International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2025: 7.089

Peripheral Intravenous Cannula Failure, its Contributing Factors, Complications and Treatment among Pediatric Patients in Selected Hospitals of Kolkata

Sanchari Chatterjee[1], Purnima Mondal[2], Rakhi Ghosh[3]

[1]Senior Tutor, Institute of Child Health – Faculty of Nursing, West Bengal, India

[2]Professor, College of Nursing, Calcutta National Medical College and Hospital, West Bengal, India

[3]Joint Nursing Superintendent, Medical College and Hospital, West Bengal, India

Abstract: ***Objectives: To identify the prevalence, contributing factors, complications and treatment of Peripheral Intravenous Cannula failure and to determine the association between Peripheral Intravenous Cannula failure and selected contributing factors and demographic variables among pediatric patients in selected hospitals of Kolkata. Methods: This study was a hospital based exploratory survey. 184 pediatric patients were selected by systematic random sampling technique. Data were collected by using semi structured interview schedule, Infusion Nurses Society Infiltration, Extravasation and Phlebitis scale by Becky Linn, record analysis proforma and observation checklist. Results: Among 184 study participants, 44% pediatuic patients with Peripheral Intravenous Cannula had failure among which 19.7% developed complications and got cold compress as treatment. Among contributing factors, unclean (67%), wet (59%), non-intact (64%) dressing were found for failure patients, antecubital fossa the most common site (33%) of insertion for failure patients. Statistically significant association was found between Peripheral Intravenous Cannula failure and age, number of days from admission and total days of IV therapy, dry dressing, intact dressing, site of insertion of cannula, age-appropriate use of cannula size, antibiotic therapy, blood / blood component transfusion and chemotherapeutic drug infusion at 0.05 level of significance. Conclusion: The frequent and premature peripheral intravenous cannula failure not only interferes with the timely and proper treatment of the patient or the quality of life but it also may lead to some serious complications like infiltration, extravasation or phlebitis which may call on for prolonged treatment procedures by itself.***

Keywords: Peripheral Intravenous Cannula failure, contributing factors, complications pediatric patients, Treatment

1. Introduction

One of the most common medical devices is the Peripheral Intravenous Cannula, which is necessary for the insertion in many pediatric acute care patients in order to administer medication, fluids and electrolytes to veins.

Even though it's a routine process, placing a Peripheral Intravenous Cannula can be challenging and time-consuming, especially for newborns and young children in emergency rooms because of their smaller, less noticeable veins, decreased co-operation during the procedure and parental stress. Only 40%-50% of pediatric peripheral intravenous cannula placements are successful on the first try, and success usually takes 20-30 minutes.[1]

Complications are common during PIVC therapy, and many survey findings revealed that around a quarter of adults and a third of children with a PIVC experienced complications post-insertion, many of which were potentially preventable and could be mitigated by more active involvement of the patient/family in their care.[2]

Most previous PIVC studies and guidelines have focused on adult patients, there are relatively few PIVC studies that are focused on pediatric patients, and these are focused mainly on PIVC insertion, bloodstream-associated infection, and flushing, while studies on fixation in pediatric patients are rare.

This study aims to assess the prevalence of Peripheral Intravenous Cannula (PIVC) failure, its contributing factors, complications and treatment among pediatric patients in selected hospitals of Kolkata.

2. Methods

This study was a hospital based exploratory survey conducted at pediatric medicine and surgery wards of selected hospitals of Kolkata between February 2024 to March 2024. During this study period, 184 pediatric patients were included in the study and were assessed for Peripheral Intravenous Cannula failure, contributing factors, complications and treatment by semi structured interview schedule, record analysis proforma and observation checklist.

The information regarding prevalence of Peripheral Intravenous Cannula failore were got by interviewing the primary care giver present with the baby.

All the pediatric patients with the predetermined age group with Peripheral. Intravenous Cannula were included in the study throughout the time allotted for specific settings.

Failure patients were identified by observing the study participants for 72 hours after insertion of Peripheral Intravenous Cannula.

Third tool was administered on completion of 72 hours of successful cannulation for non- Peripheral Intravenous Cannula failure patients and just before the removal of cannula for Peripheral Intravenous Cannula failure patients.

The tool for complications and treatment were administered only on the failure patients by observing and recording after removal of failed cannula.

Data Analysis:
Analysis of the data was presented in the form of table and diagram. Data was analysed using both descriptive and inferential statistics.

3. Results

In this study, total 305 successful IV cannulation were done among which 44% developed failure and 56% had no Peripheral Intravenous Cannula failure.

184 study participants were assessed and among them 28% of the study participants who had Peripheral Intravenous Cannula were within the age group 6 months 1 day-12 months.61% were boy baby, 75% were admitted in medicine ward, 23% were admitted with respiratory disorder and 56% were admitted for more than 5 days on the day of data collection, majority of the baby i. e 65% had optimal body weight according to age and 59% baby received IV therapy up to 05 days.

For Peripheral Intravenous Cannula failure 67% study participants did not have clean dressing, 59% study participants did not have dry dressing and 64% study participants did not have intact dessing, 33 % study participants had cannula in antecubital fossa followed by 20 % in dorsum of hand and least i. e. 12% had in lower arm, 89% had splint under insertion site. (Table 1.)

Table 1: Frequency and percentage distribution of contributing factors of Peripheral Intravenous Cannula failure among pediatric patient, $n_{PIVC\ failure} = 81$

Contributing factors	Peripheral intravenous cannula failure			
	Yes		No	
	Frequency	Percentage	Frequency	Percentage
Condition of dressing				
Clean	27	33	54	67
Dry	33	41	48	59
Intact	29	36	52	64
Site of insertion -				
Dorsum of hand	16	20	-	-
Wrist	14	17	-	-
Antecubital fossa	28	33	-	-
Lower arm	10	12	-	-
Foot	13	16	-	-
Splint under insertion site	72	89	9	11
Cannula palpable	6	7	75	93
Device used for medication/ fluid administration				
Pediatric drip set	81	100	-	-
Infusion pump	27	33	-	-
Syringe pump	53	65	-	
Age appropriate size of cannula used	37	46	44	54

In peripheral intravenous cannula failure 93% patient's cannula could not be palpated. In case of device use for medication / fluid administration pediatric drip set were used in 100 % cases in peripheral intravenous cannula failure, infusion pump was used for 33% peripheral intravenous cannula failure patients and syringe pump was used for 65% failure patients.

Data also shows that in case of 54% cases appropriate gauze of cannula were not used among peripheral intravenous cannula failure patients. (Table 1 cont.)

It was also found that 98% study participants got antibiotic therapy among Peripheral Intravenous Cannula failure patients. Under antibiotic therapy, 76 % study participants got Inj. Meropenem which was in majority and 46% got Inj. Netilmycin which was least among peripheral intravenous cannula failure patients. Crystalloid infusion therapy was given to 94% Peripheral Intravenous Cannula failure patients.59 % cannula failure patient got blood and / blood component transfusion.

Data also shows that 14 % cannula failure patient got chemotherapeutic drug as a part of treatment.

Table 2: Frequency and percentage distribution of complications of pediatric patients with peripheral intravenous cannula failure, $n_{complication} = 16$

Complications	Frequency	Percentage
Infiltration, Extravasation	16	100
Grade I	12	75
Grade II	4	25
Phlebitis	-	-

Data in table 2 indicates that infiltration and extravasation was found in 100 % of cases who developed complications after cannula failure among which 75 % was grade I. No cases of phlebitis was found within 72 hours.

For treatment of complication, among 16 Peripheral Intravenous Cannula failure pediatric patients who developed complications 87% patient got elevation of limb as a treatment, 100% patient got cold compression among which 37% patient advised it 2times/day and 63% advised 3 times/day. Topical heparin ointment was advised for 81% patients among which 2times /day dose frequency was given to 31 %, 3 times/day was given to 23 % patients and 46% patient got this treatment 4 times/day. The data also depicts that 14% patients got MgSO4 as treatment of complications.

For finding association, Chi -square values were computed to find out the association between Peripheral Intravenous Cannula failure and selected demographic variables. In these values, age ($p<0.01$), number of days from admission ($p<0.03$) and total days of IV therapy ($p<0.09$) were statistically significant at 0.05 level of significance.

Chi- square values were computed to find out the association between Peripheral Intravenous Cannula failure and contributing factors. In these values, dry dressing ($p< 0.001$), intact dressing ($p <0.002$), site of insertion of cannula ($p< 0.66$), age appropriate use of cannula size ($p< 0.01$), antibiotic therapy ($p<0.01$), blood and/ blood component transfusion ($p< 0.02$) and chemotherapeutic drug infusion ($p< 0.05$) were found to be statistically significant at 0.05 level of significance.

4. Discussion

In relation to the first objective, the findings of the present study revealed that prevalence of Peripheral Intravenous Cannula failue was 44% which is supported by a study conducted by Kumar D. (2020) stated that baseline Peripheral Intravenous Cannula failure rate was 48.5% in a pediatric critical care unit of Eastern India.[3]

The current study showed that 59% failure patient were transfused with blood and / or blood component and crystalloid infusion was administered to 94% failure patients. These findings are supported by the study conducted by Mewahegn A A. et al. (2021) where they showed that the reason for removal of peripheral intravenous cannula was statistically significant with crystalloids infusion ($p= 0.04$), blood transfusion (AOR = 2.407; 95% CI (1.005–5.572).[4]

The present study showed that, 19.7 % study participants developed complication i. e-infiltration and extravasation among them 75% had grade I. These findings was supported by a study conducted by Qin R. K. et al. (2021) where they showed that the most frequent cause of PIVC failure was infiltration (33.3% RR: 12.0; P =.001).[5]

According to an article published by Children's Minnesota (2023) the recommended treatment for infiltration and extravasation are elevating the site as much as possible, apply warm or cold compress for 30 mins every 2-3 hours which supports the present study findings that showed 87% failure patients advised elevation of affected limb and 100% failure patients advised cold compress among which 63% were advised for 3 times/day.[6]

5. Limitation

The following limitations are observed in the study:

- Study findings can not be generalized beyond tertiary government hospitals of Kolkata.
- Certain areas could not be studied in depth i. e-affected limb elevation time.

6. Conclusion

The issue and its implications has been left neglected and are often not addressed in a proper manner and orientation. The peripheral intravenous cannula failure among pediatric patients, often putting on the burden of the comorbidity and serious sequelae that affects the treatment outcome and the overall wellbeing of the patient. The prolongation of hospital stay of the patient has some serious impact on the sustainability of the intravenous cannula. It is noted from the study that the infusion of certain drugs and intravenous components as well as transfusion of blood and blood products hampers the longevity of the cannula.

Acknowledgement
The present study has been completed under the guidance and supervision of Ms. Purnima Mondal, Professor, College of Nursing, Calcutta National Medical College and Hospital, Kolkata -73.

All the MSVP of the selected hospitals for enormous support and co -operation.

References

[1] Hollaway W., Broeze, C., Borland, M. L. (2017). Prospective observational study of predicted usage of intravenous cannulas inserted in a tertiary paediatric emergency department. Journal of Emergency Medicine Australasia, 29 (6), 672–677. https: //doi. org/10.1111/1742-6723.12881
[2] Cooke M, Ullman AJ, Ray-Barruel G, Wallis M, Corley A, Rickard CM. Not “just” an intravenous line: Consumer perspectives on peripheral intravenous cannulation (PIVC). An international cross-sectional survey of 25 countries. PLoS One.2018; 13 (2): e0193436. Available from: http: //dx. doi. org/10.1371/journal. pone.0193436.
[3] Diwakar K, Kumar S, Srivastava P, Uddin MW, Mishra S. Reduction in the incidence of infusion-related phlebitis in a pediatric critical care unit of Eastern India: A quality improvement initiative. Med J Armed Forces India.2024; 80 (1): 46–51. Available from: http: //dx. doi. org/10.1016/j. mjafi.2021.07.010
[4] Mewahegn AA, Tadesse B, GebreEyesus FA, Tarekegn TT, Amlak BT, Emeria MS, et al.
[5] Lifespan and associated factors of peripheral intravenous cannula among hospitalized children in public hospitals of the Gurage zone, Ethiopia, 2021. Pediatric Health Med Ther.2022; 13: 81–93. Available from: http: //dx. doi. org/10.2147/phmt. s351759

[6] Qin KR, Ensor N, Barnes R, Englin A, Nataraja RM, Pacilli M. Standard versus long peripheral catheters for multiday IV therapy: A randomized controlled trial. Pediatrics.2021; 147 (2). Available from: http: //dx. doi. org/10.1542/peds.2020-000877
[7] Children's Minnesota. https: //www.childrensmn. org › Infiltration and extravasation care