

Nursing Knowledge and Compliance regarding Central Line Associated Blood Stream Infection Bundle in Neonatal Intensive Care Units: An Assessment Study

Soheir Emad Mahmoud¹, Prof. Dr. Safy Salah El-Dien Al-Rafay², Prof. Dr. Safaa Salah Ismail³

²B.Sc. of Nursing; ² Professor of Pediatric Nursing, Faculty of Nursing, Ain Shams University, ³Dean of Helwan Faculty of Nursing, ³Bachlore in Science of Nursing

Abstract

Background: Central Line Associated Blood Stream Infections (CLABSI) are the most common healthcare associated infections in the Neonatal Intensive Care Unit (NICU). The nurse has an important role in CLABSI bundle during insertion and maintenance. **This study aimed to:** Assess nursing knowledge and compliance regarding CLABSI bundle. **Setting:** This study was conducted at the (NICU) in Children University Hospital (Abu Elrish) El-Mounira and New Kasr El-Ani Teaching Hospital. **Design:** A descriptive design was used. **Sample:** A purposive sample of 86 nurses included in the study working at the previously mentioned setting. **Tools:** The first tool is a predesigned questionnaire to assess nurses' knowledge about CLABSI bundle; the second tool was observational checklist to assess nurses' compliance for neonates with CVL. **Results:** Revealed that less than half had poor knowledge and more than half had average knowledge about CLABSI bundle while more than half had incompetent practice. **Conclusion:** The current study provides a picture of the current nursing knowledge and compliance of CLABSI bundle in NICUs. The study conducted that less than half had poor knowledge and less than half had average knowledge about CLABSI bundle while more than half had incompetent practice. In addition, the study illustrated an absence of a uniform protocol for prevention of CLABSI in the studied NICUs and absence of adequate training. This indicates the need for developing a protocol for CLABSI prevention based upon current evidence based guidelines and make education program on this protocol. There is also a need for establishing a system to implement prevention protocols and the monitoring of adherence and CLABSI bundle. **Recommendations:** Collaboration and continuing education of the staff in the NICUs are vital to improve their knowledge and practices of care provided for neonates with central venous line. Standardized nursing guide lines about CLABSI bundle should be used to guide the nurse while caring of neonate with central line. Make checklist for insertion and maintenance CLABSI bundle for each patient and also make kits for CVL insertion and dressing change.

Key words: CLABSI, Knowledge, Compliance, Infection, Bundle, Nurses & Neonates.

Introduction

Healthcare associated infections (HAIs) are of increasing concern in Neonatal Intensive Care Units (NICUs) due to advances in invasive therapeutic and diagnostic procedures and increased survival of preterm babies. The overall mortality rate varies between 20%

and 80% depending on the risk factors. In addition, there is wide variation in the bacteriological profile and antibiogram of microorganisms in different NICUs which changes consistently with time (Kumar et al., 2018).

Acquiring microorganisms from the environment after the delivery are most involved. The recent advances in neonates'

management have resulted in a significant increase in survival, associated at the same time with prolonged hospitalization, mechanical ventilation, use of invasive procedures and devices which are all predisposing factors of infection (Cortese et al., 2016).

Blood stream infections (BSIs) are common in neonatal intensive care units, occurring in 5% to 42% of very low birth weight neonates. Blood stream infections are associated with a substantial increase in the risk of death, poor neurodevelopmental outcomes and longer, more costly hospitalizations (Shepherd et al., 2015). Central line associated bloodstream infections (CLABSIs) have come to be recognized as preventable adverse events that result from lapses in technique at multiple levels of care and associated with increased mortality and adverse outcomes that may have lifelong consequences (Powers & Wirtschafter, 2010).

A central line-associated bloodstream infection (CLABSI) is a serious infection that occurs when germs enter the bloodstream through the central line. Healthcare providers must use stringent infection control practices each time they insert or check the line or change the dressing. Patients who get a CLABSI have a fever, and might also have red skin and soreness around the central line (Center of Disease Control and Prevention, 2011).

Preventing and managing central line-associated bloodstream infections in the neonatal intensive care units is challenging because of the need for invasive devices and the extreme vulnerability of this population. The risk of infection due to a central line varies based on a number of factors, including

birth weight, gestational age, type of line, and life of the line (Barnes et al., 2015).

Central line associated blood stream infection is costly, preventable infections targeted for eradication by the Centers for Disease Control and Prevention. After evaluation of current practice and areas for improvement, neonatal-specific CLABSI bundles is developed and implemented on the basis of available best evidence. The overall goal was to reduce infection rates at or below benchmarks set by national healthcare safety network (NHSN) (Ceballos et al., 2013).

Nurses are in a unique position to prevent CLABSIs across the health care spectrum. CLABSI prevention is completely a nursing responsibility. Nurses should feel empowered to stop the procedure if see practice lapses (Sandoval., 2015).

Significance of the study:

In Egypt, central line-associated bloodstream infections rate was 7.3 per 1000 catheter day in neonatal intensive care units (NICUs)(9, 10). In the view of neonates' safety goals, all neonates deserve not to acquire infections from hospital (Rasslan et al., 2012 and Talaat et al., 2016). Bundles compliance improve neonates outcome and decrease the rate of infection. According to study made in Kingdom Saudi Arabia (KSA), CLABSI rate had reduced from 8.2 to 2.6 per 1000 umbilical catheter days in NICU after using CLABSI bundles (Ratna et al., 2016).

So that, it is very important to assess nursing knowledge and compliance regarding CLABSI bundle to shed light on nursing compliance. Moreover, it will help

in construction of database regarding this issue to be incorporated in the future plan of care for these neonates and it might generate an attention and motivation for further researchers into this area.

Aim of the study

This study aims to assess nursing knowledge and compliance regarding central line associated blood stream infection bundle.

Research questions:

1. What are the nurses' knowledge about Central Line Associated Blood Stream Infection bundle?

2. What are nurses' compliance with Central Line Associated Blood Stream Infection bundle?

3. Are there a relationship between nurses' characteristics and their knowledge and compliance regarding Central Line Associated Blood Stream Infection bundle?

Subjects and methods

This study was portrayed under four main designs as follows:

Technical design:

Settings:

The study was conducted at Neonatal Intensive Care Units (NICUs) in children university hospital (Abu Elrish) El-Mounira, New Kasr El-Ani teaching hospital.

Research Subjects:

A convenient sample composed of

(86) nurses were working at (NICU) at caring of neonates regardless their age, gender, years of experience and educational level who included in the study from in the previously mentioned settings where, (47) nurses from El-Kasr Al-Ainy University Hospital and (39) nurses from Abu Al-Rish Al-Munira.

Tools for data collection:

Two tools were used for data collection:

First tool:

Questionnaire knowledge was developed by the researchers based on review of recent and related literature in an Arabic language to suit the nurses' level of understanding and divided into two parts:

Part 1: Characteristics of nurses such as Age, Gender, Years of experience, and Educational Level, Position and Training Courses).

Part 2: Assessment of nurses' knowledge regarding central line associated blood stream infection bundles included; 23 questions about insertion and maintenance bundles causes, signs and symptoms of infection, complications of central line and nursing management based on Association for Professional in Infection Control and Epidemiology (APIC) 2014.

Scoring system: A score of "one" was given to the "correct" answer and score of "zero" was given to the "incorrect" answers. The scores of items were summed up and the total divided by number of the items.

Total score:

These score were converted into a percent. The nurses' knowledge was considered "poor" if the percent score was from 0% to 50% refer. "Average" if they scored from 50% to 75% and "good" if nurses scored from 75% to 100%. Means and standard deviations were computed

Second tool: Observational checklist that was adopted from Association for Professional in Infection Control and Epidemiology (APIC) Guidelines (2014) to assess CLABSI bundle compliance of nurses. The observational checklist had 2 parts regarding insertion and maintenance items that the nurses should follow to prevent CLABSI.

Scoring system: Observational checklists were used to assess practice of nurses as follows:

Each step was scored by "one" if it is done "competent" whereas "incompetent" step was scored "zero"

Total score:

Scores of each observational checklist were summed up and categorized into:

"Compliance" if score more than 80% or "non-compliance" if scores less than 80%

Operational design:**Preparatory phase**

A review of the past and current related literature covering various aspect of nursing care of neonates with central line was done using available books,

articles, periodicals and magazines to get acquainted with the research problem and to develop the study tools.

Content validity

It was ascertained by a Jury consisting of three professors in the field of Pediatric Medical and Nursing who revised the tools for clarity, relevance, applicability, comprehensiveness and understanding. According to their opinion minor modification were applied.

Reliability of the study tool.

Cornbrash alpha coefficient was used to assess the internal consistency of the tool. The questionnaire value was (0.80).

Pilot study

A pilot study was conducted over period of two months, from the beginning of September 2017 up to the end of October 2017. It was conducted on 10% (8 nurses) of total study sample to evaluate the research plan, clarity and applicability of the study tools. No modifications of the tool after pilot study. So that, nurses who included in the pilot study was included in the study sample.

Field work

The data have been collected over a period of 6 months the actual field work was carried out from the beginning of December 2017 to May 2018. Each nurse was interviewed and assessed individually using the study tools.

The researcher was available at each study setting by rotation, 2 days weekly (Monday, Wednesday) throughout the morning shift from 09:00 A.M to 02:00

P.M and started by researcher herself to the nurses then informing them about the purpose of study.

The time consuming for completion of questionnaire takes 10 -15 minute. As regards the nurses' practices, they were observed in the previously mentioned settings during their actual work in the shift. Time consumed for assessing esach nurse 10 - 20 minutes according to checklist.

Administrative design

An official permission to carry out the study was obtained from the Dean af Faculty of Nursing, Helwan University to the directors of El-Kasr Al-Ainy University Hospital and Abu Al-Rish Al-Munira Hospital at which the study was conducted.

Ethical considerations:

The neonatal nurses assured that the collected data would be treated confidentially and that it would be used for the purpose of the study only. The purpose of the study was simply explained to the nurses who agree to participate in the study prior to data collection. The researcher assured maintaining anonymity and confidentiality of the subject data. Neonatal nurses were informed that they allowed choosing to participate or not in the study and that they have the right to withdraw from the study at any time without giving any reason.

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 Mean± Standard Deviation (SD).

Qualitative data were expressed as frequency and percentage.

The following tests were done:

Chi-square test of significance, Spearman's rank correlation coefficient (RS), the confidence interval and probability (P-value)

Results

The present study composed of the following tabulated data which presented in tables (1-15), figures (1-6).

Table (1) shows that the mean experience was 5.35 ± 3.29 years and half of studied nurses had 2 training courses and there is no protocol for CLABSI bundle in hospital.

Table (2) shows that more than half of nurses (57%, 66.3%, 69.8%, 67.4%, 67.4%) have correct answers about uses of CVL, mechanisms of blood stream infection, causes of CLABSI, complications of CVL and signs and symptoms of CLABSI

Table (3) shows that less than half (39.5%, 33.7%) of nurses had knowledge about using betadine 10% as skin antiseptis and its contact time. The most of studied nurses (61.6%) have correct answer that surgical hand washing should be used before CVL insertion. The table also reveals that more than half (58.1%) of nurses have correct answers about personal protective equipment that the nurse should wear during CVL insertion.

Table (4) shows that the majority (81.3%) of nurses have incorrect answer about changing IV line every 3 days if maintain closed cycles and also about changing IV lines of blood and blood

products every 24 hours. The table also shows that more than half (53.5%) of nurses have correct answer about changing non transparent dressing every 2 days, but more than half (55.8%) of them have incorrect answer about changing CVL transparent dressing every 7 days. Regarding discard IV line after disconnecting from CVL, more than half (62.8%) of nurses have incorrect answer. While more than half (64%) of nurses have correct answer about disinfecting the CVL opening with alcohol 70% and care of CVL.

Table (5) shows that half (50%) of nurses had correct answer about nursing care during CVL removal and removing the umbilical arterial catheter before 5 days. While more than half (60.5%) of them have correct answer about removing the umbilical venous catheter before 14 days and the time when the CVL should be removed. Table (6) shows that more than half (54.7%) of nurses have good knowledge about CLABSI bundle and one quarter (25.6%) have average knowledge. While the minority (19.8%) of studied nurses have poor knowledge about CLABSI bundle. Table (7) shows that the majority (84.9%) of studied nurses covered the site of insertion with sterile gauze while less than half (41.9%) of them used the maximal barrier precautions. The table also reveals that more than half (55.8%) of nurses didn't follow aseptic technique during insertion and shows that more than half (54.7%) of nurses performed surgical hand washing before insertion. Regarding the total compliance of CLABSI insertion bundle, less than half (41.9%) of nurses complied with insertion bundle.

Table (7) shows that the majority (84.9%) of studied nurses covered the site of insertion with sterile gauze while less than half (41.9%) of them used the

maximal barrier precautions. The table also reveals that more than half (55.8%) of nurses didn't follow aseptic technique during insertion and shows that more than half (54.7%) of nurses performed surgical hand washing before insertion. Regarding the total compliance of CLABSI insertion bundle, less than half (41.9%) of nurses complied with insertion bundle.

Table (8) shows that the majority of the nurses (62.8%) didn't follow the proper maintenance practice and more than three quarters of nurses assess the CVL daily and only less than half of them (41.9%) used aseptic technique during dressing change. Table shows also that more than half of nurses didn't change intravenous line according to APIC guidelines and didn't scrub access port with alcohol 70%. More than half (54.7%) of them comply with hand hygiene. More than half of studied nurses didn't use sterile device when accessing CVL. Regarding dressing change, half of studied nurses change gauze of dressing every 2 days. Regarding total compliance, more than one third (37.2%) of nurses compliance with maintenance CLABSI bundle.

Table (9) shows that less than half (44.2%) of the studied nurses follow the bundles and this result reveals that the nurses don't comply with CLABSI bundles.

Table 10 shows that there were statistical significant relations ($p < 0.05$) between level of nurses' knowledge and their Age (years), Education level, Occupation, Years of Experience, training courses and Are there any guidance from the hospital, with p-value.

Table (11) shows that there were statistical significant relations ($p < 0.05$) between the studied nurses level of practice and their Age (years), Education

level, Occupation, Years of Experience and Training courses.

Table (12) shows that there were statistical significant relations ($p<0.05$) between the studied nurses level of knowledge and their level of practice about CLABSI insertion bundle.

Table (13) shows that there were **statistical significant relations** ($p<0.05$) between the studied nurses level of knowledge about CLABSI maintenance bundle and their level of practice.

Table (14) shows that there were statistical significant relations ($p<0.05$) between the studied nurses level of knowledge and their level of practice.

Table (15) showed that, there were positive correlation and significant between total score of nurses' knowledge and total practice about CLABSI bundle at statistically significance ($p< 0.05$).

Part (I): Characteristics of the studied nurses:

Table (1): Number and Percentage Distribution of Nurses According to Their Socio-Demographic Data (N=86).

Socio-demographic data	No.	%
Age (years)		
<20 years	10	11.6%
20-<30 years	19	22.1%
30-<40 years	36	41.9%
≥40 years	21	24.4%
mean ± S D		33.14±6.30
Name of the Hospital		
El-Kasr Al-Ainy University	47	54.7%
Abu Al-Rish Al-Munira	39	45.3%
Years of Experience		
<3 years	23	26.7%
3-<6 years	30	34.9%
≥6 years	33	38.4%
mean ± S D		5.35±3.29
Training courses		
Yes	42	48.8%
No	44	51.2%
Attending previous training course(n=42)		
1	17	40.5%
2	21	50.0%
3	4	9.5%
Is there any protocol for CLABSI bundle in hospital		
Yes	0	0
No	86	100%

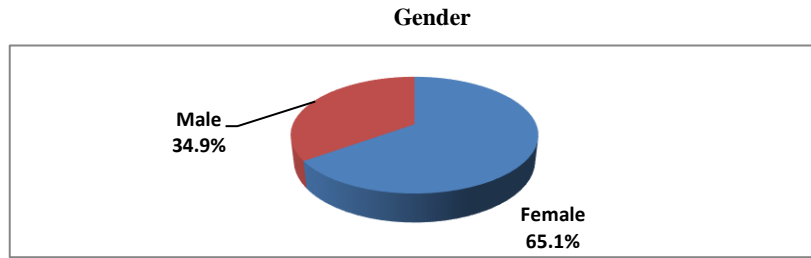


Figure (1): Percentage distribution of Nurses According to Their Gender.

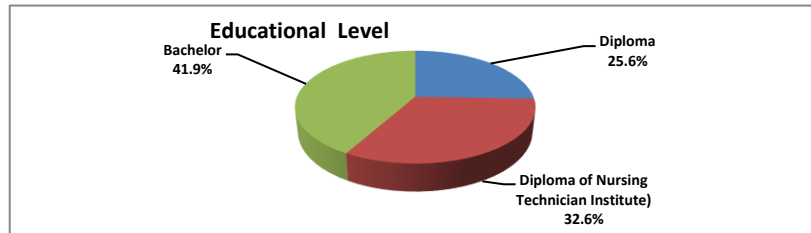


Figure (2): Percentage Distribution of Nurses According to Their Educational Level.

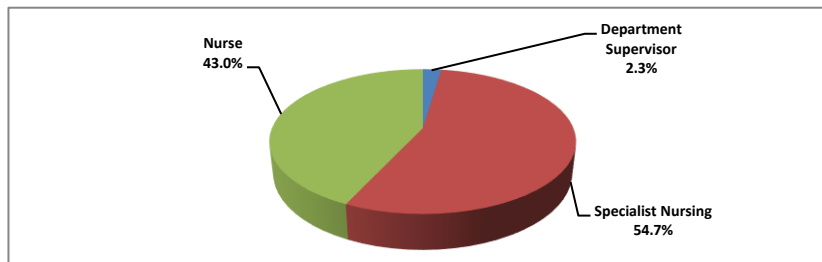


Figure (3): Percentage Distribution of Nurses According to Their Occupation.

Table (2): Number and Percentage Distribution of Nurses According to Their Knowledge about Central Line (n=86).

Knowledge about central line and CLABSI	Correct		Incorrect	
	No.	%	No.	%
Uses of central venous line	49	57%	37	43%
Mechanisms of blood stream infection	57	66.3%	29	33.7%
Causes of CLABSI	60	69.8%	26	30.2%
Complications of CVLs	58	67.4%	28	32.6%
Signs and symptoms of CLABSI	58	67.4%	28	32.6%

Table (3): Number and percentage distribution of nursing according to their knowledge about insertion CLABSI bundle (n=86).

Knowledge about insertion CLABSI bundle	Correct		Incorrect	
	No.	%	No.	%
Using surgical hand washing	53	61.6%	33	38.4%
Wearing personal protective equipment	50	58.1%	36	41.9%
Using betadine 10%	34	39.5%	52	60.5%
The contact time of betadine	29	33.7	57	66.3%

Table (4): Number and percentage distribution of nursing according to their knowledge of maintenance CLABSI bundle (n=86).

Knowledge about maintenance CLABSI bundle	Correct		Incorrect	
	No.	%	No.	%
Assessing need of CVL	53	61.6%	33	38.4%
Changing non transparent dressing	46	53.5%	40	46.5%
Changing of intravenous line of clear fluids	16	18.7%	70	81.3%
Changing transparent dressing	38	44.2%	48	55.8%
Disinfecting the CVL opening	55	64%	31	36%
Personal protective equipment during change CVL dressing	47	54.7%	32	37.2
The care of CVL	58	67.4%	28	32.6%
Changing of intravenous line of blood and blood products	11	12.8%	74	86
Discard IV line if disconnecting from CVL	32	37.2%	54	62.8%

Table (5): Number and percentage distribution of nursing according to their knowledge of central venous catheter removal (n=86).

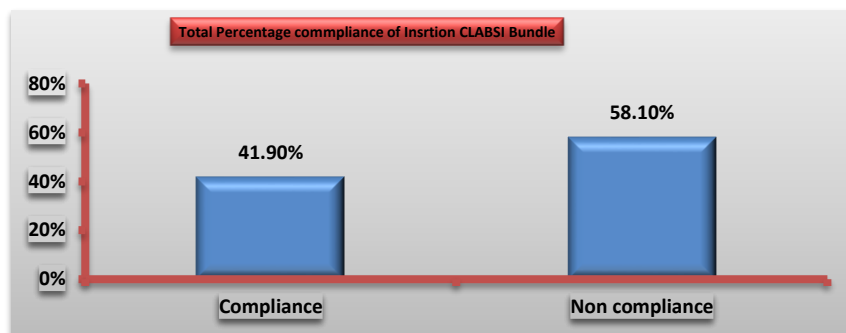
Knowledge about removal of CVL	Correct		Incorrect	
	No.	%	No.	%
Removing CVL	44	51.2%	42	48.8%
Removing the umbilical arterial catheter	43	50%	43	50%
Removing the umbilical venous catheter	52	60.5%	34	39.5%
The nursing care during removal of CVL	43	50%	43	50%

Table (6): Number and percentage Distribution of Nurses According to Their total Knowledge about CLABSI Bundle (n=86).

Total Knowledge about CLABSI bundle	No.	%
Poor (<50%)	17	19.8%
Average (50-75%)	22	25.6%
Good (>75-100%)	47	54.7%
Total	86	100%

Table (7): Number and Percentage Distribution of Nurses Compliance of Insertion CLABSI Bundle (n=86).

Follow proper insertion practice	Done		Not done	
	No.	%	No.	%
Perform surgical hand washing or hand rub before insertion.	47	54.7%	39	45.3%
Use maximal barrier precautions (i.e. surgical mask, cap, sterile gown & gloves, sterile full body drape).	36	41.9%	50	58.1%
Perform skin antisepsis with iodophore for 2 min. then wash with sterile water or saline.	43	50.0%	43	50.0%
Adhere to aseptic technique	38	44.2%	48	55.8%
Choose the best site to minimize infections and mechanical complication	69	80.2%	17	19.8%
Cover the site with sterile gauze or sterile transparent, semipermeable dressing	73	84.9%	13	15.1%
Total compliance	36	41.9%	50	58.1%

**Figure (4): Percentage Distribution of Nurses According to Follow Proper Insertion Practice (n=86).****Table (8): Number and Percentage Distribution of Nurses According to Follow Proper Maintenance Practice (n=86).**

Follow proper maintenance practice	Done		Not done	
	No.	%	No.	%
Comply with hand hygiene	47	54.7%	39	45.3%
Scrub the access port or hub immediately prior to each use	32	37.2%	54	62.8%
Access catheters only with sterile devices	32	37.2%	54	62.8%
Dressing change	43	50%	43	50%
Perform dressing changes under aseptic technique	36	41.9%	50	58.1%
Tubing and device change	36	41.9%	50	58.1%
Assess need of CVL	73	84.9%	13	15.1%
Total compliance	32	37.2%	54	62.8%

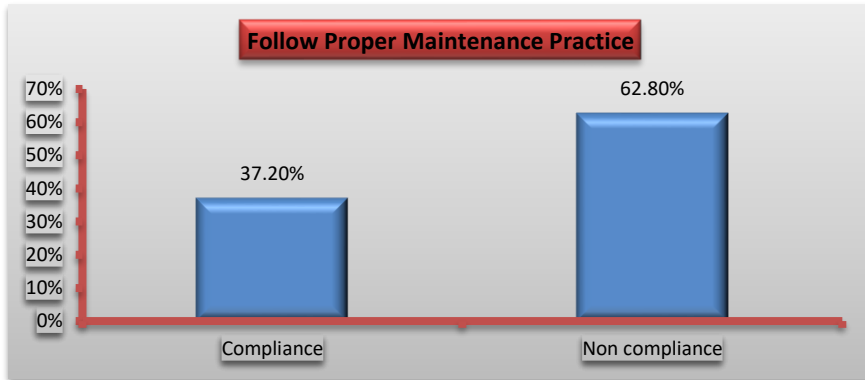


Figure (5): Percentage Distribution of Nurses According to Follow Proper Maintenance Practice (n=86).

Table (9): Number and Percentage Distribution of nursing according to their total compliance about CLABSI bundle (n=86).

Total practice about CLABSI bundle (insertion & maintenance)	No.	%
Compliance	38	44.2%
Non compliance	48	55.8%
Total	86	100%

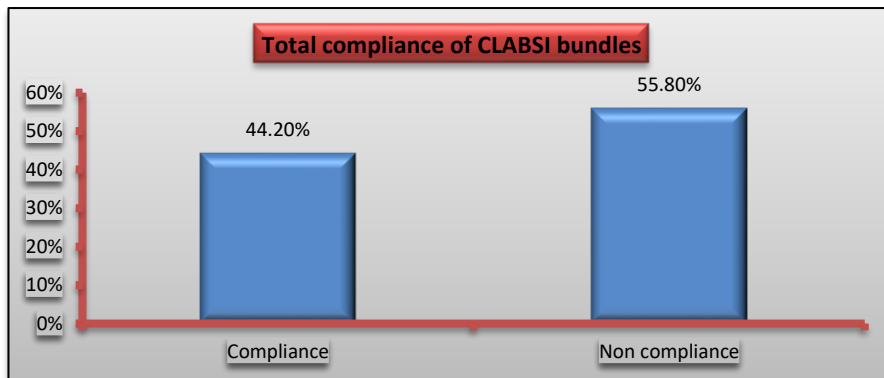


Figure (6): Percentage Distribution of Nurses According to their Total Compliance about CLABSI Bundle (n=86).

Table (10): Relation between nurses poor, average, good level of knowledge and their socio-demographic data (n=86).

ocio-Demographic data	Level of knowledge						Chi-square test	
	Poor (n=17)		Average (n=22)		Good (n=47)		x ²	p-value
	No.	%	No.	%	No.	%		
Gender								
Female	11	64.7%	14	63.6%	31	66.0%	0.037	0.982
Male	6	35.3%	8	36.4%	16	34.0%		
Age (years)								
<20 years	4	23.5%	2	9.1%	4	8.5%	35.519	<0.001**
20-<30 years	11	64.7%	5	22.7%	3	6.4%		
30-<40 years	2	11.8%	12	54.5%	22	46.8%		
≥40 years	0	0.0%	3	13.6%	18	38.3%		
Education level								
Diploma	10	58.8%	7	31.8%	5	10.6%	26.256	<0.001**
Specialized Diploma (Nursing Technician Institute)	6	35.3%	10	45.5%	12	25.5%		
Bachelor	1	5.9%	5	22.7%	30	63.8%		
Occupation								
Department Supervisor	0	0.0%	0	0.0%	2	4.3%	8.746	0.047*
Specialist Nursing	5	29.4%	12	54.5%	30	63.8%		
Nurse	12	70.6%	10	45.5%	15	31.9%		
Name of the Hospital								
New palace in Al Ain	11	64.7%	12	54.5%	24	51.1%	0.938	0.626
Abu Al-Rish Al-Munira	6	35.3%	10	45.5%	23	48.9%		
Years of Experience								
<3 years	7	41.2%	10	45.5%	6	12.8%	18.611	<0.001**
3-<6 years	9	52.9%	6	27.3%	15	31.9%		
≥6 years	1	5.9%	6	27.3%	26	55.3%		
Training courses								
Yes	0	0.0%	12	54.5%	30	63.8%	20.742	<0.001**
No	17	100.0%	10	45.5%	17	36.2%		
Is there any protocol for CLABSI in hospital?								
Yes	3	17.6%	10	45.5%	32	68.1%	13.291	<0.001**
No	14	82.4%	12	54.5%	15	31.9%		

Table (11): Relation between Nurses Level of Practice and Their Socio-Demographic Data (n=86).

Socio-Demographic data	Level of practice				Chi-square test	
	Done (n=38)		Not done (n=48)		x ²	p-value
	No.	%	No.	%		
Gender						
Female	26	68.4%	30	62.5%	0.119	0.731
Male	12	31.6%	18	37.5%		
Age (years)						
<20 years	2	5.3%	8	16.7%	23.843	<0.001**
20-<30 years	1	2.6%	18	37.5%		
30-<-40 years	19	50.0%	17	35.4%		
≥40 years	16	42.1%	5	10.4%		
Education level						
Diploma	2	5.3%	20	41.7%	26.494	<0.001**
Diploma of Nursing Technician Institute	9	23.7%	19	39.6%		
Bachelor	27	71.1%	9	18.8%		
Occupation						
Department Supervisor	2	44.7%	0	22.9%	7.207	0.027*
Specialist Nursing	25	44.7%	22	35.4%		
Nurse	11	10.5%	26	41.7%		
Name of the Hospital						
New palace in Al Ain	20	52.6%	27	56.3%	0.112	0.738
Abu Al-Rish Al-Munira	18	47.4%	21	43.8%		
Years of Experience						
<3 years	3	7.9%	20	41.7%	23.815	<0.001**
3-<6 years	10	26.3%	20	41.7%		
≥6 years	25	65.8%	8	16.7%		
Training courses						
Yes	30	78.9%	12	25.0%	24.704	<0.001**
No	8	21.1%	36	75.0%		
Are there any guidance from the hospital?						
Yes	27	71.1%	18	37.5%	9.572	0.002*
No	11	28.9%	30	62.5%		

Table (12): Relation between Nurses Level of Knowledge about Insertion CLABSI bundle and their level of practice "follow proper insertion" (n=86).

Follow proper insertion practice	Knowledge of CLABSI insertion bundle						Total		Chi-square test	
	Poor		Average		Good		No.	%	x ²	p-value
	No.	%	No.	%	No.	%				
Done	4	20.0%	8	29.6%	24	61.5%	36	41.9%	11.792	0.003*
Not done	16	80.0%	19	70.4%	15	38.5%	50	58.1%		
Total	20	100.0%	27	100.0%	39	100.0%	86	100.0%		

Table (13): Relation between Nurses Level of Knowledge about maintenance CLABSI bundle their level of practice (n=86).

Follow proper maintenance practice	Knowledge of CLABSI maintenance bundle						Total		Chi-square test	
	Poor		Average		Good		No.	%	x2	p-value
	No.	%	No.	%	No.	%				
Done	3	21.4%	6	21.4%	23	52.3%	32	37.2%		
Not done	11	78.6%	23	82.1%	20	45.5%	54	62.8%	9.757	0.007*
Total	14	100.0%	29	103.6%	43	97.7%	86	100.0%		

Table (15): Correlation between total knowledge score and total practice score (n=86).

Total knowledge score		
	R	p-value
Total practice score	0.784	<0.001**

Discussion

Central line associated blood stream infection is the most common hospital-acquired infection in the Neonatal Intensive Care Unit (NICU) accounting for 28% of all nosocomial infections in this population followed by ventilator-associated pneumonia (VAP) (**Almuneef et al., 2006**). The incidence of CLABSI rate was 22.5 per 1000 line-days in respiratory ICU and 18.8 in the pediatric ICU (**Rasslan et al., 2012**).

This study aimed to assess nurses' knowledge and compliance about Central Line Associated Blood Stream Infection (CLABSI) bundle at Neonatal intensive Care.

Part (I): Characteristics of the studied nurses:

The current finding illustrated that, more than one quarter of the studied nurses' aged between 30<40years with mean and standard deviation was 33.14±6.30 years. In addition, more than half of the studied nurses' were females while more than one quarter of them had Bachelor degree. Also, less than half of studied nurses take training courses.

This study was in accordance with the study of **El-bilgahy et al., 2016** about "Nursing Practice for Prevention of Central Line Associated Blood Stream Infection (CLABSI) in A Pediatric Intensive Care Unit in Mansoura University children' Hospital Egypt who mentioned that more than two thirds of nurses had experience less than 6 years and nearly half of nurses didn't have enough training courses about CLABSI bundle.

Regarding gender of staff nurses, the current study was in accordance with the study of **Esposito, 2017**, about "Knowledge, attitudes, and practice on the prevention of central line-associated bloodstream infections among nurses in oncology care (2011)": A cross-sectional study in an area of southern Italy who mentioned that more than half of nurses were females. In addition, regarding nurses' educational level, the finding is in agreement with the study of **El-sol & Badawy, 2017** about "the effect of a designed teaching module regarding prevention of central-line associated blood stream infection on icu nurses' knowledge and practice" in Prince Mutaip-Bin Abd el Aziz hospital who found that nearly two fifth of studied nurses had bachelor degree of nursing.

Part (II): Nurses' Knowledge Regarding to Central Line Associated Blood Stream Infection bundle.

Consistency with Jaslina Gnanarani, 2018 who studied "the effectiveness of central line bundle care upon the knowledge and compliance staff nurses" stated that that the majority of nurses had an inadequate level of knowledge regarding CVC care and the level of practice of nurses during CVC insertion study was also considered to be poor . From point of view, these results related to deficiency of educational program regarding CLABSI bundle.

Regarding nurses' knowledge about disinfecting the central line ports with alcohol 70%, the current study illustrated that more than half of nurses have correct answers. This study finding is in disagreement with the study of **Esposito, 2017** about "Knowledge, attitudes, and practice on the prevention of central line-associated bloodstream infections among nurses in oncological

care (2011)": A cross-sectional study in an area of southern Italy who found that quarter and half of nurses had knowledge about disinfecting the port of central line with alcohol swabs.

The current study shows that less than half of studied nurses have correct answers about when to change dressing, and this result is in disagreement with **Chen et al., 2017** in study about Knowledge of "Guidelines for the prevention of intravascular catheter-related infections (2011)": A survey of intensive care unit nursing staffs in China who found that more than quarter and half of the studied nurses know when change dressing.

Regarding the current study, less than half of studied nurses have good knowledge about central line associated blood stream infection bundle, and this result related to limited education programs and no protocol for CLABSI in hospital.

Part (III): Nurses' compliance regarding Central Line Associated Blood Stream Infection bundle.

The current study revealed that, there was limited education provided to nurses regarding prevention of CLABSI. Therefore, the compliance rate with APIC guidelines was less than optimal. These findings was in agreement with **Taylor et al., (2014)** who reported in his study limited education provided to nursing staff. In contrast **Snarski et al., (2015)** in study about Current practices used for the prevention of central venous catheter-associated infection in hematopoietic stem cell transplantation recipients (2013): a survey from the Infectious Diseases Working Party and Nurses' Group of EBMT in European centers reported that, all of the healthcare professionals who

managed CVCs underwent specific training in 91% of the centers included in his study. In all of these centers, the training was direct, nurse-to-nurse or physician-to-physician and included some training under supervision. Moreover, 47% of the centers also provided indirect training, including lectures and instructional videos.

While the current study revealed that more than half of the studied nurses complied with hand hygiene before dressing change and access device change, this result is disagreement with **Esposito et al., (2017)** in study about Knowledge, attitudes, and practice on the prevention of central line-associated bloodstream infections among nurses in oncological care (2011): A cross-sectional study in an area of southern Italy who found that more than three quarters of nurses complied with hand hygiene with antiseptic solutions. The current study also showed that less than half of the studied nurses complied with maximal barrier precautions during insertion, and this result is in disagreement with **Valencia et al., (2016)** in a study about Poor adherence to guidelines for preventing central line-associated bloodstream infections (CLABSI) (2015): results of a worldwide survey who said that more than three quarter of the nurses complied with PPE during insertion. This result showed poor compliance with hand hygiene and PPE which indicates continuous education, training and monitoring.

The using of chlorhexidine for skin disinfection before insertion or dressing change of a CVC was recommended by APIC. Furthermore, the safety and efficacy of chlorhexidine use in children under the age of 2 months is not resolved (**O'Grady et al., 2011**). In the current study chlorhexidine was not used in the hospital and povidone-iodine was used in

skin preparation and during dressing change; this could be explained by the lack of appropriate solution on hospital because it is so expensive.

There is variation in nursing practice was the frequency of change of the administration set for clear fluid. Despite the APIC recommendation to change administration sets no more frequently than 96 hour except the administration sets for blood transfusion and for parenteral nutrition. The results of the current study showed that, only a quarter of the nurses in NICUs comply with APIC recommendation. This result was in an agreement with **Taylor et al., (2014)** in a study about a survey of central venous catheter practices in Australian and New Zealand tertiary neonatal units (2012) who reported in his study that, only one third of studied nurses compliant with APIC recommendation regarding replacement of administration set for clear fluid. The duration of time for replacement of administration sets are left for the hospital policy and consideration made to extend routine changes to at least 96 hour.

The external surface of the catheter hub is the main portal of entry of microorganism to the blood stream causing CLABSI. Therefore, scrubbing the access port with an appropriate antiseptic (chlorhexidine, povidone iodine, an iodophor, or 70% alcohol) for 15 second and allowed to dry and accessing the port only with sterile devices were recommended. The current study showed that, less than one third of nurses were compliant with the APIC recommendation regarding scrubbing the CVC hub before accessing the port and this result is agree with **Silva & Olivera (2018)** in a study about medical and nursing team self-reported knowledge on bloodstream infection prevention measures, and disagreement with

Concannon et al., 2014 in a study about Sustained reduction of central line-associated bloodstream infections outside the intensive care unit with a multimodal intervention focusing on central line maintenance (2008) who found that more than three quarters complied with disinfecting the hub with alcohol swabs.

In addition, the result of the present study revealed that less than half of the nurses in NICU follow APIC recommendation regarding changing needless connector every 72 hours. This result was in disagreement with **Taylor et al., (2014)** who reported in his study that less than quarter of studied nurses were replacing needless connector every 72 hour.

Regarding the total compliance of CLABSI bundle, the current study conducted that the majority of the studied nurses un-compliance with care bundles and this is in disagreement with **Aloush & Alsaraireh, 2018** in study about Nurses' compliance with central line associated blood stream infection prevention guidelines in Saudi Arabia (2017) who showed that more than half of nurses had competent compliance with bundles.

Among the different activities related CLABSI insertion and maintenance bundle, the vast majority of the studied nurses complied with covering the site of insertion with sterile gauze dressing and performing daily audits for central need. This results indicates that the staff nurses need more training programs and continuous monitoring.

In addition the current study showed that there were statistical significant relations between the studied nurses level of knowledge and nurses' education level, years of experience, Training courses and also there were

statistical significant relations between the studied nurses level of practice and their level of knowledge and this result is in agreement with **Aloush & Alsaraireh, 2018** in study about Nurses' compliance with central line associated blood stream infection prevention guidelines in Saudi Arabia (2017) who showed that more than half of nurses had competent compliance with bundles who showed that there were strong relation between nursing characteristics and nurses' compliance.

Therefore educating the staff about CLABSI bundle is very important. The infection control department has major important role in education the staff; provide them with essential equipment and supplies and also monitoring the nurses compliance. The infection control department and the hospital management should give the nurses the power to implement the bundle items. Implementation of CLABSI bundle will decrease the rate of infection and increase the quality of care.

Summary

This study was designed to assess nursing knowledge and compliance regarding central line associated blood stream infection bundle at Children University Hospital (Abu Elrish) El-Mounira and New Kasr El-Ani Teaching Hospital in neonatal intensive care units, Egypt. The questionnaire sheet was developed by the researcher to assess nurses' level of knowledge regarding central line associated blood stream infection bundles and observational checklist to assess nurses' compliance. There were a positive correlation between the sample Knowledge of CLABSI bundle and their performance.

The current study provides a picture of the current nursing knowledge and compliance of CLABSI bundle in NICUs. The study conducted that less than half of studied nurses had poor knowledge and more than half of the studied nurses had average knowledge about CLABSI bundle while more than half had incompetent practice. In addition, the study illustrated an absence of a uniform protocol for prevention of CLABSI in the studied NICUs and absence of adequate training. This indicates the need for developing a protocol for CLABSI prevention based upon current evidence based guidelines and make education program on this protocol. There is also a need for establishing a system to implement prevention protocols and the monitoring of adherence and CLABSI bundle.

Recommendations

In the light of the finding of the current study the following recommendations are suggested.

1. Collaboration and continuing education of the staff in the NICUs are vital to improve their knowledge and practices of care provided for neonates with central venous line.

2. Standardized nursing guidelines about CLABSI bundle should be used to guide the nurse while caring of neonate with central line.

3. Make checklist for insertion and maintenance CLABSI bundle for each patient and also make kits for CVL insertion and dressing change.

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