Minia Scientific Nursing Journal (Print - ISSN 2537-012X) (Online - ISSN 2785-9797) Vol. (10) No. (1) December 2021

Nursing Guidelines and its Effect on Reducing Central Line Related Infection among Traumatic Patients

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Abstract:

Background: Central venous catheter is required in multiply injured patients either in the initial resuscitation phase or during an intensive care unit stay. There are potential complications associated with central line access as infection. Nurses play a crucial role in preventing this infection. **Aim of the study:** To evaluate the **effect of nursing guidelines on reducing central line related infection among traumatic patients. Design:** A quasi-experimental research design. **Sample**: A purposive sample of 60 newly admitted adult patients with central venous catheter divided equally into two groups (study and control). **Setting:** The current study was conducted in traumatic intensive care unit of Qena university hospital, Qena governorate, Egypt. **Tools:** Two tools structure interview questionnaire and central line related infection assessment sheet. **Results:** There were highly statistically significant differences between the study and control groups regarding central line related infection with ($p<0.001$). **Conclusion:** The application of nursing guidelines was effective in reducing central line related infection among traumatic patients. **Recommendations: N**ursing guidelines for preventing central line-related infection should be educated for nurses of intensive care units in Qena university hospital.

Key Words: Nursing- Guidelines - Central line- infection – traumatic patients.

Introduction

Central venous catheter (CVC) is the most important procedure at intensive care unit (ICU). Although there are many benefits of (CVC) as medication administration, blood sampling, and measurement of the central venous pressure (CVP) **(Aloush et al. 2018).** It is associated with numerous complications such as infection, bleeding, thrombosis, and mortality. Infections are the most common complications that can be developed. Incidence of infections varies according to the patient`s health status, duration of insertion time and localization, as well as with the type of catheter and asepsis precautions **(Drašković et al., 2019)**.

Trauma patients account for one third of all ICU admissions as the improvement in surgical techniques and life support management of critically injured patients increased survival after the injury. **(Djuric et al. 2018).** Because of the multitude of lines required in trauma patients especially CVC, central line related infections are very common. They are one of the major contributors of bacteraemia **(Sartelli & Tranà 2019).**

Central line-related infections in critically ill trauma patients are potentially fatal infections and are associated with a substantial increase in long hospital stay and total hospital cost**.** Nosocomial infections are preventable by adherence to procedures and policies designed to limit spread of infection between patients and between ICU staffs and patients **(Sartelli and Tranà 2019)**.

The ICU staff must take the lead in establishing infection control protocols, including procedures for aseptic technique for catheter insertion, standards for universal precautions, duration of catheter placement, appropriate use of antibiotics, procedures in the event of finding antibiotic-resistant microorganisms, and the need for isolation of patients **(AbouZied. 2018).**

Nurses play an important role in providing care for patients connected with central venous catheters. They assist in central line insertion, care of its dressing, withdrawing a venous blood sample, and delivery of drugs. As well as, they teach the patients if oriented and their family about the specialized care of central venous catheters. Therefore, they contribute to reducing the risk of infection (**Khalil 2018).**

Significance of The Study

Central line related infection is an important cause of mortality in ICU patients. The infection rate is considerably higher than that in recent studies from developed counties, but it is still lower than the rates reported in comparable published studies in Egypt. Strict adherence to the standard infection prevention practices for critically ill patients is highly recommended. In Egypt, a study was conducted in the ICUs of 3 hospitals at Cairo University, and central line related infection rates varied widely, from 2.9 to 14.3 per 1,000 central line-days, with an overall rate of 9.1/1,000 central line-days **(Malek et al. 2018).**

Although there were various studies focusing on estimating the incidence rates of CVC-related infections among critically ill patients; there was little researches focus on implantation and nursing interventions for reducing this infection especially in our geographical area. Furthermore, from the researcher's clinical experience, it was found that there was a high incidence of central-line related infection among traumatic ill patients in Qena university hospital without any previous conducted educational intervention in this setting. So study was to evaluate the effect of nursing guidelines on reducing central line related infection among traumatic patients.

Aim of the study

The current study aimed to:

To evaluate the effect of nursing guidelines on reducing central line related infection among traumatic patients.

Research hypothesis

Traumatic patients who received nursing guidelines about central-line care will have reduced central line-related infections than those who not received.

III- Study Procedure

Preparatory phase

Research Design:

This study was conducted using a quasi-experimental research design.

Setting:

The current study was conducted at traumatic intensive care unit of Qena university hospital, Qena governorate, Egypt. The ICU locates on the first floor of the hospital and contains about 12 beds.

Sample:

The study included a purposive sample of 60 newly admitted adult patients of both sexes, selected from ICU patients, with central venous catheter. The selected patients of the study were meeting the inclusion criteria and classified into two equal groups (study and control groups, thirty cases for each group).

Sample equation:

The study sample was collected according to the following formula:-

$$N = \frac{t^2 \times p(1-p)}{m^2}$$

$$N = \frac{(1.96)^2 \times 0.04(1-0.04)}{0.05^2 N}$$

N = 60 patients

Description:

N = required sample size.

t = confidence level at 95 % (standard value of 1.960).

p = estimated prevalence of patient with central venous catheter at ICU in Qena University Hospital 2017 (0.040).

m = margin of error at 5 % (standard value of 0.050).

Both groups of the study selected according to the following inclusion and exclusion criteria:

Inclusion criteria:

Both groups of the study selected according to the following inclusion and exclusion criteria:

- Newly admitted patients (no more than 48 hrs).
- Newly inserted central venous catheter.
- Traumatic patients (head, chest, and abdominal trauma).

Exclusion Criteria:

- Immuno-compromised patients.
- Patients with systemic infections.
- Patients receiving corticosteroid or chemo-radiotherapy.

Study Duration:

Data collection of the present study was done over a period of twelve (12) months, which started from beginning of January to the end of December, 2019.

Tools of the study:

Two tools were designed and tested after extensive literature review by the researcher for data collection to detect presence of central line related infection among traumatic patients

First Tool: General patient assessment sheet: A structured interview questionnaire sheet: It was used one time for each patient of both groups. It was divided into 3 parts:

1st Part: Demographic data that includes (Patient's name, Age, sex, marital status, place of residence, etc.).

2nd Part: Medical data profile that includes **(**date of admission, medical diagnosis, past medical history, Drug used, etc.).

3rd Part: Central Venous Catheter assessment sheet included the following items as (date of insertion, catheter type, catheter size, number of lumens, and the site of insertion).

Second Tool: Central line related-infection assessment sheet: It used to determine the generalized and localized manifestation of central line related infection among traumatic patients and included two parts:

1st Part: the general and localized signs and symptoms of central line related infection: Fever, malaise, insertion site color change, drainage, swelling, pain, palpable tenderness and catheter occlusion etc.

- These items rated on a rating scale of (Yes, No)
- Scores for each item assigned as follows:
  Yes = score one
  No = score zero

1st part of the 2nd tool was used daily from the first day of the study to the sixth day for both study and control group.

2nd Part: Bacterial colonization indicator used to detect the presence of central line related infection, this part was included three laboratory investigation as following: skin swab analysis normally negative **(Lemuel. 2021)**, white blood cells count normally 4,500 to 11,000 WBCs per microliter (4.5 to 11.0 × 10^9/L)**(Chernecky & Berger. 2013)**, and blood culture normally negative **(Robinson. 2020).**

The 2nd part of 2nd tool was assessed twice (one at the 1st day to provide base line data and to ensure that the patient is free from infection and the second time after the 6th day to compare the effect of applying the nursing guidelines on reducing the central line related infections among both studied groups).

Procedure

Validity and Reliability:

The tool was tested for content validity by a jury of five experts in the field of the study (medical surgical nursing) and necessary modifications were done. The tool was tested for internal consistency.

Reliability of the tools was performed to confirm its consistency by using Cronbach's alpha test. The reliability scores of the second tool (1st part) as above 0.87, which indicates the tool internal consistency of the used tool.

Pilot study

A pilot study was conducted on 6patients (10% of the total sample) to test clarity, completeness and to determine the time involvement. Results of the pilot study illustrated that no any refinements and modifications needed so the subjects were included to the actual sample.

Ethical Considerations:

A written initial approval was obtained from the research ethical committee of the faculty of nursing, Minia University. The purpose of this study was explained for every patient except unconscious patients and each patient has the right to accept or refuse participation in the study. Oral informed consent was obtained from patients who participated in this study. They also informed that the information obtained will be confidential and will be used only for the purpose of the study. Each assessment sheet was coded and patients' names did not appear on the sheets for the purpose of anonymity and confidentiality.

An official permission to conduct the proposed study was obtained by the researcher from the manager of Qena University Hospital. Also, the official approval for data collection was obtained from the medical consultant and the head nurse of the study setting after explanation of the purpose of the study. Also, verbal consent was obtained from each patients participated in the study. Clarification of the nature and purpose of the study was done on initial interview with each patient. The researcher emphasized that the participation was absolutely voluntary and confidentiality of each patient will be assured throughout the whole study.

Implementation phase:

Once the permission was obtained to conduct the study, the researcher initiated data collection. The researcher started data collection by collecting the control group firstly which receive routine nursing care that took about 5 months, started at January and end at May. After completion of control group, data were collected from the study group which receives nursing guidelines adopted from **(Marschall et al.2014)** that took about 7 months started at June and end at December.

The nursing guidelines which applied for study group include: 1- Comply with hand hygiene requirements using antiseptic soap or gell. 2- Bathe intensive care unit patients with a chlorhexidine preparation on a daily basis. 3- Scrub the access port or hub with friction immediately prior to each use with an appropriate antiseptic (chlorhexidine). 4- Use only sterile devices to access catheters. 5- Immediately replace dressings that are wet, soiled, or dislodged. 6- Perform routine dressing changes using aseptic technique with clean or sterile gloves. A- Change gauze dressings daily. B- Disinfect the insertion site using chlorhexidine solution or Use a chlorhexidine impregnated dressing for the six continuous days of the study. 7- Change administrations sets for continuous infusions no more frequently than every 4 days, but at least every 7 days. A- If blood or blood products or fat emulsions are administered change tubing every 24 hours. B- If propofol drug is administered, change tubing every 6-12 hours or when the vial is changed **(Marschall et al.2014)**.

Both groups (control and study) were assessed firstly using first tool (first part + second part) once only on the patients admission.

Evaluation phase

Both group of the study were assessed and evaluated at the first day of the study for signs and symptoms of central line related infection using 1st part of second tool and daily continued till the sixth day.

Both group of the study were assessed and evaluated for presence of site and blood stream infection using 2ndpart of second tool which started at the first day of study and repeated again at the sixth day of the study.

Statistical analysis data

The statistical analysis was done using SPSS–20 statistical software package. Data were collected, revised, coded, analyzed, and tabulated using number and percentage distribution. Data were presented using descriptive statistics in the form of frequency and percentages for quantitative continuous data which were compared by using student T–test in case of comparisons between the mean scores of the two groups. For multiple groups F–test or (ANOVA) was used. Person correlation analysis was used for assessment of the interrelationships between Infection total score and numbers of manipulations. Statistical significance was used at p. value < 0.05.

Results:

Table (1) Frequency distribution of the studied groups according to their Demographic characteristics (study and control groups)(n 60)

Demographic data	Study group N (30)		Control group N (30)		P – value
	(N)	(%)	(N)	(%)	
(1) Age					
Mean + SD	41.3 ± 12.30		41.60 ± 12.05		0.924 N.S
18-28yrs	5(16.7%)		6(20%)		
29-39yrs	9(30%)		7(23.3%)		
40-49yrs	6(20%)		9(30%)		
<50yrs	10(33.3%)		8(26.7%)		
(2)Gender					
• Male	17	56.7	17	56.7	0.603 N.S
• Female	13	43.3	13	43.3	
(3) Marital status					
• Single	6	20	7	23.3	0.509
• Married	17	56.6	20	66.6	
• Divorced	3	10	2	6.6	
• Widowed	4	13.3	1	3	
(4) Place of residence					
• Rural	14	46.6	18	60	0.219
• Urban	16	53.3	12	40	

N.S= Not significant *** p = ≤.05 (statistical significance)**

Table (1) illustrate that more than half of both group are men with the mean age of 41.3 ± 12.30 and 41.60 ± 12.05for the study and control group respectively. As regards marital status it was found that (56.6% & 66.6 %) of the study and control group

were married respectively. Concerning place of residence (46.6% & 60.0%) of study group and control group respectively living in rural area and (53.3% & 40%) of study and control group living in urban area respectively.

Table (2) Frequency distribution of the study subjects according to the central venous catheter data

Centeral venois cathter data	Study group N (30)		Control group N (30)		X2	P – value
	(N)	(%)	(N)	(%)		
Site of catheter insertion						
• Right jugular vein	11	36.6	10	33.3	1.68	0.641 **N.S**
• Left jugular vein	3	10	5	16.6		
• Subclavein vein	16	53.3	14	46.6		
• Femoral vein	0	-	1	3.3		
Type of catheter						
• Non tunneled	30	100.0	30	100.0	-	-
Size of the catheter					-	-
• 7f x8 (20 cm)	30	100.0	30	100.0	-	-
Number of lumens						
• Triple (three)	30	100.0	30	100.0	-	-
Type of antiseptic solution						
• Chlorhexidine	30	100.0	0	0.0	60.0	0.000**
• Betadine	0	0.0	30	100.0		
Type of dressing (bandage)						
• Povidone iodine	30	100.0	30	100.0	-	-
Number of manipulation						
• 5 to 6 times/day	2	6.6	17	56.6	33.07	0.000**
• 7 to 8 times/day	2	6.6	9	30		
• 9 to 10 times/day	19	63.3	4	13.3		
• More than 10/day	7	23.3	0	-		
Catheter exchange						
• NO	27	90	19	63.3	5.96	0.01
• YES	3	10	11	36.6		

Chi-Square Tests, N.S = Non significant difference P>0.05, Significant difference P≤0.05 highly significant p<0.01.

Table (2) clarifies frequency distribution of the study subjects according to the insertion sites. It is revealing that (53.3% & 46.6%) of study & control group had subclavian veins inserted catheter respectively. As regards the catheter exchange, it was found that 90% for study group has no catheter exchange. But, 36.6% of control group there catheter were changed. The number of manipulation was lower in the study group than the control groups which had its effect on the catheter related infection presence. There were statistical significance difference between the study and control groups regarding the (number of manipulation and catheter exchange) presented by P value (0.000** & 0.01) respectively.

Table (3) Comparison between the study and control groups regarding presence of the localized signs of infection (n 60)

	Pain						Erythema					
	Study (n 30)		Control (n 30)				Study (n 30)		Control (n 30)			
	N	%	N	%	X 2	P value	N	%	N	%	X 2	P value
Day 1	3	10	8	26.6	2.7	0.90	3	10	4	14	0.16	0.50N.S
Day 2	3	10	2	6	0.21	0.50	3	10	6	20	1.17	0.23N.S
Day 3	3	10	4	14	0.16	0.500	3	10	12	40	7.2	0.008**
Day 4	6	20	14	46.6	4.80	0.02	6	20	21	70	15.1	0.001**
Day 5	6	20	21	70	15.1	0.001	3	10	24	80	29.6	0.000**
Day 6	9	30	26	86	18.9	0.000	6	20	26	86	26.7	0.000**
	Tenderness						**Swelling**					
	Study (n 30)		Control (n 30)				Study (n 30)		Control (n 30)			
	N	%	N	%	X 2	P value	N	%	N	%	X 2	P value
Day 1	9	30	14	46.6	1.76	0.14	0	-	2	6	2.06	0.24 N.S
Day 2	9	30	8	26.6	0.08	0.50	6	20	5	16.6	0.11	0.500 N.S
Day 3	6	20	9	30	0.80	0.27	3	10	12	40	0.702	0.008**
Day 4	8	26.6	23	76.6	15.0	0.000	3	10	20	66.6	20.3	0.000**
Day 5	9	30	26	86	19.8	0.000	3	10	24	80	29.6	0.000**
Day 6	6	20	28	93.3	32.8	0.000	6	20	30	100	40.0	0.000**

Chi-Square Tests, N.S = Non significant difference P>0.05, Significant difference P≤0.05 highly significant p<0.01.

Table (3): illustrates regarding to pain that (10% & 26.6%) of study and control group had pain at the first day of the study. There were no statistical significance difference between them p-value =0.90. On the other hand (30%) of the study group had pain at the sixth day but (86%) of the control group had it also. p-value =0.000. Regarding the swelling it was found that (0.00% & 6%) of study and control group had swelling at the first day p-value =0.24 comparing to (20% & 100%) of study and control group at the sixth day. there was a highly statistical significant difference between the study and control groups concerning the presence of the localized signs of infection at the sixth day reflected by p-value =0.000.

Table (4) Comparison between the study and control groups regarding the catheter related signs of infection (n 60)

	Fever						Chills					
	Study (n 30)		Control (n 30)				Study (n 30)		Control (n 30)			
	N	%	N	%	X 2	P value	N	%	N	%	X 2	P value
Day 1	0	-	2	6	2.06	0.24	0	-	4	13.3	4.2	0.05*
Day 2	3	10	2	6	0.21	0.50	8	26.6	2	6	4.3	0.04*
Day 3	6	20	8	26.6	0.37	0.38	3	10	13	23.3	8.5	0.004*
Day 4	3	10	17	56.6	14.7	0.000	3	10	17	56.6	14.7	0.000**
Day 5	6	20	20	66.6	13.3	0.001	3	10	20	66.6	20.3	0.000**
Day 6	9	30	21	70	9.6	0.002	4	13.3	26	86.6	32.2	0.000**
	Purulent drainage						Cather occlusion					
	Study (n 30)		Control (n 30)				Study (n 30)		Control (n 30)			
	N	%	N	%	X 2	P value	N	%	N	%	X 2	P value
Day 1	0	-	0	-	-	-	0	-	0	-	-	-
Day 2	0	-	1	3	1.01	0.500	0	-	0	-	-	-
Day 3	3	10	4	13.3	0.16	0.500	0	-	0	-	-	-
Day 4	6	20	21	70	15.1	0.000	3	10	2	6	0.21	0.50 N.S
Day 5	4		26	86.6	32.2	0.000	1	3	5	16.6	2.9	0.01*
Day 6	6	20	25	83.3	24.1	0.000	5	16.6	6	20	0.11	0.500

Chi-Square Tests, N.S = Non significant difference P>0.05, Significant difference P≤0.05 highly significant p<0.01.

Table (4) represents regarding fever that (0.00% & 6%) of study and control group respectively had fever at the first day comparing to (30% & 70%) of study and control group respectively at the sixth day. There was a statistical significant difference between the study and control groups concerning the presence of fever at the sixth day reflected by p-value =0.002.

Regarding the purulent drainage it was found that (0.00% & 0.00%) of study and control group had purulent drainage respectively at the first day comparing to (20% & 83.3%) of study and control group at the sixth day respectively. Also it was highly statistical significant difference between the study and control groups concerning the presence of chills and purulent drainage at the sixth day reflected by p-value =0.000. But there is no statistical significant difference between the study and control groups concerning the catheter occlusion reflected by p-value =0.500.

Table (5): Comparison between the study subjects according to their total infection score at the first, third and the six days of the study

Total infection score	Study group N (30)	Control group N (30)	T	P – value
	Mean ± SD	Mean ± SD		
• 1st day	0.600±0.67	1.46±1.75	2.52	0.014*
• 3rd day	1.50±1.22	3.55±2.08	3.101	0.003**
• 6th day	2.10±1.58	7.76±104	16.38	0.000*
• Total	4.20±1.62	12.10±3.01	12.64	0.000*

T-Test, Ns= Non significant differenceP>0.05 significant P≤0.05 highly significant p<0.01.

Table (5) presents that there is a highly statistically significance difference between study and control group concerning their total infection score revealed by p-value = 0.000 at the sixth day.

Table (6) Comparison between the groups of the study about the laboratory infection indicators

Bacterial colonization data	Study group				Control group				X^2	P value
	Negative		Positive		Negative		Positive			
	N	%	N	%	N	%	N	%		
Skin swab										
• First day	30	100.0	0	0.0	30	100.0	0	0.0	13.3	0.000*
• Sixth day	20	66.7	10	33.3	6	20.0	24	80.0		
Blood culture										
• First day	30	100.0	0	0.0	30	100.0	0	0.0	4.44	0.032*
• Sixth day	22	73.3	8	26.6	14	46.6	16	53.3		
WBCs										
	Mean± SD				Mean± SD				T	P value
• First day	6.17±1.33				7.74±2.47				3.07	0.003**
• Sixth day	11.32±4.01				21.59±7.58				6.55	0.000**

Chi-Square Tests, T- test, Ns= Non significant differenceP>0.05 significant P≤0.05 highly significant p<0.01.

Table (6) illustrates that there is a highly statistically significance difference between study and control group concerning the skin swab and WBCs presented by p-value = 0.000. Also it was statistically significance difference between study and control group concerning the blood culture revealed by p-value = 0.032 at the 6th day of the study.

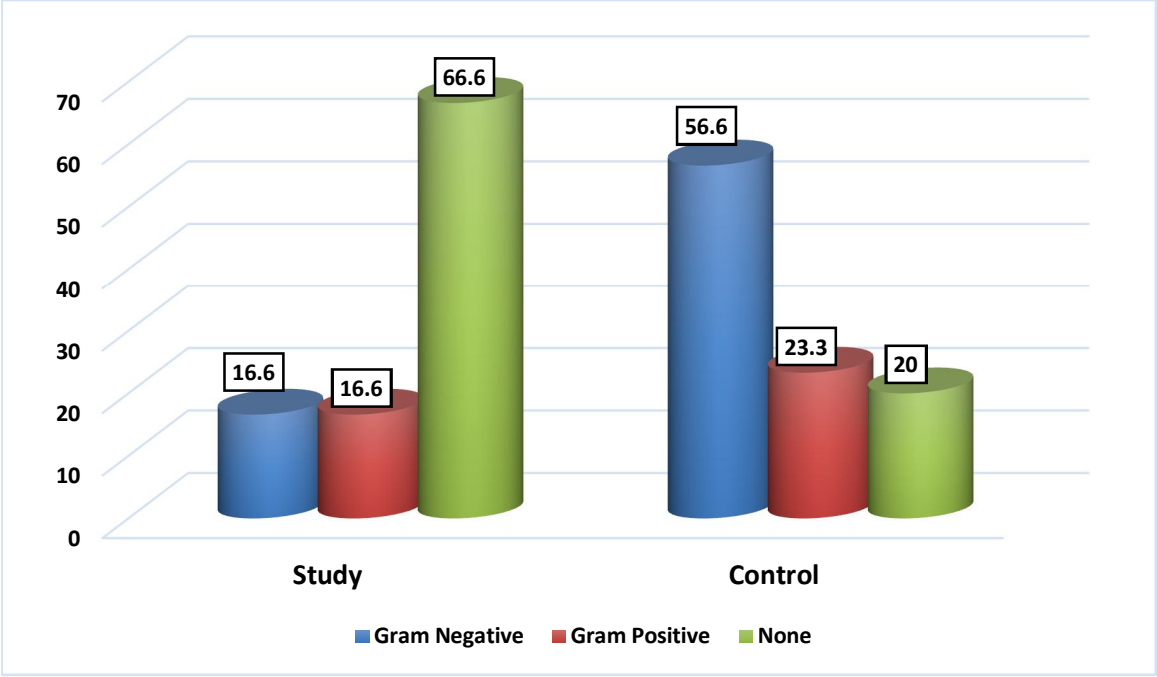

Figure (1) Frequency distribution between the studied groups of the study regarding the type of organism

Figure (1) illustrates that 16.6% &56.6% of the study and control group was gram negative respectively. Whereas, 16.6% & 23.3% of the study and control group was gram positive respectively. There is a highly statistically significance difference between study and control group presented by p-value = 0.000.

Discussion:

Central venous catheterization is a procedure which is frequently performed for the traumatic patients and associated with several potential complications **(Odendaal et al, 2017).** So this research was conducted to evaluate the effect of nursing guidelines on reducing central line related infection among traumatic patients.

Regarding the age, the present study revealed that more than half of both group are men where in the middle of their age. This may be explained that the majority of people were men, who have to travel from the rural to urban for their work and education. So, the possibility of a car accidents increased. This study supported by the study of **(Khalil et al, 2018, Patil et al 2019**) who reported that half of both group were men with the same age represented in the current study. Also further validation by **(Mathur et al, 2020)** who revealed that half of both group were men. Concerning to marital status more than half of both groups (control and study groups) were married; this may be due to the habits of early marriage in Upper Egypt especially in the rural areas. This result was in agreement with **(Al Hassan et al, 2017),** who demonstrated in his study that more than two thirds of the sample were married.

As regard place of residence, it was found that about half of both of group were lived in rural area. This explained by the car accidents that happened while travelling to their work and education. Also, caused by the quarrels that happened between the families in the rural areas that lead to increased numbers of injured people. The same result concluded by the study of (**Fortunatti. 2017**).

Regarding the insertion site of the catheter, this study was revealed that nearly half of both study & control group had subclavian veins inserted catheter. It may be explained that the subclavian vein may reduce the CVC-related infection rate in severe trauma patients, compared to insertion through the internal jugular or femoral veins. Also, this may have relevance to mediators that promote colonization of the skin near to jugular vein such as coughing of sputum, difficulties in catheter fixation and frequent dressing. This study supported by the study of **(Sun et al, 2020)** who found that most of study & control group were subclavian veins respectively. Also validation by the study of **(Ong et al. 2020)** who revealed that There were no differences in central line infection rates by insertion site except when we compared internal jugular CVCs with subclavian CVCs; the internal jugular site was associated with a higher CLABSI rate. This study in contrast with the study of **(Khanna et al. 2017)** who revealed that minority of both group had subclavian veins inserted catheter and the majority had internal jugular veins inserted catheter. The possible explanation for this finding may be related to difficulty of technique of subclavian insertion that requires more expertise during insertion. As well, insertion of CVC catheter utilizing subclavian route took more than 20 minutes during insertion utilizing guide wires.

As regards the catheter exchange, there were statistical significance differences between the study and control groups (P value 0.01) as the vast majority of the study group did not change the cathere while control group did. The possible explanation from the researcher's point of view, this may attributed to routine nursing care which the nurses applied for the control group to deal with CVC can lead to appearance of localized signs and symptoms of CVC infection which may oblige the physician to change the site of the catheter comparing to the study group who receive nursing guidelines. This study in the harmony with the study of **(Guttmann et al. 2018)** who said that Catheter Exchange accounting for 12 of 25 (48%) exchanges in the control group and 6 of 36 (16.6%) exchanges in the study group. P = significant.

In our findings, the number of manipulation was lower in the study group than the control groups which had its effect on the catheter related infection presence. There were highly statistical significance difference between the study and control groups regarding the number of manipulation

presented by P value (0.000**). This may explained that, unnecessary usage of CVC in the control group which may lead to presence of signs and symptoms of CVC infection. Also, due to Changing administrations sets for the study group for continuous infusions every 4 to 7 days and changing the dressing every days or as necessary. This study supported by the study of **(zingg et al. 2019)** who conducted study entitled with Hospital-Wide Multidisciplinary, Multimodal Intervention Programme to Reduce Central Venous Catheter-Associated Bloodstream Infection said that there were statistical significance difference between both groups concerning the number of manipulation revealed by P value (0.001).

Regarding the local presence of the localized signs of infection this study presented that there was a highly statistical significant difference between the study and control groups concerning the presence of the localized signs of infection at the sixth day reflected by p-value =0.000. This fact achieved the current study hypothesis in which the application of nursing guidelines of care about CVC significantly reduced the incidence of central line infection, this is due to use of chlorhexidine solution during changing the dressing and Scrubbing the access port or hub with friction immediately prior to each use. This study in the agreement with the study of **(Buetti et al .2020)** who conducted study entitled with "Local signs at insertion site and catheter-related bloodstream infections: an observational post hoc analysis using individual data of four RCTs "said that in the control group, local signs were significantly associated with CRBSI in the ICU. In the first 7 days of catheter maintenance, local signs increased the probability to observe CRBSI among the control group.

Regarding the catheter related signs of infection our study said that few of study and control group had fever at the first day and one third of study group and more than tow third of control group had at the sixth day. There was a statistical significant difference between the study and control groups concerning the presence of fever at the sixth day reflected by p-value =0.002 .Researcher views that this fact may be related to effect of nursing guidelines in the study group which have its effect in the incidence of CVC infection and inappropriate usage of CVC in the control group. It is supported by the study of **(Rode et al. 2017)** who conducted study entitled with "Study of central line-associated bloodstream infections in intensive care unit: a prospective observational study" revealed that Fever was the most common symptom present in the vast majority of the control group and account for less than one third of the study group at the end of the study.

Regarding the purulent drainage it was found that no one of study and control group had purulent drainage at the first day but the minority of study group & vast majority of control group had at the sixth day. Also it was highly statistical significant difference between the study and control groups concerning the presence of chills and purulent drainage at the sixth day reflected by p-value =0.000. This may be due to that the use of chlorhexidine solution during changing the dressing for the study group significantly reduced the incidence of CVC-related infections especially purulent drainage. Therefore in this study, chlorhexidine was used for skin antisepsis at the catheter insertion site as a part of the guidelines. It is in the agreement with **(Rode et al. 2017)** who said that the purulent drainage were present in less than one quarter of the study group and in the majority of control group at the 7th day.

Regarding the signs of infection this study supported by the study of **(Marschall et al. 2019)** who show that although the number of patients in (protocol group) PG with infection signs at the catheter insertion site was less than those in (control group) CG, there was no significant difference between the two groups ($p < 0.05$). The possible explanation is optimal attention to aseptic technique for control group during the time of maintaining and changing the dressing in emergency cases and when the catheters accessed for hemodynamic measurements or to obtain samples for laboratory analysis.

Regarding the total infection score our findings presented that there is a highly statistically significance difference between study and control group concerning their total infection score revealed by p-value = 0.000 at the sixth day. This result was attributed to decline in catheter-related infection rate in nursing guidelines applied patients and improvement in their general condition. This result was in harmony with that of **(Rosado et al. 2019)** who conducted a study of "Risk factors and preventive measures for catheter-related bloodstream infections" said that that, in the United States, a multicenter study of 29 ICUs found a reduction of 43% in infection incidence density (from 5.4 to 3.1 infections per 1,000 CVC-days) after the adoption of infection prevention measures as CVC insertion and maintenance bundles. Also this finding agrees with **(Fortunatti. 2017)** who conducted study entitled with "Impact of two bundles on central catheter-related bloodstream infection in critically ill patients" said that, It was possible to observe a 54.5% decrease in the rate of central catheter infection (3.48 vs 1.52 x 1000 days/catheter, $P < 0.05$) when compared with the control group

Regarding the WBCs this study illustrated that there is a highly statistically significance difference between study and control group regarding WBCs revealed by p-value = 0.000. This interpreted the reasons as; washing the hands using antiseptic soap or gell and bathing study group with a chlorhexidine preparation on a daily basis. This is in the agreement with of **(Fell et al. 2020)** who revealed the same findings. Also, this is in contrast with the study of **(Malek et al. 2018)** who clarified that no significant difference in terms of mean number of leucocytes and lymphocytes ($p < 0.05$).

Regarding the blood culture this study show that it was statistically significance difference between study and control group concerning the blood culture revealed by p-value = 0.032 at the 6^{th} day of the study. This may be attributed to sufficient precautions applied for study group while using CVC especially for blood transfusion which makes the catheter poor media for growing and multiplication of microorganisms and vice versa in the control group who received routine nursing care. It supported by the study of **(Chapman 2020)** who illustrated that however**,** hemoculture positivity was less in the study group, and this difference was statistically significant between two groups ($p < 0.05$).

Regarding the skin swab this study illustrated that there is a highly statistically significance difference between study and control group. In the researcher point of view this may be related to washing the hands before dealing with the catheter, bathing all the body of patients by 2% chlorhexidine solution daily, and disinfection the site of insertion using chlorhexidine solution. There is a validation by the study of **(khalil et al, 2018)** who illustrated that Of the 120 patients enrolled in this study, all subjects' skin swabs displayed no growth of microorganisms at the end of the insertion

procedure for both group. While, one third of the study group and vast majority of control group developed the growth of bacteria 7 days after insertion of central venous catheters. This may be cause by low compliance with hand hygiene and the nurse-to-patient staffing ratios in hospitals are low.

Regarding the microorganisms that were responsible for infection our findings illustrated that the majority for control group were gram negative bacteria while in the study group it's divided equally between gram negative and gram positive. The possible explanation for that finding been is attributed to poor compliance with skin cleaning with antiseptics around the catheter insertion site for control group especially for a Gram- negative bacterium normal flora that lives on the surface of the skin. It is similar to those of previous study of **(Youn et al, 2019)** who said that 17.8% &55.2% of the study and control group was Gram negative respectively and 15.5% & 38% of the study and control group was Gram positive respectively.

As well, our finding is agreed with a recent similar study done by **(Mishra et al, 2017)** who studied central venous catheter colonization and blood stream infection in a tertiary teaching hospital in India and revealed that negative staphylococci was the most common organism found causing central related blood stream infection .Moreover ,our finding was agreed with the results of previous studies done by **(Mitt et al. 2019 & Lorente et al. 2018)** that have found that a dominance of Gram-negative bacteria that may be related to the colonization of the hands of healthcare providers in that hospitals. Similarly, our data are supported by similar study done by **(Abramczyk et al. 2018)** who displayed domination of negative bacteria causing blood stream infection among children in ICU. Furthermore this study in the line with study of **(Sun et al 2020)** who show that 57.84% of the pathogens causing CRLI were due to Gram-negative organisms and 42.16% were Gram-positive. On the hand, our finding is contradicted with a similar study done **(Kaur et al. 2019)** who found gram positive co-cci were the most common organisms colonizing CVCs followed by Gram negative Bacteria. Furthermore, our study is contradicted with previous study of **(Labeau et al 2018)** which has reported that, gram-positive bacteria are the most common. Also the study of **(Ong et al. 2020)** who demonstrated that Most of the responsible organisms were gram-positive bacteria, with the rest divided almost equally between fungal organisms and gram negative rods.

Conclusion:

Based on the findings of the present study, it can be concluded that traumatic patients who received nursing guidelines showed decrease in the signs and symptoms of central line related infections than the traumatic patients who receive the routine nursing care. And this is supported by the research hypothesis.

Recommendations

1. The nursing guidelines are significantly efficacious in the prevention of central line related infections. So, training of nurses and healthcare workers on using these guidelines are recommended.
2. Written Arabic booklets or brochure and posters including the nursing guidelines should be available at ICUs and given to care givers.
3. It is recommended that similar studies must be done on bigger and different sampling groups.

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