

## Nurses' Performance Regarding Intravenous Access For Neonates in Intensive Care Unit: An Assessment Study

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### Abstract

**Background:** Newborn babies who need intensive medical care are often admitted to neonatal intensive care unit. Neonates with health conditions such as respiratory disorders, heart problems, infections. **Aim of the study,** this study aimed to assess the nurses' performance regarding intravenous access for neonates in neonatal intensive care unit. **Research design:** descriptive design was used. **Sample:** A convenient sample included all available nurses at the NICU. **Setting:** This study was conducted at neonatal intensive care unit at Menyat El Naser hospital affiliated to Dakahliya Directorate of health **Tools:** Three tools were used for data collection (1) **Pre-designed questionnaire format,** to assess characteristics of studied nurses and studied neonates also to assess nurse's knowledge regarding intravenous access in neonatal intensive care unit. (2) **Observational check list** to assess nurses practice regarding intravenous access in neonatal intensive care unit. (3) **Attitude assessment scale** to assess nurses attitude regarding intravenous access in the NICU. **Result** Displays that there is a relation between nurses' total knowledge regarding intravenous access and their qualification and years of experience with highly statistically significant difference ( $P < 0.01$ ). Demonstrates that there is a positive correlation between total nurses' knowledge, their total practices and total attitude regarding intravenous access for neonates. **Conclusions:** This study reveals that there is a positive correlation between total nurses' knowledge, practices and attitude regarding intravenous access for neonates **Recommendations:** Design training programs at NICU to improve and refresh nurses' practice regarding the invasive procedures such as intravenous access for neonates and update their performance regarding umbilical venous catheter based on scientific evidence base.

**Key words:** Intravenous Access, Neonates, Nurses Performance.

### Introduction:

Neonatal intensive care unit (NICU), is an intensive care unit (ICU) specializing in the care of ill neonates. Neonatal period refers to the first 28 days of life and obtaining secure and reliable vascular access is an integral component of provision of care to patients in the Neonatal Intensive Care Unit (NICU) (Al-Awaisi *et al.*, 2022).

There are different types of neonatal units, and they are named depending on the level of specialist care they offer as special care baby unit, local neonatal unit (LNU) and Neonatal intensive care unit (NICU). Neonates are cared in (NICU) when they: need for breathing support given through ventilation,

have severe disease affecting their breathing called respiratory disease (Pramod *et al.*, 2018).

Intravenous drug administration presents a series of challenges that relate to the pathophysiology of the neonate and intravenous infusion systems in neonates. These challenges arise from slow intravenous flow rates, small drug volume, dead space volume and limitations on the flush volume in neonates (Catherine, 2020).

The need for intravascular access in the neonate is frequent; neonates require vascular access for many indications, including hydration, infusion of parenteral nutrition, administration of medications, and obtaining blood samples for laboratory analysis. The veins

in newborns are very tiny and small-caliber, the frequency of cannula change is high as is the incidence of thrombophlebitis. Also, due to miniaturization of the intravenous devices, it is possible to gain access even in the tiniest of neonates. So, it needs considerable experience and skill to achieve this and a good care of the same (Bliss., 2020).

Veins in the newborn are small and fragile which imply low tolerance to pH and osmolality. Because of these factors the extravasations rates are more than 40%; the degree of trauma to the blood vessel during intravenous (IV) access and the dwell affect this outcome. It is important to consider that phlebotomy in neonates is an invasive and stressful procedure, usually causing fear, anxiety, and insecurity (Moreal et al., 2021).

**The nursing Role** regarding intravenous access for neonates in NICU is essential because nurses have avital role in making assessment for choosing suitable access to administer according to health states, length of duration, type of medication, type of fluids and nutrients, also nurses have avital role in administering peripheral intravenous cannula for resuscitation and admitted newly neonates as theses procedure needs practical experience and knowledge. In addition, nurses have avital role in caring for umbilical venous catheter before and after insertion and helping during preparation and insertion by using aseptic technique (Legemaat M,2020).

### **Significance of the study:**

The need for intravenous access for newborn in the intensive care unit is frequent and important. All nurses who works in the neonatal intensive care unit should increase their knowledge regarding intravenous access both short- and long term and their feasibility, associated complications, and duration to reduce number of skin break down, and consequences of infection.

Veins in the newborn are small and fragile which imply low tolerate to PH and osmolality. Because of these factors the extravasations rates are more than 40%, up to 91% of peripheral IV lines are removed prematurely due to cannula complications (Zaki, A., 2018).

The mean catheter dwelling time of umbilical venous catheter(UVC), peripheral inserted central catheter (PICC), and central venous line(CVL) were  $143.5 \pm 104.5$ ,  $120.0 \pm 70.3$ , and  $142.1 \pm 118.2$  hours respectively.

Complications occurred with 46.4% of CVCs, 77.3% of PICCs, 52.8% of CVLs and 44.3% of UVCs.

The most frequent complication among cases with UVCs was clinical sepsis, followed by leakage, and CLABSI(central line associated blood stream infection)18.7, 1%12.6%, and 11.7% (Mohamed., 2019).

### **Aim of the study:**

This study aims to assess nurse's performance regarding intravenous access for neonates in intensive care unit.

### **Research Questions:**

1. What are the nurses' knowledge regarding intravenous access for neonates in neonatal intensive care unit?
2. What are the nurses' practice regarding intravenous access for neonates in neonatal intensive care unit?
3. What are the nurses attitude regarding intravenous access for neonates in neonatal intensive care unit?
4. Are there a relation between total nurses' knowledge & practices and their attitude regarding intravenous access for neonates in intensive care unit?

### **Subjects and Methods**

#### **i-technical design:**

The technical design included research design, setting, subject and tools of data collection.

#### **Research design:**

A descriptive design was used to achieve the objectives of the study.

**Research Setting: -**

This study was conducted in at neonatal intensive care unit (NICU) at Menyat El Naser hospital affiliated to Dakahliya Directorate of health.

**Research Subject:**

A convenient sample was conducted to all available nurses at the NICU regardless of their age, qualifications and experience.

**Tools of data collection:**

Data was collected through the following tools.

**I-Predesigned Questionnaire Format**

It was designed by the researcher in Arabic language to suit nurses after reviewing the related literature and consists of two parts:

**Part 1: characteristics of studied subject as the following:**

**a-Characteristics of studied nurses include:** age, qualification, years of experience, and attending training courses regarding intravenous access for neonates.

**b- Characteristics of studied newborns include:** Gestational age, chronological age, duration of hospitalization in NICU by days, gender, birth weight, current weight, infant ranking in the family, diagnosis and type of delivery.

**Part II: Assessment of nurse's knowledge regarding intravenous access in intensive care unit include:** importance of intravenous access, types, indications of each type, sites of insertion,

**❖ Scoring system:**

Nurses knowledge was determined by summing up the scores from responses to questions, and the whole number of each question was (0-1).

- Zero for wrong answer.

- One for right answer.

The total questions of nurses' knowledge were (19) questions, (4) of them were closed questions and the other (15) were multiple choice questions. The total score was (19) degree, each item equals one degree.

The sum of scores at the end of questionnaire was categorized as good knowledge if score  $\geq 14$  point, also be considered average knowledge if score 11-14 point and poor knowledge when score  $< 11$  point.

**II: An observational checklist:** There are three observational checklists, one of them on peripheral venous cannula, and others about umbilical venous catheter.

**1-The checklist of peripheral venous cannula** consisted of (**17 items**) and the total score was (**17 degree**). Each item equals one degree. scoring system was followed to assess nurses' practice regarding intravenous cannula was determined by the scores from the responses to the statements and the whole number of each statement was (**0-1**)

- Zero for not done.
- One mark for done.

The sum of scores at the end of checklist was categorized as:

- Competent if score  $\geq 90\%$ .
- Incompetent if score  $< 90\%$ .

**2- The checklist of umbilical venous catheter** before insertion consisted of (**14 items**) and the total score was (**14 degree**). Each item equals one degree as following:

- Zero for not done.
- One mark for done.

The sum of scores at the end of checklist was categorized as:

- Competent if score  $\geq 90\%$ .
- Incompetent if score  $< 90\%$ .

**3-The checklist of umbilical venous catheter care after insertion** consisted of (**8items**) and the total score was (**8degree**). Each item equals one degree as following:

- Zero for done.
- One mark for not done

The sum of scores at the end of checklist was categorized as:

- Competent if score  $\geq 90\%$ .
- Incompetent if score  $<90\%$ .

**III: Attitude assessment scale:** A modified Likert scale type rating scale was used to assess nurses attitude regarding intravenous access in the NICU (**Bertram, 2010**).

#### ❖ Scoring system:

A scoring system was followed to assess nurses' attitude toward neonatal intravenous access in the NICU consisted (**16 item**) and determined by summing up the scores from nurses' responses and accordingly and the whole number was (**1-3**).

1. mark for agree
2. marks for un certain
3. marks for disagree

The scores of all the scale statements was summed up and total scoring will be classified into 2 categories:

- Positive attitude if score  $\geq 60\%$ .
- Negative attitude if score  $<60\%$ .

#### Content Validity and Reliability:

The revision of tools for clarity, relevance, comprehensive, under-standing and applicability was done by group of three experts of the pediatric nursing department to assess the content validity. The modifications of tools were done according to the panel judgment on the clarity of sentences, appropriateness of content and sequence of items.

#### II -Operational Design:

The operational design included preparatory phase, content validity, pilot study and field work.

##### -Preparatory phase:

It includes reviewing current, past, local and international related literature and

theoretical knowledge of various aspects of the study using books, articles, internet, periodicals and magazines to develop tools for data collection. Also, in this phase the researcher went to previous mentioned setting for data collection to take overview of the setting and peoples.

#### Ethical Considerations:

Verbal approval obtained from each participated nurse before inclusion in the study, a clear and simple explanation given according to their level of understanding, physical and mental readiness. Every nurse informed that she has the right to withdraw from the study at any time and without giving any reasons. They secured that all the gathered data as confidential and used for research purpose only.

##### - Pilot Study:

The Pilot study was carried out for 10% of studied nurses; they were 6 nurses who working at previously mentioned setting and included in the study sample, to evaluate the clarity and applicability of the tools also to estimate the time needed for filling the structured study tools, this was estimated to be about (10-25) minutes was needed to fill every sheet. After fulfilment of this study tools there is no modifications of the study tools, and the sample was included in the whole sample.

#### Field Work:

The data collection of this study started from beginning of January 2022, till the end of march2022, covering three months for data collection. The researcher was available at 2 days/week (Sunday and Monday) from 8am to 2pm in the previously mentioned hospital to collect data. Firstly, the researcher introduced himself to nurses, explained the purpose of the study and secured that the data collected was used for the purpose of the research only. The researcher observed the nurse while administering a procedure related to intravenous access for neonates as peripheral venous cannula and umbilical venous catheter. The questionnaire sheets were distributed to nurses; data were gathered from nurses during their suitable time at their work site and the

researcher testing the observational checklist in the study setting. Time needed was ranged from (10-15) minutes to answer knowledge questionnaire sheet, (10-25) minutes for observational checklist and (15-20) for attitude assessment scale.

### III-Administrative design:

An official permission to conduct the study obtained through an issued letter from the Dean of Faculty of Nursing, Ain Shams University to directors of the previously mentioned setting. A letter issued to them from the Faculty of Nursing, Ain-Shams University. The researcher then met the hospital director, to carry out the study, an approval obtained from the manager of Menyat al Nasr hospital

**Table (1):** shows that the mean age of studied nurses is Mean  $\pm$  SD  $28 \pm 9.77$  with 65% of them aged  $20 < 30$  years, also regarding qualification 38.4% of them have are qualified in health technical institute. More over 45.0% of studied nurses have  $5 < 10$  year of experience and 83.3% of them attended training courses regarding intravenous administration for neonates.

**Table (2):** reveals that 95.0% of studied nurses have right answer regarding "Using of the peripheral venous cannula", "The appropriate sites for the insertion of peripheral venous cannula", "The appropriate size for the peripheral venous cannula in neonates" "Advantages of peripheral cannula in neonates" and "Repeating attempts of peripheral Cannula insertion increases the chances of infection", While 91.7% of them of them have wrong answer regarding "Days which the peripheral

explaining the aim of the study in order to obtain their permission and cooperation.

### IV-Statistical design:

Data collected from the studied sample was revised, coded and entered using 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 ( $X^2$ ) used for comparisons between qualitative variables. Pearson correlation to assess the linear dependence (correlation) between two variables Statistical significant was considered at  $p$ -value  $< 0.05$ .

### Result:

cannula should be removed after insertion" and 70.0% of them have wrong answer regarding "Disadvantages of peripheral venous cannula in neonates".

**Table (3):** shows that all of studied nurses carried out most of the steps related to peripheral cannula insertion, while 16.7 % of them not done two steps (6<sup>th</sup> & 17<sup>th</sup>).

**Figure (1):** illustrates that 66.7% of studied nurses have competent level, While 33.30% of them have incompetent level regarding care of intravenous access for neonates.

**Table (4):** demonstrates that there was a positive correlation high statistically significant between total nurses' knowledge, total practices and total attitude of the studied nurses regarding intravenous access for neonates .

**Part I: Characteristics of the study subjects****Table (1):** Distribution of studied nurses according to their characteristics (n=60).

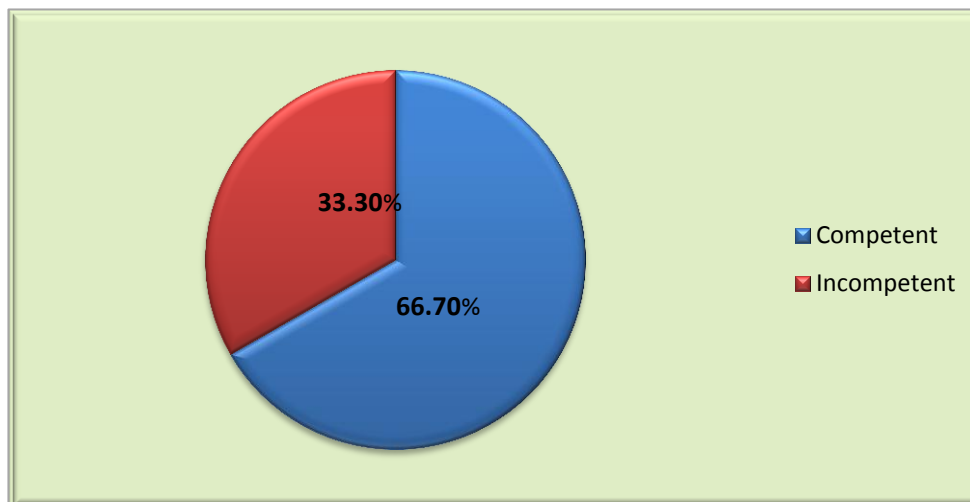
Nurses characteristics	No	%
<b>Age in years</b>		
20 < 30	39	65
30<40	12	20
≥40	9	15
<b>Mean ± SD 28 ± 9.77</b>		
<b>Qualification</b>		
Diploma in Nursing	9	15.0
Health Technical Institute	23	38.4
Bachelor of Nursing	14	23.3
Postgraduate Studies	14	23.3
<b>Years of experience in nursing</b>		
< 5	24	40.0
5 < 10	27	45.0
≥ 15	9	15.0
<b>Attend training courses regarding intravenous administration for neonates</b>		
Yes	50	83.3
No	10	16.7

**Part II: Nurses' knowledge regarding intravenous access in neonatal intensive care unit****Table (2):** Distribution of studied nurses according to their knowledge regarding the peripheral intravenous access for neonates (n=60).

Items	Right		Wrong	
	No	%	No	%
1 Importance of intra venous access	52	86.7	8	13.3
2 Types of intravenous access	47	78.3	13	21.7
3 Using of the peripheral venous cannula	57	95.0	3	5.0
4 The appropriate sites for the insertion of peripheral venous cannula	57	95.0	3	5.0
5 The appropriate size for the peripheral venous cannula in neonates	57	95.0	3	5.0
6 Advantages of peripheral cannula in neonates	57	95.0	3	5.0
7 Disadvantages of peripheral venous cannula in neonates	18	30.0	42	70.0
8 Repeating attempts of peripheral Cannula insertion increases the chances of infection	57	95.0	3	5.0
9 Signs that the cannula should be removed	52	86.7	8	13.3
10 Using of transparent medical adhesive help in speeding any of the symptoms and signs of infection	52	86.7	8	13.3
11 Days which the peripheral cannula should be removed after insertion	5	8.3	55	91.7
12 Possible to use peripheral Cannula after 48 hours without signs and symptoms of infection	33	55.0	27	45.0

**Part III: Nurses' practices regarding intravenous access for neonates****Table (3):** Distribution of studied nurses' practices regarding peripheral cannula insertion (n=60).

	Steps	Done		Not done	
		No	%	No	%
1	Preparing the required equipment.	60	100.0	0	0.0
2	Full sterile technique must be used as hand washing, mask, and sterile gloves.	60	100.0	0	0.0
3	Identify suitable veins for cannulation.	60	100.0	0	0.0
4	Palpate selected site aiming to choose.	60	100.0	0	0.0
5	Using an appropriate disinfectant, clean the skin in a circular motion.	60	100.0	0	0.0
6	Swab for at least 30 seconds, allow to dry and don't palpate.	50	83.3	10	16.7
7	Stabilize vein below the site of insertion and pull the skin taut.	60	100.0	0	0.0
8	Gently occlude venous flow.	60	100.0	0	0.0
9	Use a24gauge cannula.	60	100.0	0	0.0
10	Hold cannula at the sides to allow view of flash back chamber.	60	100.0	0	0.0
11	Insert the cannula smoothly the skin at about a10-degree angle with point of introducer down and bevel up.	60	100.0	0	0.0
12	Advance cannula until blood flashback appears.	60	100.0	0	0.0
13	Press forefingers, remove stylet and place it in a proper container to discard appropriately.	60	100.0	0	0.0
14	Gently inject.9% normal saline to distend the walls of the vein.	60	100.0	0	0.0
15	Tape the IV securely.	60	100.0	0	0.0
16	Dispose of sharps and other IV equipment in a safe appropriate manner.	60	100.0	0	0.0
17	Document all insertions on observation chart.	50	83.3	10	16.7

**Figure (1):** Percentage distribution of studied nurses according to their total practices level regarding care of intravenous access for neonates (n=60).

**Part VI: Correlations between total studied nurses' knowledge, practices and attitude.****Table (4):** Correlation between total nurses' knowledge, practices and attitude regarding intravenous access for neonates (n=60) .

Variables	Total Knowledge		Total practices		Total Attitude	
	r	P-value	r	P-value	r	P-value
Total Knowledge	-----	-----	2.945	.034*	0.743	.002**
Total practices	2.945	.034*	-----	-----	1.326	.025*
Total Attitude	0.743	.002**	1.326	.025*	-----	-----

(\*) Statistically significant at  $p < 0.05$ . (\*\*) highly statistically significant at  $p < 0.01$

**Discussion:**

Gaining intravenous (IV) access is often needed within minutes after birth, for administering medications, fluids, and nutrients during postnatal stabilization. There are different methods for neonatal vascular access including umbilical venous catheter, peripheral intravenous cannula (**Doherty, 2018**).

The placement of an intravenous cannula and the ongoing management is based on the principles of best practice. An appropriate and consistent accreditation is maintained for the insertion of the cannula in neonates, the technique is instructed and supervised by experienced neonatal fellows, nurse practitioners or designated who have demonstrated excellent procedural and teaching skills. Before undertaking the program, staff should consider their suitability in terms of their availability to fulfil the accreditation requirements and on-going skill maintenance. (**Artelt et al, 2019**).

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, intravenous insertion is a valuable and crucial skill for pediatric intensive care nurses to master. Insertion of VA is the most frequently performed invasive procedures. Difficulty establishing IV access can delay treatment, which can be detrimental in emergent situations (**Paterson et al., (2022)**), so, the current study aimed to assess nurse's performance regarding intravenous access for neonates in intensive care unit.

According characteristics of the studied nurses, the current study result showed that almost two thirds of studied nurses aged ranged from  $20 < 30$  years, with the mean age was (Mean  $\pm$  SD)  $28 \pm 9.77$ . This result could be related to the younger nurses were almost working in intensive care units which considered as a dynamic and fast-moving environment which needs an active young nurse. Also, regarding qualification more than one third of them were qualified in health technical institute. This finding may be due to the fact that, the number of health technical institute of nursing graduates is more than the number graduated from other agencies as faculty of nursing

These results were in agreement with **El Khateeb et al., (2019)** who conducted study on "Assessment of Nurses' Documentation Skills in Neonatal Intensive Care Units" and showed that more than one third of them are qualified in health technical institute. Also, this result was supported with the study done by **Ahmed & Kafli, (2019)** entitled "Knowledge and practice of the critical care nurses on vascular access devices related infection" who reported that, nearly two third.

Concerning to nurses' knowledge regarding the peripheral intravenous access for neonates, the current study showed that Most of studied nurses had right answer regarding Using of the peripheral venous cannula, The appropriate sites for the insertion of peripheral venous cannula, The appropriate size for the peripheral venous cannula in neonates, Advantages of peripheral cannula in neonates and Repeating attempts of peripheral Cannula insertion increases the chances of infection", While most of them have wrong answer



regarding "Days which the peripheral cannula should be removed after insertion" and More than two third of them have wrong answer regarding "Disadvantages of peripheral venous cannula in neonates. From the researcher point of view, this result may be due majority of them attended training courses regarding intravenous administration for neonates which rich their information about peripheral intravenous access.

This result was in agreement with, **Kleidon et al., (2021)** who conducted study on " Implementation of a pediatric peripheral intravenous catheter care bundle " and stated that, most of studied nurses have right answer regarding "The appropriate sites for the insertion of peripheral venous cannula", "The appropriate size for the peripheral venous cannula in neonates" and "Repeating attempts of peripheral Cannula insertion increases the chances of infection". Also, this result supported by **Ndarwati et al., (2020)**, who conducted study on "Incidence of peripheral intravenous catheter failure and complications in pediatric patients" and reported that most of studied nurse have the right answer regarding "Advantages of peripheral cannula in neonates".

Conversely, this result disagrees with **Hallam & Denton, (2020)** who revealed that most of studied nurses had correct answer regarding "Days which the peripheral cannula should be removed after insertion" on their study about minimizing the risks of vascular access.

Concerning to studied nurses' practices regarding peripheral cannula insertion, the current study revealed that all of studied nurses carried out most of the steps related to peripheral cannula insertion, while Less than fifth of them not done two steps (6<sup>th</sup> & 17<sup>th</sup>); "Swab for at least 30 seconds, allow to dry and don't re-palpate" & "Document all insertions on observation chart". From the researcher point of view, this result may be due to nurses do disinfection of the site of insertion in a routine way; not for 30 seconds or allow drying and they document only the right insertion not all.

This finding was similar to the study done by **Pereira et al., (2020)** who conducted study on "The use of peripherally inserted central venous catheter in the Neonatal Intensive Care Unit" and reported that all of studied nurses carried out most of the steps related to peripheral cannula insertion. Also, this result was in agreement with **Ho & Tang, (2019)** who conducted study on "Nurses' Knowledge and Practice in Relation to Peripheral Intravenous Catheter Care" and stated that all of studied nurses carried out most of the steps related to peripheral Intravenous Catheter insertion.

According to Correlation between total nurses' knowledge, practices and attitude regarding intravenous access for neonates, the current study showed that there was there was a positive correlation between total nurses' knowledge and their total practices and total attitude regarding intravenous access for neonates. From the researcher point of view, satisfactory level of knowledge is associated with competent level of nurses' practice and their attitude. This result agreement with, **Deshmukh & Shinde, (2019)** who conducted study on Impact of structured education on knowledge and practice regarding venous access device care among nurses & **Saltah & Abusaad, (2021)** who conducted study on "Assessment of Nurses Knowledge and Practice about Peripherally Inserted Central Catheters at Neonatal Intensive Care Units", they reported that was there is a positive correlation between total nurses' knowledge and their total practices and total attitude. In the same direction, this finding was in accordance with a study done by **Marsha et al., (2021)**, it was reported that there was a significant positive correlation between nurses' knowledge level and their practice level.

### **Conclusion:**

The study concluded that there is appositve correlation between total nurses' knowledge, practice and attitude regarding intravenous access for neonates in neonatal intensive care unit.

**Recommendation:**

- The study recommended that design training programs at NICU to improve and refresh nurses' practice regarding the invasive procedures such as intravenous access for neonates and update their performance regarding umbilical venous catheter based on scientific evidence base. Regular infection control courses to enhance using aseptic technique during insertion of intravenous access to prevent infection.

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