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**Original Research Article**

# Incidence of phlebitis among children having peripheral intravenous line in selected hospital, Siliguri

**Primi Kumar[1]*, Ankita Dhar[2], Susmita Banik[2], Anannya Saha[2], Amrita Banik[2], Prity Biswas[2], Dipika Roy[2], Nitushree Mondal[2], Sabina Khatun[2], Aditi Ghosh[2], Riya Chanda[2]**

[1]Department of Pediatric Nursing, Anandaloke Institute of Nursing Education, Siliguri, West Bengal, India
[2]Anandaloke Institute of Nursing Education, Siliguri, West Bengal, India

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***Correspondence:**
Primi Kumar,
E-mail: primi11may@gmail.com



## ABSTRACT

**Background:** Vascular access is the most common and widely used medical device in hospital setting especially peripheral intravenous line rather than central venous line and it is more essential in the pediatric and newborn group in accessing and maintaining a safe and reliable venous access for continuous management. Though it is the most common procedure, complication like phlebitis, extravasation, induration, dislodgement related to PIVC are also high.
**Methods:** A prospective cohort study which included 86 children of age 1-7 years admitted in pediatric ward in selected hospital, Siliguri during the year 2023 in the month of May and June. Objective of the study was to find out the incidence of phlebitis among children admitted in pediatric ward. Observational method was adopted to collect data from the participants. Jackson's VIP scale and FLACC scale was used to collect data along with demographic variables and peripheral intravenous catheter characteristics.
**Results:** The study revealed that all the 86 children developed phlebitis where 64% of children developed phlebitis Grade 2 of phlebitis and 19% grade 3 on day 2 from the day of insertion where on day 3 8% had grade 2 and 9% had grade 3. The mean duration of PIVC was 53.11±0.87 hours and the major risk factor associated with phlebitis was site of insertion (OR=33.8, 95% CI-0.5, 207).
**Conclusions**: By identifying early signs of phlebitis among children, one can manage it at appropriate time and can reduce the further complication related to the PIVC.

**Keywords**: PIVC, Incidence, Phlebitis, Children

## INTRODUCTION

In the hospital settings most widely used medical device is vascular access (peripheral intravenous catheter, central venous catheter) and yet most vital element of care. 80% of the patients who are hospitalized have PIVC in situ for a particular time.[1] Vascular access provide easy access for administration of drugs, fluids, parenteral nutrition, blood products and to monitor the hemodynamic status for hospitalized people.[1,2]

Vascular access can be determined in children by two means first one in the peripheral intravenous catheter (PIVC), the most common access and the second one is central venous catheter (CVC). CVC is the stable and efficient one and only used to manage critical cases. The chance of phlebitis in the second one is for more less than the first one. Various studies comparing the site and duration of vascular access it was seen that peripheral veins for the neonates and children are soft and fragile and they even possess high difficulty in cannula fixation.[3] PIVC are the indwelling, single lumen plastic conduits which are introduce directly into peripheral veins. It comes into various sizes, starting from 14 gauge (largest) to 26 gauge (smallest). Whereas 22-, 24- and 26-gauge cannula are usually used in pediatric and newborn. It becomes

more essential when it comes to neonates and pediatric group in accessing and maintaining a safe and reliable venous access for continuous management. A fully functional PIVC is essential for long term administration of medication and fluids. Though PIVC is the most common procedure carried out in hospital and despite it's important in medical practice, the complications related to PIVC are also more in numbers, especially in pediatric and newborn group as their veins are so fragile. So, the insertion of IV cannula also becomes difficult.[4] Besides that high percentage of adipose tissue and thinner venous network.

Various complications are associated with PIVC insertion. Among the complications most common is the phlebitis.[5] Phlebitis is defined as inflammation of vein, which is further categorized as chemical, mechanical and bacterial phlebitis. Solutions such as antibiotics, blood products, glucose containing fluids and rapid infusion rates or irrigating medication causes chemical phlebitis. Mechanical phlebitis occurred when a cannula is for long period, cannula in flexed areas or joints are involved, catheter gauges larger than the vein and poorly fixed catheters. Bacterial phlebitis results from poor hand hygiene, not maintaining aseptic technique, failure to check properly all equipment before use and failure to recognize early sign and symptoms of phlebitis. Phlebitis is characterized by reddened warm area around the site of insertion or along the path of vein, pain or tenderness at the site or along the vein.[1] According to the CDC guidelines cannula should be removed within 72-96 hours to reduce the risk and complications but for children no such recommendation period have provided.[6] However, 3.2% to 71.25% of hospitalized patients receiving IV therapy through PIVC develop phlebitis.[1] Another study conducted in Jordan on incidence of peripheral intravenous catheter related phlebitis and risk factors, it was seen that among 307 children from 5 government hospitals, 164 (53.4%) children develop phlebitis.[4]

### *Aims and objectives*

The objective of the present study was to identify the incidence of phlebitis, to find out the association of phlebitis with demographic variables and between incidence of phlebitis with peripheral IV-line characteristics.

## METHODS

The period of present study was from the month of March 2023 to July 2023.

### *Data collection period and population*

The data was collected in the month of May to June, 2023 in Siliguri District Hospital, Darjeeling. Prospective cohort design was adopted and convenient sampling technique was used for collecting data from the participants by observational method. Total of 86 children of age 1-7 years having newly inserted peripheral intravenous catheter were enrolled in this study. Informed written consent was obtained from the legally authorized representative (LAR) of the participants before collecting data by taking signature or thumb impression of LAR. The study was approved by Institute ethical committee, Anandaloke institute of nursing education, Siliguri and permission for collection of data was taken from the selected hospital.

### *Inclusion and exclusion criteria*

Children of age 1-7 years admitted in pediatric ward had newly inserted peripheral intravenous catheter in the ward and are willing to participate with written consent are included in the inclusion criteria. Whereas child with skin disease, burns, history of allergy, children getting blood or blood product, had 26 gauze cannula and severely ill child were excluded in this study.

### *Study instrument*

The study instrument was divided into three sections: Section A demographic proforma and peripheral intravenous catheter characteristics: It deals with demographic variables of the hospitalized child. It included age of the child, gender of the child and diagnosis as infectious and non-infectious and in the peripheral intravenous line characteristics its included- size of insertion, joint involved, size of cannula, type of IV drug, type of infusion, cannula flush before administration.

Section B: Jackson's Visual infusion phlebitis (VIP) scale: Jackson's visual infusion phlebitis scale is standardized tool consist of 6 components starting from 0 to 5. Where 0 is the lowest means no phlebitis and 5 means severe phlebitis and from grade 2 considered early signs of phlebitis which need to be intervened. Intravenous line was monitored for 3 days in 2 shifts at a uniform hour.

Section C- FLACC scale: FLACC Scale was used to assess to level of pain of the child for the pain component in Jackson's VIP scale. The FLACC scale or "Face", "Legs", "Activity", "Cry", "Consolability" scale is a measurement used to assess pain for children between the ages of 2 months and 7 years or individuals that are unable to communicate their pain. The scale is scored in a range of 0 -10 with 0 representing no pain, 1-3 representing mild pain, 4-6 representing moderate pain and 7-10 represents severe pain.

### *Data collection procedure and analysis*

Data collection procedure: Data was collected in pediatric ward of selected hospital Siliguri. Formal written permission was obtained for conducting the study from the institute and hospital. The eligible children were identified by the investigators based on inclusion and exclusion criteria. Written informed consent was obtained from the mothers or Legally Authorized Representative (LAR) after explaining the study in verbal forms. After getting written

informed consent, data was collected from the children from the first day of newly inserted peripheral IV line and date of insertion was labeled near to the IV line. Assessment was done and noted twice a day at uniform interval and at the same time till 3rd day of IV line for occurrence of phlebitis. Pain was assessed by the FLACC scale. Demographic and peripheral intravenous line characteristics were collected from the child's mother and case sheet.

***Data analysis***

The data collected from the subjects were transferred into master sheet and analysed in Microsoft Excel. The categorical variables such as age, gender & diagnosis of the children was expressed in frequency and percentage. The distribution of data on phlebitis will be expressed in terms of mean with standard deviation. The association of Incidence of phlebitis with demographic variables was analysed by Chi Square or Fisher's exact test. The measurement of effect of possible risk factors for incidence of phlebitis with Peripheral intravenous line characteristics was analysed by Odds ratio.

## RESULTS

Total of 86 children were enrolled in this study and the grades of phlebitis was considered where intervention was needed (grade 2 of Jackson's VIP scale). All the children 86 (100%) developed phlebitis from 2nd day of insertion. 55 (64%) children developed grade 2 phlebitis and 16 (19%) developed grade 3 in day 2 and on day 3rd 7 (8%) children had grade 2 and 8 (9%) had grade 3 phlebitis (Fig 1).

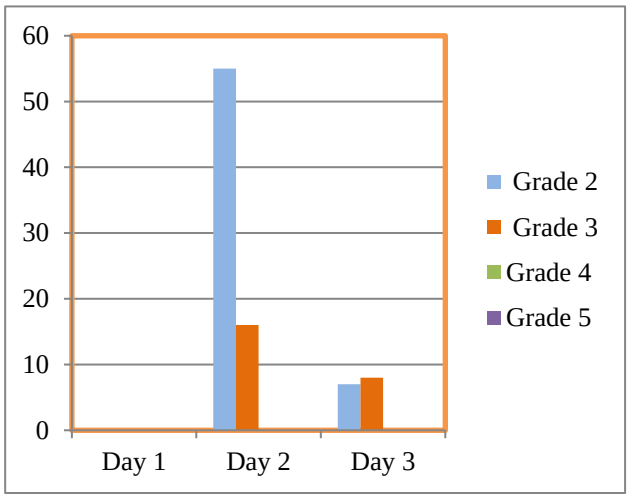


**Figure 1: Incidence of phlebitis according to the day of occurrence.**

The mean indwelling time for PIV line was 53.11±0.87 hours. A significant association was found between incidence of phlebitis with type of infusion flushing of cannula before administration and the reason for removal. ($p<0.05$). Measuring the effect of risk factors, site of insertion showed higher risk factors for the cause of phlebitis (OR=33.8, 95% CI-0.5,207) (Figure 2). The demographic data and peripheral intravenous line characteristics details which was taken from mother or caretaker (legally authorized representative) and case sheet it was seen that majority of the children 48(55.8%) children belonged to 1-3 years of age, 38 (44.2%) children belong to 4-7 years of age and out of 86 children 45 (52.3%) were female and 41 (47.7%) were male. While discussing about the diagnosis, 68 (79%) children were diagnosed as and 18 (21%) were non-infectious. Related to the site of insertion, 84 (97.7%) children had peripheral intravenous line in dorsum of hand and only 2 (2.3%) having in the dorsum of foot. Concerning to the joint of involvement 78 (90.7%) children's joint was not involved and for only 8 (9.3%) joint was involved. Regarding size of cannula 22G was inserted to 14 (16.3%) children and 24G was inserted to 72 (83.7%) children. 79 (91.9%) children were getting antibiotics and 7 (8.1%) were on other IV drugs (antiemetics and anticonvulsive drugs). Out of 86 children, 83 (96.5%) children's cannulas were flushed before administration whereas for only 3 (3.5%) children's cannulas were not flushed. Major reason for removal of cannula was phlebitis 66 (76.8%) followed by discharge of child 10 (11.6%), occlusion 8 (9.3%) and dislodgement 2 (2.3%) (Figure 3) (Table 1).

**Table 1: Distribution of data for demographic and peripheral intravenous line characteristics (n=86).**

| Characteristics | Categories | N | % |
|---|---|---|---|
| **Age** | 1-3 | 48 | 55.8 |
| | 4-7 | 38 | 44.2 |
| **Gender** | Male | 41 | 47.7 |
| | Female | 45 | 52.3 |
| **Diagnosis** | Infectious | 68 | 79 |
| | Non-infectious | 18 | 21 |
| **PIV line characteristics** | | | |
| **Site of insertion** | Dorsum of hand | 84 | 97.7 |
| | Dorsum of foot | 2 | 2.3 |
| | Antecubital | 0 | 0 |
| **Joint involved** | Yes | 8 | 9.3 |
| | No | 78 | 90.7 |
| **Size of cannula** | 22 | 14 | 16.3 |
| | 24 | 72 | 83.7 |
| **Type of IV drug** | Antibiotic | 79 | 91.9 |
| | Other (Antiemetic or Anticonvulsive) | 7 | 8.1 |
| **Type of infusion** | Continuous | 72 | 83.7 |
| | Intermittent | 14 | 16.3 |
| **Cannula flush before administration** | Yes | 83 | 96.5 |
| | No | 3 | 3.5 |
| **Reason for removal** | Phlebitis | 66 | 76.8 |
| | Occlusion | 8 | 9.3 |
| | Discharge of the patient | 10 | 11.6 |
| | Dislodgement | 2 | 2.3 |

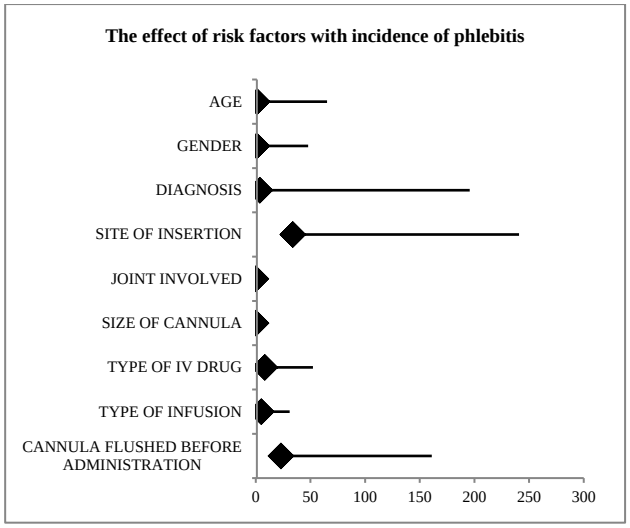


**Figure 2: Measuring the effect of risk factors with incidence of phlebitis.**

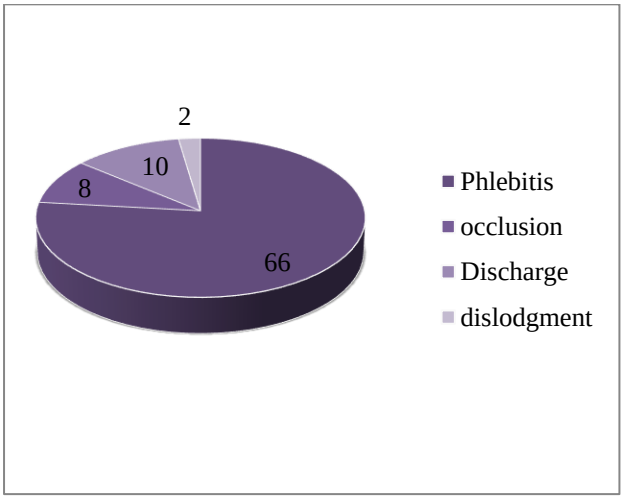


**Figure 3: Reason for removal of peripheral intravenous line.**

## DISCUSSION

Hospitalized children are in need of effective IV access which is reliable and long term and the most common is the peripheral intravenous line. Phlebitis is the common and painful complication of peripheral intravenous line and reduces the peripheral intravenous line dwell time despites its benefits of IV therapy. The result of this study gives a baseline data to understand the pattern of phlebitis with the help of Jackson's VIP scale. It was observed that grades of phlebitis increase with each progressing day of IV cannulation. Here in this study, grades of phlebitis were assessed where need of intervention was required. With the early detection of phlebitis improves both child outcome and nursing care.

The first objective was to find out the incidence of phlebitis among children having peripheral intravenous line: In this study all the children involved developed phlebitis on 2nd and 3rd day of PIV line insertion where majority of the children, 55 (64%) were having phlebitis grade 2 in day 2 whereas 16 (19%) children were having phlebitis grade 3 in day 2. On day 3 only 7 (8%) children had grade 2, 8 (9%) had grade 3 and 0% children reached to VIP scale grade 4 and grade 5. The study also showed that mean score of duration of PIV line patency is 53.11±0.87 hours. The findings were supported by a study conducted by Tefera et al where 380 pediatric patients were enrolled. The incidence of phlebitis in this study was 337% the indwelling time of IV cannula was 48-72 hours.[1] Similarly, a study conducted by Nagpal et al revealed that incidence of phlebitis as 75.25% and grade 2 phlebitis was most common 46.25%. The study concluded that grades of phlebitis increases after 24 hours of IV canulization which is similar to the present study findings.[8] Further quasi experimental study conducted in Iran, Showed that 89.1% was occurrence of phlebitis in control and 45.9% in interventional group.[7] Another study conducted by Bitencourt et al revealed that incidence of phlebitis where 26% and the mean dwell time of the device was 49.98±43.19 hours.[2] In addition, a study by Suliman M showed that 53.4% of children developed phlebitis.[4]

The second objective was to find association between incidence of phlebitis with demographic variables and peripheral intravenous characteristics: From the present study, significant association was found between incidence of phlebitis with flushing of cannula before administration (p=0.01), type of infusion (p=0.04) and the reason for removal of cannula (p=0.05). A study conducted in Haryana by Nagpal P has also found significant association of grades phlebitis with administration of free water solutions, potassium chloride and IV fluid informed in 24 hours which is supporting the present study findings.[8] Another study conducted by Jacinto AKL et al, showed that the occurrence of phlebitis did not had any association with demographic variables.[9] The third objective was to measure the effect of risk factors for incidence of phlebitis with demographic variables and peripheral intravenous line characteristics: Here, in this study showed that the insertion of cannula are most likely cause of phlebitis (OR=33.8, 95% CI 0.5, 207). By comparing, the study conducted in Indonesia by Hidayat AAA et al demonstrated that the location and duration of infusion were more influential on the incidence of phlebitis in children aged 1 month to 10 years (Y=1,737+0,600).[5] Likewise, a prospective study by Karaoglan et al logistic regression revealed that age in month, hospitalization in a surgery ward and placement of the catheter in the veins of anticubital fossa were significant independent risk factors for the development of phlebitis (p<0.001).[10]

### *Limitations*

The study was confined to the children of age 1-7 years admitted in pediatric ward in Siliguri district hospital having peripheral intravenous catheter and who are willing to participate in the study. It was also limited to only one hospital with limited number of children.

## CONCLUSION

The present study concludes that children will get phlebitis which need to be intervened at day 2 of insertion. The indwelling mean time of PIV line was 53.11±0.87 hours. It was also found that there was significant association of incidence of phlebitis with the type of infusion flushing of cannula and reason for removal of cannula whereas site of insertion was considered major cause of phlebitis in this study. By identifying the early signs of phlebitis or complications related to PIVC one can manage to provide appropriate action as early as possible.

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