

Evaluate Nurses' Application to Infection Control Measures in Total Parenteral Nutrition Administration via Neonatal Jugular Central Venous Catheter



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ABSTRACT

Background. Total parenteral nutrition (TPN) is a medication used in the management and treatment of malnourishment. It is administration via central venous catheter for neonates who are unable to initiate normal nutrition. When nurses complained for applying infection control measures with this procedure that impact on preventing or decreasing central line associated blood stream infection, decreasing morbidity and mortality rate and improving medical service satisfaction. **Aim.** Evaluate nurses' application to infection control measures in TPN administration via neonatal jugular central venous catheter. **Method.** A cross-sectional research design was conducted in this study used purposive sampling technique to select the participants. All nurses(40)who are working in neonatal surgical intensive care unit of Mansoura University Children's Hospital. **Tools.** The researchers developed two tools for data collection. Tool 1 structured interview questionnaire which consist of two-parts; part 1 nurses' socio-demographic and occupational characteristics, part 2 assessed nurses' knowledge regarding infection control measures related to TPN administration. Tool 2 an observation checklist to assess nurses 'application of infection control measures pre, during and post TPN.

Results. The majority of nurses had poor knowledge related to TPN administration and had unsatisfactory level of performance related to infection control measures pre, during and post TPN administration via neonatal jugular central venous catheter. **Conclusion.** There is no significant correlation between nurses' knowledge and their performance related TPN administration via neonatal jugular central venous catheter. **Recommendations:** conducting regular in-services, training programs to improve nurses' knowledge and performance regarding care of TPN administration via neonatal jugular.

Keywords: Total parenteral nutrition, Jugular central venous catheter, Neonatal surgical intensive care unit, assessment, Nurses, Infection control measures

Introduction:

Nutrition is a basic need for saving life, neonates need nutritional elements to promote physical and mental development. Total parenteral feeding is a formation that consists of all nutritional elements (glucose, saline, amino venous, lipids, vitamins, electrolytes, and trace elements). Total parenteral feeding is the solution of cases with dysfunction of gastrointestinal tract because nutrition cannot be absorbed normally by mouth or nose.

Early initiation of parenteral nutrition is very necessary for life saving of preterm neonates, neonates with respiratory problems or on ventilator, digestive system problems undergo surgery and need neonatal surgical intensive care unit . (Aparajita, Naik, Panda& Shasanka, 2016) . (National Institute for Health Care Excellence[NICE], 2020).

In spite of the importance of TPN there are some complications can be found as metabolic complications, liver problems, refeeding syndrome, catheter complications and central line associated blood stream infection(CLABC).These complications of TPN due to long use of central venous catheter (CVC) suppressed immunity, reduced milk-associated immune function, and abnormal gut microbiome (Choi, Kim, Park &Shin, 2019).

There is more than one site for CVC insertion as femoral vein, umbilical vein, subclavian vein and jugular vine, which is the most one used in NSICU and is increasing the opportunity of infection because it is a big vein in the body and inserted directly to the heart (Koh &Shin, 2019).

Applying infection control measures may help to decrease incidence rate of CLABSI, these measures divided into TPN and CVC related infection control measures, TPN should be followed before, during and after administration. And CVC should be followed during and post insertion.

Nurses play importance role in applying infection control measures as prepare and administer TPN under septic technique, sterilize all surfaces and follow non touch technique to any unsterilized surfaces, sterilize hand washing and wearing all personnel protective equipment. In addition, change bag, line of TPN every 24 hours and deliver TPN through special line in CVC with aseptic restricted technique. This technique should be followed through insertion and maintain CVC infection control bundles after insertion (Thomas, 2020).

Significance of the study:

Neonates whom receiving TPN are at high risks for central line- associated bloodstream infection (CLABSI) due to CVC problems as it is directly to the heart, neonate's problem as prematurity. Nosocomial BSI due to parenteral nutrition is a potentially fatal complication with an attributable mortality rate of 11% in neonates. (Adwaita, Nasra & Tawfiq, 2017). Therefore, applying infection control measures in TPN administration for neonates at NSICU is a vital point in decrease rate of mortality, morbidity and lifesaving of neonates.

Aim of the study:

Evaluate nurses' application to infection control measures in total parenteral nutrition administration via neonatal jugular central venous catheter.

Research questions:

- What is the level of nurses' knowledge regarding infection control measures related to total parenteral nutrition administration at NSICU?
- What is the level of nurses' performance regarding infection control measures to total parenteral nutrition administration at NSICU?

Methods

Study design

The researchers used cross-sectional design in this study.

Setting

This study was carried out in Neonatal Surgical Intensive Care Unit (NSICU) affiliated to Mansoura University Children's Hospital (MUCH), which provides health services to children cases in Mansoura city & surrounding areas at Dakahlia governorate. The NSICU is located on the third floor. It consists of 1 room, with 8 incubators, 8 monitors, 8 commodes, 1 heater, 2 phototherapy, 1 X ray device, 1 wash station, 6 ventilators.

Subjects and sampling:

All nurses from both genders who are invited to participate in the study with different years of experience in the previously mentioned setting. Those participants were participated in the preliminary assessment phase.

Sample size of nurses

All the nurses (40 nurses) working in NSICU participated in the study.

Type of sample

Purposive sampling technique.

Tools of data collection

The researchers developed two tools for data collection in the Arabic language:

Tool I (Appendix1) : Structured interview questionnaire which consist of two-parts

Part one: In this part the researchers assessed nurses' socio-demographic and occupational characteristics as, age, gender, educational qualifications, and years of experience.

Part two: This part concerning with nurses' knowledge, the researchers assessed nurses' knowledge regarding infection control measures related to Total Parenteral Nutrition (TPN) administration.

The tool is composed of 63 questions and classified into 8 categories. One mark awarded for each correct answer and zero for incorrect or didn't know answer as the following:

1. TPN definition It includes 1 item = 1 mark).
2. Benefits of TPN such as lifesaving of critically ill neonates equal (It includes 4 items = 4 marks).
3. Components of TPN equal (It includes 11 items = 11 marks).
4. Indications of TPN such as preterm (immature) neonates equal (It includes 5 items = 5 marks).

5. Complications of TPN such as central line associated bloodstream infection (CLASBI) equal (It includes 5 items = 5 marks).
6. Symptoms of CVC infection such as redness equal (It includes 7 items = 7 marks).
7. Caring of CVC such as hand washing and wearing sterile gloves before dealing with the central catheter equal (It includes 10 items = 10 marks).
8. Caring of TPN such as prepare TPN under completely strict sterile technique equal (It includes 20 items = 20 marks).

Scoring system:

This total score of knowledge is ranged from 0 to 63 marks according to (Saleh, et al 2019), the knowledge scores categorized into three levels Poor = scores less than 65% (less than 41 marks) of total scores, Average = scores 65% to 75% (41 to 47 marks) of total scores and Good = scores more than 75% (more than 47 marks) of total scores.

Tool II: An observation checklist:

The researchers used this tool to assess nurses 'application of infection control measures pre, during and post TPN administration via neonatal jugular CVC which include caring of TPN through preparation of TPN, administration of TPN to neonates via CVC, post TPN administration.

The tool is composed of 53 questions and classified into 4 categories. One mark awarded for each correct proper completes step and “zero” for improper and not done step as the following:

1. Caring of TPN through preparation of TPN formulation (It includes 16 items = 16 marks).
2. Caring of TPN through administration (It includes 27 items = 27 marks).
3. Caring of TPN after administration (It includes 4 items = 4 marks).
4. Documentation (It includes 6 items = 6 marks)

Scoring system:

The total score of performance ranged from 0 to 53 items. According to researcher cut of point, the total score of performance consists of two categories as:

Unsatisfactory scores less than 85% (0- 42 marks).

Satisfactory scores 85% or more (42- 53 marks).

Phases of the Study

Preparatory Phase: this phase includes the following:

1. **Administrative process:** The researchers get an official letter from the faculty of nursing, Neonatal Surgical Intensive Care Unit affiliated to Mansoura University to the directorate of Mansoura University Children's Hospital (MUCH), to carried out this study.
2. **Ethical considerations:** The researchers obtained an ethical approval from the Research Ethics Committee of Faculty of Nursing, Mansoura University. then obtained written informed consent from the study participants after being informed about the purpose of the study also, they assured that their identities and response to the questionnaire would be confidential, answering voluntary. Additionally, they informed that they have the right to withdraw at any time from the study.

Operational phase:

1. Literature review:

The researchers reviewed the current and past literature of national and international scientific published articles, internet search and textbooks related to TPN administration via Neonatal Jugular Central Venous Catheter and infection control measures.

2. **Developing the study tools:** the researchers developed the following tools (I,II).

Validity of the study tools: Seven experts in the study field of infection control and prevention, community health nursing and pediatric nursing tested the content and face validity of the tools and the required modifications carried out.

Pilot study

A pilot study will be carried out on 10%(4) of participants to evaluate clarity and applicability of the study tools. The needed modifications, additions and omissions were done accordingly. Participants included in the pilot study excluded from the sample to prevent contamination of the study results.

Implementation phase

1. Data collection

- The researchers-initiated data collection once gets the permission to conduct the study.
- The researchers introduced them self and gave brief explanation before distributed the questionnaire. Then visited the study setting

daily during morning or afternoon shifts, to collect data using tool 1 from three to five nurses per day. The required time for each nurse ranged from 45-60 minutes.

- The researchers assessed nurses' performance used observation checklist. Each nurse was observed during morning or afternoon shifts (before, during and after TPN administration).

Statistical analysis

The researchers used statistical package for the social sciences (SPSS) for windows version 25.0 (SPSS, Chicago, IL). Regular distribution applied to continuous data and expressed in mean ± standard deviation (SD). Categorical data were expressed in frequency and percentage. For the purpose of evaluating the relationships between the quantitative variables, Pearson correlation analysis was utilized. The Chi-square test was conducted to test the association between two categorical variables. Multiple linear regression analysis was utilized to determine the independent predictors of the challenge domains after the full regression models had been tested for normality, normal distribution, and analysis of variance. Statistical significance was set at $p < 0.05.0000$

Result:

Table 1 shows demographic characteristics of the studied nurses. The mean age of nurses was 30.28 ± 5.05 . The majority of nurses (80.0%) was

female and slightly less than half (47.5%) had bachelor's degree of nursing. The mean of nurses' experience peryears was 9.04 ± 6.10 .

Table 2 illustrates levels of nurses' knowledge related to TPN administration. It was observed that 97.5% of nurses had poor knowledge level with a mean score 31.27 ± 4.15 .

Table 3 shows levels of nurses' performance related to infection control measures pre, during and post TPN administration via neonatal jugular central venous catheter. It observes that 72.5 % of nurses had unsatisfactory level of performance related to infection control measures pre, during and post TPN administration via neonatal jugular central venous catheter with mean score 52.38 ± 4.51 and mean percentage 80.58. The majority of nurses (77.5%) had satisfactory level of performance related to pre TPN administration with mean score 23.75 ± 0.49 and mean percentage 87.96. The majority of nurses (75.0%) had an unsatisfactory level of performance during TPN administration with mean score 18.65 ± 4.57 and mean percentage 69.07. All nurses 100% had satisfactory level of performance related to post TPN administration with mean score 9.98 ± 0.16 and mean percentage 99.8.

Table 4 clears that there is no significant correlation between nurses' knowledge and their performance related TPN administration via neonatal jugular central venous catheter.

Table (1). Distribution of the studied nurses according to demographic characteristics

Characteristics	No	%
Age (years)		
▪ 20-25 years	7	17.5
▪ 26-30 years	17	42.5
▪ > 30 years	16	40.0
Mean ±SD	30.28 ± 5.05	
Gender		
▪ Male	8	20.0
▪ Female	32	80.0
Educational level		
▪ Nursing school	4	10.0
▪ Nursing institute	10	25.0
▪ Bachelor of nursing	19	47.5
▪ Postgraduate studies	7	17.5
Years of experience in nursing		
▪ < 5	14	35.0
▪ 5-10	11	27.5
▪ >10	15	37.5
Mean ±SD	9.04 ± 6.10	

Table (2). Levels of nurses 'knowledge related to the total of parenteral nutrition administration (TPN).

Levels of nurses 'knowledge related to TPN administration	Score	N	%
Poor (<65%)	0-40	39	97.5
Average (65-75%)	41-47	1	2.5
Good (>75%)	48-63	0	0.0
Mean ±SD	31.27±4.15		

Table (3). Levels of nurses' performance related to infection control measures pre, during and post the total of parenteral nutrition administration (TPN) via neonatal jugular central venous catheter.

Nurses 'performance related to TPN administration	Levels of nurses 'performance related to TPN administration	Score	N	%
Pre TPN administration	Unsatisfactory (<85%)	0-23	9	22.5
	Satisfactory (≥ 85 %)	24-28	31	77.5
Mean± SD	23.75±0.49			
Mean percentages	87.96			
During TPN administration	Unsatisfactory (<85%)	0-22	30	75.0
	Satisfactory (≥ 85 %)	23-27	10	25.0
Mean± SD	18.65±4.57			
Mean percentages	69.07			
Post TPN administration	Unsatisfactory (<85%)	0-8	0	0.0
	Satisfactory (≥ 85 %)	9-10	40	100.0
Mean± SD	9.98±0.16			
Mean percentages	99.8			
Overall nurses' performance	Unsatisfactory (<85%)	0-55	29	72.5
	Satisfactory (≥ 85 %)	56-65	11	27.5
Mean± SD	52.38±4.51			
Mean percentages	80.58			

Table (4). Correlation between nurses' knowledge and performance related total parenteral nutrition administration via neonatal jugular central venous catheter.

	Nurses' performance related TPN administration	
	R	P
Nurses' knowledge related TPN administration	0.15	0.37

* Statistically significant $p \leq 0.05$

Discussion:

The results of the present study revealed that, around two quarters of the studied nurses belonged to the age group between 26 to 30 years old (Table1), and reported that around two quarters of the studied nurses were between 25 to 30 years old with mean 30.28 ±5.05

The finding of the current study demonstrated that, the majority of the studied nurses were females (Table 1).

Regarding nurses' years of experience, the current study clarified that, slightly more than one third of the studied nurses had more than ten years of work experience with the mean 9.04 ±6.10 (table 1).

In relation to educational level of the studied nurses, the present study showed that, slightly less than half of the studied nurses had bachelor's degrees of nursing (Table 1).

The finding of the current study demonstrated that the majority of nurses had a poor level of knowledge (table 2). This finding was agreed with Abdel-Fattah, Mostafa & Shafik, (2018), in Benha who reported that the majority of the studied nurses had a poor level of knowledge. Also, this finding was agreed with the finding of Ismail, Khalifa, (2018), who studied " assessment of critical care nurse's knowledge and practices regarding care of patients receiving total parenteral nutrition "in Cairo and clarified that the great majority of the studied sample had unsatisfactory

subtotal knowledge score regarding general information about total parenteral nutrition. And the study of Elsayed, Essam & Hussien, (2022) in Helwan who reported that the majority of the studied nurses had unsatisfactory knowledge level regarding TPN.

Also agreed with the study of Taha & Mohamed, (2014) who studied "critical care nurses' knowledge and practice regarding administration of total parenteral nutrition at critical care areas in Egypt" and reported that slightly more than half of the studied sample had unsatisfactory knowledge scores related to administration of TPN while slightly less than half of the studied sample had satisfactory knowledge scores. And agreed with Abed & Faris, (2022) who studied "effectiveness of an educational program on nurses' knowledge toward parenteral nutritional support for unconscious patient at critical care unit in imam al-Hussein medical city in holy Karbala" in Iraq and reported that the study group's knowledge on parenteral nutrition support for unconscious patients in intensive care units is inadequate at the pre-test.

The current study revealed that the majority of nurses had a poor level of knowledge, the minority of nurses had an average level of knowledge (table 2). This finding agreed with Hashem, Ismail & Helmy, (2021) finding who studied "nurses' performance regarding parenteral nutrition at neonatal intensive care units" in Egypt and reported that slightly less than half of the studied nurses had average level of total knowledge about parenteral nutrition. Also, less the one quarter of them had a good level of total knowledge about parenteral nutrition. While nearly one third of them had a poor level of total knowledge about parenteral nutrition.

Also Ameri, Kallor & sadeghi, (2016) who studied "effect of a comprehensive total parenteral nutrition training program on knowledge and practice of nurses in NICU" in Iran and reported that the knowledge scores of the nurses in PN were above average.

It was clarified that three quarters of the nurses of the current study had unsatisfactory level of performance related to infection control measures pre, during and post TPN administration via neonatal jugular central venous catheter (table 3). This finding was agreed with the finding of Ismail, Khalifa, (2018), in Cairo who reported that, the entire studied sample had unsatisfactory practice level regarding care of patients receiving TPN therapy. And also agree with the finding of Hussien, Sayed & Essam, (2022), in Helwan who

reported that, four fifths of studied nurses had incompetent level of practice regarding administration of total parenteral nutrition

Also, the study of Bostanabad, (2018). who studied "performance of nurses in parenteral nutrition-related care at Tabriz university of medical sciences NICUs" in Iran and reported that the nurses have got low practice scores pertinent to administration of total parental nutrition especially related to preparation of total parenteral nutrition solutions, changing central catheter dressing, monitoring patient reaction to total parenteral nutrition administration.

This study clarified that there is no significant correlation between nurses' knowledge and their performance related TPN administration via neonatal jugular central venous catheter (table 4). In the opposite the study of Ismail, Khalifa, (2018), who reported that there is significance statistical difference was found between nurse's knowledge and practice. Also not agreed with Taha & Mohamed, (2014) who pointed in their study "critical care nurses' knowledge and practice regarding administration of total parenteral nutrition at critical care areas in Egypt" and reported that there was statistically significant relation between level of education (bachelor's degree), with nurses knowledge.

Conclusion:

Based on the findings of the current study, the researchers concluded that most of nurses had poor level of knowledge related to TPN administration and the majority had satisfactory level of performance related to pre TPN administration and had unsatisfactory level of performance during TPN administration while all of nurses had satisfactory level of performance related to post TPN administration. There is no significant correlation between nurses' knowledge and their performance related TPN administration via neonatal jugular central venous catheter.

Recommendations:

In the light of the findings of the current study, the researchers are suggested the following recommendations:

- Provide regular in-services, training programs to improve nurses' knowledge and practice regarding infection control measures related to total parenteral nutrition administration via Jugular central venous catheter at NSICU.
- Monitoring nurses' compliance to infection control measures related to total parenteral nutrition administration via Jugular central venous catheter at NSICU.

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Competing Interests :

The authors have no competing interests .

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