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EFFECTIVENESS OF NURSE-LED EVIDENCE BASED APPROACH AMONG NURSES ON FREQUENCY OF PHLEBITIS AND ITS ASSOCIATED FACTORS IN CHILDREN AT PUBLIC SECTOR HOSPITAL

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ABSTRACT

Background: Hospital care is fundamental for the prevention and promotion of health, patient safety, and the restoration of health and well-being. Between 80.6% and 86.4% of hospitalized patients receive an intravenous bolus/push medication, and almost 60% of hospitalized patients receive at least one Peripheral intravenous cannulation. Up to 69% of hospitalized patients experience early access failure due to PIVC complications such as infiltration, extravasation, blockage, dislocation, and phlebitis.

Objective: To determine the existing frequency and associated factors of phlebitis in children and to find out the effectiveness of Nurse-led evidence based approach among nurses in term of improvement in frequency and associated factors of phlebitis in children.

Methodology: This quasi-experimental single-group pre-post study was conducted in the Public Sector Hospital Sialkot. A sample size of 36 nurses was selected through purposive sampling. Data collection spanned nine months, encompassing pre-intervention assessment, a 20-week training phase, and post-intervention evaluation. The training involved bedside sessions, presentations, and hands-on activities focused on standard techniques for IV cannulation care. The Visual Infusion Phlebitis (VIP) scale and an observational checklist were used to assess outcomes. Data analysis was performed using SPSS Version 24, with paired sample t-tests and Chi-square tests to determine the intervention's impact on phlebitis incidence.

Results: This study involved 36 nurses, primarily with 4-6 years of experience (72.2%) in the Nursery (63.9%). The intervention significantly reduced the frequency of phlebitis in pediatric patients from 58.3% to 41.6% and improved mean severity scores. Various factors, including age and cannulation attempts, showed different associations with phlebitis development, with the intervention particularly effective for irritant drugs and first-day cannulation. Nurses' practice scores improved significantly post-intervention, increasing from 8.36 ± 1.51 to 15.89 ± 1.06, indicating the effectiveness of targeted educational strategies in enhancing nursing practices and patient outcomes.

Conclusion: The study concluded that education and adherence to best practices in IV cannulation, showing significant improvements post-intervention through targeted training. Future research should continue optimizing IV cannulation practices to minimize complications.

Keywords: Nurse-led; Evidence-based approach**;** Phlebitis**;** Frequency**;** Associated factors**;** Children**;** Public sector hospital.

Introduction

Hospital care is fundamental for the prevention and promotion of health, patient safety, and the restoration of health and well-being (Smith *et al.,* 2024). In the United States, 80% of hospitalized patients have one or more intravenous catheters inserted during their stay (Marsh *et al.,* 2023). The most common method of drug delivery is through a peripheral intravenous catheter (PIVC). Between 80.6% and 86.4% of hospitalized patients receive an intravenous bolus/push medication, and almost 60% of hospitalized patients receive at least one PIVC (Noshy *et al.,* 2023).

Peripheral intravenous (PIV) cannulation involves inserting an indwelling single-lumen plastic tube through the skin into a peripheral vein to deliver fluids, medications, and other therapies directly into the vascular system (Munoz-Mozas & Gabriel, 2024). Up to 69% of hospitalized patients experience early access failure due to PIVC complications such as infiltration, extravasation, blockage, dislocation, and phlebitis. These complications necessitate the insertion of replacement devices, delay therapy, and increase costs. Additionally, catheter-related bloodstream infections (BSIs) pose a global threat to medical outcomes (Indarwati *et al.,* 2020)

Phlebitis, characterized by swelling, redness, warmth, and discomfort around the veins, is the most prevalent and significant PIVC-related complication, affecting 7–44% of catheters (Del Barco, 2022). The severity of phlebitis is typically based on the presence of erythema, discomfort, swelling, and thrombosis in the veins (Alisahal, 2022). Early detection and treatment of phlebitis symptoms are crucial to prevent severe cases (Johnson *et al*., 2023)

Phlebitis poses significant challenges in pediatric patients due to their smaller vein size and varying levels of activity and cooperation during medical procedures. Symptoms such as pain, swelling, redness, and warmth at the catheter site can lead to complications, including infections and blood clots, if not promptly addressed (Daud & Mohamad, 2021). In public sector hospitals, addressing phlebitis is particularly important due to the large and diverse patient population, including many children requiring intravenous therapy.

Nurses play a crucial role in the prevention and management of phlebitis, acting as the frontline of patient care. Their responsibilities include regular assessment and monitoring of intravenous sites for early signs of phlebitis, such as redness, swelling, and pain, which enables timely intervention (Bibi *et al.,* 2022). Proper catheter insertion and maintenance, following best practices like aseptic techniques and using the appropriate catheter size and material, are essential steps nurses take to prevent phlebitis. They also educate patients and their families about the signs and symptoms of phlebitis and the importance of prompt reporting of any changes (Bibi *et al.,* 2023).

Objectives of Study

- To determine the existing frequency and associated factors of phlebitis in children.
- To find out the effectiveness of Nurse-led evidence based approach among nurses in term of improvement in frequency and associated factors of phlebitis in children.

Materials and Methods

This quasi-experimental study utilized a single-group pre-post design and was conducted in the Pediatric Units of Allama Iqbal Memorial Teaching Hospital and Sardar Begum Teaching Hospital in Sialkot. The study included 30 staff nurses and pediatric patients who developed phlebitis. A Visual Infusion Phlebitis (VIP) Scale was used to assess phlebitis severity(Ventura et al., 2021), while an observational checklist evaluated nurses' adherence to IV therapy practices(Trinidad, 2021). Data collection occurred in three phases: pre-intervention, intervention, and post-intervention, over a total of 20 weeks. Training included bedside instruction on PVC insertion, maintenance bundles, and phlebitis grading, utilizing PowerPoint presentations, videos, and hands-on training. Monthly audits and feedback were provided to nursing staff, particularly for those with increased phlebitis rates.

Statistical analysis using SPSS Version 24 revealed a significant improvement in nurses' practice scores, with a mean increase from 8.36 to 15.89 ($p = 0.000$). The study also explored associations between various factors and phlebitis development using Chi-square tests and logistic regression analysis. Overall, the findings highlight the effectiveness of targeted educational strategies in reducing phlebitis incidence and severity among pediatric patients.

RESULTS

Demographic Characteristics of Nurses

Table 4.1: Gender wise comparison of demographic information of Nurses

Study Variable	Category	Gender		Total	p-value
		Male	Female		
Age	< 30 years	2(40.0%)	7(22.6%)	9(25.0%)	0.718
	31-35 Years	2(40.0%)	17(54.8%)	19(52.8%)	
	36-40 Years	1(20.0%)	7(22.6%)	8(22.2%)	
Work Experience	1-3 Years	2(40.0%)	8(25.8%)	10(27.8%)	0.429
	4-6 Years	3(60.0%)	23(74.2%)	26(72.2%)	
Unit of work	Nursery	2(40.0%)	21(67.7%)	23(63.9%)	0.239
	General Pediatric Ward	3(60.0%)	10(32.3%)	13(36.1%)	

In this study 36 nurses were asked to participate, age of 9(25.0%) was below < 30 years, 19(52.8%) was 31-35 Years and 8(22.2%) was 36-40 Years. Among them 5(13.9%) were male and 31(86.1%) were female. Table 1 shows that among the nurses 10(27.8%) have 1-3 Years working experience and 26(72.2%) have 4-6 Years of working experience. There was no association between gender and work experience (p-value 0.429). Among the nurses 23(63.9%) were working in Nursery and 13(36.1%) were working in General Pediatric Ward. There was no association between gender and workplace/unit (p-value 0.239).

Demographic Characteristics of Children

Table 4.2: Demographic Characteristics of Children

Demographic characteristics	Frequency (%)
Age	
< 1 month	1(1.40%)
1-12 month	21(29.20%)
1-4 year	24(33.30%)
5-8 year	16(22.20%)
9-12 year	10(13.90%)
Gender	
Male	34(47.20%)
Female	38(52.80%)
Presence of Co-morbidity	
Diabetes	1(1.40%)
Renal Problems	13(18.10%)
Liver Dysfunctions	14(19.40%)
Others	44(61.10%)
Attempts of Cannulation	
1st attempt	25(34.70%)
2nd attempt	33(45.80%)
3rd attempt	11(15.30%)

> 4th attempt	3(4.20%)
Size of Cannula used	
Gauge 16	1(1.40%)
Gauge 18	4(5.60%)
Gauge 20	3(4.20%)
Gauge 22	26(36.10%)
Gauge 24	38(52.80%)
Site of insertion cannula	
Head, Forehead	8(11.10%)
Upper Arm	29(40.30%)
Forearm	3(4.20%)
Hand	29(40.30%)
Wrist	2(2.80%)
Lower Extremities	1(1.40%)
Duration of cannula (Days)	
1st Day	25(34.70%)
2nd Day	31(43.10%)
3rd Day	14(19.40%)
>4th Day	2(2.80%)
Types of intravenous drugs	
Irritants (Phenol and Capsaicin)	5(6.90%)
Vesicant (Calcium gluconate, Calcium bicarbonate, Potassium chloride etc)	1(1.40%)
Others	66(91.70%)
Medications via IV Cannulation	
Yes	60 (83.3%)
No	12 (16.7%)
Blood Transfusion	
Yes	47 (%65.3)
No	25 (%34.7)

The table presents demographic and clinical characteristics of patients undergoing intravenous (IV) cannulation. It reveals that the majority of patients were aged between 1 month and 4 years, with a slight female predominance (52.8% female vs. 47.2% male). Most patients (61.1%) had additional medical conditions, primarily liver dysfunction (19.4%) and renal problems (18.1%). In terms of cannulation attempts, 45.8% required two attempts, while 34.7% were successful on the first try. The most commonly used cannula size was Gauge 24 (52.8%), with the upper arm and hand being the preferred insertion sites (40.3% each). The duration of cannulation was predominantly 1 to 2 days, affecting 77.8% of patients. A significant majority (83.3%) received medications via IV, and 65.3% underwent blood transfusions.

Frequency of Phlebitis before and after Intervention

Table 4.3: Frequency of Phlebitis before and after Intervention

Phlebitis development	Frequency	Percentage	Mean±SD
Pre Intervention	42	58.3%	3.5 ± 1.2
Post Intervention	30	41.6%	2.5 ± 0.8

The data presented in the table 3 outlines the frequency of phlebitis before and after an intervention aimed at reducing its occurrence. Prior to the intervention, 42 cases of phlebitis were reported,

accounting for 58.3% of the total observations, with a mean severity score of 3.5 and a standard deviation of 1.2. Following the intervention, the incidence of phlebitis decreased to 30 cases, representing 41.6% of the total, and the mean severity score improved to 2.5 with a standard deviation of 0.8. This indicates a significant reduction in both the frequency and severity of phlebitis after the intervention, highlighting its effectiveness in managing this complication.

Table 4.4: Factors associated with Phlebitis Development

	B	S.E.	Wald	df	p-value.	Exp(B)
Presence of comorbidity			13.10	3.00	0.00	
Diabetes	-19.11	40192.97	0.00	1.00	1.00	0.00
Renal problems	1.90	0.92	4.31	1.00	0.04	6.71
Liver Dysfunction	3.07	0.87	12.53	1.00	0.00	21.51
Ward/Unit			5.08	3.00	0.17	
General Pediatric Ward	0.46	0.74	0.38	1.00	0.54	1.58
Nursery ICU	2.24	1.01	4.94	1.00	0.03	9.35
Size of Cannula			8.10	3.00	0.04	
<18 Guage	3.41	1.29	6.99	1.00	0.01	30.14
Guage 20	-0.84	2.48	0.11	1.00	0.74	0.43
Guage 22	-0.37	0.76	0.23	1.00	0.63	0.69
<1 day	-22.17	15945.92	0.00	1.00	1.00	0.00
Constant	19.98	15945.92	0.00	1.00	1.00	477000331.65

The table presents the results of a logistic regression analysis examining factors associated with phlebitis development. Among the presence of comorbidities, renal problems and liver dysfunction are significant predictors, with odds ratios of 6.71 (p=0.04) and 21.51 (p<0.001), respectively, indicating a higher risk of phlebitis. In terms of ward/unit, patients in the Nursery ICU have an increased risk of phlebitis, with an odds ratio of 9.35 (p=0.03), while those in the General Pediatric Ward show no significant association (odds ratio of 1.58, p=0.54). Regarding cannula size, using a cannula size less than 18 Gauge is associated with a significantly higher risk of phlebitis (odds ratio of 30.14, p=0.01), while sizes Gauge 20 and Gauge 22 show no significant associations (odds ratios of 0.43 and 0.69,' respectively). The duration of cannula use of less than one day also shows no significant association (odds ratio of 0.00, p=1.00). The constant term has an exceptionally high odds ratio of 477,000,331.65, which may indicate issues such as small sample size or multicollinearity. Overall, the analysis suggests that renal problems, liver dysfunction, Pediatric ICU admission, and smaller cannula sizes are significant predictors of phlebitis development in this patient population.

Practices of Nurses Regarding Intravenous Cannulation

Table 4.19: Comparison of overall Pre and Post Practice Score of Nurses

Variable	Mean	Std. Deviation	t- Value	P- Value
Pre-Test	8.3611	1.51474	-25.366	.000
Post-Test	15.8889	1.06309		

Table presents that the pretest score was 8.36±1.51 and post test score was 15.89±1.06. the mean difference between pre and posttest was statistically significant. The t-value of -25.366 indicates a substantial difference between the two sets of scores, and the p-value of .000 confirms that this difference is statistically significant.

Discussion

The study shows a significant reduction in both the frequency and severity of phlebitis after the intervention, with incidence dropping from 58.3% to 41.6% and severity scores improving from 3.5 to 2.5. These findings align with previous research, such as Guanche-Sicilia et al. (2021) and Smith et al. (2020), which highlight the effectiveness of educational interventions in reducing phlebitis through improved nursing practices. The observed phlebitis rates are consistent with the literature, and the reduction aligns with studies emphasizing the impact of structured protocols and monitoring (Guanche-Sicilia et al., 2021).

The study also found that younger children were particularly at risk for phlebitis, consistent with Karaoglan et al. (2020). No significant gender differences were observed, supporting findings by Da Silva-Oliveira et al. (2020) that suggest gender is not a major risk factor. The reduction in phlebitis, especially in patients with comorbidities, underscores the importance of tailored interventions, as supported by (Çiftçi et al., 2024) and (Higginson & Parry, 2022).

Successful first-attempt IV cannulation was associated with lower phlebitis risk, while multiple attempts increased it, reinforcing findings by Da Silva-Oliveira et al. (2020). Cannula size also played a role, with smaller gauges like Gauge 22 reducing phlebitis incidence, echoing studies by (Peixoto & May, 2021; Urbanetto et al., 2023)

The intervention was effective in reducing phlebitis related to irritants and vesicants, aligning with Hajiabadi et al. (2023). However, the emergence of higher-grade phlebitis cases post-intervention suggests the need for more focused strategies to prevent severe complications (Endla et al., 2020).

The study also highlighted improvements in nursing practices post-intervention, with significant increases in adherence to best practices, such as hand hygiene and IV cannula maintenance. These findings are consistent with Jones et al. (2021) and (Suliman et al., 2020), who emphasize the importance of continuous education in improving infection control and patient outcomes.

Overall, the intervention effectively reduced phlebitis incidence and severity, particularly in younger children and cases involving irritant drugs. However, the study suggests that more targeted strategies are needed to prevent severe complications, and future research should focus on refining these interventions.

Conclusion

This study of 36 nurses found that an intervention significantly reduced pediatric phlebitis from 58.3% to 41.6%, improved severity scores, and enhanced nursing practices. Factors like age and cannulation attempts influenced phlebitis, with the intervention most effective for irritant drugs and first-day cannulation. Nurses' scores improved from 8.36 to 15.89 post-intervention, demonstrating the benefits of targeted education. The study highlights the intervention's efficacy in mitigating phlebitis and underscores the importance of structured training programs for patient safety. Future research should refine interventions and explore additional factors to optimize outcomes.

Limitations of Study

- One major limitation of this study was to enroll nurses in the study, because they were busy and had high burden of patients.
- Secondly, time was limited, it needed more time to observe the nurse’s practices of IV cannulation.
- Study was conducted in only two public sector hospitals; this does not generalize the results.

References

1. Alisahal, N. A. (2022). *Reducing the development of Phlebitis in adults with Peripheral Intravenous Catheter* Royal College of Surgeons in Ireland].
2. Bibi, A., Ali, M., Pervaiz, S., Mary, S., Mary, M., Bagga, S., Khalid, S., Sami, A., & Khan, R. (2023). Knowledge Regarding Risk Factors of Phlebitis and its Association with Education Among Nurses at Tertiary Care Hospital, Karachi: Knowledge Regarding Risk Factors of Phlebitis. *Pakistan Journal of Health Sciences*, 75-78.

3. Bibi, S., Parveen, K., Abdullahi, D. K., Afzal, M., & Gilani, S. A. (2022). KNOWLEDGE REGARDING PERCEPTION OF RISK FACTORS FOR PHLEBITIS AMONG NURSING STUDENTS. *Globus an International Journal of Medical Science, Engineering & Technology, 11*(1).
4. Çiftçi, M., Akgün, M., & Demirdağ, H. (2024). Frequency of Phlebitis Development and Associated Factors in Hospitalised Adult Patients: A Descriptive and Correlational Study.
5. Daud, A., & Mohamad, F. (2021). Patient characteristics related to phlebitis in the east coast of peninsular Malaysia hospital. *Jurnal Keperawatan Indonesia, 24*(1), 25-31.
6. Del Barco, A. W. (2022). Implementation of a Phlebitis Prevention Bundle on a Neurotrauma Critical Care Unit.
7. Endla, S., Singh, A., Gangawar, R., & Kaur, R. (2020). Effectiveness of Planned Teaching Programme on Knowledge and Practice regarding Cannulation among Student Nurses Studying at Ganga Sheel School of Nursing Bareilly. *International Journal of Advances in Nursing Management, 6*(3), 223-226.
8. Guanche-Sicilia, A., Sanchez-Gomez, M. B., Castro-Peraza, M. E., Rodríguez-Gómez, J. Á., Gomez-Salgado, J., & Duarte-Climents, G. (2021). Prevention and treatment of phlebitis secondary to the insertion of a peripheral venous catheter: a scoping review from a nursing perspective. Healthcare,
9. Higginson, R., & Parry, A. (2022). Phlebitis: treatment, care and prevention. *Nursing times, 107*(36), 18-21.
10. Indarwati, F., Mathew, S., Munday, J., & Keogh, S. (2020). Incidence of peripheral intravenous catheter failure and complications in paediatric patients: systematic review and meta analysis. *International Journal of Nursing Studies, 102*, 103488.
11. Johnson, J. L., Norton, C., Fryfogle, E., Fincher, T. K., & Burmeister, M. A. (2023). The pharmacist's role in reducing infusion-related phlebitis. *American Journal of Health-System Pharmacy, 80*(15), 974-983.
12. Marsh, N., Larsen, E. N., Ullman, A. J., Mihala, G., Cooke, M., Chopra, V., Ray-Barruel, G., & Rickard, C. M. (2023). Peripheral intravenous catheter infection and failure: A systematic review and meta-analysis. *International Journal of Nursing Studies*, 104673.
13. Munoz-Mozas, G., & Gabriel, J. (2024). A safe and effective winged peripheral intravenous cannula for use in clinical practice. *British Journal of Nursing, 33*(2), S12-S19.
14. Noshy, M. K., Mohamed, M. M. A. E.-R., El-Reheem, A., & Abd El, H. A. E.-R. (2023). Peripheral Intravenous Catheter-Related Phlebitis, Infiltration, and Its Contributing Factors among Patients at Port Said Hospitals. *Port Said Scientific Journal of Nursing, 10*(3), 284-308.
15. Peixoto, C., & May, T. (2021). Incidence of phlebitis associated with the use of peripheral IV catheter and following catheter removal. *Revista Latino-Americana de Enfermagem, 24*, e2746-e2746.
16. Smith, J., Hooper, V., & Thyagarajan, R. (2024). Exploration of the Current State of Peripheral Intravenous Catheter Complications and Documentation: A Point Prevalence Study. *Journal of Infusion Nursing, 47*(4), 215-221.
17. Suliman, M., Saleh, W., Al-Shiekh, H., Taan, W., & AlBashtawy, M. (2020). The incidence of peripheral intravenous catheter phlebitis and risk factors among pediatric patients. *Journal of pediatric nursing, 50*, 89-93.
18. Trinidad, M. C. O. (2021). *The Direct Practice Improvement Project on Peripheral Intravenous Infiltration and Extravasation Prevention* Grand Canyon University].
19. Urbanetto, J. d. S., Peixoto, C. G., & May, T. A. (2023). Incidence of phlebitis associated with the use of peripheral IV catheter and following catheter removal. *Revista Latino-Americana de Enfermagem, 24*, e2746.
20. Ventura, D. R. P., Freitas, J. A. S., & Lindo, J. F. F. (2021). Reliability study of Visual Infusion Phlebitis Score Portuguese European version.