Effect of Educational Program about Management of Intravenous Infiltration and Phlebitis on Nurses' Performance in Neonatal Intensive Care Units

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ABSTRACT

Background: Peripheral venous catheters, which are often used at the critical care units for newborns, may lead to serious complications; the most frequent issues associated with Catheters for peripheral veins implantation are infiltration and Phlebitis. **Aim:** This study's aim was to evaluate the effect of the educational program about Management of Intravenous Infiltration and Phlebitis on Nurses' Performance at the critical care units for newborns. **Subjects and Method: Design:** a quasi-experimental research design was used. **Setting:** The research carried out in the Universal Health Insurance Hospitals (Al-Nasr Specialized Hospital, Al Salam, Obstetrics and Gynecology hospital, and Alhayat hospital) in Port Said City. **Subjects:** A convenient sample of all nurses who are currently employed at the neonatal intensive care units at the time of the study. **Tools:** Three instruments for gathering data consisted of; Self-administered Questionnaire for nurses' knowledge regarding Management of Intravenous Infiltration and Phlebitis, observational checklist for Management of Intravenous Infiltration and Phlebitis, Pediatric peripherally inserted IV (PIV) Rating Scale. **The Results**: The results indicated that there is a statistically significant improvement of knowledge and practice of IV infiltration and phlebitis after program, this is showed in decreasing IV complication after program compared with preprogram. **Conclusion**: the educational program about Management of Intravenous Infiltration and Phlebitis had positive effect on the skills and expertise of nurses in relation to phlebitis and infiltration management, and prevention. The instructional program worked well for neonates on decreasing IV complication. **Recommendations**: Continuous education should be provided to nurses in order to instruct them in managing and preventing PIV complications.

***Keywords*:** Infiltration, Phlebitis, Peripheral intravenous catheterization.

INTRODUCTION

In the intensive care unit for newborns (NICU) dependable vascular access must be available in order to provide feeding, hydration, medication, and blood products to patients in the intensive care unit (NICU) for newborns. Getting intravenous therapy early is beneficial for critically sick and premature newborns. Right now, peripheral and central veins serve as the primary access points for intravenous vascular access (Faheim & Hassan, 2018).

In the NICU, peripheral intravenous cannulation is the most often utilized technique. Peripheral intravenous catheter (PIVC)-related complications are more common in premature and sick newborns. This is partly because of the young immune system, smaller, more delicate blood vessels, and the anatomy and physiology of the skin (Van Rens, et al., 2021).

The placement of peripheral intravenous catheter is more challenging in high-risk infants than in adults because of their smaller vessel sizes, difficulty palpating their veins, and lack of sight. These difficulties often prevent a nurse from finding a vein. The infusate kind, the anticipated length of therapy, the newborn's birth weight, and the policies of the intensive care unit for newborns (NICU) all participate in selecting the best vascular access device (Riskin, et al., 2022).

One of the main clinical concerns in NICUs is peripheral intravenous catheter related problems. Infection, phlebitis, thrombosis, dislodgement, or unintentional removal, leakage, obstruction, Extravasation and infiltration of peripheral intravenous, are among the typically experienced problems. Blood products, medicines, and fluid infusions are administered via peripheral venous access. These products account for 23–78% of peripheral IV access complications when they penetrate surrounding tissues through an IV access, resulting in infiltration or extravasation damage (van Rens, et al., 2021).

There are five degrees of peripheral IV infiltration, following the Infusion Nurse Society Standards of Practice, ranging from zero to four. The most frequently seen grade is 2 (67.2%), followed by 3 and 1. The most serious injury, grade 4 (0.4%), is hardly ever documented. Serious sequelae, such as total loss of skin, necrosis of the muscles and tendons, necessitating amputation or reconstructive

surgery, are possible in grade 4 instances. These problems also increase the risk of morbidity and increase the cost of care. IV infiltration can be treated by withdrawing the gadget for vascular access, lifting the afflicted limb, and using a heated or chilly compress (Wang, et al., 2022).

The most frequent side effect linked to PIC insertion is phlebitis, which can occur anywhere between 25% and 59% of the time. The symptoms of phlebitis, an inflammation of the vascular wall, include palpable venous cord, edema, redness, and localized pain. Along with lengthening hospital stays and increasing medical expenses, it can also result in additional complications like cellulitis, septicemia, and DVT. There are four primary categories of patient variables that might lead to the development of phlebitis: first, patient characteristics, including age, gender, and underlying medical disorders; second, chemical factors; third, mechanical components, including the kind, dimensions, and length of the catheter's cannulation; and fourth, medical procedures (Mandal, & Raghu, 2019).

Venous access depletion may result from repeated PVC insertions, which increases the necessity of central venous access devices due to their increased expense and likelihood of major difficulties; PVC failure puts a strain on Health care spending plans due to more items and staff time; and delays time to sensitive treatments such as antibiotics or chemotherapy, raising the possibility of preventable injury. The installation of a new catheter and treatment of any minor or major problems are usually necessary for failed PVCs, which can be distressing and uncomfortable for the patient. (Marsh, et al, 2020).

Through appropriate application of their knowledge and abilities to IV interventions, neonatal nurses play a critical role in preventing or decreasing problems from IV interventions and guaranteeing patient safety. In order to ensure a safe peripheral intravenous catheterization, neonatal nurses should also be aware of the factors that lead to the development of infiltration and phlebitis. Based on these factors, they should take the appropriate actions to use scales to periodically evaluate and record the location, recognize these issues early and provide appropriate care when necessary. (Atay, Sen, & Cukurlu, 2018; Kahraman, Gerceker& Yardimic, 2020).

Significance of the study:

In the neonatal critical care unit, peripheral intravenous problems are frequent, because such complications occur more often in newborns than in adults or older kids. Despite the possibility of severe morbidity, relatively little information has been published on this subject. In Egypt, it was found that peripheral venous infection rate in hospitals is high, and complications as infiltration, phlebitis, and many other complications can cause pediatric suffering, longer hospital stays and more medical care, more expenses, and even death. (Ismail, 2015). So, the researcher focused on studying this topic to promote knowledge and practices for neonatal nurses regarding infiltration and phlebitis management, and prevention. To acquire the information and abilities necessary to prevent and manage PIV problems, nurses must complete specialized education and training.

AIM OF THE STUDY

Evaluate the effect of educational initiative regarding management of intravenous infiltration and phlebitis on nurses' performance at intensive care units for newborns.

Objectives

1. Assess nurses' knowledge and practice about management of intravenous infiltration and phlebitis.
2. Design educational program for nurses in neonatal intensive care units about management of intravenous infiltration and phlebitis.
3. Implement educational program for nurses in neonatal intensive care units about management of intravenous infiltration and phlebitis.
4. Evaluate the outcomes of educational program about management of intravenous infiltration and phlebitis on nurses' performance in neonatal intensive care units.
5. Determine the severity of intravenous infiltration and phlebitis in the units of neonatal intensive care before and after implementing the educational program about management of intravenous infiltration and phlebitis.

Research hypotheses

1. Neonatal nurses' performance is expected to enhance after implementation the educational program about management of intravenous infiltration and phlebitis.
2. The severity of phlebitis and intravenous infiltration among neonates in neonatal intensive care units is reduced after implementing the educational program about management of intravenous infiltration and phlebitis.

SUBJECTS AND METHOD

A. Technical design:

The research design, setting, subjects, and data collection instruments are all described in this design.

Study design:

A quasi-experimental (pretest/posttest one-group design) research design was employed.

Study setting:

The study was carried out at four distinct settings at neonatal critical care units; Al-Nasr Specialized Hospital, Al-Hayat Port Fouad Hospital, AL-Salaam Port Said Hospital, and specialist obstetrics and gynecology hospital in Port Said governorate.

Subjects

A convenient sample of all nurses who are currently employed at the neonatal intensive care units at the time of the study (100 nurses in NICUs).

Tools for data collection:

Three tools were used for data collection:

Tool (I): Self-administered Questionnaire for nurses' knowledge regarding Management of Intravenous Infiltration and Phlebitis:

Faheim and Hassan (2018) created the questionnaire to gauge nurses' understanding on how to treat phlebitis and intravenous infiltration. It is composed of the following components:

Part 1: Sociodemographic characteristics of nurses in NICUs:

This part was designed to obtain information about Sociodemographic data of the nurses under study, including their age, gender, marital status, level of education, years of experience, and whether they have taken any training courses, facing the problem of IV infiltration and phlebitis, the severity of problem.

Part 2: Nurses' knowledge regarding management of intravenous infiltration:

This part consists of 6 open questions to assess nurses' knowledge regarding management of IV infiltration such as: (definition, causes, clinical manifestations, prevention, complications, and nursing management)

Part 3: Nurses' knowledge regarding management of phlebitis:

This part consists of 6 open questions to assess nurses' knowledge regarding management of phlebitis such as: (definition, causes, clinical manifestations, prevention, complications, and nursing management)

Scoring system: The response was analyzed as categorical variable (correct or in correct answer). A score of 1 was given to correct answer (yes) and 0 to the incorrect answers (no or I don't know). The total score of knowledge was converted to percentage and used to categorize them as done by (Faheim, & Hassan, 2018) as follows:

Knowledge	**No. of**	**Score**		
		Range	**Unsatisfactory (<75%)**	**Satisfactory (≥75%)**
IV Infiltration In NICUS	**6**	**0 – 12**	0 – 8	9 – 12
Phlebitis in NICUs	**6**	**0 – 12**	0 – 8	9 – 12
Total knowledge	**12**	**0 – 24**	0 – 16	17 – 24

Tool (II): Observational checklist for Management of Intravenous Infiltration and Phlebitis:

The tool was created by the investigator following an examination of American Management National Health Care Education Services (2014) to assess nursing practice regarding management of intravenous infiltration and phlebitis. The checklist consisted of 30 items were scored as one for done and zero for not done. They were categorized using the following method once the overall practice score was converted to a percentage.

Practices	No. of	Score		
		Range	Unsatisfactory (<75%)	Satisfactory (≥75%)
Infiltration In NICUS	**15**	**0 – 15**	0 – 11	12 – 15
Phlebitis in NICUs	**15**	**0 – 15**	0 – 11	12 – 15
Total practices	**30**	**0 – 30**	0 – 22	23 – 30

Tool (III): Pediatric peripherally inserted IV (PIV) Rating Scale: This part was developed by the Infusion Nurses Society (2011). The Intravenous Nursing Society (INS) complication scales have been updated for use with pediatric patients. It assesses and measures the extent and severity of phlebitis in peripheral vascular access devices (PVADs). It includes the following:

Part (1): Neonates' demographic characteristics:

This part was designed to obtain information about demographic characteristics of the studied neonates as weight, gender, Date of birth, date of admission, and medical diagnosis.

Part (2): IV infiltration scale: describes the severity of infiltration in neonatal skin, and consist of five grades. **Grade (0)** means Asymptomatic- Flushes easily, **grade (1)** of infiltration Flushes with difficulty -Localized swelling- Discomfort at site, **grade (2)** which means Slight swelling at the site or beneath it; redness; discomfort at the place, **grade (3)** of infiltration Moderate swelling; pain at the location; chilly skin to the touch; presence of blotting; decreased pulse beneath the spot, **grade (4)** with one or more symptoms of Severe edema, infiltration, chilly skin to the touch,

blistering, necrosis, diminished or absent pulses, pain at the location, and capillary refill time greater than four seconds.

Part (3): Phlebitis Rating Scale: describes the severity of phlebitis in neonatal skin, and consist of five grades. **Grade (0)** means Asymptomatic, **grade (1)** of phlebitis Paint or not, erythema at the access place, **grade (2)** which means Edema and/or erythema at the access site, **grade (3)** of phlebitis Pain at access site with palpable venous cord, streak development, erythema, and/or edema, **grade (4)** with one or more symptoms of Pain at the point of access with erythema and/or edema, development of streaks, palpable venous cord longer than 1 inch, purulent discharge.

B- Operational design:

The following stages were used to conduct the study field of work:

Preparatory Phase:

In order to help the researcher become more familiar with the subject and create the tools for data collection, it involves reviewing recent and relevant literature on the research topic, various studies, and theoretical knowledge of various aspects of the problems using all official websites such as PUBMED, GOOGLE SCHOLAR, MEDLINE database, CINAHL, EBESCO Cochrane Database and Scopus, as well as scientific books, articles, and periodicals and Nursing Center.

Tools validity

Six experts from Port Said University's pediatric nursing department made up the jury that made the decision. The three tools were examined by professors for their application, comprehensiveness, clarity, and relevance. The jury's remarks and recommendations were taken into account, and the items were modified, corrected, and clarified as needed.

Tools reliability:

The Cronbach's alpha coefficient test was utilized to evaluate the internal consistency of the study instruments and determine their reliability. A result of

0.910, indicating strong reliability, was found for the knowledge tool's internal consistency reliability.

Pilot Study:

A pilot research was carried out on 10% (10 nurses) of the sample prior to the start of the main study in order to evaluate the study tools' feasibility, practicability, and clarity as well as to determine how much time would be needed for interviews. Based on the pilot study's findings, the two tools underwent the necessary adjustments.

Field work:

Assessment, program formulation, implementation, and evaluation are the four stages that make up the study's execution. The eight months from the start of August 2022 to the end of March 2023 were used for data collection. The following stages were used to conduct the study:

Phase (I): Assessment Phase: The researcher visited the study locations and made arrangements with the nursing director for the study's actual implementation at this phase of getting official permissions to conduct the study. Following tool preparation, the study sample was gathered. The next step was to gather baseline data. To assess the study sample's current level of knowledge and practice regarding the management of infiltration and phlebitis, a pre-tested questionnaire was given to them. From the start of the morning shift to its conclusion, the hospitals were visited three days a week.

After introducing herself and outlining the purpose of the study, the researcher asked the nurses she was studying whether they would be interested in participating in it. She then conducted interviews with the nurses and gave them the questionnaire. Each item or question on a data collection sheet is read aloud by the researcher during the interview, who also explains its meaning. The nurses were then instructed to record their responses in writing. Filling out each sheet took roughly thirty minutes, and the confidentiality of all the data gathered was firmly guaranteed.

Phase (II): Program Planning: Under the supervision of the supervisors, the researcher created the educational program based on the data gathered from the initial assessment as well as literature. Its primary goal is to enhance the nurses'

understanding and practice of managing phlebitis and infiltration. A PowerPoint presentation that addressed every aspect of managing peripheral catheter problems was created for nurses.

Phase (III): Program Implementation: The four hospitals listed above, which are connected to the Port Said governorate's health care authority, hosted the instructional program. For interviewing the participants' nurses, the researcher depended on coordination with the hospitals training team in collecting information about nurses who works in neonates critical care units. The researcher was collected pre-test data at the first three weeks before conducting implementation phase. In roughly thirty to forty-five minutes, the tool sheets were completed.

The nurses under study were first split up into groups of 13 to 15 nurses apiece, and each group was then assembled in a conference room at each facility. The group was gathered during the morning working shifts, and the session was conducted at the time that worked best for them.

On Saturday, Sunday and Tuesday of each week, data was gathered. Beginning in August 2022 and ending in March 2023, the latest research fieldwork lasted eight months. They received the eight-hour, organized program education course, which was broken up into four sessions of about 120 minutes for every session.

Phase (IV): Evaluation (Post-test): Using the same instruments as the pretest, the post-test was conducted following program implementation to assess the program's impact right away. Using the observational checklist, the researcher observed the practice of the nurses under study in each hospital following the implementation of the instructional program.

Ethical considerations:

Based on the committee's standards, the study was approved by the Faculty of Nursing's Research Ethics Committee (REC) at Port Said University with code number(16): NUR 7/8/2022. Informed consent was obtained for research participation. Prior to data collection, each patient and nurse were also briefed on the purpose and methodology of the study. Patients and nurses have the option to

accept, reject, or leave the study at any time. Conversely, the researcher protected the participants' anonymity and confidentiality.

C- Administrative design

After outlining the purpose of the study, the dean of the nursing college sent formal letters to the manager of the aforementioned hospital asking for their participation and permission to carry out the study. Additionally, prior to beginning data collection, patients' verbal agreement was acquired.

D. Statistical design

Version 20.0 of the Statistical Package for the Social Sciences (SPSS) software was used on a personal computer to record, tabulate, and analyze the gathered data at a significance level of P 0.05. To examine the relevant data, the study used both descriptive and inferential statistics.

RESULTS

Table 1 illustrates the distribution of the sociodemographic traits of the NICU nurses under study. As the table clarified, more than half of the studied nurses (53%) their age group were from 25 to less than30 years old, and the most (84%) of them were females, more than half (52%) of them were married regarding educational level, less than two thirds (60%) of the studied nurses had Bachelor degree in Nursing, and slightly above two thirds (66%) of them had experience from one to less than 5 years. Furthermore, less than half (44%) of the studied nurses receive training courses on IV infiltration and phlebitis. The majority (98%) of the studied nurses faced the problem of IV infiltration while administering IV fluids to neonates, while more than half (51%) of them were faced moderate severity of IV infiltration. Also, more than two thirds (68%) of the studied nurses faced the problem of IV phlebitis while administering IV fluids to neonates, and more than half (51%) of them were faced moderate severity of IV phlebitis.

Figure 1 Presents NICU nurses' knowledge about IV infiltration. As shown in the figure, only 8% of the studied nurses had satisfactory knowledge regarding infiltration

in NICU pre- program, which improved to the 47% of them had satisfactory knowledge post-program.

Figure (2) demonstrates NICU nurses' knowledge about IV phlebitis pre- and post-program. As shown in the figure, only 4% of the studied nurses had satisfactory knowledge regarding infiltration in NICU pre- program, which improved to the 53% of them had satisfactory knowledge post-program.

Figure (3) presents NICU nurses' performances of phlebitis management pre- and post-program. The figure illustrated that there was no obvious improvement in performances of phlebitis management, and 53% of the studied nurses had satisfactory practices regarding infiltration management in NICU pre- program, which not changed post-program.

Table 2 describes severity of infiltration in neonatal skin in NICUs pre- and post-program. The table indicated that, there was a marked improvement related to infiltration incidence among the studied neonate post-program implementation. As evidence, 28% of the studied neonate had grade 1 and grade 2 pre-program which improved post-program to 36% had grade 0 and 34% had grade 1.

Table 3 illustrates severity of phlebitis among the studied neonates in NICUs pre- and post-program. The table elaborated that, there was a marked improvement post-program in the studied neonates' skin condition post-program implementation. As evidence, 32% of the studied neonate had grade 1 and 28% of them had grade 2 pre-program which improved post-program to be 46% of them had grade 0 (no symptoms).

Table 4 demonstrates the relationship between the pre- and post-program knowledge and practice levels of the nurses under study. The amount of nurses' knowledge and their level of practice with regard to infiltration and phlebitis therapy in the NICU were found to be no obvious statistically significantly correlated.

Table (1): Percentage distribution of studied NICUs nurses regarding Sociodemographic characteristics (n=100).

Sociodemographic data	No.	%
Age (years)		
> 20 years old	1	1.0
20 >25	27	27.0
25 >30	53	**53.0**
30 +	19	19.0
Gender		
Male	16	16.0
Female	84	**84.0**
Marital status		
Married	52	**52.0**
Single	43	43.0
Divorced	5	5.0
Educational qualification		
Nursing Diploma	1	1.0
Health Technician Institute	39	39.0
Bachelor of Nursing	60	**60.0**
Years of experience		
> one year	5	5.0
1year > 5 years	66	**66.0**
< 5 years	29	29.0
Have you received any training courses on IV infiltration and phlebitis?		
No	56	**56.0**
Yes	44	44.0
Have you faced the problem of IV infiltration while administering IV fluids to neonates		
No	2	2.0
Yes	98	**98.0**
The severity of IV infiltration (n=98)		
Mild	38	38.7
Moderate	50	**51.0**
Severe	10	10.2
Have you faced the problem of phlebitis while administering IV fluids to neonates?		
No	32	32.0
Yes	68	**68.0**
What was the severity of phlebitis (n=68)		
Mild	22	32.35
Moderate	35	**51.47**
Severe	11	16.17

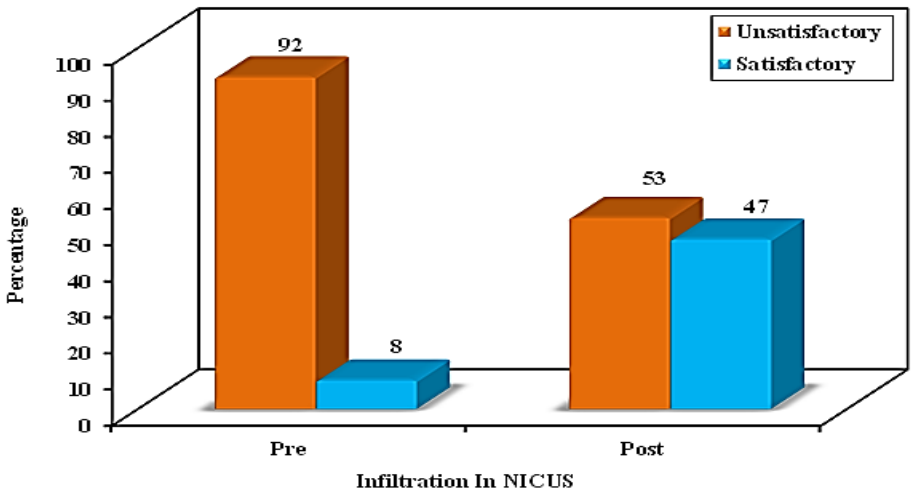

Figure (1). NICU nurses' knowledge about IV infiltration (n= 100).

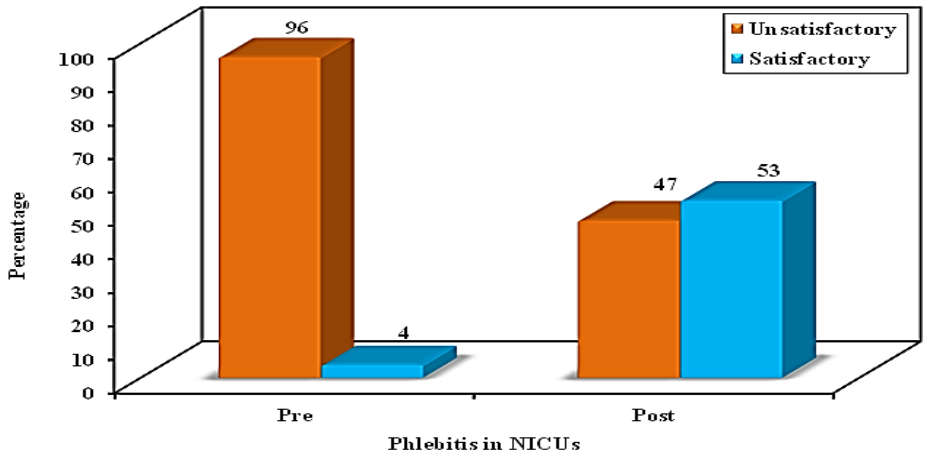

Figure (2). NICU nurses' knowledge about IV Phlebitis pre- and post-program (n= 100).

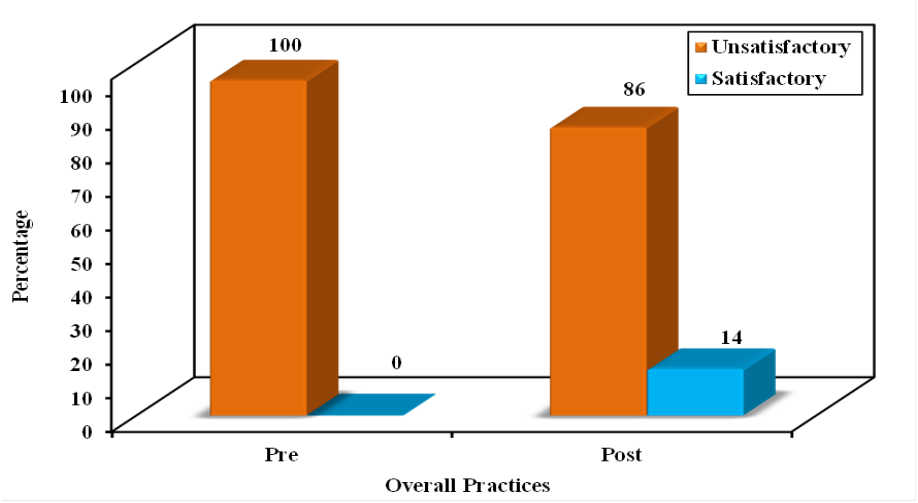

Figure (3): Total score for Overall performances (n= 100).

MH: Marginal Homogeneity Test p: p value for comparing between **Pre** and **post**

*: Statistically significant at $p \leq 0.05$

Table 2. Comparison between infiltration severity pre- and post-program according to Infiltration scale in neonates (n = 50).

Infiltration scale	Pre		Post		MH	P
	No.	%	No.	%		
Grade 0	11	22.0	18	36.0		
Grade 1	14	28.0	17	34.0		
Grade 2	14	28.0	10	20.0	20.500	0.001*
Grade 3	8	16.0	4	8.0		
Grade 4	3	6.0	1	2.0		

Table 3. Comparison between phlebitis severity pre- and post-program according to phlebitis rating scale in patient in neonates (n = 50).

Phlebitis rating scale	Pre		Post		MH	P
	No.	%	No.	%		
(Grade 0)	16	32.0	23	46.0	20.000	0.003*
(Grade 1)	14	28.0	17	34.0		
(Grade 2)	10	20.0	5	10.0		
(Grade 3)	3	6.0	2	4.0		
(Grade 4)	7	14.0	3	6.0		

MH: Marginal Homogeneity Test p: p value for comparing between **Pre** and **post**
*: Statistically significant at $p \leq 0.05$

Table 4. Correlation between total nurses' knowledge and practices scores about management of intravenous infiltration and phlebitis in NICUs. (n= 100).

		Pre	Post
Knowledge vs. Practices	**R**	-0.190	-0.195
	P	0.058	0.051

r: Pearson coefficient

*: Statistically significant at $p \leq 0.05$

DISCUSSION

Since Compared to adults, children are more prone to suffer from peripheral intravenous problems, particularly pediatric IV infiltration, and phlebitis; these conditions are prevalent in pediatric facilities, especially neonatal intensive care units and pediatric intensive care units. (Ibrahim, & Alaswad, 2020). Intravenous therapy presents unique hurdles for neonates because of their increased adiposity, thin and difficult-to-see capillaries, and frailty. These elements make venipuncture and other similar procedures more complex, challenging, and time-consuming. Furthermore, it

becomes essential to properly fix and maintain peripheral intravenous devices (PIVD). (Al-Awaisi, Al-Harthy, & Jeyaseelan, 2022).

Therefore, An educational initiative about neonates' IV infiltration and phlebitis management had to be designed for neonates' nurses in order to meet their particular training and educational requirements in order to gain and advance their knowledge and practice. The increasing incidence of pediatric IV infiltration and phlebitis, as well as the importance of appropriate professional training in nursing management of neonatal IV problems, made this important. (Abouzeid, et al., 2024).

In this regard, the current study was carried out to assess how nurses' performance in newborn critical care units was impacted by a training program about the management of intravenous infiltration and phlebitis. The results of this study highlight how crucial it is to put in place educational programs about the treatment of phlebitis and intravenous infiltration, as well as to regularly and appropriately train pediatric nurses. Such programs are essential for improving the quality and safety of IV therapy in neonatal intensive care units, as seen by the examined NICU nurses' notable post-program improvements in knowledge and practice.

Regarding nurses' knowledge about intravenous infiltration and phlebitis control in NICUs, The current findings showed that pre-program and post-program knowledge differed statistically significantly. As proof, just a small percentage of the nurses in the study knew enough about phlebitis and infiltration in the NICU before the training, but this improved to over half after the program. This research demonstrates the value of guidelines and educational initiatives aimed at improving the skills and expertise of nurses working in neonatal critical units.

Abdel-Fattah Mahmoud, Shafik Mahmoud& Mostafa Khalaf(2018). did a study in Egypt that looked at the quality of nurses' performance with regard to parenteral feeding in newborn critical care units, and the current findings were at odds with that study. According to their results, more than three-quarters of the nurses in question had precise and thorough information about cannula problems before the program. Additionally, Bayoumi, Khonji, and Gabr (2022) revealed that nurses' theoretical knowledge improved statistically significantly after an education intervention. They also examined improvements in nurses' clinical practice and knowledge in managing local IV problems.

Additionally, the present results are consistent with a study by Ahmed, Mohammed, L Ayed, El-Ghadban, & Amin (2022). that found that more than two-thirds of the nurses in the study had poor knowledge about peripheral catheter complications before the educational program, but that most nurses' knowledge improved to a good level after the program, and that there was a highly statistically significant difference between the nurses' knowledge levels before and immediately after the program and two months after it was implemented. The researchers concluded that the implementation of educational training was very effective and reflected the necessary understanding of the simulated-based education implementation in order to improve knowledge.

As regards nurses' performance of management of intravenous infiltration and phlebitis in NICUs, The current result showed the differences between the mean ratings for pre-program and post-program practices were marked improvement with regard to many points in the level of NICU nurses' infiltration and phlebitis management practices, As evidence, only (14%) of nurses were checked the patient's pulse during capillary refill pre-program which improved post-program to more than two thirds (70%) were checked the patient's pulse during capillary refill. Furthermore, the majority (95%) of the studied nurses weren't took pictures of the infiltration area pre-program which decreased post-program to one fifth (80%), this is due to the hospitals polices that prevent taking pictures of any patient. According to the study, in order to enable nursing staff meet the unique needs of neonates while using catheters inserted into peripheral veins and so lower the incidence of adverse events during hospitalization, it is imperative to enhance experience.

The current findings were consistent with a study by Behairy, Abdel Hakeim, El-Naby, and Gomaa (2023) titled "Effect of Nursing Training regarding Peripheral Intravenous Cannula on Nurses' Performance and Incidence of Complications." The study indicated that overall practice improved after training. Furthermore, the current results are consistent with those of Saltah and Abusaad (2022), who investigated the impact of implementing an educational program on the knowledge, practice, and newborn outcomes of nurses with peripherally implanted central catheters. They explained that there was statistically significant difference in the nurses' performance mean score after the educational program was implemented compared to before, with a higher mean score in terms of management to prevent peripheral catheter problems.

Regarding the severity of intravenous infiltration and phlebitis in NICU pre- and post-program, the present results indicated that there was a marked improvement related to infiltration severity among the studied neonate post-program implementation. As evidence, (22%) of the studied neonate had grade 0 pre-program, which improved to (36%) post-program. grade (0) means no symptoms. While (6%) of the studied neonate had grade 4 pre-program, which decreased to (2%) post-program. grade(4) means the worst level of symptoms with one or more symptoms of Severe swelling-Infiltration-Skin cool to touch-Blanching-Necrosis-Blistering-Diminished or absent pulses-Pain at site-Capillary refill > 4 seconds. This indicates that the studied neonates had lower incidence of infiltration post-program compared to pre-program results. This finding may be because over three-fifths of the nurses in the study did not take phlebitis and infiltration management training courses pre-program and the educational program has potential benefits in improving the safety and outcomes of IV therapy in neonates.

This current result is in line with research findings by Ibrahim and Alaswad (2020), which showed that while only one fifth of the children in the studied group experienced infiltration from IV therapy, roughly two- In the control group, three-quarters of the kids did. The authors hypothesized that the studied group's lower incidence of infiltration was due to improved Nurses' understanding and application regarding the complications of intravenous therapy following the implementation of an educational intervention. Additionally, The incidence of infiltration among neonates significantly decreased following the implementation of the staff nurses' educational program, according to Emamgholi, Khanjari, and Haghani (2020), who looked at how nurses' performance in caring for neonates with peripherally placed central catheters was affected by an educational program.

Relating to phlebitis severity, the current findings elaborated that, there was a marked improvement post-program in the studied neonates' skin condition post-program implementation. As evidence, (32%) of the studied neonate had grade 0 pre-program, which improved to (46%) post-program. grade (0) means no symptoms. While (14%) of the studied neonate had grade 4 pre-program, which decreased to (6%) post-program. grade (4) means the worst level of symptoms with one or more symptoms of Pain at access site with erythema and/or edema, streak formation, palpable venous cord > 1 inch in length; purulent drainage. This demonstrated that the

studied neonates had a significantly lower risk of experiencing phlebitis post-program compared to pre-program results.

The results of Büyükyılmaz, Şahiner, Cağlar, and Eren (2019), who investigated the effect of an intravenous protection device on catheter dwell duration and phlebitis score in pediatric patients, were in agreement with the present findings. They also explained that less than one-fifth of the children in the study experienced phlebitis after the nurses' training were applied. Furthermore, Saltah and Abusaad (2022) found that before the educational program began, over three-quarters of newborns had mechanical phlebitis and filtration, but that this number dropped after three months of the start of the educational session.

Finally, concerning correlation between nurses' knowledge and practices, the present results illustrated a positive, statistically significant relationship existed between nurses' knowledge level and their level of practices regarding infiltration and phlebitis management in NICU in many points, but overall there is no marked statistically significant relationship existed. This result may due to that nurses' gaining knowledge affect positively on many points of their practice. And the overall results may be because of some hospitals policies which prevent taking pictures of the affected area as example. The current findings concurred with those of Fischer (2023), who investigated staff education to reduce peripheral intravenous infiltrates and came to the conclusion that nurses' performance and their knowledge of reducing the incidence of peripheral intravenous infiltrates were positively correlated. Additionally, the present findings concur with those of Ibrahem et al. (2020) and Abouzeid et al. (2024), who found a strong positive association between neonatal nurses' performance and their understanding of intravenous therapy complications.

CONCLUSION

It is possible to draw the following conclusions from the current study's findings:

The skills and knowledge of nurses on the management and prevention of infiltration and phlebitis were positively impacted by the teaching program on the management of intravenous infiltration and phlebitis. Additionally, the educational program helped newborns experience fewer IV complications. The post-program

evaluation of the nurses under study revealed statistically significant differences in NICU nurses' expertise and methods about intravenous infiltration and phlebitis management during the time before and after the program.

RECOMMENDATIONS:

- ***The following suggestions were made in light of the current study's findings:***
- Increase nurses' awareness about the necessity of routinely updating their skills and knowledge in intravenous therapy administration.
- Periodically workshops and practical instruction to nurses on how to handle and prevent peripheral intravenous therapy complications.
- Continuous training nurses on the latest advancements and best practices in intravenous therapy administration, maintaining their knowledge and expertise in this crucial area of medical care.
- Every neonatal unite should implement ongoing enhancing nurses' adherence to evidence-based guidelines for intravenous infiltration and the treatment and prevention of phlebitis.

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تأثير برنامج تعليمي عن رعاية التسريب والالتهاب الوريدي علي اداء الممرضين في وحدات الرعاية المركزة لحديثي الولادة

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الخلاصـــة

يتعرض حديثي الولادة لخطر متزايد للإصابة بالمضاعفات المرتبطة بالقسطرة الوريدية الطرفية. ومن أجل منع حدوث المضاعفات مثل التسريب والالتهاب الوريدي يجب على زيادة وعي الممرضين برعاية التسريب والالتهاب الوريدي. ولذلك، تهدف الدراسة الحالية الى تقييم تأثير برنامج تعليمي عن رعاية التسريب والالتهاب الوريدي علي اداء الممرضين في وحدات الرعاية المركزة لحديثي الولادة. تم اجراء الدراسة الحالية في مستشفيات المبرة والسلام والحياة بورفؤاد بمحافظة بورسعيد بين 100 من ممرضين وحاد الرعاية تم جمع البيانات باستخدام استبيان مستوى معرفة الممرضين عن رعاية التسريب والا لتهاب الوريدي، إستمارة تقييم ممارسة القسطرة الوريدية الطرفيه. النتائج: كان هناك فرق ذو دلالة إحصائية بين درجات ما قبل وبعد البرنامج فيما يتعلق بمعرفة الممرضين بالدراسة حول التسريب والتهاب الوريدي ($p<0.001$). كما أوضحت نتائج الدراسة أنه لا يوجد تحسن واضح في ممارسات رعاية التسريب والتهاب الوريدي مع وجود فرق احصائية طفيفة ذات دلالة إحصائية بين مرحلة قبل وبعد تنفيذ البرنامج. وقد تخلصت الدراسة بوجود تأثير ايجابي للبرنامج التعليمي عن رعاية التسريب والالتهاب الوريدي على أداء ومعرفة الممرضين بوحدات العاية المركز لحديثي الولادة. وأوصت الدراسة بتنفيذ ورش التعليم المستمر للممرضين عن الوقاية من مضاعفات القسطرة الوريردية الطرفيى للاطفال وحديثي الولادة.

الكلمات المرشدة: التسريب الوريدي، الإلتهاب الوريدي، الرعاية المركزة، الممرضين، برنامج تعليمي، حديثي الولادة.