition and to monitor hemodynamic status of patients. There are three distinct types of catheters: non-tunneled, which includes peripherally inserted central catheters (PICCs) and acute short-term lines; tunneled (Broviacs and Hickmans); and totally implanted CVCs (port-a-cat/s) [1].

In the United States, 15 million central vascular catheter (CVC) days (i.e., the total number of days of exposure to CVCs among all patients in the selected population during the selected time period) occur in intensive care units (ICUs) each year and studies have variously addressed catheter -related

bloodstream infections (CRBSI).These infections independently increase hospital costs and length of stay but have not generally been shown to independently increase mortality at the same time as 80,000 CRBSIs occur in ICUs each year and a total of 250,000 cases of BSIs have been anticipated to occur annually, if entire hospitals are, the cost of these infections is significant, both in terms of morbidity and financial resources spent [2].

In a systematic review study, 15,979 children with CVC were reviewed of all locations of CVCs implanted, the incidence of thrombosis was 1.7% [95% confidence interval (CI): 0.8–2.8]; however, the highest incidence was in umbilical CVCs 3.7% (CI: 0–12.2) and non-tunneled CVCs 3.7% (CI: 0–11.1) [1].

CVC is a larger, longer catheter that's put into a large vein with many diverse types available either short term or long-term CVC is selected according to the patient condition to give treatment [2]. Several types of CVCs can stay for many weeks, months and even years. The catheter can stay in as long as the patient getting treatment so, patients do not need to be stuck with a needle each time which can effectively relive the pain of the patients. At all types of CVCs all have its own specific nursing care because they have diverse complications and possible problems [3].

Central line association blood stream infection (CLABSIs) lead to prolonged hospital stays and increase health care costs and mortality. An estimated 250,000 bloodstream infections occur annually, and most are related to the presence of intravascular devices [4]. CVL usually remain in place for a longer period of time than other venous access devices, especially when the reason for their use is longstanding such as total parenteral nutrition in a chronically ill patient. For this sterile technique is a greatly important here, as a line may serve as a place of entrance for pathogenic organisms, and the line itself may become infected with organisms such as staphylococcus aureus and coagulase-negative staphylococci [5]. Nurses are obliged to take care for various I.V. devices and when central venous access should be discontinued. They should be aware of some low-resistance lines, such as those used for dialysis; often need anticoagulant flushes, while other lines with valves, intended for long-term access do not require heparin flushes. A highlighting on meticulous sterile technique, both during the placement of lines and during routine care, is necessary and taking away of unused lines reduces infection risk [6]. CLABSIs are widespread hospital acquired infections with reported mortality of 12-25%and the use of antibiotics and strict aseptic technique can significantly reduce the rate of infection [7].

The nurses play a major role in providing care to the patients in all phases to control the infection which can help decrease the risk of central venous catheter related blood stream infection by using meticulous hand hygiene before performing CVL care using either waterless alcohol-based product, or using an antibacterial soap with water and sufficient rinsing. It should be a regular practice in worldwide to employ the infection control nurses to establish the knowledge and practice of infection control. The enhancement of knowledge and practice regarding infection control is essential in preventing complications [8].

The Institute for Healthcare Improvement (IHI) stressed the importance of decreasing central venous catheter related bloodstream infections. They have implemented a 5 Million Lives campaign that was aim is protecting patients from incidents of medical harm, including catheter infections, and to help healthcare professionals achieve this, the IHI has developed a care bundle aimed at preventing central venous catheter infections. A care bundle is a group of practices that together result in better outcomes than if the practices were implemented individually [9].

CVL may be made out of either polyvinyl chloride or polyurethane material. Studies have indicated that catheters made out of polyurethane have a lower infection rate than catheters made out of polyvinyl chloride [10].

The decision to use a particular CVC should be guided by risk–benefit analysis (including the risk for adverse events), device availability, and expected time on the waiting list for implantation, patient preference, and cost [11].

Steps for drawing blood from the catheter, consist of remove the access cap before drawing blood, clean the catheter hub with alcohol, and attach the syringe directly to the catheter hub then when finished replace the access cap with a new sterile cap.

Every time the access cap is removed, or if it becomes contaminated with blood or other fluid the cap must be replaced with a new sterile cap [11]. In study done in selected hospitals of Delhi on CLABSI showed that lower CLABSI rates were achieved through educational measures without increasing costs to the hospital. In this approach, every health professional was approached individually regarding the insertion technique and maintenance of central venous catheters [7]. In addition knowledge and practice on central venous line care are vital for nurses to prevent consequence associated with improper central venous line approach.

The majority of vascular access device-related complications are preventable or, if they occur, adverse effects can be mitigated through early identification and intervention [12]. This study is going to evaluate impact of mini structured education program on ICU

nurses knowledge and practice regarding prevention of central venous line associated blood stream infection.

1-2Justifications

Proper technique uses in care of the central venous line reduce the risk of central venous line associated blood stream infection. (CLABSI)and occlusion. The nurses lack of awareness and improper care about of central venous line lead to serious complications such as extravasation of drugs, air embolism, pneumothorax, haemothorax, retroperitoneal hematoma, arterial puncture, Local hematoma, thoracic duct injury, chlothorax, catheter knots and vessel stenosis and these complications my result in significant morbidity and mortality incidence of catheter related infections which was estimated as 200,000cases worldwide each year.

1-3 Research questions
1. What is the baseline knowledge and practice of ICU nurses" regarding care of CVL to prevent central venous line associated blood stream infection?
2. What is the impact of mini structured education program on ICU nurses" knowledge regarding care of CVL to prevent central venous line associated blood stream infection?
3. What is the impact of mini structured education program on ICU nurses" practice regarding care of CVL to prevent central venous line associated blood stream infection?

1-4 Research Hypotheses
H01- There will be no difference between pre and post-test mean knowledge scores toward Prevention of Central Venous Line Associated Blood Stream Infection.
H11- There will be a significant difference between pre and post-test mean knowledge scores toward Prevention of Central Venous Line Associated Blood Stream Infection.
H02- There will be no difference between pre and post-test mean improvement in practice toward Prevention of Central Venous Line Associated Blood Stream Infection.
H12- There will be a significant difference between pre and post-test mean improvement in practice toward Prevention of central Venous line Associated Blood Stream Infection.

2-SUBJECT AND METHOD
Study design and setting
Interventional pre –posttest hospital based study design was used to evaluate impact of mini structured education program on ICU nurses knowledge and practice regarding prevention of central venous line associated blood stream infection. The study was carried out in ICU in three phases in Alshaab teaching hospital which is special for cardiac and respiratory diseases and the criteria for selecting this setting were geographical proximity, feasibility for conducting the study, availability of the required sample because nurses working in these units are in charge for a larger number of patients with CVL.

Study population
The target population of the study was all nurses (graduate and post graduate) working in respiratory intensive care unit (RICU) and open heart surgery unit (OHS) in Alshaab teaching hospital.

Inclusion criteria
Both sexes

Exclusion criteria
All nurses attended training program or workshops on CVl care were excluded.

Sampling method
Full coverage sampling method was used.

Sample size
Full coverage which equal 32 nurses

Study Phases

Methods of Data collection
The data collected by the researchers using self-administer standardized questionnaire in form of questions, the questionnaires consist of two parts:

Part 1
Include socio demographic data and consisted of four variables (Age, Sex, Level of qualification and Duration of work).

Part 2
Consisted of10 items concern about assessment of ICU nurses knowledge regarding care of CVL according to last updated CDC guidelines of care at October 2017 [2]. Items scored (10 questions = 10 scores) each correct answer was given a score of „one" mark and wrong answers „zero" score after that obtained score percentage = ---- x 100 =total score. To find out the association with the selected variables, the knowledge aspect was categorized into three groups. Below 50% = Inadequate knowledge. 51–75% = Moderate knowledge. Above 75% = Adequate knowledge.

Part 3:-Concern about direct observational checklist which consisted of 16 items based according to last updated CDC guidelines of care at October 2017 [2]. On practice about care of CVL in order to prevention of central venous line associated blood stream infection. Each item of the check list had one mark, and the total score of the practice check list was 16 scores. The researchers observed the nurses during working hours in three shifts per day (morning, afternoon and night).

Study Phases
Phase 1 (from October to November 2019)
The researcher observed the participants practice regarding 16 elements of care of CVL according to last updated CDC guidelines of care at October 2017[2] that related to nursing practice (infection control procedures, Assessment site of central line, care of catheter).

Phase 2 (from December 2019 to January 2020)
In phase 2, participants completed the multiple choice question (MCQ) assessment tests before an educational program. The pretest was administered to all participants during their work hours. Small group mini structured educational sessions of a 30-minute on prevention of central venous line associated blood stream infection were given immediately following the pretest. Participants were afforded time to ask questions regarding subject material covered during the educational program. A posttest was then administered after 2 weeks from end of the educational program poster also putted in ICU wall to remind the staff all the time. The program was prepared and delivered by the researchers.

Phase 3 (from January to March to 2020)
The researchers performed the observation of practice over a two-month period.

Data analysis methods
The collected data entered then analyzed using statistical package for social sciences SPSS descriptive and inferential statistics, mean, SD and paired T test and P value to determine whether there is a significant difference in the mean knowledge score and practice scores of pre-test and post-test.

Ethical considerations
- Approval was taken from hospital manager for agreement to conduct this study.
- Approval was taken from the participant for participation.

RESULTS

In this study an interventional pre –post teststudy conducted a full coverage sampling method was used incorporated 32 ICU nurses working in respiratory intensive care unit (RICU) and open heart surgery unit (OHS) in Alshaab teaching hospital.

Table-1: Distribution of study subjects regarding their demographic background (n=32)

Characteristics	Frequency	%
Age:		
• 20-30 years	29	90,6
• 31-40 years	1	3,1
• 41-50 years	1	3,1
• Above 50 years	1	3,1
Sex:		
• Male	4	12,5
• Female	28	87,5
Level of qualification:		
• Diploma	2	6,2
• B S C	29	90,6
• M S C	1	3,1
• P H D	0	0
Duration of work:		
• less than 1 year	5	15,5
• more than1year	27	84,4
Total	32	100

Among 32 nurses included, mean age of participant was 25 years, almost of participants were female 87,5% while(29) 90,6% had BSc level of qualification and 84,4% had mean more than 1year duration of work. The overall mean of pre-test knowledge scores regarding prevention of central venous line associated blood stream infection was found to be 5.8 with statically significant difference ($p=0.000<0.05$) and in post-test found to be increased to 8,2 with statically significant difference ($p=0.000<0.05$). Regarding practice the overall mean of pre-test knowledge scores toward care of CVL in order to prevent central venous line associated blood stream infection was found to be 11.8 with statically significant difference ($p=0.000<0.05$) and posttest increased to 15.7 with statically significant difference ($p=0.000<0.05$).

This table shows that mean age of participant was 25 years, almost of participants were female 87,5% and(29) 90,6% had a BSc level of qualification and (27) 84,4% had mean duration of work more than 1years.
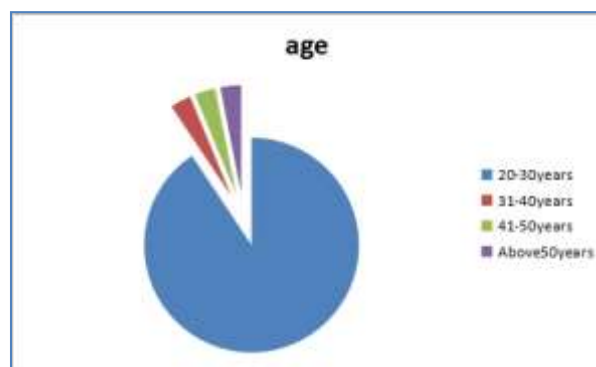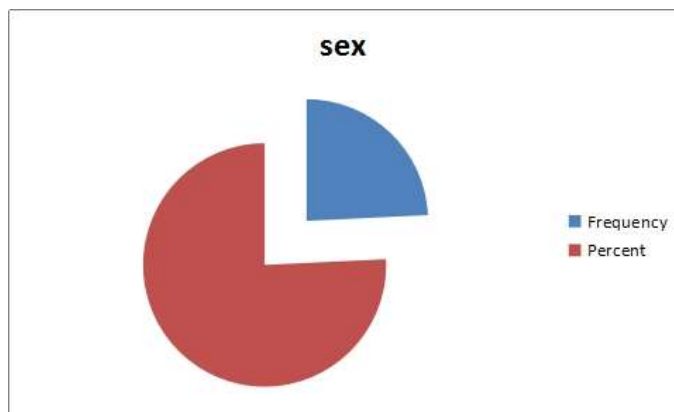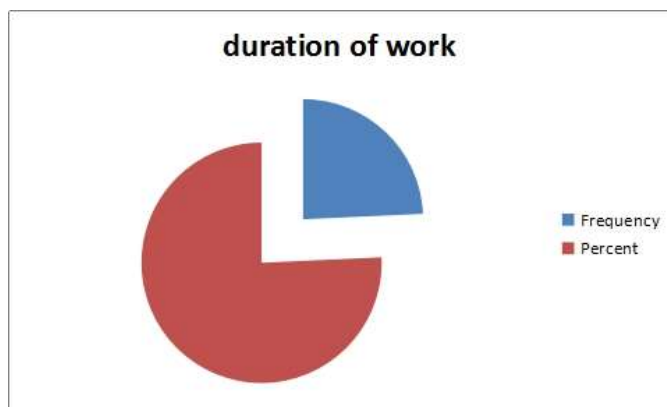

Fig-1: Respondents age

Fig-2: Respondents sex

Fig-3: Respondent duration of work

Table- 3.2: (ICU nurse's knowledge regarding care of CVL. (n=32)

Respondent knowledge	No	Respondent knowledge						P-value
		Pre test			Post test			
		mean	SD	Error SD	Mean	SD	Error SD	
1-When you preparing the skin prior to CVC insertion, you must ….	32	,7188	,45680	,08075	,39656	,39656	,07010	,447
2-in assessment site of CVC you should assess for the …..	32	,7812	,42001	,07425	,8750	,33601	,05940	,374
3- After administration of medication or fluid you must flush the lumen with …..	32	1,0000	,00000	,00000	1,0000	,00000	,00000	,000
4-The site of CVC is covering by….	32	,9375	,24593	,04348	,9688	,17678	,03125	,572
5- Before administration medication or fluid you must ……	32	,1875	,3965	0,7010	,6875	,47093	,08325	,000
6- Frequency of the change the cap of CVC must be ……	32	,5000	,50800	,08980	,6875	,47093	,08325	,110
7-Which from the following dose not decrease the risk of CVC blood stream infection?	32	,2812	,45680	,45680	,4375	,50402	,08910	,231
8-Frequancy of change gauze dressing done every ……..	32	,5312	,50701	,08963	,9688	,17678	,03125	,000
9-Frequancy of replace the IV administration set done every…..	32	,4062	,49899	,08821	,8438	,36890	,06521	,000
10-The solution use for care of CVC is ….	32	,5000	,50800	,08980	,9375	,24593	,04348	,000
Total of respondent knowledge	32	5,8438	1,43930	,25443	8,2188	,1,60110	,28304	,000

Table.2 represents that overall mean of pre-test knowledge scores regarding prevention of central venous line associated blood stream infection was found to be 5.8 with statically significant difference (*p*=0.000<0.05) and in post-test found to be increased to 8,2 with statically significant difference (*p*=0.000<0.05).

Table-3: Direct observational checklist of care of central venous line. (n=32)

Items	No	Respondent knowledge						P value
		Pre test			Post test			
	32	Mean	SD	Error SD	Mean	SD	Error SD	
1-Perform hand hygiene before and after care	32	,9062	,26914	,05235	1,0000	,00000	,00000	,083
2-Identify the patient	32	,9375	,36890	,04348	1,000	,00000	,00000	,161
3-Close curtains around bed and close the door to the room, if possible.	32	,8438	,36890	,06521	,9062	,26914	,05235	,423
4-Explain what you are going to do and why you are going to do it to the patient.	32	,8750	,33601	,05940	,9688	,17678	,03125	,184
5-Assist the patient to a comfortable position that provides easy access to the CVAD dressing.	32	,8438	,36890	,06521	1,0000	,00000	,00000	,023
6-Wear mask	32	,4688	,50701	,08963	,9062	,29614	,05235	,000
7-Wear sterile gloves	32	,8438	,36890	,06521	1,0000	,00000	,00000	,023
8-Assess site of central line (redness, hotness, odor, discharge)	32	,9062	,29614	,05235	1,0000	,00000	,00000	,083
9-Flush the lumen with normal saline after the administration of medication or fluid	32	,7812	,42001	,07425	1,0000	,00000	,00000	,006
10-Use sterile gauze or sterile transparent semipermeable dressing to cover the catheter site	32	,8750	,33601	,05940	1,0000	,00000	,00000	,044
11-Change caps no more often than 72 hours (or according to the manufacturer's recommendations and whenever the administration set is changed).	32	,5312	,50701	,08963	,8125	,36956	,07010	,027
12-Disinfect the needleless connectors before administer medication or fluid	32	,9375	,24593	,04348	,9688	,17678	,03125	,572
13-Change gauze dressing every 2 days, clear d, dressing every 7 days unless dressing becomes damp, loosened, or visibly soiled then change.	32	,8438	,36890	,06521	,9688	,36890	,17678	,103
14-Replace the IV administration sets every 72 hours	32	,8438	,06521	,36890	,9688	,17678	,03125	,103
15-Perform catheter site care using 2% chlorhexidinegluconate in 70% isopropyl alcohol to clean the insertion site during dressing changes	32	,4688	,50701	,08963	,9375	,24593	,04348	,000
16- Label dressing with date, time of change	32	,5938	,49899	,08821	,9062	,29614	,05235	,005
Total of practice	32	11,8438	3,61992	,63992	15,7500	1,34404	,23760	,000

Table .3 reveled that overall mean of practice pre-test scores toward care of CVL in order to prevent central venous line associated blood stream infection was found to be 11.8 with statically significant difference (*p*=0.000<0.05) and posttest increased to 15.7 with statically significant difference (*p*=0.000<0.05).

DISCUSSION

The majority of vascular access device-related complications are preventable or, if they occur, adverse effects can be mitigated through early identification and intervention [12]. This study was done in order to evaluate impact of mini structured education program on ICU nurses knowledge and practice regarding prevention of central venous line associated blood stream infection included 32 subject , pre-posttest study using standardize questionnaire based on the guideline to care of CVL. The pre-test and initial assessment done followed by implementation of mini teaching program inform of interactive session and practical demonstration on how to care for CVC according to guidelines of care then post-test and final assessment was conducted after 2 weeks from the end of teaching program to evaluate the effectiveness of structured mini teaching program.

1- Demographic data

The findings of this study showed that mean age of nurses work in ICU was 25years, majority were

female 28(87, 5%) also the majority of participants had BSc degree and the majority of nurses 27(84.4%) work more than 1 year in ICU. In this study nurses knowledge about care increased in nurses with years' of experience more than 1 year, which is similar to the findings of study done in Saudi Arabia in Aldammam teaching hospital which was showed that the level of knowledge increase by years of experience (1-4) years constituted (24.2%), nurses have years of experience [5-9] years constituted [13].

2-Knowledge regarding care of CVL to prevent of CVL associated blood stream infection

The present study confirmed that, there was a statistically significant improvement in knowledge after the implementation of the mini structured education program.

In pretest and posttest knowledge regarding care of CVC the study found that nurses knowledge about care increased in nurses with years' of experience more than 1 year. In the present study the total pretest mean 5.8 and posttest 8.2, the comparison level of

knowledge between pre and post is significance with(p value =0.000). Which is agreed with study done in Walden revealed that the mean pretest score was 72.1% and the mean posttest score was 94.1%. and the comparison of pre -and post-test scores reflect a 22% increase in test scores, therefore, this program increased knowledge [14].

3- Practice regarding care of CVL to prevent of CVL associated blood stream infection

In this study pretest and posttest regarding care of CVL to prevent of CVL associated blood stream infection, the nurses practice level improved after mini structured educational program toward care of CVC ,the pretest mean 11.8 and posttest 15. and the comparison between pretest and posttest was highly significant with (P value =0.000).This finding was also supported by study done in Saudi Arabia in Aldammam teaching hospital in that there is association between nurses' practice and the years of experience in nursing field (P value=0.05) [13].

The mini structured educational program administered in this study was effective and this appears in mean between pre and post toward level of knowledge and practice regarding care of CVL. In comparison with the study done in Walden demonstrated that the project contributed to positive social change by improving nursing practice through increasing nurses' knowledge of proper care and maintenance e of central lines, which can translate into evidence based practice changes and improve patient outcomes [14].

4-Hypothesis Testing

H01- There will be no difference between pre and post-test mean knowledge scores toward Prevention of Central Venous Line Associated Blood Stream Infection.

The above null hypothesis is rejected, so the alternative hypothesis is accepted, since there was a significant change between the pre- and post-test mean knowledge scores toward prevention of central venous line associated blood stream infection with significance level (p=0.000), as shown in (Table 2).

Hence, the stated hypothesis H11 is accepted as there was a significant improvement in knowledge scores of staff nurses after implementation of the structured teaching program.

H02- There will be no difference between pre and post-test mean practice toward of care in order to prevention of central venous line Associated Blood Stream Infection.

The above null hypothesis is rejected, so the alternative hypothesis is accepted, since there was significant change between the pre- and post-

intervention assessment mean practice improve toward prevention of central venous line associated blood stream infection at a significant level (p=0.000), as shown in (Table 3).

Hence, the stated hypothesis H12 is accepted as there was significant improvement in practice of ICU nurses staff after implementation of the structured teaching program.

Strengths of the study

- It is challenge to me to do like this interventional pre post study within the short period of time specified to this research.
- Followed standardized guideline of care.
- Made a poster and put it in ICU about guidelines of CVC.
- There is no previous published study done in this issue in Sudan.

Limitations of the study

- The study is limited to nurses" staff in Alshaab teaching hospitals, Khartoum state which will be very interested if it was done in multiple hospitals to make a comparison.
- Small number of subjects limits the generalization of the study.
- It was difficult to gather all nurses for structured teaching program.

CONCLUSION

The study concluded that the nurses' knowledge and practice improved after mini structured education program. There is significant improvement in ICU nurses' staff knowledge and practice toward prevention of central venous line associated blood stream infection. Nurses necessitate for continuous in-service training, workshops and Regular courses and training programs about CVC care in order to prevent blood stream infection in patient with CVC. In addition to up to date guidelines on CVC care inform of posters should be in place.

REFERENCES

1. Jaffray, J., Bauman, M., & Massicotte, P. (2017). The impact of central venous catheters on pediatric venous thromboembolism. *Frontiers in pediatrics*, 5, 5.
2. O'grady, N. P., Alexander, M., Burns, L. A., Dellinger, E. P., Garland, J., Heard, S. O., & Healthcare Infection Control Practices Advisory Committee (HICPAC)(Appendix 1). (2011). Guidelines for the prevention of intravascular catheter-related infections. *Clinical infectious diseases*, *52*(9), e162-e193.
3. Xu, H., & Wu, Y. (2017). Central venous catheter: care and prevention of infection.

4. Haddadin, Y., Annamaraju, P., & Regunath, H. (2020). Central line associated blood stream infections (CLABSI). *StatPearls [Internet]*.

5. O'Leary, R., & Bodenham, A. (2011). Future directions for ultrasound-guided central venous access. *European Journal of Anaesthesiology (EJA)*, *28*(5), 327-328.

6. Nunnally, M.E. (2012). The role of IVs and central lines in critical care, Kevin, MD, 2012, JULY 22.

7. Gowhar, N. (2018). A descriptive study to assess the knowledge of staff nurses regarding central line associated blood stream infections (CLABSI) with a view to develop information booklet on prevention of (CLABSI) in selected hospital of Srinagar (J&K). *International Journal of Medical Science And Diagnosis Research*, *2*(6).

8. Stiji, S. (2016). Effectiveness of planned teaching programme on the knowledge and practice regarding infection control measures for postoperative cardiac patients among staff nurses at a selected hospital, Chennai (Doctoral dissertation, MMM College of Nursing, Chennai).

9. Hadaway, L.C. (2008). Central venous access devices, *Nursing Critical Care*, (5):26-33.

10. Taxbro, K., Hammarskjöld, F., Thelin, B., Lewin, F., Hagman, H., Hanberger, H., & Berg, S. (2019). Clinical impact of peripherally inserted central catheters vs implanted port catheters in patients with cancer: an open-label, randomised, two-centre trial. *British journal of anaesthesia*, *122*(6), 734-741.

11. Declan, Walsh, M.D. (2007). Guidelines for the prevention of intravascular catheter-related infections, Palliative Medicine, *MMWR*, 51(RR10):1-28.

12. Gorski, Lisa, A. (2017). "The 2016 infusion therapy standards of practice." *Home healthcare now, 35*(1): 10-18.

13. Shadia, M. (2019). Assessment of nurses' Knowledge and Practice Related to Caring of Central Venous Line in KSA at Aldamam hospital., Shaqra University, *IOSR Journal of Nursing and Health Science (IOSR-JNHS)*, *8*(01), 53-56.

14. Cooper, M. (2019). "Improving Nurses' Knowledge of Central Line-Associated Bloodstream Infection."