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Effect of Implementing Central Venous Line Bundle Care on Reducing Blood Stream Infection among Critical Ill Patients

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Abstract: **Central line-associated bloodstream infection is an important healthcare-associated infection in the critical care units. It causes substantial morbidity, mortality and incurs high costs. The use of central venous line bundle has been shown to decrease the incidence of CLABSIs.** ***The aim of this study*** **was to assess the effect of implementing central line bundle care on reducing blood stream infection among critical ill patients.** ***Design:*** **a quasi-experimental study.** ***Setting:*** **the study was carried out at Medical Intensive Care Units at at El-Hussein Hospital, Al-azhare University.** ***Study subjects:*** **a purposive sample of 60 adult patients with different age group and gender were included in this study.** ***Data collection tools:*** **structured patient assessment sheet and assessment sheet for insertion site.** ***Results:*** **this study revealed that, there was astasitically significance diferance between study and control group in wich study group show lower incidence of CLABSIs than control group.** ***Conclusion:*** **based on the study finding, applying central line bundle care during insertion and maintain dialy care after insertion decrease the incidance of central line associated blood stream infection.** ***Recommendations:*** **this study recommends The importance of implementation of central venous line bundle in intensive care units and empahsis on bundle compliance.**

Keywords: **Central venous line, Central line-associated blood stream infection, Central line bundle, Critical ill patients.**

1. INTRODUCTION

Central venous catheter (CVC) is one of the most commonly used interventions in the critically ill patients. Reasons for inserting a CVC include rapid administration of fluids during resuscitation periods, monitoring of hemodynamic status, administration of vasoconstrictors and, using large bore catheters, for the purposes of hemofiltration. Also, some drugs or fluids such as parental nutrition, potassium solution, strong vasoconstrictors and chemotherapy drugs must be given via CVC. **(Zhang et al., 2018)**

In critically ill patients, central lines are widely and increasingly used. Hence, it is important to note that central line-associated bloodstream infection (CLABSI) is a leading cause of preventable healthcare-associated infection (HAIs), which result in increases in the length of hospital stays and higher cost. Numerous studies showed that patients admitted to the Intensive Care Units and medical or surgical units are at huge risk of acquiring Hospital Acquired Infections because of the severity of illness and the use of medical and invasive devices. **(Al-Abdullah, 2018)**

Central line associated blood stream infections remain a major complication of central venous catheters and a leading cause of Hospital Acquired Infections in the Critical Care Unit. These CLABSIs not only are costly to health care systems and individuals but can also increase morbidity and mortality significantly in both developed and developing countries. CLABSIs are serious infections but often preventable when evidence-based guidelines such as CLABSI care bundle are used during the insertion and maintenance of central venous catheters. **(Jocyline, Hannah, &Waithira, 2018)**

Care "bundles" are simple sets of evidence-based practices that, when implemented collectively, improve the reliability of their delivery and improve patient outcomes. These packages of care contribute to infection prevention, reduce unnecessary antibiotic prescribing, and may limit the development of antibiotic resistance in healthcare facilities. **(Wasserman & Messina, 2018)**

CVC insertion bundle consisted of hand hygiene by the inserter; maximum barrier precautions, including the donning of sterile gloves, gowns, caps and masks by the physicians who inserted the catheter before beginning the procedure and a head-to-toe sterile drape of the patient during insertion; use of a 2% chlorhexidine gluconate (CHG) in70% ethanol scrub at the insertion site; optimal catheter site selection with avoidance of the femoral vein for central venous access in adult patients; and daily examination of the necessity of the central line. Physicians were trained in the aseptic technique for CVC insertion by presentations that were carried out by the infection control team at the beginning of the rotation. (**Salamaa, Jamalb, Mousad & Rotimi, 2015)**

The implementation of each recommendation is successful when implemented jointly, and may include, constant surveillance, health team education, insertion team training, and catheter care. Thus, the package of preventive measures based on scientific evidence (Bundle) aims to improve patient care and minimize the occurrence of catheter-related infections, by reducing the risk of hospitalized patients, thus promoting greater care security. However, the existence of protocols institutions does not guarantee their proper use. **(Manzo, et al., 2018)**

Significance of the study

Central venous catheter is an essential part of the management of critically ill patients, serving both as a reliable vascular access and venous pressure monitoring. Catheter-related infections result in considerable morbidity, mortality, increase hospital costs and length of stay. Studies have shown that in the United States of America mortality caused by these infections ranges between 12 and 35% depending on the causative agent and status of the patient and costs up to 2.3 billion dollars per year. A study involving France, Germany, Italy and the UK countries estimated there were between 8400 to 14,400 episodes of catheter-related blood stream infections per year in these countries, with associated annual costs of between EUR 35.9 and EUR 163.9 million **(Centers for Disease Control and Preventions, 2017).**

In Egypt, about 30% of infections in the intensive care unit were bloodstream infections. Central line-associated bloodstream infections (CLABSI) represent (2.6/1,000 central line days). Klebsiella were the most commonly reported organisms, accounting for 28.7% of all organisms, followed by Acinetobacter (13.7%). CLABSI represent a serious patient safety issue. To prevent these infections, bundled interventions are increasingly recommended. **(Talaat et al., 2016)**

Aim of the Study:

This study was aimed to assess the effect of implementing central line bundle care on reducing blood stream infection among critical ill patients through:

1. Assessment of studied patients clinical data
2. Implement central line bundle care for studied patients during insertion and maintenance care for central line.
3. Evaluate the effect of implementing central line bundle care.

Research Hypothesis:

The incidence rate of central line blood stream infection will be significantly decreased among patients who will receive central line bundle care than those patients who will not receive central line bundle care.

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2. SUBJECT AND METHODS

I. Research design: A quasi-experimental research design was used.

A. Setting: This study was carried out at Medical Intensive Care Units at El-Hussein Hospital, Al-azhare University.

B. Sample: A purposive sample of 60 adult patients from both genders with central line catheter was involved in this study from the above mentioned setting who accepted to participate in the study then divided into two equal groups (30 patients for each group).

II. Technical Design:

Tools of data collection: Two tools utilized in the current study.

Tool (I): Structured Patient Assessment Sheet

It was developed by the researcher based on the recent literatures **(Centers for Disease Control and Prevention, 2017)** to assess the effect of implementing central line bundle care on the occurrence of blood stream infection among critical ill patients. It was included the following parts:

A. Socio - Demographic Characteristics it was concerned with the characteristics of the patients e.g. Gender, age, sex, admission date, medical data (medical diagnosis & medical history), purpose of insertion, length of hospital stay, level of consciousness and site of insertion.

B. Patient Physical Assessment: It was filled by the researcher to assess vital signs which included (pulse, respiration rate, blood pressure and body temperature) and microbiological data as (leukocyte count, blood culture & type of microorganisms).

Tool (II): Assessment Sheet of Insertion Site: It was developed by the researcher based on the recent literatures **(Haddadin & Regunath, 2018) & (Centers for Disease Control and Prevention, 2017)** to assess signs and symptoms of central line blood stream infection. It was included local and systemic signs and symptoms of blood stream infection based on criteria for diagnosis of central line blood stream infection.

A scoring system for tool II: Assessment Sheet of Insertion Site Tool was scored as the following: Yes = 2 grade and No= 1.

III. Method included:

1. The preparatory Phase:

It included reviewing of related literature and theoretical knowledge of various aspects of the study using books, articles, internet, periodicals and magazines to develop tools for data collection and central line bundle care.

- Validity

The tools were revised by a jury of seven experts as the following; two Lecturers of medical, surgical nursing from faculty of nursing, British University, professor of medical, surgical nursing from faculty of nursing, Cairo University, two lecturers and assistance professor of medical, surgical nursing from faculty of nursing, Helwan University and professor of internal medicine from faculty of medicine, Helwan University, who reviewed the content of the tools for comprehensiveness, accuracy, clarity, relevance and applicability. Minor modifications were done.

- Reliability:

Reliability of the developed tool was tested to determine the extent to which the questionnaire items are related to each other. The Cronbach's alpha model which is a model of internal consistency was used in the analysis (value throughout the assessment are 0.83, 0.83). Statistical equation of Cronbach's alpha reliability coefficient normally ranges between 0 and 1, higher value (more than 0.7) denote acceptable reliability.

- Pilot Study:

A Pilot study was carried out on 10% of the sample under study to test the applicability, clarity and efficiency of the tools, then the tools was modified according to the results of the pilot study, patients whom shared in the pilot study were not included in the sample and replaced by other patients.

- Field Work:

I- First phase (Assessment phase):

Initial assessment was done by the researcher for all study subjects includes a control and study group to determine the purpose for central line insertion as; Hemodynamic monitoring, Long term IV therapy, Administer total parenteral nutrition and Dialysis.

II- Second phase (Implementation phase):

For the study group central line bundle care before and after central line insertion was implemented by the researcher by using central line insertion bundle and maintainace bundle after central line insertion. For the control group central line was inserted and patients received routinely care by ICU medical and nursing staff.

1. Preparation:

Preparation for central line insertion done as the following; strict hand washing and maximal barrier precautions at insertion of center line catheter, appropriate use of caps covering the hair, masks covering the nose and mouth tightly, sterile gowns, and sterile gloves, patient placed in the flat position with head on one side, sterile field with the needed equipment prepared by the researcher.

2. Catheter insertion:

Covering the patient's head to toe with a sterile drape with just a small opening allowed for inserting the catheter at the site, disinfect the skin at the insertion site with chlorhexidine 2% in 70% isopropyl alcohol and avoidance of femoral artery insertion and catheter insertion done by ICU doctor.

3. Maintenance care

Maintenance care for the catheter done daily by the researcher after insertion of the catheter which including:

- Hand washing before accessing central line

Before and after inserting, replacing, accessing, repairing, or dressing central line catheter by the researcher.

- Perform dressing:

Remove and replace the dressing when the dressing becomes damp, loosened, or soiled, inspect the insertion site and inspect the catheter for proper function and then clean the skin using chlorhexidine 2% in 70% Isopropyl Alcohol.

- **Accessing the needleless connector** through performing proper hand hygiene, vigorously scrubbing the needleless connector or hub for 15 seconds with chlorhexidine then change the needleless connectors no more frequently than every 72 hours or according to manufacturers.

- **A daily review of the line necessity** through performing a daily review of the necessity of the central catheter, document that the review has been performed and remove the catheter if no longer needed.

For the control group; routine nursing intervention before, during and after catheter insertion was implemented by the nursing staff according to hospital policy.

III-Third phase (Evaluation phase):

According to nursing process; after insertion of the catheter, both study and control group was evaluated for local and systemic manifestation of central line associated blood stream infection after one day of insertion, then after two days of insertion and after one week of insertion by the researcher using the tool (II).

Blood culture was very expensive and every patient need two blood culture (peripheral blood culture and central blood culture) mean that about 120 blood culture for once in order to diagnose CLABSI. Therefor the blood cultures were taken only at the end of the study period after one week of insertion for study group and control group. It was evaluated by using tool (I) part (2).

Diagnostic studies for study and control group were evaluated twice within the study period; the first time was after two days of insertion and the second time after one week of insertion. It was evaluated by using tool (I) part (2).

Ethical Considerations:

- The research proposal approval was obtained from a scientific research ethics committee of the faculty of nursing at Helwan University before starting the study.
- The researcher clarified the objective and aim of the study to the patients included in the study.
- The researcher assured maintaining anonymity and confidentiality of the subject data.
- Patients were informed that they are allowed to choose to participate or withdraw from the study at any time. Ethics, culture, values were respected.

Statistical Design: Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as a mean ± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

Limitations of the study

- Unavailability of chlorhexidine substance in the hospital and it was very expensive.
- Blood culture not performed as routine laboratory investigation for patients.
- Unavailability of blood culture bottle in the hospital.

3. RESULTS

Table (1): Descriptive statistics for both study and control group regarding Socio- demographic characteristics.

Socio-demographic data	Control *(n=30)*		Study *(n=30)*		Chi-square test	
	No.	%	No.	%	x2	p-value
Age (category)						
20-35 years	1	3.3	2	6.7		
36-50 years	11	36.7	8	26.7	0.912	0.634
51-65 years	18	60.0	20	66.7		
Age (years)						
Range	20-65		25-65		t=0.826	0.367
Mean±SD	51.87±11.25		54.37±10.03			
Gender						
Male	14	46.7	16	53.3	0.267	0.606
Female	16	53.3	14	46.7		
Marital status						
Single	1	3.3	0	0.0		
Married	21	70.0	26	86.7	2.865	0.239
Widow	8	26.7	4	13.3		
Residence:						
Urban	12	40	10	33.3	χ^2	0.796
Rural	18	60	20	66.7	=0.081	
Occupation:						
Professional	9	30	9	30		
House wife	16	53.3	14	46.7		

Employee Not work	3 2	10 6.7	4 3	13.3 10	$\chi 2$= 0.517	0.835
Education Illiterate Can read and write Preparatory Secondary University / Higher	 8 7 3 7 5	 26.7 23.3 10 23.3 16.7	 7 6 4 8 5	 23.3 20 13.3 26.7 16.7	0.800	0.938

*P-value >0.05 No Significant;*p-value <0.05 Significant;**p-value <0.001 Highly Significant*

Table (1): Reveals that, there was no statistically significant difference between socio-demographic characteristics of the two groups regarding age categories (P-value = 0.634), mean age (P-value = 0.367), gender (P-value = 0.606), marital status (P-value = 0.239), residance (P-value =0.796), occupation (P-value =0.835) as well as education (P-value = 0.938).

Table (2): Descriptive statistics for both study and control group regarding medical data.

Medical data	Control *(n=30)*		Study *(n=30)*		Chi-square test	
	No.	%	No.	%	x2	p-value
Current medical diagnosis						
Respiratory disease	9	30.0	8	26.7	5.470	0.603
Renal disease	3	10.0	5	16.7		
Liver disease	4	13.3	4	13.3		
Neurological disease	4	13.3	1	3.3		
Sever anemia	1	3.3	1	3.3		
Diabetic ketoacidosis	5	16.7	4	13.3		
Metabolic acidosis	4	13.3	4	13.3		
Shock	0	0.0	3	10.0		
Past medical history						
Diabetes mellitus	4	13.3	5	16.7	13.124	0.069
Hypertesion	2	6.7	7	23.3		
Diabetes and Hypertension	15	50.0	8	26.7		
Cardiac Disease	1	3.3	6	20.0		
Respiratory Disease	2	6.7	0	0.0		
Renal Disease	2	6.7	3	10.0		
Liver disease	2	6.7	0	0.0		
Neurological disease	2	6.7	1	3.3		
Level of consciousness						
Consious	12	40.0	19	63.3	3.270	0.071
Unconsious	18	60.0	11	36.7		
Purpose of central line insertion						
1. Hemodynamic monitoring	10	33.3	9	30.0	4.753	0.191
2. Long term IV therapy	14	46.7	18	60.0		
3. Administer total parentral nutrition	4	13.3	0	0.0		
4. Dialysis	2	6.7	3	10.0		
Site of insertion						
Subclavian vein	2	6.7	2	6.7	0.000	1.000
Jugular vein	28	93.3	28	93.3		
Femoral vein	0	0.0	0	0.0		

Table (2): Shows that, there was no statistically significant difference between medical data of the two groups regarding Current medical diagnosis (P-value = 0.603). respiratory diseases were the common medical diagnosis for the patients of the study group (30.0%) as well as for the patients in the control group (26.7%).

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Table (3): Comparison between the study and control group regarding vital signs.

Vital signs	Follow (1) After one day of insertion				Follow (2) `After two day of insertion				Follow (3) After one weak			
	Study		Control		Study		Control		Study		Control	
	N	%	N	%	N	%	N	%	N	%	N	%
Temperature												
< 36.5	0	0	0	0	0	0	0	0	0	0	0	0
36.5-37.5	30	100	30	100	28	93.3	25	83.3	28	93.3	24	80
>37.5	0	0	0	0	2	6.7	5	16.7	2	6.7	6	20
X	37.09		37.08		37.28		37.9		37.066		37.6	
SD	0.015		0.014		0.61		1.12		0.71		1.22	
t & P	1.68		0.103		2.217		0.035		2.641		0.013	
Pulse												
< 60b/m	0	0	0	0	0	0	0	0	0	0	0	0
60-90bm	30	100	30	100	24	80	20	66.7	25	83.3	18	60
>90bm	0	0	0	0	6	20	10	33.3	5	16.7	12	40
X	68.83		69.10		86		95		85		95	
SD	1.14		1.12		2.02		9.38		1.99		9.30	
t & P	1.278		0.326		-6.568		0.001		-6.916		0.001	
Respiration												
< 14c/m	0	0	0	0	0	0	0	0	0	0	0	0
14-20cm	30	100	30	100	24	80	19	63.3	26	86.7	18	60
>20cm	0	0	0	0	6	20	11	36.7	4	13.3	12	40
X	15.4		15.10		17		20.9		16.8		21.2	
SD	0.202		0.201		2.44		3.92		2.07		3.98	
t & P	1.43		0.161		6.911		0.001		6.886		0.001	
Blood pressure												
<120/80mmhg	0	0	0	0	13	43.3	9	30	13	43.3	9	30
120/80-140/95mmhg	7	23.3	28	93.3	11	36.7	12	40	13	43.3	10	33.3
>140/95mmhg	23	76.7	2	6.7	6	20	9	30	4	13.4	11	36.7
Fisher test & P	F=0.145		0.073		χ2=1.164		0.559		χ2=1.215		0.545	

Table (3): shows that, there was no statistically significant difference between study and control groups regarding vital signs after one day of insertion (follow up 1), Temperature (P-value = 0.103), Pulse (P-value = 0.326), Respiration (P-value = 0.161), as well as Blood pressure (P-value= 0.073). However, during follow up 2 and follow up 3 periods, the control group gained higher mean of temperature, pulse, and respiration as compared with study group. In addition to, during two follow up periods, high statistical significant difference was found between the both study and control groups (at $p \leq 0.05$) except blood pressure measurement in the three follow-up show no significant statistical difference.

Table (4): Descriptive statistics for both study and control group regarding microbiological data (blood culture) after intervention.

Microbiological data	Control *(n=30)*		Study *(n=30)*		Chi-square test	
	No.	%	No.	%	x2	p-value
Blood culture						
1) Central blood culture						
Positive	5	16.7	2	6.7	1.456	0.228

Negative	25	83.3	28	93.3		
If blood culture positive:						
1. Staphylococcus aureus	0	0.0	0	0.0		
2. Coagulase-negative staphylococcus	2	6.7	1	3.3		
3. Enteric Gram-negative bacilli	0	0.0	0	0.0		
4. Enterococci and streptococci	0	0.0	0	0.0		
5. Pseudomonas	1	3.3	0	0.0		
6. Klebsiella	1	3.3	1	3.3		
7. Candida species	1	3.3	0	0.0		
2) Peripheral blood culture:						
Positive	4	13.3	3	10.0	0.162	0.688
Negative	26	86.7	27	90.0		
If blood culture positive:						
Coagulase-negative staphylococcus	2	6.7	1	3.3		
Pseudomonas	1	3.3	0	0.0		
Klebsiella	1	3.3	1	3.3		
Acinetobacter	0	0.0	1	3.3		

Table (4): Shows that, there was no statistically significant difference between the two groups regarding Central blood culture (P-value = 0.228), as well as Peripheral blood culture (P-value = 0.688).

Table (5): Comparison between study and control group regarding the prevelace of central line associated blood stream infection.

Central line associated blood stream infection	Control *(n=30)*		Study *(n=30)*		Chi-square test	
	No.	%	No.	%	x2	p-value
Negative	26	86.7	28	93.3	0.741	0.389
Positive	4	13.3	2	6.7		

Table (5):shows that, there was no statistically significant difference between microbiological of the two groups regarding the prevelance of central line associated blood stream infection (P-value = 0.389).

Table (6): Descriptive statistics and results of the association between socio-demographic data and prevalence of bloodstream infection.

Socio-demographic data	Central line associated blood stream infection				Chi-square test	
	Negative *(n=54)*		Positive *(n=6)*		x2	p-value
	No.	%	No.	%		
Age (years)						
20-35 years	3	5.6	0	0.0	1.228	0.541
36-50 years	18	33.3	1	16.7		
51-65 years	33	61.1	5	83.3		
Gender						
Male	27	50.0	3	50.0	0.000	1.000
Female	27	50.0	3	50.0		
Marital status						
Single	1	1.9	0	0.0	0.820	0.664
Married	43	79.6	4	66.7		
Widow	10	18.5	2	33.3		

Table (6): Reveals that, there was no statistically significant association between age, gender, marital status and prevalence of CLABSI (P Value = 0.541, 1.000, 0.664 respectively). The majority of infected patients with CLABSI were in age category (51-65). about half of the infected patients with CLABSI (50%) were male and more than two third of the patients (66.7%) were married.

Table (7): Descriptive statistics and results of the association between vital signs and prevalence of bloodstream infection.

Vital signs	Central line associated blood stream infection (central/ prephiral)				Chi-square test	
	No CLABSI *(n=54)*		CLABSI *(n=6)*		x2	p-value
	No.	%	No.	%		
Temperature						
< 36.5	0	0.0	0	0.0	37.778	<0.001**
36.5-37.5	51	94.4	0	0.0		
>37.5	3	5.6	6	100.0		
Pulse						
< 60b/m	0	0.0	0	0.0	0.601	0.438
60-90bm	27	50.0	2	33.3		
>90bm	27	50.0	4	66.7		
Respiration						
< 14c/m	0	0.0	0	0.0	4.444	0.035*
14-20cm	24	44.4	0	0.0		
>20cm	30	55.6	6	100.0		
Blood pressure						
<120/80mmhg	20	37.0	2	33.3	0.442	0.802
120/80-140/95mmhg	20	37.0	3	50.0		
>140/95mmhg	14	25.9	1	16.7		

*P-value >0.05 No Significant;*p-value <0.05 Significant;**p-value <0.001 Highly Significant*

Table (7): Shows that, there was statistically significant association between vital signs of the positive blood stream infection regarding temperature and respiration (p-value <0.001 & 0.035 respectively).

Table (8): Descriptive statistics and results of the association between systemic assessment for signs and symptoms of infection and prevalence of bloodstream infection.

Systemic assessment for signs and symptoms of infection	Central line associated blood stream infection (central/ prephiral)				Chi-square test	
	NO CLABSI *(n=54)*		CLABSI *(n=6)*		x2	p-value
	No.	%	No.	%		
Fever						
Yes	3	5.6	6	100.0	37.778	<0.001**
No	51	94.4	0	0.0		
Chills						
Yes	1	1.9	2	33.3	11.267	<0.001**
No	53	98.1	4	66.7		
Hypotension						
Yes	1	1.9	2	33.3	11.267	<0.001**
No	53	98.1	4	66.7		
Decrease level of consciousness						
Yes	12	22.2	3	50.0	2.224	0.136
No	42	77.8	3	50.0		
Rapid pulse						
Yes	14	25.9	4	66.7	4.268	0.039*
No	40	74.1	2	33.3		

*P-value >0.05 No Significant;*p-value <0.05 Significant;**p-value <0.001 Highly Significant*

Table (8): Illusterate that, there was statistically significant association between systemic assessment for signs and symptoms of infection and positive blood stream infection regarding fever (p-value <0.001), chills (p-value <0.001), hypotension (p-value <0.001), as well as rapid pulse (p-value 0.039).

Table (9): Descriptive statistics and results of the association between local assessment for signs and symptoms of infection and prevalence of bloodstream infection.

Local assessment for signs and symptoms of infection	Central line associated blood stream infection (central/ prephiral)				Chi-square test	
	NO CLABSI *(n=54)*		CLABSI *(n=6)*		x2	p-value
	No.	%	No.	%		
Tenderness around site						
yes	4	7.4	6	100.0	20.119	<0.001**
no	50	92.6	0	0.0		
Redness						
yes	13	24.1	6	100.0	16.863	<0.001**
no	41	75.9	0	0.0		
Swollen vein						
yes	0	0.0	2	33.3	12.476	<0.001**
no	54	100.0	4	66.7		
Pus discharge						
yes	0	0.0	2	33.3	12.476	<0.001**
no	54	100.0	4	66.7		
Vein hard on palpation						
yes	0	0.0	1	16.7	9.153	0.002*
no	54	100.0	5	83.3		
Inability to advance flush of line						
yes	0	0.0	0	0.0	0.000	1.000
no	54	100.0	6	100.0		

*P-value >0.05 No Significant;*p-value <0.05 Significant;**p-value <0.001 Highly Significant*

Table (9):shows that, there was statistically significant associated between local assessment for signs and symptoms of infection of the positive blood stream infection regarding tenderness around site (p-value <0.001), Redness (p-value <0.001), Swollen vein (p-value <0.001), Pus discharge (p-value <0.001), as well as Vein hard on palpation (p-value 0.002).

Table (10): Descriptive statistics and results of the association between outcomes of infection and prevalence of bloodstream infection.

Outcomes of infection:	Central line associated blood stream infection (central/ prephiral)				Chi-square test	
	NO CLABSI *(n=54)*		CLABSI *(n=6)*		x2	p-value
	No.	%	No.	%		
1-Need more intervention						
Yes	2	3.7	6	100.0	43.332	<0.001**
No	52	96.3	0	0.0		
- Mechanical ventilator						
Yes	2	3.7	2	33.3	4.033	0.045*
No	52	96.3	4	66.7		
- Renal dialysis						
Yes	0	0.0	0	0.0	0.000	1.000
No	54	100.0	6	100.0		
- Renal replacement therapy						

Yes	0	0.0	0	0.0	0.000	1.000
No	54	100.0	6	100.0		
- Additional Antibiotics						
Yes	3	5.6	6	100.0	37.778	<0.001**
No	51	94.4	0	0.0		
4. Increased length of ICU stay						
yes	2	3.7	5	83.3	33.226	<0.001**
No	52	96.3	1	16.7		

*P-value >0.05 No Significant;*p-value <0.05 Significant;**p-value <0.001 Highly Significant*

Table (10): clears that, there was statistically significant association between outcomes of infection and positive central associated blood stream infection regarding need more intervention (p-value <0.001), Mechanical ventilator (p-value 0.045), Additional Antibiotics (p-value <0.001), as well as Increased length of ICU stay (p-value <0.001). All the patient with CLABSI need more intervention and treated with antibiotics(100%) and about (33.3%) need mechanical ventilator.

4. DISCUSSION

The results of the present study revealed that, the studied patients from the study and control group were homogenous in related to their socio-demographic characteristics, medical data, , assessment vital signs, and microbiological data. This could be related to, the selection of the patients based on inclusion and exclusion criteria, then divided randomly into two groups. This finding is similar to **Zaiton and Taha, (2014)** entitled "Effect of Implementing Central line Bundle on Minimizing Rate of Central Line-Associated Blood Stream Infection (CLA-BSI) among Intensive Care Patients" at Zagazig University Hospitals. who reported that the two groups were similar to each other in socio-demographic characteristics, and medical data.

In the present study, finding regarding to the patient's characteristics revealed that, about half of the total studied patients were in the age group from 51-65 years old. This may be due to patients with old age have more comorbidities, taking more medication and antibiotics and they have lower immunity than younger patients. This finding is supported by **Khalaf, (2017)** entitled "effect of nursing intervention protocol on the incidence of catheter associated urinary tract infection among critically ill patients" at Ain Shams University Hospitals, who reported that about half of the total studied patients were in the age group from 51-65 years old and this finding also similar to **Salamaa et al. (2015)** entitled "Implementation of central venous catheter bundle in an intensive care unit in Kuwait: Effect on central line-associated bloodstream infection", who report that, mean of age of the studied patients were 57.9.

Concerning gender and marital status, it was found that, about half of the total studied patients were male and married. This could be related to, male more admitted to critical care units than female due to a higher prevelance of comorbidities and chronic disease as hypertension, chronic obstructive pulmonary disease, neurological disease, and heart disease. This result is supported by **Al-Abdullah, (2018)** entitled " Epidemiology of Central Line-Associated Bloodstream infection (CLABSI) Among patients in the Intensive Care Units (ICUs) at a Teaching Hospital in Saudi Arabia ", who reported that, the same result as most of the studied patients were male and married.

Concerning medical diagnosis, this study reported that, about 30% of the studied patients were diagnosed with respiratory diseases as respiratory distress these patients were severely ill and this increased their likelihood of having multiple CVCs with multiple infusion lines and also prolonged use of these devices with prolonged hospitalization. This finding could be due to a lot of the studied patients suffered from hypertension and diabetes mellitus disease, which considered from risk factors for respiratory distress. This finding is in line with **Lin et. al (2015)** entitled " Central line-associated bloodstream infections among critically-ill patients in the era of bundle care", at the National Taiwan University Hospital, who reported that, major diagnosis in ICU were respiratory disease.

As regards level of consciousness, the result of the current study represents that, about more than half of the total studied patients were unconscious. This finding may be contributed to multiple invasive procedures like mechanical ventilation, central venous line, and critical diagnosis of the patients in Intensive Care Units. This result is in accordance with **Cavallazzi, Saad, and Marik, (2012)** entitled "Delirium in the ICU: an overview", who stated that, most patients admitted to ICU usually had a different level of altered consciousness. This result also agreed with **Upadhyay, Bhalerao**

and Pratinidh, (2017) entitled " Study of Level of Consciousness and Electrolyte Abnormalities in Patients Admitted to Intensive Care Unit (ICU) ", who stated that altered states of consciousness are commonly seen in ICU's. It is seen that in neurological and neurosurgical ICU's altered states of consciousness are the main reason for the adult ICU admission.

Concerning the purpose of central line insertion, about half of the study and control groups central line was inserted for them due to long term intravenous therapy followed by hemodynamic monitoring. This find diagreed with **Zaiton and Taha, (2014)** entitled "Effect of Implementing Central line Bundle on Minimizing Rate of Central Line-Associated Blood Stream Infection (CLA-BSI) among Intensive Care Patients", in Zagazig University Hospitals who reported that, (77.5%) of patients Inserted central line for them due to hemodynamic monitoring followed by(15%) for routine intravenous therapy while (7.5%) for Total parental nutrition. The purpose of insertion central line among control group was(60%) of patients Inserted central line for them due to hemodynamic monitoring followed by (20%) for routine intravenous therapy while (5%) for Total parental nutrition respectively.

Regarding to centeral line insertion site, result of the current study represents that, the majority of the two study groups used intra-jugular vein with no use of femoral vein during insertion. This finding could be due to internal jugular vein is associated with less complications and the policy of medical ICU and the physicians prefere internal jugular vein. This finding supported by **El Nemr et al. (2013)** entitled "An Interventional Study to Decrease Central Venous Catheter Related Blood Stream Infection in Intensive Care Units at Zagazeg University Hospital", who mention that the frequent used site for catheter insertion in emergency ICU was internal jugular vein 54.2% and 60.1% of cases before and after intervention respectively with no use of femoral site. In surgical ICU, the most frequent used site after intervention was internal jugular vein (56.6%) with no use of femoral site.

As regared to vital signs, increased temperature , pulse and respiration and decreased blood pressure were reported after two days of insertion and after one weak of insertion.This finding supported by **Rode et al. (2017) entitled** "Study of central line-associated bloodstream infections in intensive care unit: a prospective observational study", in India, who reported that, In general physical exam findings the most common positive finding was fever in 54 patients, tachycardia in 45 patients and hypotension.

As regared to microbiological data of the two groups regarding central line associated blood stream infection. The causitive microorganism was coagulase negative staphylococci followed by Pseudomonas and klebsiella. This finding agreed with **Khalil and Azqul, (2018)** entitled "Risk factors and microbial profile of central venous catheter related blood stream infection in medical cardiac care units, National Heart Institute, Egypt", who reported that the isolated micro-organisms with central venous catheter related blood stream infection were coagulase _ve staphylococci, S. aureus, klebseilla and Acinetobacter as the staphylococci were the most common isolated pathogens.Concerning central line associated blood stream infection, the control group showed higher prevelance of positve central line associated blood stream infection than the study group. This could be as a result of implementation of central line bundle which reduce the incidance of central line associated blood stream infection among study group. This finding suported by **Lee et al. (2018)** entitled "Effect of Central Line Bundle Compliance on Central Line-Associated Bloodstream Infections", who reported that CLABSI rates according to the performance of each component of the CL bundle. The CLABSI rate was lower in patients for whom complete hand washing than in patients for whom hand washing was not performed.

Regarding the association between socio-demographic data as age, gender, marital status and prevalence of CLABSI. There was no statistically significant association among the study and control groups but the prevalence of CLABSI increases in both women and men with increasing age . This finding may explained as, increasing age pose agreat risk for CLABSI due to the variety of anatomic and functional changes, which arise with aging such as weakened immune defense. This finding supported by **Khalil, and Azqul, (2018) entitled** " Risk factors and microbial profile of central venous catheter related blood stream infection in medical cardiac care units " who reported that there was no statistical significant difference between the participants' age and gender and CRBSI occurrence. the study did not find that gender represents a risk factor for CRBSI occurrence. There was no statistically significant association between medical diagnosis, past medical history of comorbidities disease, level of consciousness, Purpose of central line insertion, site of catheter insertion and prevalence of CLABSI. This finding disagreed with who **Malek et al. (2018)** entitled "Incidence Of Central Line-associated Bloodstream Infections In Intensive Care Units In A Private Hospital (Cairo, Egypt) ", who report that, there was a statistically significant association between the occurrence of CLA-BSI and heart failure as a chronic

underlying condition, coinciding with the results of a case-control study that found that medical cardiovascular disease was a newly identified independent risk factor in patients with CLA-BSI. However, there was no relationship between diabetes or solid-organ transplant and the development of CLA-BSI.

Regarding the association between site of central line insertion site and the prevalence of CLABSI, There was no statisically significant among the studied patients. This finding is in line with **Kumar et al. (2014)** entitled "Diagnosis of central venous catheter-related bloodstream infection without catheter removal: A prospective observational study", who reported that, There was no statistical difference in the central venous catheter-related bloodstream infection incidence with respect to either the site of catheter placement (Internal Jugular Vein or Subclavian. Since femoral route was not used for CVC insertion in any of the patients.

Regarding the association between increased length of ICU stay and prevelance of CLABSI , There was a statistically significant among the studied patients.This can be explained by the fact that the longer the CVC is in situ the more exposure to microorganisms and the increased chances of infection. This finding agrees with **Jocyline, Hannah &Waithira, (2018)** entitled "Predictors and Prevalence of Central Line Associated Blood Stream Infections Among Adult Patients in Critical Care Units -Kenyatta National Hospital", who mention that the prevelance of CLABSI increased with length of hospitalization with CVC in situ and There was a strong positive correlation between CLABSI and number of days with CVC Thus an increase in number of days with CVC led to an increase in CLABSI risk and also report that, Most Patients with CLABSI had a CVC in situ for more than 14 days. Those who had a CVC for 7 days or less did not develop CLABSI.

There was statistically significant association between outcomes of infection and positive central associated blood stream infection in which the patient with CLABSI need mechanical ventilator and antibioics. This finding agreed with **Lin et al. (2017)** entitled "Central line-associated bloodstream infections among critically-ill patients in the era of bundle care", who reported that the percentage of adequate empirical antibiotics was very high in the CLABSI group and additional infection-control measures to control endogenous flora spreading and empiric antibiotic for CLABSI are essential.

5. CONCLUSION

Based on the study findings, the following can be concluded; the incidance rate of CLABSI was decreased in the study group than the control group and there was statistically significant relation between outcomes of infection and positive blood stream infection regarding the need for more interventions as increase the need for additional antibiotics and increase length of ICU stay. Implementation of central line bundle is essential and has a positive impact on the reduction of Central Line Associated Blood Stream Infection in critically ill patients.

6. RECOMENDATION

The study recommended that:

1. The importance of implementation of central venous line bundle in intensive care units and health care providers should adhere to care bundle elements with empahsis on bundle compliance.

2. Establish policies and procedures for applying central venous line bundle in intensive care units.

3. Build team which include all staff involved in CVC insertion and maintenance and specialized for central line bundle implementation.

4. Blood culture should performed as routine laboratory investigation for patients for early detection of central line associated blood stream infection.

5. Chlorhexidine substence should be provided as a potent antiseptic solution in the hospital.

6. Developing a simplified and comprehensive booklet about central venous line bundle for health care staff (nurses and physicians) in intensive care units.

7. The study should be replicated on large sample and different units in hospitals in order to generalize the results

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