



INCIDENCE AND RISK FACTORS OF PERIPHERAL INTRAVENOUS CANNULATION ASSOCIATED INFECTION AND INFLAMMATION

Nursing

Elizabeth M Varghese

Prof & Principal, College of Nursing, Lucknow

Aruna KR*

Prof, College of Nursing, Lucknow *Corresponding Author

ABSTRACT

Background Peripheral intravenous cannula is a critical tool in today's healthcare settings. A study was conducted to assess the incidence and risk factors of peripheral intravenous cannulation associated infection and inflammation among children admitted in Pediatric Ward of a Tertiary Care Hospital in Mumbai.

Objectives :To assess the incidence of peripheral intravenous cannulation site infection/inflammation among children who underwent peripheral intravenous cannulation, To identify the risk factors, To suggest changes in practices.

Methodology :A non experimental observational design was used in this study. The calculated sample size was 125. All children below age 144 months admitted in paediatric ward of a tertiary care hospital over a period of three months were taken as sample.

Results: The study revealed incidence of 2.4% phlebitis. There were statistically significant association between types of gloves used and phlebitis.

KEYWORDS

Peripheral intravenous cannulation, Infection , Inflammation

INTRODUCTION

Peripheral intravenous cannula is a critical tool in today's healthcare settings. It is the most commonly used device for vascular access, with more than 300 million used each year in India alone¹. Infection, either local around the intravenous catheter insertion site or systemic in the blood stream, can be a potential complication with any intravenous catheter. Approximately 90% of all patients entering the hospital environment for care have some form of intravenous therapy during their hospital stay³. A safe and stable vascular access by intravenous catheter is essential to the practice of modern medicine. Catheter related infection account for approximately 30% of all hospital acquired infections and can be reduced by scrupulous adherence to asepsis during catheter insertion techniques and subsequent care.⁵

Peripheral intravenous cannula insertion penetrates the skin, creating an open pathway for microorganisms to enter the bloodstream. Skin antiseptics cannot eliminate all organisms in the lower layers of the skin. Phlebitis is very suggestive of an intravenous related origin of infection². The intravenous therapy performed in children is considered as a complex procedure, and may exist determinant aspects in the development of complications such as catheter used, the technique of insertion and catheter stabilisation, the insertion site, the characteristics of the infusion solution and the total duration of use of the device.⁷

PROBLEM STATEMENT

A study to assess the incidence and risk factors of peripheral intravenous cannulation associated infection and inflammation among children admitted in Pediatric Ward of a Tertiary Care Hospital in Mumbai.

OBJECTIVES

- To assess the incidence of peripheral intravenous cannulation site infection/inflammation among children who underwent peripheral intravenous cannulation.
- To identify the risk factors
- To suggest changes in practices.

METHODOLOGY

A non experimental observational design was used in this study. Sample size collection was calculated using Epi Info Ver 7. 95% two sided confidence level and 80% power was maintained. The sample size was calculated based on a background thrombophlebitis rate of 9% and decrease in rate to 1% with good asepsis practices. The calculated sample size was 125. All children below age 144 months admitted in paediatric ward of a tertiary care hospital over a period of three months were taken as sample. Children with bleeding disorder, Diabetes mellitus, Immunocompromised state or admitted for one day for any diagnostic investigation (MRI, DTPA, PET scan, CT scan) were excluded from the study.

The tool used for the study was observation check list which consisted of three parts. **Part I: Demographic Data** – It included date of admission, age, sex, weight, diagnosis of child, whether operated, whether immune-compromised or immune-suppressed, presence of any other invasive device and the prescribed treatment. **Part II: Information related to cannulation** - which included date, time, size of cannula, site, number of attempts, cleaning solution used, type of adhesive used, gloves used, change of cannulation, reason for change. The condition of cannula site was observed four times a day for three consecutive days i.e. day 1, 2 and 3 at 0530hrs, 1330hrs, 2130hrs for redness, swelling, hardness, warmth and pain.(VAS score). **Part III : Vascular Access Score (VAS)** was adopted from British Journal of Nursing⁷. If the was VAS score was more than 04 the IV was discontinued and the tip of cannula and blood culture was sent for presence of infection. If sent for culture then the details of organism grown after 48hours and its sensitivity to drugs was recorded. Complaints of child/parents were also considered as relevant observational data.

Necessary permission to conduct the study was obtained from ethical committee. Informed verbal consent was taken from mothers of all children before observation. Confidentiality of the samples was maintained.

ANALYSIS AND INTERPRETATION

Collected data was tabulated and entered in excel sheet. Descriptive statistics was used to interpret the demographic variables. Chi square test was used to find the association of specific demographic variable with the VAS score. A score of 01 was allocated to presence of each of the five components- redness, swelling, hardness, warmth and pain. The interpretation of the VAS score was as follows: Grade 0 = No phlebitis, Grade I = Possible phlebitis, Grade II = Early phlebitis, Grade III =Medium phlebitis, Grade IV = Advanced phlebitis, Grade V = Advanced stage of thrombophlebitis.

A total of 125 observations were made out of which 34(27.2%) were female children and 91(72.8%) were male children. Among them maximum (32%) were schoolers.

Maximum number of children were admitted for medical conditions (84%). None of the children were immune-compromised or in immune-suppressed state. It was also found that the common diagnosis among children were fever (21.6%), seizure (9.6%), head injury (6.4%), acute gastroenteritis (3.2%) and fracture (5.6%).86.4% of the cannula was inserted in first attempt. In 56.8% cases gloves were not used. Elastopaster was the choice of material for securing the cannula in 58.4%. 4(2.4%) samples showed the signs of advanced phlebitis. The study revealed incidence of 2.4% phlebitis. It was found that 32% of the observations did not have any sign of phlebitis even on third day of insertion. 41.6% developed first sign of phlebitis (Grade I) on day 2,

28% developed early phlebitis (Grade II) on second day. 3.2% observations revealed medium thrombophlebitis (Grade III). (Fig 1).

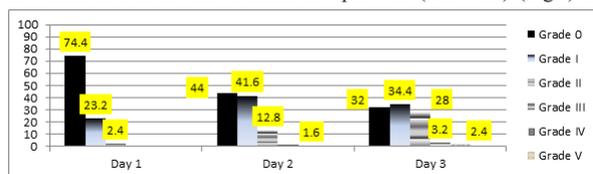


Fig 1: Incidence of peripheral intravenous cannula infection/inflammation based on vascular assessment score

There were statistically significant association between sterility of gloves used and phlebitis (Table 1) as the infection rate was found to be less among the samples in which sterile gloves were used (p=0.03).

Table No.1: Association of peripheral IV cannula infection and inflammation with use of sterile gloves vs clean gloves.

Gloves Used	Developed Infection	No infection	Total	Pvalue
Clean gloves	10	08	18	0.03
Sterile gloves	09	27	36	
TOTAL	19	35	54	

(n =125)

DISCUSSION

Approximately 90% of all patients entering the hospital environment for care have some form of intravenous therapy during their hospital stay. A safe and stable vascular access by IV cannula is essential to the practice. However, the insertion and daily use of these devices is associated with risk and complications that can significantly impact the clinical status and outcome of the patient. [8]

Evidence suggests that the addition of drugs such as heparin and hydrocortisone can reduce the incidence of phlebitis (Ikeda et al, 2004); patients on intravenous steroid therapy have a lower incidence of steroid therapy have a lower incidence of phlebitis (Kohn et al, 2009). However, this applies only to the administration of antineoplastic drugs and so is limited to patients receiving cancer chemotherapy. To avoid chemical phlebitis, the possibility of bringing drug pH or osmolarity in line with physiological ranges should be explored (Kuwahara et al, 1999). For example, patients undergoing antibiotic or potassium therapy have a higher phlebitis risk due to the low pH of these solutions and neutralising such solutions may help prevent phlebitis (Kuwahara et al, 1999), although this is not usually done by nurses. Extravasations of certain medications into surrounding tissues can cause sloughing, nerve damage, and scarring. In this study common drugs administered were Ceftriaxone (16.0%), Amikacin (14.4%), Augmentin (5.6%) and Magnex (4.80%).

This study revealed an incidence of 2.4% phlebitis (Grade IV as per vascular assessment score). It is similar to the findings of study conducted by Amanda et al [7] which revealed that among 338 pediatrics surgical patients in Sao Paulo tertiary level hospital the incidence of phlebitis was 2.7%. It was found that 32% of the observations did not have any sign of phlebitis even on third day of insertion. 41.6% developed first sign of phlebitis (Grade I) on day 2, 28% developed early phlebitis (Grade II) on third day. 3.2% observations revealed medium thrombophlebitis (Grade III).

No gender differences were observed in the development of phlebitis which is congruent with the study of Petro velga et al. [12] in which study showed that correlation between age and phlebitis was not significant among the sample size of 317. In our study out of 125 samples (children between 1 month to 144 months) the maximum samples were from the age group of 72 months to 144 months.

In our study the site which was used frequently for cannulation was right dorsum of the palm i.e. 51.2% . No statistically significant differences were observed between the specific anatomical site used (hand and forearm) and phlebitis which is congruent with studies by Regueiow Pose et al (2005) and Owens et al (1998) [6] in which on catheterizing upper extremities, patients had less than 72% chances of developing phlebitis. However, dorsal sides of the hand veins are predictive of high risk of thrombophlebitis. They concluded that catheter insertion in flexion or high mobility areas contributes to the development of traumatic phlebitis. In our study sample, proper splinting of the part was done which had lowered the incidence of thrombophlebitis.

Most of the samples had IV cannula of 22 and 24 gauge. Size of catheter has not influenced phlebitis. And similar result was found in other study of Salgueiro Oliveria Anabela. et al. [12] which recommended use of smaller gauge catheters as these allow blood to flow in the adjacent tissue, preventing vein damage.

The effect of number of attempts taken for insertion of cannula was also considered. The effect was found insignificant. And also no other study showed any association between thrombophlebitis and number of attempts. It was worthwhile to note that in maximum number of samples cannula was inserted on first attempt itself (86.4%).

In most of the cases the material used to secure the catheter was Elasto - plaster (58.4%) . The study done by Salgueiro Oliveria Anabela. et al. [12] compared use of sterile gauze with a transparent film and concluded that there were no statistically significant difference between both type of dressing and early detection of phlebitis. According to Saini Ruchi. et al. [11], it was observed that 35% of the cases were affected with infiltration and phlebitis due to the soiling of the securement device.

In our study sterile gloves were used only in 28.80% of IV cannulation. Clean gloves were used for 14.40% and in maximum number of observations no gloves were used (56.80%). There were statistically significant association between types of gloves used and phlebitis (Table 1) as the infection rate was found to be less among the samples in which sterile gloves were used (p = 0.03).

The present study reported that duration of cannula placement ranges from 0-3 days. The incidence of infiltration and phlebitis was maximum within 48 hours of cannula placement which is consistent with the findings of Barker et. al. randomized clinical trial which found a significant reduction in the incidence of infusion phlebitis with elective change of cannula every 48 hours.

Intravenous cannula with vascular assessment score of 4(Grade V) or more (advanced phlebitis) were sent for pathological review. Tip of intravenous cannula along with the blood culture was sent for pathological examination. 4 (2.4%) sample out of 125 showed the signs of advanced phlebitis. The culture result of both the cannula tip and blood culture showed no growth of any organism.

RECOMMENDATION

It is recommended that standard technique of cannula insertion and identification of early signs of thrombophlebitis to be practised and also date and time of insertion should be written. Only sterile gloves should be used while insertion of peripheral intravenous cannulation. Tegaderm may only be used as adhesive device for securing the cannula. The study should be conducted in large population for longer duration.

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