

Nurses' Performance Regarding Central Venous Catheters at Neonatal Intensive Care Units

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Abstract

A descriptive study was Neonates with central venous catheters constitute a significant group in Neonatal Intensive Care Units. There is no doubt that, adequate care should be applied to them to keep them away from infection. **Aim:** The study aimed to assess the nurses' performance regarding neonates with central venous catheters. **Research design:** A descriptive research was used to conduct this study. **Research settings:** The study was conducted at the Neonatal Intensive Care Units of Obstetric & Gynecological Hospital, Children Hospital affiliated to Ain Shams and Tanta University Hospital. **Research subjects:** A purposive sample included 60 nurses and 60 neonates with central venous catheters. **Tools of data collection:** Four tools were used, interviewing questionnaire sheet to assess knowledge, observational checklists to assess practice, and likert type rating scale to assess the attitude. **The Results:** The study revealed that, nearly half of the studied nurses had poor knowledge regarding central venous catheters, and more than half of them had incompetent practice regarding central venous catheters. **Conclusion,** Based on the researcher's question, it can be concluded that, the nurses had poor knowledge, incompetent practice regarding central catheters, and had positive attitude regarding central venous catheter care. **Recommendations,** Implementation of nursing training programs with emphasis and improve nurses' knowledge and practice regarding central venous catheters.

Key words: Central venous catheters, Neonatal Intensive Care Units, Nurses' performance.

Introduction

In The neonatal period is defined as the first four weeks subsequent to birth. Neonates require observation and care that is beyond the scope of a normal newborn nursery, these are called High Risk Neonates (HRNs) who have a greater than average chance of morbidity or mortality (*Teitler et al., 2016*).

Neonates who need intensive medical attention are often admitted into a special

area of the hospital called the Neonatal Intensive Care Unit (NICU) which provides specialized care for the neonates (*Elsayed et al., 2013*). Most neonates admitted to NICU undergo Intravenous (IV) cannulation, IV access is often necessary to provide adequate nutritional and pharmacological support (*Orquiola et al., 2010*).

Nothing is more difficult, time consuming and frustrating than obtaining a

vascular access in critically ill neonates. Maintaining access with peripheral cannulation is often difficult and impractical, so central venous access is indicated when peripheral veins are inaccessible (*Irwin & Rippe, 2011*).

Millions of central catheters are used worldwide, so central catheter insertion is one of the most frequently performed procedures in critically ill neonates, for the administration of potent vasoactive drugs such as, dopamine and norepinephrine and for the administration of irritating or hypertonic drugs such as Potassium Chloride (KCl) (*Gomes et al., 2015*).

Central Line Associated Blood Stream Infections (CLABSIs) are the leading cause of morbidity and mortality in the NICU. The incidence of infection is higher in developing countries, in Egypt the risk of contamination and infection increases each time the line is accessed, as 2308 newborns with culture-proven sepsis, (65-90% of all sepsis cases) were caused by Gram-negative bacteria, the predominant pathogens (*Rupp et al., 2012*).

Central Venous Catheter insertion requires both experienced staff and the necessary equipment, it also requires knowledge about the benefits and risks of potential sites, using full sterile technique, ability to monitor the neonate during and after CVC insertion and knowledge about managing potential complications. And final a full documentation of procedure and any complications (*Marschall et al., 2014*).

Aim of the study

This study aimed to assess the performance of the studied nurses regarding neonates with Central Venous Catheters at Neonatal Intensive Care Units through:

1▪ Assessment of nurses' knowledge about; definition, importance, sites of

insertion and types of central venous catheters.

2▪ Assessment of nurses' practice regarding central venous catheters.

3▪ Assessment of nurses' attitude regarding central venous catheters.

SUBJECTS AND METHODS

The subjects and methods of the current study was designed under the following four (4) designs:

I. Technical Design

II. Operational Design

III. Administrative Design

IV. Statistical Design

I. Technical design: included research design, settings, subjects as well as tools of data collection.

Research design:

A descriptive research design was used to conduct this study.

Research settings:

The study was conducted at the NICU of Obstetric & Gynecological Hospital & NICU in Children Hospital affiliated to Ain Shams University Hospitals, and NICU affiliated to Tanta University Hospitals).

Description of the Settings:

Neonatal Intensive Care Unit of Obstetric & Gynecological Hospital located in 2nd floor close to labour suite, NICU contains 28 incubator and 9 mechanical ventilators), NICU in Children Hospital located in 1st floor, contain 11 incubators and 4 mechanical ventilator), NICU at Tanta

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University located in 2nd floor, and NICU contains 26 incubator and 12 mechanical ventilator).

Research subjects:

A purposive sample composed of 60 nurses, (30 from NICU at Tanta University, 15 from NICU at Obstetric & Gynecological Hospital and 15 from NICU at Children Hospital) and 60 neonates aged from 1-28 day and had central venous catheters.

Tools of data collection

Data were collected through using the following tools:

I: Interviewing Questionnaire Sheet (Appendix I):

It was designed by the researcher, revised by supervisors and written in simple Arabic language based on scientific literature review to gather data in relation to the following parts:

Part I:

It concerned with characteristics of he studied nurses` such as age, sex, qualifications, marital status, years of experience.

Part II:

It concerned with nurses' knowledge regarding CVCs such as definition, sites of insertion, importance, types, complications.

Scoring system: The total score level for the questionnaire sheet was 19 marks (100%). The correct answer scored one, the incorrect scored zero, the nurses' knowledge was checked with a model key answer and accordingly their knowledge was categorized into either:

- Score of < 85 referred to poor knowledge.

- Score of 85 <90 referred to average knowledge.

- Score of $90 \leq 100$ referred to good knowledge.

II: Medical Assessment Sheet (medical record):

It concerned with characteristics of the studied neonates such as gender, weight at birth, gestational age, ranking, diagnosis, length of stay, neonate ventilated, neonate status progress, complications during hospitalization .

III: Observational Check List (Appendix II):

It was adopted from **Perry and Potter, (2014) and Noaman et al., (2016)**, and used to assess the practice of nursing staff regarding flushing, nursing care before, during, and after insertion of CVCs.

Scoring system:

The done step was scored one, and the not done was scored zero. These scores were summed-up and converted into a percent score and classified to:

- Score of < 95 referred to incompetent.

- Score of $95 \leq 100$ referred to competent.

IV: Modified Likert Type Rating Scale (AppendixIII):This scale was adopted from Sobeh, (1994) and Ahmed, (1998),and used to assess nurses attitude toward neonates with central venous catheter.

Scoring system:

Those nurses who strongly agree had (2) points, agree to have (1) points and disagree had (0) point. Scores were summed-up and classified into:

- Score of $10 < 20$ referred to negative.
- Score of $20 \leq 30$ referred to positive.

Validity and Reliability:

It was ascertained by a group of the experts in field of Pediatric Nursing (5) to test its content clarity & applicability tested statistically, test retest for performing reliability..

II- Operational Design:

The operational design for this study consisted of preparatory phase,ethical considerations, pilot study and fieldwork.

• Preparatory phase:

The researcher reviewed the local and international literature related to performance of the studied nurses regarding central venous catheter at neonatal intensive care units using books, articles, journals, and internet. This served to develop the study tools for data collection. During this phase, the researcher also visited the selected places to get acquainted with the personnel and the study settings. Development of the tools was under supervisors' guidance and experts' opinions were considered.

Ethical Considerations:

The ethical research considerations included the following:

- The research approval was obtained from the Faculty Ethical Committee before starting the study.

- The researcher clarified the objectives and aim of the study to nurses included in the study before starting
- The researcher was assuring maintaining anonymity and confidentiality of nurses data included in the study
- The nurses were informed that they are allowed to choose to participate or not in the study and they have the right to withdraw from the study at any time.

Pilot study

A pilot study was carried out on 10% (6) of nurses at the NICU of Obstetric &Gynecological, Children Hospitals affiliated to Ain Shams University Hospitals and NICU affiliated to Tanta University Hospitals in order to test the applicability of the constructed tools and the clarity of the included questions related to performance of the studied nurses regarding CVCs at NICUs. The pilot has also served to estimate the time needed for each subject to fill in the questions. According to the results of the pilot, some corrections and omissions of items were performed as needed, so the participants in the pilot study were not included in the main study sample.

• Field work

The data collection process started from the beginning of September 2016 until the end of March 2017.The researcher was available at the study settings 4 days/week (Saturday, Sunday at Ain shams Hospital in morning shift from 9am to 2pm, Tuesday and Wednesday at Tanta Hospital in afternoon shift from 2pm to 9pm. The researcher first met the nurses at the previously mentioned settings, introduced herself, and explained the aim of the study to gather the necessary data using the previously mentioned tools of the study.Each nurse was interviewed individually

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for about half an hour for questionnaire sheet, and it took about twenty minutes for each nurse to assess her practice, and ten minutes for each nurse to assess her attitude.

III. Administrative design:

An official permission to conduct the study obtained from the Medical and Nursing Director of NICUs affiliated to Ain Shames University Hospitals and Tanta University Hospitals. The researcher then met the Hospital Director and explained the purpose and the methods of data collection.

IV. Statistical design:

Data collected from the studied sample was revised, coded and entered using Personal Computer (PC). Computerized data entry and statistical analysis were fulfilled using the Statistical Package for Social Sciences (SPSS) version 20. Data were presented using descriptive statistics in the form of frequencies, percentages. Chi-square test (X^2) was used for comparisons between qualitative variables. Statistical significant was considered at p-value <0.05. Pearson correlation to assess the linear dependence ([correlation](#)) between two variables, it has a value between +1 and -1 inclusive. Statistical significant was considered at p-value <0.05.

Results

Part (I): Characteristics of the Studied Samples

Table (1): Distribution of studied nurses according to their demographic characteristics (no =60)

Items	No	%
Age in years		
<20	15	25.0
20 < 30	25	41.7
30 < 40	20	33.3
Mean ±SD	25.4±2.6	
Sex		
Male	8	13.3
Female	52	86.7
Qualifications		
Bachelor	25	41.7
Technical institute	20	33.3
Diploma nurse	15	25.0
Marital status		
Single	14	23.3
Married	44	73.4
Divorced	2	3.3
Experience years		
1 < 5	9	15.0
5 < 10	43	71.7
10 < 20	8	13.3
Mean ±SD	6.8±1.4	
Training courses		
Yes	15	25.0
No	45	75.0

Table (1): Shows that, the mean age of nurses ranging from 20 years to less than 30 years is 25.4 ± 2.6 , while 86.7% were females. Regarding qualifications 41.7% were Bachelor degree. In relation to marital status 73.4% of nurses were married, while 71.7% of them have from 5 years to less than 10 years experience, and the mean years of the experience is 6.8 ± 1.4 years, and 75% of them did not attend training programs regarding care of neonates.

Part (II): Nurses' Total Knowledge regarding Central Venous Catheters

Table (2): Distribution of the studied nurses knowledge regarding definition, indications, insertion sites, contraindications and complications of central venous catheter (No=60)

Items	No	%
Definition		
Catheter inserted into thoracic wall	12	20.0
Catheter inserted into vein to give medication	18.3	31.6
Catheter inserted into artery to give medication		
Don't know	25	41.6
Indications		
Give medication & infusion	28	46.7
To open narrow artery - valve	11	18.3
Relieve severe chest pain	7	11.7
Don't know	30	50.0
Insertion site		
Jugular vein	24	40.0
Femoral vein	16	26.7
Femoral artery	10	16.7
Don't know	31	51.7
Central catheter complications		
Urinary tract infection	12	20.0
Arthritis	9	15.0
Enter of air bubbles	21	35.0
Don't know	30	50.0

Number isn't mutually exclusive

Table (2): Shows that, 41.6%, 50.0%, 51.7%, 50.0% of nurses don't know definition, indications, insertion sites, and complications of central venous catheters respectively.

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Figure (1): Distribution of the studied nurses according to their total knowledge regarding central venous catheter (No =60)

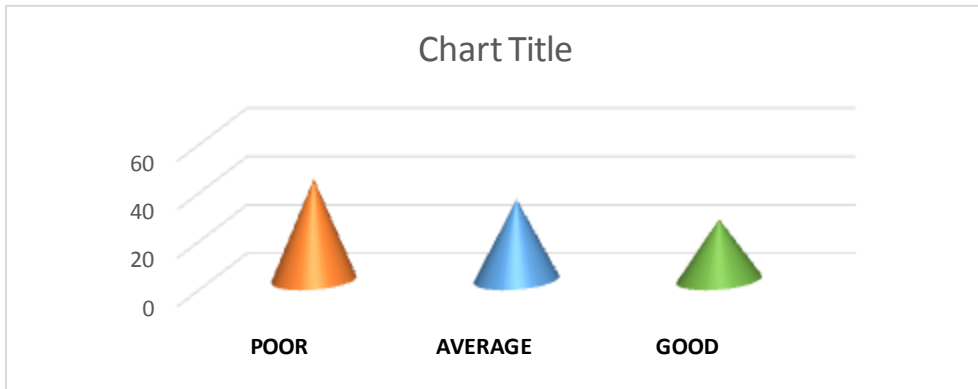


Figure (1): Shows that 41.7% of nurses had poor knowledge, 33.3% of them had average knowledge, while 25.0% of them had good knowledge.

Figure (2): Distribution of the studied nurses according to their total practice regarding central venous catheters (No =60)

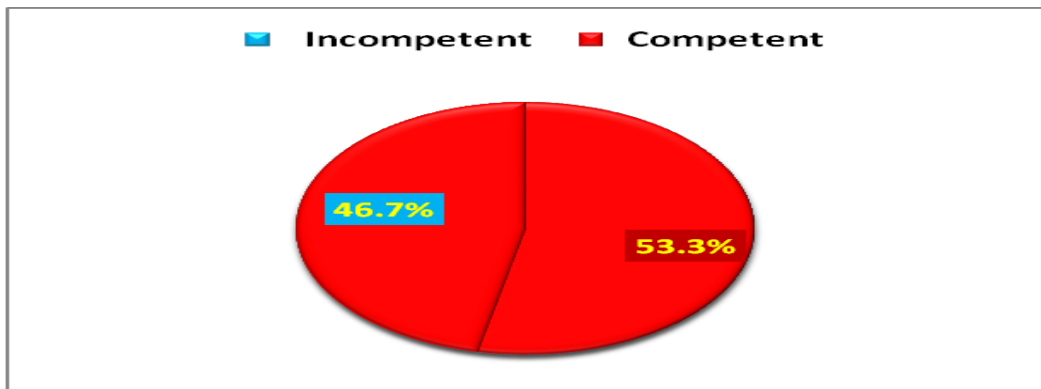


Figure (2): Shows that 53.3% of the studied nurses had incompetent practice regarding the care of central venous catheters insertion, while 46.7% of them had competent practice regarding the care of insertion.

Part (IV): Nurses' Attitude toward Central Venous Catheters

Table (3): Distribution of the studied nurses according to their attitude toward central venous catheters (No=60)

Items	Dis agree		Agree		Strongly agree	
	No	%	No	%	No	%
Nursing care before and after CVL fixation have positive impact on child status	13	21.7	20	33.3	27	45.0
Nurses who deal with CVC need focus training	8	13.3	22	36.7	30	50.0
Nurses who deal with CVC have big role and task	21	35.0	20	33.3	19	31.7
Child who take medication through CVC need more monitoring and follow up	12	20.0	17	28.3	31	51.7
Need to explain the aim from CVC insertion to parents	16	26.7	12	20.0	32	53.3
Shortening of CVC care make the nurse feels guilty	11	18.3	20	33.3	29	48.3
Nurses need to know prevention and infection control during deal with CVC	22	36.7	20	33.3	18	30.0
Respect and answering family questions	10	16.7	21	35.0	29	48.3
Any qualified nurse can keep CVC in place	8	13.3	20	33.3	32	53.3
Observation of complication increase nurse awareness and decrease danger	45	75.0	13	21.7	2	3.3
Total score	16	26.7	17	28.3	27	45.0

Table (3): Shows that 53.3% of nurses strongly agreed to explain the aim from CVC insertion to parents, and any qualified nurse can keep CVC in place, while 75.0% of them dis agreed that observation of complication increase nurse awareness and decrease danger that affect child status.

Table (4): Correlation between nurses' knowledge in relation to their practice regarding central venous catheters

Item	Practices	
	r	P Value
Knowledge	0.71	*0.02

Table (4): This table illustrates positive correlation between nurses' knowledge in relation to their practice regarding to central venous catheters with statistical significant difference between nurses' knowledge in relation to their practice about central venous catheters at (P< 0.05).

Discussion

Central Venous Catheters are intra vascular access devices which are essential for administration of fluids and medications

to critically ill neonates admitted to hospital. The results of the current study is discussed to compare them with other related studies, as well as representing the researcher interpretation of results. The aim of the

current study is to assess the performance of the studied nurses regarding central venous catheters at neonatal intensive care units at Tanta and Ain Shams University Hospitals. Sixty nurses who were available at the period of data collection.

Concerning the characteristics of the studied nurses, it was found that, the mean age of nurses ranging from 20 years to less than 30 years, with mean and stander deviation (25.4 ± 2.6), while the majority of them were females. Regarding qualifications of the studied sample it was clear that, nearly half of them were bachelors nurses. In relation to marital status nearly three quarters of nurses were married, and had from 5 years to less than 10 years' experience, with mean of the experience years (6.8 ± 1.4) years, also, approximately three quarters of them did not attend training programs regarding care of neonates, these study findings were highly supported by the study of **Comerford & Mooney, (2017)**, who study central venous line is a device inserted into the superior vena cava or right atrium, mentioned that the majority of the study sample were females, but he identified that most of the studied sample take training before start working. This may be due to in Egypt there was no training about any procedures in the Universities or governorate hospitals, but the training for the orientation program only, compared with the specialty hospital and the non-Egyptian hospitals, the nurses should be trained before start to master any procedures.

Regarding to nurses' knowledge about central venous catheter, the study findings revealed that, the studied nurses had incorrect answer regarding to definition, indications, insertion sites, and complications of central venous catheters, this study was in an agreement with the study of (**Alkubati et al., 2015**) who illustrated that health care workers had low knowledge regarding the prevention of CVC-RI and low compliance with the standard guidelines of CVC care. Therefore, health care workers should be periodically evaluated for their knowledge and practices

regarding guidelines for the prevention of CVC-RI. Also, this study supported with **Labeau et al., (2015)**, who studied Centers for Disease Control and Prevention guidelines for preventing central venous catheter-related infection: Results of a knowledge test among 3405 European intensive care nurses, and NICU, mentioned that Opportunities exist to optimize knowledge of central venous catheter-related infection prevention among European NICU nurses during CVC mentioned that most of the studied sample answered the pretest incorrectly regarding definition, indications, insertion sites, contraindications and complications of central venous catheters.

Regarding to the nurses' knowledge about central venous catheters. The result of the current study showed that less than half of the studied nurses had poor knowledge about central venous catheters. The finding goes with the opinion of **Mlinar, (2012)**, who concluded that promoting the education for professionals who insert and handle intravenous catheters is internationally recommended, since the proper level of knowledge is fundamental for working. In the same line, **Cicolini, et al., (2014)**, who supported this opinion concluded that the nurses' knowledge is frequently low and he could be a potential risk factor for patient safety, so healthcare managers should improve nursing training and education according to clinical risk management perspectives relevance to clinical practice.

This finding was contradicted with **Noaman, (2016)**, who stated that, two thirds of the studied nurses had good knowledge about central venous catheters.

In addition more than half of the study sample had incompetent practice regarding the care of central venous catheters insertion, this study was in an agreement with the study of **Trieschmann, et al., (2015)**, who study Central venous catheters in children and neonates, what is important?, Mentioned that Treatment for many children with blood

disorders or cancer includes the use of central venous catheters (CVCs). Few prospective studies have been conducted to address flushing guidelines in pediatric hematology oncology patients. Eighteen pediatric hematology oncology units were surveyed regarding current CVC flushing policies and procedures. Results reported extreme variations in CVC flush procedures, which instigated this systematic review which reported that most of the studied sample didn't flush the CVC by saline or heparin, but the studied sample used aspiration techniques and direct drug administration, while this finding was not in accordance with **Noaman, (2016)**, who mentioned that the answers of more than half of nurses regarding care during flushing of CVC were correct.

On assessing the Nurses' Attitude toward Central Venous Catheters, the current finding illustrated that nearly half of the studied nurses strongly agreed to apply central venous catheters care to neonates, while more than one quarters of them didn't agree to apply central venous catheters care, this study was in accordance with the study of **Wesley, et al., (2012)**, who studied venous air embolism from central venous catheterization: A need for increased physician and nurse's awareness, mentioned that most of the studied sample had negative attitude regarding CVC care acceptance.

Conclusion

The study concluded that nearly half of the studied nurses' had poor knowledge toward neonates with central venous catheters, more than half of them had incompetent practice regarding central venous catheters, and nearly half of them had a positive attitude toward central venous catheters. In addition to, there was highly statistically significant differences between the nurses' knowledge and their practice regarding central venous catheters.

Recommendations

In the light of the study finding the following recommendations are suggested:

- ◆ Implementation of training programs at NICU to improve nurses' practice regarding the invasive procedures such as Central Venous Catheters.
- ◆ Continuous supervision and follow up for nursing staff based on principles and guidelines for the application of standardized nursing procedures.
- ◆ Further researches are required to emphasize the importance of central venous catheter care.

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