

## The Incidence of Thrombophlebitis Following the Use of Peripheral Intravenous Cannula in Post-Operative Patients A Prospective Observational Study

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### Abstract

**Background:** Peripheral venous cannulation is indispensable in the practice of modern medicine. This study aims to investigate the incidence of thrombophlebitis in post-operative patients having peripheral venous cannula and to evaluate some important related risk factors.

**Methods:** This observational study was conducted on 82 patients aged above 18 years admitted post operatively to the surgical ward of a tertiary care hospital during the period of July and August 2014. These patients were visited daily for three days after the surgery and examined for signs of thrombophlebitis: warmth, erythema, tenderness, swelling, palpable venous cord. The risk factors studied in this research were patient age, gender, comorbidities like hypertension, diabetes mellitus, hyperlipidaemia, smoking, duration of cannulation, cannula size and IV medications used. Thrombophlebitis was graded using Visual Infusion Phlebitis Score suggested by Infusion Nurses Society.

**Results:** In total, 82 patients were recruited with incidence rate of thrombophlebitis of 50%. Among those who developed thrombophlebitis 61% had Grade 1 and remaining 39% had Grade 2 thrombophlebitis. Grade 3, 4, 5 were not found. Results showed that the risk factors considered did not significantly influence the incidence of thrombophlebitis.

**Conclusion:** Phlebitis is still an important ongoing problem in medical practice. We recommend daily examination of catheters for signs of thrombophlebitis by a health care personnel. Future studies are to be made to improve the understanding of risk factors for thrombophlebitis especially comorbidities like Diabetes Mellitus and to discover more effective protection methods

**Keywords:** Intravenous cannula, Thrombophlebitis, Visual Infusion Phlebitis Score

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### I. Introduction

In the modern medical practice, up to 80% of the hospitalized patients receive intravenous (IV) therapy at some time during their admission<sup>1</sup>. The peripheral venous catheterization is a commonly done invasive procedure to administer medications, fluids and bio products. The most common complication associated with it is thrombophlebitis with incidence varying according to different settings (3.7% - 67.24%)<sup>2</sup>. Thrombophlebitis is the inflammation of the vessel wall due to the formation of blood clot. Clinical signs of phlebitis are localized redness, warmth, swelling and palpable venous cord<sup>3</sup>. Over the last two decades, studies about phlebitis have divided the riskfactors into four main groups: patient characteristics, therapy administered, health professional practices and cannula characteristics.

The condition may resolve easily or proceed to complications like DVT, pulmonary embolism, septicemia, cellulitis, nodule formation or hyper pigmentation of skin. Moreover, it causes patient discomfort and insertion of a new catheter at a different site is required. The complications associated with peripheral IV cannula and IV therapy can have a devastating effect on patient's health and quality of life and also increase the costs of health care through prolonged hospital stay and treatment. Given thrombophlebitis can put patient's safety at risk, this study is aimed to identify its incidence and associated riskfactors in our local community.

### II. Materials And Methods

This study was a prospective observational study on elective post-operative patients who had a cannula inserted, after approval by the institutional review board and ethics committee.

All elective postoperative patients admitted in our tertiary care center who had a peripheral venous catheter inserted for atleast 72 hours and had also given their written informed consent were enrolled. Patients who were unconscious, patients with pre-existing septicemia, patients who were hemodynamically unstable were excluded.

The sample size required was calculated using the nMaster Sample size calculation software to be 82 with the expected incidence of thrombophlebitis to be 50% (Wilkinson study) and the population proportion to be 35% with power of 80% and alpha error of 5%. (Calculated by nmaster software produced by department of Biostatistics, Christian Medical College, Vellore).

All patients who gave their written informed consent were enrolled into the study and their demographic details and risk factors were recorded in the Case Report Form. Each patient was visited daily for three days and the catheter site was examined for signs of thrombophlebitis. When the signs of thrombophlebitis were noticed, the Visual Infusion Phlebitis Score (VIPS) was used to grade it. The data was entered and analysed using SPSS version 16 and the results were tabulated.

The information obtained was analysed using the SPSS version 16.0. The relationship between the variables was analysed using Chi square test. The test of significance was based on a 95% confidence interval and a p value of <0.005. As the numbers were small we could not establish a significant relationship between the risk factors considered.

**Table 1: Visual Infusion Phlebitis Score<sup>4</sup>**

GRADE 0	Site appears healthy	No sign of phlebitis	
GRADE 1	One of the following is evident ➤ Slight pain near IV site ➤ Slight redness near IV site	possible sign of phlebitis	observe cannula
GRADE 2	Two of the following is evident ➤ Pain near IV site ➤ Erythema ➤ Swelling	early stage of phlebitis	resite cannula
GRADE 3	All of the following are evident ➤ Pain along the path of cannula ➤ Erythema ➤ Induration	medium stage of phlebitis	resite cannula, consider treatment
GRADE 4	All of the following are evident and extensive ➤ Pain along the path of cannula ➤ Erythema ➤ Induration ➤ Palpable venous blood		resite cannula, consider treatment
GRADE 5	All of the following are evident and extensive ➤ Pain along the path of cannula ➤ Erythema ➤ Induration ➤ Palpable venous cord ➤ Pyrexia	late stage of phlebitis	resite cannula, initiate treatment

### III. Results

A total of 82 postoperative patients were successfully recruited for this study. Out of them, 41 [50%] of the postoperative patients developed thrombophlebitis secondary to a peripheral venous catheter. Among those who developed thrombophlebitis, 60.97% and 39.02% developed grade 1 (erythema and redness) and grade 2 (pain, erythema, swelling) respectively. Out of 10 diabetic patients, 7 developed thrombophlebitis indicating that the risk is 40% more in diabetic patients. More than half of the smokers (55%) developed thrombophlebitis. It was also found that the maximum incidence of thrombophlebitis (73%) occurred within 12-24 hours of insertion of cannula. Others developed thrombophlebitis as follows: 0-12 hours (7%), 24-36 hours (15%) and 36-48 hours (5%). Table 2 shows relationship between risk factors and incidence of thrombophlebitis.

**Table 2. Demographic Data**

	Patients with thrombophlebitis n=41[Number (%)]	Patients without thrombophlebitis n=41[Number (%)]	Total N=82 [Number (%)]
<b>Age Number</b>			
< 45 years	18 (50%)	18 (50%)	36 (43.9%)
> 45 years	23 (50%)	23 (50%)	46 (56.1%)
<b>Gender</b>			
Male	19 (48.7%)	20 (51.3%)	39 (47.6%)
Female	22 (51.2%)	21 (48.8%)	43 (52.5%)
<b>Comorbidities</b>			
Diabetes mellitus	7 (70%)	3 [30%]	10 [12.1%]
Hypertension	9 [69.2%]	4 [30.8%]	13[15.8%]
Hyperlipidaemia	5 [50%]	5 [50%]	10 [12.1%]
<b>Smoking</b>	4 [44.4%]	5 [55.6%]	9 [10.9%]
<b>Surgery done</b>			

Thyroidectomy	15 [51.7%]	14 [48.3%]	29 [35.4%]
Hernioplasty	13 [54.2%]	11 [45.8%]	24 [29.2%]
Others	13 [44.8%]	16 [55.2%]	29 [35.4%]
<b>Cannula Size</b>			
18 guage	5 [33.3%]	10 [66.7%]	15 [18.2%]
20 guage	18 [45%]	22 [55%]	40 [48.7%]
22 guage	18 [66.7%]	9 [33.7%]	27 [32.9%]

#### IV. Discussion

Thrombophlebitis is the most common complication of intravenous catheters and can lead to many problems and increased costs. It is now established that the etiology of thrombophlebitis is multifactorial. In our study the incidence of thrombophlebitis was found to be 50% which is comparable with incidence rates reported at other centres around the world. The reported incidence of peripheral vein thrombophlebitis ranges from (3.7% – 67.24%)<sup>2</sup>. The peripheral vein is traumatised during the insertion of the peripheral venous catheter. This initial trauma and presence of foreign body in the vein stimulates an inflammatory response which predisposes to the development of thrombus and thus thromboembolism. We graded the thrombophlebitis observed according to the Visual Infusion Phlebitis Score<sup>4</sup> into five grades. However in our study only Grade 1 [redness and pain] and Grade 2 [pain, redness, and swelling] thrombophlebitis were only observed. Grade 1 was more common. This might be because of the good nursing care provided to the patients. Most cases of thrombophlebitis were detected and preventive measures taken before severe forms or complications developed. In our hospital, the cannula was immediately replaced once the patient complains of pain or even slight erythema or swelling, so grade 3, 4 and 5 were not observed.

Patients were divided into 2 groups based on their age into > 45 years and < 45 years and compared, it was found that there was no difference in the incidence of thrombophlebitis in the two groups. It was found that both males and females had equal incidence of thrombophlebitis.

In our study, minimal increase in incidence of thrombophlebitis in post-operative patients with 22 guage cannula was seen. But there was no statistically significant difference from patients with 18 guage or 20 guage cannula. Many authors however had highlighted the advantages of using smaller guage cannula<sup>5, 6, 7 and 8</sup>. According to our studies, no statistically significant difference was found between the catheter dwell-time and thrombophlebitis. However it was found that most cases of thrombophlebitis were reported after 12 hours of insertion. This is not found in any of the studies. One reason for the incidence of thrombophlebitis after 12 hours could be due to the use of intravenous induction agents used for general anaesthesia in these patients. The pH and osmolarity of these drugs may have contributed to this. But as we did not collect data regarding the anaesthetic agents used, this result observed requires further research. Most studies recommend that cannula must be replaced every 72 hours.<sup>9,10</sup> Some studies have shown that the rate of phlebitis increases with the time the cannula remains in situ<sup>13</sup>. So scheduled replacement of IV cannula has been recommended. But recent studies showed that there is no increase in cannula related complications when the duration prolonged up to 96 hours. But the cannula must be checked daily and if any evidence of phlebitis or infection is detected it must be removed immediately<sup>14,15</sup>.

Our studies could not establish any relationship between intravenous drug administered and incidence of thrombophlebitis. However some studies have shown that medications and fluids of low pH and high osmolality are associated with chemical thrombophlebitis.<sup>11, 8, and 12</sup>

There is no statistically significant relationship between different comorbidities like diabetes mellitus, hypertension and hyperlipidemia and the development of thrombophlebitis. But it was found that incidence of developing thrombophlebitis is 40% more in diabetics than in non-diabetics. These risk factors were evaluated only in few studies. A higher incidence in diabetic patients may be due to the endothelial damage induced by diabetes mellitus. Half the patients with hyperlipidemia developed thrombophlebitis, however as the numbers were small it was a non-significant risk factors. Smoking was also found to be a no significant risk factor.

Our study had certain limitations such as small study sample, Cannula was inserted by different groups of people, IV fluids and IV anesthetic agents administered during the surgery were not considered.

#### V. Conclusion

The incidence of peripheral catheter related thrombophlebitis is found to be 50% which was comparable with other centers of the world. In this study only grade 1 and grade 2 thrombophlebitis were observed according to the VIPS. All patients with peripheral venous catheter should be examined for signs of thrombophlebitis at least once daily. A suitable peripheral vein catheter chart should include date of catheterization, development of warmth, erythema, tenderness and a palpable venous cord. These signs should be examined during every review of the patient. The risk factors identified serve as targets for interventions to reduce the possible complications. The incidence rate found make the medical personnel aware of the care they have to put in during intravenous cannulation.

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