

# Study on incidence of phlebitis following the use of peripheral intravenous catheter

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## ABSTRACT

**Context:** Peripheral vein cannulation is commonly performed for rapid and accurate administration of medications. Phlebitis is one of the commonest complications that develop after intravenous catheter application. **Aims:** This study aims to investigate the incidence of phlebitis and to evaluate factors contributing to the development of phlebitis. **Settings and Design:** This was a prospective observational study conducted on patients admitted at 4 Air Force Hospital Kalaikunda. **Methods:** Study conducted on 150 patients who were admitted to the medical and surgical division of the hospital during the period from July 2018 to April 2019. The factors studied were age, gender, site of insertion, place of insertion, cannula size, IV medications, and blood products used. Phlebitis was graded using Visual Infusion Phlebitis Score. **Statistical Analysis Used:** The incidence of phlebitis was expressed in percentage and odds ratio was calculated to estimate the effects of suspected risk factors. **Results:** Incidence of phlebitis was found to be 31.4% from our study. The increased incidence rate of phlebitis was seen in the female gender, age less than 60 years, insertion in the lower limb, large catheter size, catheters inserted in emergency situations, and IV drugs administration. **Conclusion:** Phlebitis is an important on-going problem in present-day clinical practice. Avoiding of preventable risk factors, proper nursing care, and daily inspection of catheters needed for prevention of phlebitis.

**Keywords:** Incidence, intravenous catheter, phlebitis

## Introduction

Primary care physicians are the first responders in majority of the cases that reports to hospital. One of commonly performed and at times lifesaving procedure performed in hospital is placement of peripheral intravenous catheter (PIC).<sup>[1]</sup> Incidence rate of intravenous catheter placement in a patients admitted to hospital is about 50%.<sup>[2]</sup> Main uses of a peripheral intravenous catheter are the administration of intravenous fluids, blood sampling, administration of medications and blood products.<sup>[3]</sup>

Despite the advantages, PIC insertion is associated with some complications. The most common complication associated with

PIC insertion is phlebitis with reported incidence ranges from 25% to 59%.<sup>[4]</sup> Phlebitis not only causes patient discomfort and frequent catheter change it may also cause further complications like cellulitis, septicemia, DVT, and make the patient stay in the hospital for a longer time and increase the cost of healthcare.

Phlebitis is an inflammation of the vessel wall and it manifest as localized pain, redness, edema and palpable venous cord.<sup>[5]</sup> Factors contributing to development of phlebitis are divided into four main groups namely, (1) patient factors such as age, gender and underlying conditions; (2) chemical factors such as type of drugs and fluids; (3) mechanical factors such as catheter material, size and duration of cannulation; and (4) health professional practices.<sup>[6]</sup>

Due to the wide variation in the results among the available literature, we decided to conduct this study to evaluate the incidence of phlebitis and risk factors associated with it.

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## Methods

This was a prospective, observational study conducted at the peripheral hospital set up after taking approval from our Institutional ethical committee during the period from July 2018 to April 2019. The study involved 150 patients who were admitted to the medical and surgical division of the hospital. Patients who were unconscious, patients who had preexisting skin diseases, patients who had a history of allergy to any medications, burn patients and patients who refused to give written informed consent were excluded.

All patients who gave written informed consent were visited daily for three days and the catheter insertion site was examined for signs of phlebitis using visual infusion phlebitis score (VIPS) [Table 1].<sup>[7]</sup> Data like patient age, gender, size of the cannula, place of insertion, details of intravenous fluid, medications administered and blood products if used any were noted.

Based on previous studies, the incidence of phlebitis was found to be 50%.<sup>[8]</sup> We hypothesized the incidence of phlebitis as 35% and with an alpha error of 5% and a power of 95%, sample size estimation showed 138 patients required for the study. We included 150 patients to increase statistical power.

Information collected was analyzed. The incidence of phlebitis was expressed in percentage and odds ratio was calculated to estimate the effects of suspected risk factors.

## Results

One hundred fifty patients were included in the study, out of which 89 were male (59.33) and 61 were female (40.7%) [Table 2].

Majority of the patients were aged less than 60 yrs (54%). Catheters were inserted for the reasons such as administration of fluids, intravenous drugs, and blood products. One hundred and twenty patients had catheter insertion in upper limb (80%) and 30 patients in lower limb (20%). One hundred and fifteen catheters were inserted in emergency situations (76.7%) and 35 in non-emergency situations (23.4%). Catheter size was 18 G in 79 patients (52.6%) and 20 G in 71 patients (47.4%). Incidence of phlebitis in our study was 31.4%. Thirty percent (30%) of male patients and 32% of female patients had phlebitis during the stay in hospital. Thirty-five percent (35%) phlebitis occurred in the age group less than 60 years and 26% in more than 60 years. Phlebitis was more in the catheter inserted in lower limb (56.66%) when compared to upper limb (16.6%). Incidence of phlebitis was found to be higher in patients who had an 18 G catheter (37.97%) when compared to patients with 20 G (23.94%). Incidence of phlebitis was higher in the catheters inserted in emergency situations (34%) when compared to non-emergency situations. Patients who were given Intravenous drugs (37.93%) and blood products (53.33%) had higher incidences of phlebitis.

## Discussion

Primary care physicians are the first contact care providers to the patients visiting hospital. They perform many procedures on patients both in emergency and elective situations. Peripheral intravenous catheter insertion is a common procedure that is performed by first responders to provide the care to the patients who are admitted in the hospital. It is commonly used for infusion of intravenous (IV) fluid and other important clinical interventions. Phlebitis is the most common complication of intravenous catheter insertion and in-turn causes further complication to patients. The etiology of

**Table 1: Visual infusion phlebitis score**

Grade 0	IV site appears healthy	No signs of phlebitis	Nil
Grade 1	ONE of the following is evident: Slight pain near I.V. site slight redness near I.V site	Possible first signs of phlebitis	Observe cannula
Grade 2	TWO of the following is evident: Pain near I.V site Erythema Induration	Early stages of phlebitis	Resite cannula
Grade 3	ALL of the following is evident: Pain along path of cannula Erythema Induration	Medium stage of phlebitis	Resite/remove cannula consider treatment
Grade 4	ALL of the following is evident and extensive: Pain along path of cannula Erythema Induration Palpable venous cord	Advanced stage of phlebitis or start of thrombophlebitis	Initiate treatment resite/remove cannula
Grade 5	ALL of the following is evident and extensive: Pain along path of cannula Erythema Induration Palpable venous cord Pyrexia	Advanced stage of thrombophlebitis	Initiate treatment resite/remove cannula

**Table 2: Risk factors for phlebitis**

Variables	Number of patients in study	Number of patients developed phlebitis	Incidence of phlebitis	OR	95% CI for OR
Age					
<60 yrs	81	29	35.80	1.58	0.78-3.19
>60 yrs	69	18	26.08		
Gender					
Male	89	27	30.33	1.21	0.55-2.55
Female	61	20	32.78		
Size of catheter					
18 G	79	30	37.97	1.94	0.95-3.95
20 G	71	17	23.94		
Site of catheter					
Upper extremities	120	20	16.66	1.275	0.05-0.30
Lower extremities	30	17	56.66		
Situations					
Emergency	115	40	34.78	2.133	0.85-5.31
Non- emergency	35	07	20.00		
IV Antibiotics					
Yes	87	33	37.93	2.700	1.29-5.63
No	53	14	26.41		
Blood products					
Yes	15	08	53.33	2.81	0.95-8.28
No	135	39	28.88		

**Table 3: The centre for disease control and prevention recommendation for preventing post infusion phlebitis in peripheral vein**

Use of an upper extremity is preferable to lower extremity.  
 Select catheter based on intended purpose and duration of use and known complications.  
 Use midline catheter or peripherally inserted central line catheter when duration of IV therapy will likely to exceed six days.  
 Practice aseptic techniques for insertions.  
 Disinfect site before insertion with alcohol, povidone iodine or chlorhexidine.  
 Replace catheter or rotate peripheral venous site every 48-72 hrs.  
 Secure catheter with sterile gauze or transparent dressings.  
 Replace dressings when catheter is removed, placed or when dressings becomes damp, loosened or damp  
 Evaluate catheter insertion site once daily by palpating for tenderness.

phlebitis is multifactorial. Phlebitis may range from mild form to severe form. These may cause suffering which may range from mild discomfort to frank sepsis Thus, a variety of studies have been performed to investigate the characteristics of phlebitis so that risk factors can be identified which in turn helps in the development of the strategies and guidelines in management.<sup>[9,10]</sup> Since there is a wide variation in result we undertook a study to assess the incidence of phlebitis and to evaluate the risk factors that are associated with phlebitis.

Incidence of phlebitis in our study was 31.4% which is comparable with incidence rates reported in other studies.<sup>[11,12]</sup> The reported incidence of phlebitis ranges from 25 to 59%. We found that the risk of developing phlebitis was more in the age group less than 60 years (34.80% Odds ratio [OR] 1.58, 95% Confidence Interval [CI] 0.78- 3.19), this is comparable to study conducted by Singh *et al.*<sup>[13]</sup> and Diwedi *et al.*<sup>[14]</sup> In contrast to

above findings Carballo *et al.*<sup>[15]</sup> and Bregenzer *et al.*<sup>[16]</sup> found out that incidence was more in age group more than 60 years. One of the reasons quoted in literature regarding lower incidence rate in the elderly is impaired inflammatory response. As there is wide variation in results among the studies the same need to be confirmed from further research.<sup>[17]</sup>

Female gender is associated with a higher risk of development of phlebitis secondary to peripheral venous catheterization (32.78% OR 1.21, 95%CL 0.55- 2.55). Similar findings have been reported by Tagalakis *et al.* and Cicolini *et al.*<sup>[4,18]</sup> but Tager *et al.*<sup>[19]</sup> and Comely *et al.*<sup>[20]</sup> found that gender was not a risk factor. In contrast to above Diwedi *et al.*<sup>[14]</sup> and Salma U *et al.*<sup>[17]</sup> found out that incidence was higher in the male patients. We have no satisfactory explanation for our findings, but hormonal differences may be a contributing factor for phlebitis in females.<sup>[21]</sup>

Our study found out that catheters placed on the lower limbs had a higher incidence of phlebitis than catheters in the upper limb (56.6% OR 1.275,95% CI 0.05–0.30) which is comparable to Maki *et al.*<sup>[22]</sup>

We analyzed the incidence of phlebitis against the gauge of the IV catheter. Incidence of phlebitis was higher when a larger caliber catheter like 18 G (37.97% OR 1.94, 95% CI 0.95-3.85) was used and it was less in 20 G catheter. These findings coincide with the study conducted by Magerotel *et al.*<sup>[23]</sup> Many authors have highlighted the advantages of using smaller gauge catheter as these catheters allow blood to flow in the adjacent tissue, preventing damage to vein.<sup>[24]</sup>

We found that phlebitis is more common when the catheter is inserted in an emergency situation (34.78% OR 2.13, 95%

CI 0.85–5.31) which is comparable to the study conducted by Nassaji-Zavarch *et al.*<sup>[25]</sup> and Salma U *et al.*<sup>[17]</sup> one of the hypotheses for this observation is that in emergency insertions preparatory care may have been inadequate and mechanical irritation of the vein wall is more common.<sup>[25]</sup>

This study confirms the findings of the study conducted by Kardang *et al.*<sup>[12]</sup> that the administration of IV antibiotics substantially increases the risk of phlebitis (37.93% OR 2.70, 95% CI 1.29–5.63). One of the reasons may be related to the fact that the intravenous antibiotics cause a chemical reaction of the endothelium with resultant phlebitis.

The number of patients who administered blood in our study was a less but significant number (53.33%) of them developed phlebitis, same has been reported by some studies but it was not statistically significant.<sup>[13]</sup>

We would like to recommend that all patients with peripheral vein catheter *in situ* be screened for complications of the peripheral venous catheter at least once daily as recommended by the CDC guideline on prevention of intravascular catheter-related infections [Table 3].<sup>[24]</sup> Patients with signs and symptoms of phlebitis should have their catheters replaced at a different site. Observation chart to document the development of signs of phlebitis may be developed in a hospital. This would help detect phlebitis much earlier and decrease patients' discomfort and pain.

## Conclusion

Incidence of peripheral vein infusion-related phlebitis among our patients was comparable with other centers in the world. We confirmed there is an increased risk of developing phlebitis among age group less than 60 years, female patients, site of insertion, size of catheter used, and usage of the catheter for infusion. Proper insertion, good nursing care, and the avoidance of the above risk factors may lower the incidence of phlebitis.

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## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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## Conflicts of interest

There are no conflicts of interest.

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