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Evaluation of peripheral cannulation technique among nurses in maternity and Dr. Jamal Ahmad Rashid pediatric teaching hospitals in Sulaimaniyah, Iraq

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Abstract

Background Obedience to the excellent standards of nursing practice is the ultimate attitude to develop patient outcomes and avoid nursing process related-infections. Inserting the peripheral intravenous cannula is the utmost mutual aggressive technique achieved in nursing care for patients. Therefore, nurses must have adequate knowledge and practice to ensure the procedure's success.

Objectives To determine the peripheral cannulation technique evaluation among nurses working in the emergency departments.

Methods This descriptive-analytical study was conducted at Maternity and Pediatric Teaching Hospitals in Sulaimaniyah, Iraq on 101 randomly selected nurses, from 14th December 2021 to 16th March 2022. Data collection was carried out through a structured interview questionnaire aimed to gather the nurses' general characteristics and an observational checklist to assess the nurses' pre, during and post practices regarding peripheral cannulation technique.

Results According to general practice, 43.6% of nurses had an average level, 29.7% had a good level, and 26.7% had a poor level of practice in the evaluation of the peripheral cannulation technique. Our study also showed a positive association between socio-demographic characteristics of the studied samples with the overall level of practice regarding peripheral cannulation technique.

Conclusions Nurses were not practised peripheral cannulation technique appropriately; however, half of the nurses' had an average level of practice, although their practices were not followed the standard protocols.

Keywords Peripheral cannulation, Technique evaluation, Nursing practice, Descriptive-analytical study

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Introduction

Peripheral intravenous cannulation (PIC) is the commonly used intravenous process in medical practices [1]. However, it is an invasive procedure implemented mainly in hospitalized patients [2] to administer diverse solutions, medications, blood and its products. The technique is almost same in children and adults [3].

PIC is an essential part of an expert nursing exercise in healthcare practices for various dedications [4], which insert and remain for a limited duration of time mainly based on the patient's situation with a possible danger of bacterial contaminations [2], which are mainly a part of nosocomial infections that related to increased hospitalization duration, as well as, rate of infection and death, with high cost [5].

Annually, intravenous medications are mainly given to most hospitalized patients (60%) using PIC worldwide, resulting in 6.2% of hospitals acquiring bacterial contamination and then septicemia [6]. Therefore, PIC is frequently related to localized than widespread infection. The most common complications of PIC are thrombophlebitis with a rate of 2.3–67%, and phlebitis in 1.5–60% of patients. However, complications such as infection, pain, leaking, dislodgement, extravasations and occlusions are not uncommon [7].

A common nursing action is an insertion, monitoring, and assessment of PIC sites as the cannula should be placed into the flexor aspect of the forearm, while the femoral vein is avoided as a high amount of normal flora are available in that region and might results in a high risk of infection [8].

Infection prevention is a potential element of a nurse's profession. The majority of preventative strategies and interventions are included in standard nursing care. The nurse should be knowledgeable and familiar with the preparation and use of intravenous cannulas, as well as the avoidance, treatment, and management of local/systemic problems that can be supported by dynamic evidence-based practice guidelines [9].

The ability to implant and maintain medical devices is essential for all medical and nursing staff who works as medical personnel in hospitals and care for patients. Beginning with an intravenous remedy is one of the most effective ways as a combat medic that may avert mortality on the battlefield, including an intravenous cannula [10].

Intravenous cannulation is a common cause of nosocomial infections in hospitals due to bacterial flora migration on the site of introduction into the cannula's cutaneous tract with the cannula's outer surface. The use of superficial veins in the lower limbs is discouraged due to the increased risk of infection. If the cannula is inserted into the lower extremities, it might quickly become resistant [11]. Competent people should oversee the procedures that are being implemented. It

is reasonable to anticipate recommendations to evaluate clinical practice for such a remarkable surgery when asked which catheter they preferred and why most nurses stated that they had formed their cannula insertion tradition from habit or experience accumulated over time or based on the availability of equipment in the hospital [12].

Based on the facts mentioned above, this study was assigned to evaluate the PIC technique among nurses concerning the care and conservation of intravenous cannula and difficulties they faced during work at Maternity and Dr. Jamal Ahmad Rashid Pediatric Teaching Hospitals in Sulaimaniyah, Iraq.

Materials and methods

Participants and study setting

This descriptive-analytical-observational research was conducted on 101 active nurses in Maternity Teaching Hospital and Dr. Jamal Ahmad Rashid Pediatric Teaching Hospital in Sulaimaniyah, Iraq, from 14th December 2021 to 16th March 2022, using a convenience sample technique.

Measurement tools

Required data were obtained through direct interview and observational checklist [13] using a validated questionnaire that involves two parts. The first part had 7 items and was related to the nurses' socio-demographic variables such as age, level of education, marital status, financial status, years of experience as a nurse, participation in training sessions concerning PIC technique, and duration of the training. The second part was an observational checklist modified by the researchers based on the guidelines for the PIC technique and divided into 3 sections with 37 items; the pre-practices, during practices, and post practices, each section had 11, 22, and 4 items, respectively and each question was answered by 'Yes' or 'No'. The correct practice was marked as 1.0, while the wrong practice was scored as 0.0 (Supplementary file).

Meanwhile, the activity for each nurse performed during cannula insertion has been checked, while she/he performs her/his work, and each of them was observed on an individual basis without being informed during 3 visits for the same practice.

On the other hand, for pre-practice evaluation, a total score of 0 to 11 was used, when a score 0–5 was poor, 6–8 was average, and 9–11 was good practice. Total scores from 0 to 22 were used during-practices when score 0–10 indicated poor, score 11–16 showed average, and score 17–22 demonstrated good practice. Additionally, a total score from 0 to 4 was used to measure post-practices; when score 0–1 showed poor, score 2 represented average, and score 3–4 illustrated a good practice. The response was scored as 'Yes' or 'No'. The scales

Table 1 Pre-, during, and post-practice score evaluation among nurses

Variable	Pre-practice (1) For correct practice/(0) For incorrect practice	During-practice	Post-practice	All practice
Total scores	11	22	4.0	37
Range	0.0–11	0.0–22	0.0–4.0	0.0–37
Poor ($\leq 49\%$)	0.0–5.0	0.0–10	0.0–1.0	0.0–18
Average (50–75%)	6.0–8.0	11–16	2.0	19–27
Good ($\geq 75\%$)	9.0–11	17–22	3.0–4.0	28–37

Table 2 Distribution of studied nurses according to socio-demographic characteristics

Socio-demographic characteristic	Frequency	%
Age (Years)		
≤ 20	14	13.9
21–40	51	50.5
> 40	36	35.6
Level of education		
Intermediate school graduate	14	13.9
Secondary school graduate	22	21.8
Institute graduate	53	52.5
College graduate	12	11.9
Marital status		
Married	55	54.5
Unmarried	43	42.6
Widow	3	3
Financial Status		
Sufficient	88	87.1
Barely Sufficient	12	11.9
Insufficient	1	1
Experience in Maternity Teaching Hospital (Years)		
< 6	32	31.7
6–15	50	49.5
> 15	19	18.8
Experience in Pediatric Teaching Hospital (Years)		
< 10	58	57.4
10–19	30	29.7
> 19	13	12.9
Participation in training session concerning cannulation		
Yes	43	42.6
No	58	57.4
Total	101	100

were classified as poor ($\leq 49\%$) with scores 0–18, average (50–75%) with scores 19–27, and good levels ($\geq 75\%$) with scores 28–37 for all practices. Individuals' practice scores were calculated to give the total practice score (Table 1).

Inclusion criteria

Active nurses who worked at the Emergency department of the hospitals regardless of age, gender, and nationality.

Exclusion criteria

Nurses who worked as a volunteer with less than 2 years of experience.

Statistical analysis

Obtained data were analyzed using Statistical Package for Social Science (SPSS, version 24, Chicago, USA). Results were presented as frequencies and percentages. Chi-square test was used to determine the association between pre-practices, during, and post-practice with their socio-demographic data. Statistical difference considered significance ($p < 0.05$), highly significant ($p < 0.001$), and very highly significant ($p < 0.000$), while $p > 0.05$ was regarded as non-significant difference.

Results

Regarding the nurse's socio-demographic characteristics, 51 participants (50.5%) were aged 21–40 years, while nurses < 20 years old were 14 (13.9%). Furthermore, 53 (52.5%) nurses graduated from the institute, and only 12 (11.9%) had university certificates. Regarding marital status, only 55 (54.5%) were married, and 88 (87.1%) of the participants were from sufficient financial status backgrounds. Concerning work of experience in both hospitals as a nurse, 50 (49.5%) nurses had 6–15 years of experience in Maternity Teaching Hospital, and 58 (57.4%) participants had < 10 years' experience in Pediatric Teaching Hospital. Also, 58 (57.4%) nurses participated in training sessions concerning the PIC technique for 2–4 days (Table 2).

Concerning PIC technique evaluation, we found that 42.6% of the respondents had an average level, 30.7% had a poor level, and only 26.7% had a good level of practice regarding pre-practice. Moreover, 42.6% of the participants had an average level, 31.7% had a good level, and 25.7% had a poor level during practice. However, 80.2% of nurses had a poor level, 10.9% had an average level, and 8.9% had a good level of post-practice. Therefore, according to the overall practice, 43.6% had an average level, 29.7% had a good level, and 26.7% had a poor level of practice, respectively (Table 3).

In respect to determining the association between all practices of nurses and socio-demographic characteristics, there was a very highly significant difference between the level of all practice concerning PIC concerning age

Table 3 Distribution of information related to pre- during and post practices of nurses

Variable	Pre-practice Fr (%)	During-practice Fr (%)	Post-practice Fr (%)	All practices Fr (%)
Poor	31 (30.7)	26 (25.7)	81 (80.2)	27 (26.7)
Average	43 (42.6)	43 (42.6)	11 (10.9)	44 (43.6)
Good	27 (26.7)	32 (31.7)	9 (8.9)	30 (29.7)
Total	101 (100)	101 (100)	101 (100)	100

Fr: Frequency

Table 4 Association between practices concerning peripheral intravenous cannulation technique with socio-demographic characteristics

Socio-demographic	Poor Fr (%)	Average Fr (%)	Good Fr (%)	Total	p-value
Age (Years)					
≤ 20	12 (44.4)	2.0 (4.5)	0.0 (0.0)	14	< 0.000*
21–40	9.0 (33.3)	29 (65.9)	13 (43.3)	51	
> 40	6.0 (22.2)	13 (29.5)	17 (56.7)	36	
Level of education (Nursing)					
Intermediate school	12 (44.4)	1.0 (2.3)	1.0 (3.3)	14	< 0.000*
Secondary school	4.0 (14.8)	10 (22.7)	8.0 (26.7)	22	
Institute	7.0 (25.9)	32 (72.7)	14 (46.7)	53	
College	4.0 (14.8)	1.0 (2.3)	7.0 (23.3)	12	
Experience in Maternity Teaching Hospital (Years)					
< 6	18 (66.7)	11 (25)	3.0 (10)	32	< 0.000*
6–15	4.0 (14.8)	27 (61.4)	19 (63.3)	50	
> 15	5.0 (18.5)	6.0 (13.6)	8.0 (26.7)	19	
Experience in Pediatric Teaching Hospital (Years)					
< 10	21 (77.8)	25 (56.8)	12 (40)	58	< 0.000*
10–19	5.0 (18.5)	18 (40.9)	7.0 (23.3)	30	
> 19	1.0 (3.7)	1.0 (2.3)	11 (36.7)	13	
Participation in training session concerning cannulation					
Yes	20 (74.1)	18 (40.9)	5.0 (16.7)	43	< 0.000*
No	7.0 (25.9)	26 (59.1)	25 (83.3)	58	
Total	27 (100.0)	44 (100.0)	30 (100.0)	101	

*: Very highly significant difference using Chi-square test, Fr: Frequency

($p < 0.000$), level of education ($p < 0.000$), years of experience in Maternity Teaching Hospital ($p < 0.000$), years of experience in Pediatric Teaching Hospital ($p < 0.000$) and participation in training session concerning PIC technique ($p < 0.000$) (Table 4).

Discussion

An intravenous cannula is one of the most routine procedures in hospitals. In several hospitals, intravenous cannula insertion is the primary job of nurses despite having specialized intravenous cannula teams in many centres to perform cannula insertion professionally [14]. Regardless of the regularity of this performance, few studies were conducted to guide the medical personnel to the most appropriate and successful means of conductance [15]. So, the present study evaluated the PIC technique among nurses at Maternity and Pediatric Teaching Hospitals in Sulaimaniyah, Iraq.

Analysis of socio-demographic characteristics of the nurses recruited in this study showed that 50.5% of nurses aged 21–40 years which is similar to other findings reported by other studies [10, 16]. Half of our study's health care workers (52.5%) graduated from the nursing institute, while 11.9% of nurses graduated from the College of Nursing, nearly the same as another study that found 48.3% of nurses had graduated from the Nursing Institute [10].

Regarding their previous years of experience, 49.5% of nurses had 6–15 years of experience, and 57.4% had < 10 years' experience in Maternity and Pediatric Teaching Hospitals, respectively. Opposite to our findings, Soliman et al., 2019 revealed that 49.4% of health care workers had < 3 years' experience [17]. This study also illustrated that 57.4% of nurses reported not attending previous training courses concerning PIC technique which is agreed with another study that found 52% of nurses were not attended any training course [17]. However, it is

opposite to Sriupayo et al. 2014, which found that >50% of the studied nurses had previous training or conference attendance concerning PIC technique [18].

Furthermore, we found that 43.6% of nurses had an average level of practice, and 26.7% had a poor practice concerning PIC protocols, which might be related to that nurses were not practised appropriately. However, 29.7% of nurses' level of practice about the PIC technique was good, but still, the practices were not according to the standard protocols. These outcomes were similar to those found in other studies that mentioned most nurses had unsatisfactory practice. Measures were generally higher during preparation, with a low level of practice during the actual performance and post-procedure of the PIC technique [10, 19].

Consequently, our results showed a very highly significant difference between all practices related to age, level of education, years of experience, and participation in training sessions concerning PIC technique with the level of practice. These findings did not agree with the findings of other studies that mentioned no association between socio-demographic characteristics of the studied nurses and the overall level of practice concerning PIC technique [17, 20]. However, Lund et al., 2012 found a positive association between level of practice with age, level of education, and participation in training courses [21]. These variations might be related to cultural factor, environmental factor, educational program/level, periodic nursing evaluation, and hospital facilities and services that should be offered to nurses continuously to improve their practical/clinical background without affecting their work quality.

Conclusions

As revealed by the current study's findings, nearly 1/2 of the studied nurses had an average level of practice, and >1/4 had poor and good level practice in evaluating PIC technique. We also showed a positive association between the nurse's socio-demographic characteristics and the overall level of practice concerning the PIC technique. Also, these results can assist in formulating an improve model to reduce the chances of PIC-related infections to raise the average care. Therefore, we recommend that hospital nurses receive thorough training in PIC techniques. These specially trained and qualified should instruct other hospital medical staff as documentation and labelling should be required during PIC procedures. In addition, nurses should know more about caring for and maintaining PIC as this procedure is necessary for any setting of health care. Hence, as part of health care providers, nurses should be aware of their practice level and how to handle the procedure in a very proper manner.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12912-023-01349-y>.

Supplementary Material 1

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Authors' contributions

G.F.: Conceptualization and data collection A.A.: Data analysis, resources, visualization N.I.: Data collection, validation, writing the original manuscript D.Q.: Writing the original manuscript, edition, revision All authors reviewed the manuscript.

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Data Availability

The datasets used and/or analyzed during the current study available from the corresponding author on reasonable request.

Declarations

Ethical approval and consent to participate

Our experiments on nurses were followed the appropriate guidelines and regulations belonging to the declaration of Helsinki. The Scientific and Ethics Committee of the College of Nursing at University of Sulaimani approved the study proposal. Before collecting data, formal authorization was obtained from health and government authorities. The study sample were provided explanation about the purpose of the study and written informed consent was obtained. The participation was voluntary, their data kept confidential, and nurses had right to withdraw at any time during data collection period without giving reason.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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References

1. Webster J, Osborne S, Rickard CM et al. Clinically-indicated replacement versus routine replacement of peripheral venous catheters. *Cochrane Database of Systematic Reviews* 2019 (1).
2. Urbanetto JdS, Peixoto CG, May TA. Incidence of phlebitis associated with the use of peripheral IV catheter and following catheter removal. *Rev Latinoam Enferm* 2016;24.
3. Nickel B. Peripheral intravenous access: applying infusion therapy standards of practice to improve patient safety. *Crit Care Nurse*. 2019;39(1):61–71.
4. Arbaee I. Nurses knowledge and practice towards care and maintenance of. *Qualitative Res*. 2016;1(3):385–405.
5. Osti C, Wosti D, Pandey B, et al. Ventilator-Associated Pneumonia and Role of Nurses in its Prevention. *J Nepal Med Association*. 2017;56(208):461–8.
6. Simin D, Milutinović D, Turkulov V, et al. Incidence, severity and risk factors of peripheral intravenous cannula-induced complications: an observational prospective study. *J Clin Nurs*. 2019;28(9–10):1585–99.
7. Indarwati F, Mathew S, Munday J, et al. Incidence of peripheral intravenous catheter failure and complications in paediatric patients: systematic review and meta analysis. *Int J Nurs Stud*. 2020;102:103488.

8. Ray-Barruel G, Xu H, Marsh N, et al. Effectiveness of insertion and maintenance bundles in preventing peripheral intravenous catheter-related complications and bloodstream infection in hospital patients: a systematic review. *Infect disease health*. 2019;24(3):152–68.
9. Boykin Sr GL. Measuring intravenous cannulation skills of practical nursing students using rubber mannequin intravenous training arms. *Mil Med*. 2014;179(11):1361.
10. Qamar Z, Afzal M, Kousar R, et al. Assess nurses knowledge and practices towards care and maintenance of peripheral intravenous cannulation in Services Hospital Lahore, Pakistan. *Saudi J Med Pharm Sci*. 2017;3(6B):608–14.
11. Juszcakiewicz P, Dykowska G, Czerw A. Patient's safety as regard to realization of procedures related to short-term iv peripheral venous access devices use by midwives. *J Public Health Med Rescue*. 2018;3:45–50.
12. Parker RA, McNeill JA, Pelayo LW, et al. Pediatric clinical simulation: a pilot project. *J Nurs Educ*. 2011;50(2):105–11.
13. Dougherty L, Lister S. *The Royal Marsden manual of clinical nursing procedures*. John Wiley & Sons; 2015.
14. Yildiz H, Demiray A. Virtual reality in nursing education 3D intravenous catheterization E-learning: a randomized controlled trial. *Contemp Nurse* 2022;1–13.
15. Carr PJ, Rippey JC, Budgeon CA, et al. Insertion of peripheral intravenous cannulae in the emergency department: factors associated with first-time insertion success. *J Vasc Access*. 2016;17(2):182–90.
16. Al-Naeli K, Hassan H. Effectiveness of an interventional program on nursing staffs' Practices toward Prevention of Peripheral Intravenous Cannula Complications in Al-Diwaniyah Teaching Hospital. *Kufa J Nurs Sci*. 2021;11(1):1–11.
17. Soliman HH, Ouda WE-S, Mahmoud MF. Nurses' knowledge and Practices regarding Peripheral Intravenous Cannulation and Blood Sampling in Pediatric Health Care settings. *Port Said Scientific Journal of Nursing*. 2019;6(3):50–67.
18. Sriupayo A, Inta N, Boonkongrat S, et al. Effectiveness of peripheral vascular catheter care bundle in the pediatric nursing service, Chiang Mai university hospital, Thailand. *Chiang Mai Medical Journal*. 2014;53(2):63–73.
19. Chang D, Lai N, Sqng N, et al. Adherence to Major Standard Precautions: an audit of venepuncture and intravenous cannula insertion in the Pediatric Unit of Hospital Sultanah Aminah, Johor Bahru, malaysia. *J Paediatr Child Health*. 2012;2(18):1–11.
20. Mahmoud FS, Abd-ElSadiq B. Effect of clinical pathway regarding promoting quality nursing care of children with meningitis exposed to invasive procedures. *J Am Sci*. 2013;9(8):383–93.
21. Lund F, Schultz J-H, Maatouk I, et al. Effectiveness of IV cannulation skills laboratory training and its transfer into clinical practice: a randomized, controlled trial. *PLoS ONE*. 2012;7(3):e32831.

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