

## Risk factors of phlebitis in adult patients of tertiary teaching hospital of North-Eastern India

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**Abstract:** The aim of the study to assess the incidence and risk factors of phlebitis. Patients aged between 20-80 years of age were included. The information was gathered using semi-structured questionnaire and observational data. Four data collectors visited the patients daily and examined for signs of phlebitis; warmth, erythema, swelling, oedema, tenderness or a palpable venous cord. Risk factors such as patients' age and gender, size of cannula, site of insertion, location of cannula, duration of catheterization, hand washing practice, type of material used for stabilization, use of catheter for infusion and type of infusate were studied. Phlebitis was graded using a phlebitis rating scale developed from the Infusion Nurses Society (2011). The phlebitis incidence was found to be higher for peripheral venous catheters placed in the upper left limb (51.72%) with a relative risk of 1.03. Also risk increased significantly with increased duration of catheterization (50.94%) and use of 20 gauge cannula size (61.54%). It found that the administration of IV antibiotics substantially increases the risk of developing phlebitis (58.33%; RR-1.5, OR-1.8). The age of patient, gender, size of cannula, site of insertion, placement of cannula and types of infusate did not significantly influence the development of phlebitis.

**Key words:** Phlebitis, Risk factors, observational study.

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### I. Introduction:

Intravenous devices are indispensable in modern day medical practice and are used in most hospitalized patients.<sup>(1)</sup> Peripheral intravenous catheters are generally inserted into a peripheral vein and used for continuous or intermittent treatments.<sup>(2,3)</sup> The Intravenous (I.V.) route ensures that the prescribed medicine concentration is delivered directly into the systematic circulation, which is termed "one hundred percent bioavailability" and avoid the need for absorption in the gut. I.V. administration overcomes any nothing-by-mouth or fasting requirement and may also overcome a patient's refusal to take oral medication.<sup>(4)</sup>

### Background of the study

Peripheral vein infusion phlebitis, the most frequent complication of peripheral venous infusion is characterized by pain, erythema, swelling and palpable thrombosis of the cannulated vein.<sup>(5)</sup> Its pathogenesis is thought to be inflammation of the vein wall that leads to thrombus formation. Catheter related factors, such as duration of catheterization, catheter material, catheter site and type of infusate increase the risk of peripheral vein infusion phlebitis. Patient related risk factor have received less attention, but biologic vulnerability to developing peripheral vein infusion phlebitis may vary from patient to patient.<sup>(6)</sup>

Studies have determined that, depending on the definition, medical-surgical patients overall develop infusion-related phlebitis at rates ranging from 2.5% to 70%.<sup>7,12</sup> Karadag and Gorgulu<sup>8</sup> with 36.8%, Maki and Ringer<sup>6</sup> with 41.8%, or Uslusoy and Mete<sup>12</sup> with 54.5%. In India, incidence of phlebitis was 56.5% and 29.8% which occurred in the same setting.<sup>9</sup> However, CDC and INS recommendations revealed that the accepted phlebitis rate is 5% or less.

In a recent prospective study of 90 hospitalized patients with PIC, 23 (26%) developed peripheral vein infusion phlebitis, among whom one third had complication that resulted in a delay in intravenous therapy,

additional IV therapy, or an extended hospital stay of 2 to 5 days.<sup>(10)</sup> Up to 50% of patients with intravenous-related bloodstream infection have peripheral vein infusion phlebitis.<sup>(11)</sup>

Phlebitis, the most frequent complication of PIV infusion may occur at rates as high as 50%<sup>(2)</sup> or even as high as 75% in patients with infection diseases.<sup>(12)</sup>

A number of risk factors have been implicated in the development of phlebitis.<sup>(12,13,14)</sup> Patients who are female or who have poor quality peripheral vein, insertion in the lower extremity, or the presence of underlying medical conditions, including cancer and immunodeficiency, are at increased risk for phlebitis.<sup>(13)</sup> A study found that insertion of catheter in the vein around the elbow increased the site of phlebitis<sup>(14)</sup> and more sources agree that phlebitis occurs more frequently when the catheter has been inserted in a lower extremity.<sup>(14)</sup> Duration of catheterization has also been suggested as a predictor of infusion related phlebitis. Therefore the CDC (Center for disease control and prevention) recommends, in adults that short peripheral venous catheters be replaced not more frequently than every 72 to 96 hours and upper extremity should be used for catheter insertion than lower extremity to reduce the risk of phlebitis.<sup>(15)</sup> The solution being infused may also be responsible for phlebitis.<sup>(10,13)</sup> The infusion nurse society (INS), which set the standards of practice for IV nursing care, stated in its 2011 Infusion Nursing standards of practice that the nurse should consider replacement of the short peripheral or midline catheters when clinically indicated.<sup>(16)</sup>

Over the last two decades, studies about phlebitis have divided the risk factors into four main groups: patient's characteristics, therapy administered; health professionals practices and material (O'Grady et al 2011, RCN 2010, Joanna Briggs institute (JBI) 2008; INS 2006; O Grady et al 2002)<sup>(15,17,18)</sup> Other studies have also reported few risk factors leading phlebitis such as demographic factor, the catheter's size, type and duration of insertion, frequency, types of infusion and time of its removal.<sup>(5)</sup>

Apart from the sepsis and pain from the phlebitis related to PIC, they also cause increase morbidity and mortality rates, increased length of hospitalization, increased staff workload and increased financial burden on the patient.<sup>(14)</sup> Peripheral vein infusion phlebitis, the most frequent complication associated with peripheral catheter use<sup>(19)</sup>, causes patient discomfort and generally leads to catheter removal and insertion of a new catheter at a different site. Repeated episodes can lead to venous access difficulties and more invasive procedures, such as central venous catheter placement.<sup>(20)</sup> As a result, administration of peripheral medications may be unnecessarily delayed, and hospital stay lengthened.

### **Need for the study**

A number of complications including phlebitis, infiltration, extravasation and infections are associated with I.V therapy. Among others factors such as age, gender, poor quality peripheral veins, underlying medical disease, duration of catheterization, type of infusate, large gauge catheter, insertion of catheter in the lower extremity, changing gauze dressings, the knowledge and experience of the nurse inserting the cannula can play a major role in preventing this complications. Nurses who have the skill and expertise for insertion of I.V catheter, as well as knowledge regarding their postinsertion care and maintenance, can significantly influence patient outcome.<sup>(21)</sup>

In a prospective observational study conducted at Kathmandu University phlebitis developed in 136/230 clients (59.1%). It was very mild in most cases. Increased incidence rate of infusion related phlebitis were associated with male sex, small catheter size (20G), insertion at the site of fore arm, I.V drug administration and blood product transfusion. The incidence rate of phlebitis rose sharply after 36 hours of catheter insertion.<sup>(22)</sup>

Tan W, Yoong J, Yeap J W, Aznal S S(2012) reported in their observational study that the incidence rate of phlebitis among 428 patients was 35.2%. Results showed that female patients, increased duration of catheterisation and usage of the catheter for infusion had a significant increased risk of developing phlebitis. The age of a patient, types of infusate used, size of catheter and site of catheter insertion did not significantly influence the development of phlebitis.<sup>(6)</sup>

For difference in risk and incidence of phlebitis in different age groups, it was found that the incidence of phlebitis was similar throughout all age group of patients. The age of a patient did not influence the development of phlebitis among the patients. The duration a catheter is left in the vein was found to significantly influence the incidence of phlebitis. Patients who have a catheter for more than 3 days are more likely to have an increased risk of developing phlebitis. Similar findings have previously been reported by Uslusoy and Barker. The duration of catheterization is the only modifiable risk factor identified. The results of many studies have shown that the risk of phlebitis increases with increased duration of catheterization. It is recommended that prophylaxis re-sitting of catheter should be practiced in all patients. The catheter should be removed or replaced in a different site after 72 hours of insertion, even when there is no sign of phlebitis.<sup>(14, 27)</sup>

Saini R, Agnihotri M, et al (2011) reported incidence of infiltration and phlebitis as 31.5% and 29.8% respectively in 168 patients conducted at Nehru Hospital (PGIMER), Chandigarh. Around 75% of the patients were males. More than 50% of the patients taken up for the study were having medical conditions such as

alcoholic liver disease, various renal and GI disorders, myocardial infection and respiratory tract infections while 43% suffered from surgical conditions while 35% of them has co morbidities such as coronary artery disease, diabetes mellitus, hypertension, tuberculosis etc. Nearly 45% of cannulae developed Grade II and Grade III phlebitis.<sup>(9)</sup>

Patient factors that increase risk of developing phlebitis include increasing age, female sex, conditions such as neutropenia, malnutrition, immunosuppression, conditions that impair circulatory function and peripheral neuropathy. The basic factors leading to phlebitis can be broadly divided into mechanical causes such as catheter size, catheter material, catheter length, insertion site, method of immobilization and the dwell time, chemical causes such as infusion of the medications or fluids with variable PH or osmolality and bacterial causes due to use of contaminated IV solution, tubing, catheter or insertion site and absence of use of septic techniques while inserting the cannula and care and handling in expert clinicians.<sup>(24, 25)</sup>

Singh R, Bhandary S, Pun KD(2008) reported in their prospective observational study that phlebitis developed in 136/230 clients (59.1%). Related risk factors as found in the study were insertion at the site of fore arm, size of catheter (20G) and dwell time (>=36 hours). There were higher incidences of phlebitis among the client with Intravenous drug administration and especially between ages 21-40 year. Therefore more attention and care is needed in these areas by the care provider.<sup>(23)</sup>

Cicolini G, Bonghi A, et al.(2009) reported in their study that the frequency of intravenous cannulae phlebitis was higher in females (OR:1.91). They further suggested that use of cubital fossa veins rather than dorsal side of the hand veins to reduce the incidence of phlebitis in patients with peripheral intravenous cannulae.<sup>(26)</sup>

Given the impact of phlebitis and its related factors, this study was aimed to identify the incidence of phlebitis and its risk factors.

It is hoped that this study would be able to shed some light on different factors that may influence the development of phlebitis among our local community, which helps to develop the possible interventions to improve care of I.V cannulae and to decrease the incidence of peripheral venous catheter related complications.

### **Objectives**

1. To assess the incidence of Phlebitis among adult patients admitted in General Wards,
2. To compare the factors influencing phlebitis among adult patients admitted in General wards.
3. To estimate the relative risk and odds ratio regarding development of phlebitis among adult patients admitted in General Wards..

### **Hypotheses**

In the light of the above objectives, the following hypotheses were formulated:

H<sub>1</sub> - There will be significant association between age and incidence of phlebitis.

H<sub>2</sub> - There will be higher incidence of phlebitis in females than males.

H<sub>3</sub> - There will be significant association between duration of canula insitu and incidence of phlebitis.

H<sub>4</sub> - There will be significant association between site of insertion and incidence of phlebitis.

H<sub>5</sub> - There will be significant association between the type of infusate and incidence of phlebitis.

### **Operational definition of Phlebitis**

Inflammation of the vein accompanied by pain, edema, erythema, streak formation/or palpable cord. It was assessed using INS phlebitis rating scale at 24 hours, 48 hours and 72 hours from the time of canula placement.

### **Delimitations**

This study is limited only to the adult patients admitted in General wards, NEIGRIHMS.

### **Research Methods:**

The descriptive observational design was adopted.

### **Setting**

The setting was NEIGRIHMS Hospital, Shillong, Meghalaya. NEIGRIHMS Hospital is situated at Mawdiangdiang, East khasi hills district. NEIGRIHMS Hospital is a tertiary care center which caters to the health care needs of the entire North East Region.

### **Ethical consideration**

Ethical approval was received for the study from Institutional Ethical Committee, NEIGRIHMS. The purpose for carrying out the research project was explained to the participants verbally and assurance of confidentiality was given. The written consent was obtained from nurses and patients.

**Sample recruitment:**

Convenience sampling technique was adopted to recruit 318 adult patients having Intravenous cannula admitted in General Wards, NEIGRIHMS Hospital, Shillong. The following inclusion criteria were employed:

- a) Adult patients having Intravenous canula.
- b) Adult patients receiving intravenous fluids through IV pump and drip sets.
- c) Patients who speak Khasi, Hindi or English.
- d) Patients aged between 18 to 80 years.

The unconscious patients and patient having problems in communication were excluded.

**Development of the data collection tool :**

The research tool was developed by doing extensive literature review. The primary and secondary sources of literature were reviewed to develop an appropriate tool. Experts from various fields like General Medicine, Microbiology, Orthopaedics, Paediatrics, Radiology, NEIGRIHMS and the Lectures of the College of Nursing, NEIGRIHMS have given their opinion and valuable suggestions to develop the research tool.

**Description of data collection tool :**

The semi-structured questionnaire comprises of three sections:

**Section I**

It comprises of demographic data and clinical data related to the patient such as age, sex, in-patient no, date of admission, diagnosis, total WBC count, hemoglobin, height, weight and BMI.

**Section II**

It comprises of the data of the personnel who performed the cannulation such as educational qualification, years of experience, self competency and preparation of canulation site, self confidence and documentation.

**Section III**

It comprises of canula related data such as date and time of insertion of canula, site of canula placement, location, size of canula, material used to stabilise the canula, type of infusate and the Phlebitis rating scale.

**Validity**

Content validity of tool was obtained from the experts belonging to various fields. The experts gave their suggestions and valuable opinions, few suggestions were incorporated as per expert's opinion. There were a total of nine validators.

**Reliability**

The interrater reliability was calculated and cohen kappa value had accepted level of agreement (0.65).

**Data collection procedure :**

Patients receiving intravenous therapy during the time period of the study were enrolled. An informed written consent was obtained from each patient and an informed verbal consent was obtained from each personnel involved in the study. The semi-structured questionnaire was introduced after the insertion of the peripheral venous catheter. Daily follow-up of the patient was done for the presence or absence of peripheral venous catheter and observation of the site for the development of signs of phlebitis for 48 hours from the time of insertion. However, if absent, the date, time and reason of removal of the peripheral venous catheter were documented and follow-up of the sites for the development of signs of phlebitis for 48 hours from the time of insertion. The peripheral intravenous site of the patient was only observed to collect data regarding size of the cannula, site of placement, signs of phlebitis according to the phlebitis rating scale developed by the Infusion Nurses Society, dressing etc. Patient drug chart and intake & output chart were observed to collect details regarding drugs administered and infusion given in last 24 hours. The data related to the personnel who performed cannulation were collected by administering the semi-structured questionnaire.

**TABLE- 1 DISTRIBUTION OF PARTICIPANTS ACCORDING TO DEMOGRAPHIC CHARACTERISTICS**

**N=318**

DEMOGRAPHIC CHARACTERISTICS	TOTAL NUMBER OF PARTICIPANTS (f)	PERCENTAGE%
<b>Age</b>		
20-30 years	78	24.53
30-40 years	54	16.98
40-50 years	36	11.32
50-60 years	36	11.32
60 -70 years	90	28.30
70-80 years	24	7.55
<b>Sex</b>		
Male	162	50.94
Female	156	49.06
<b>BMI</b>		
<18 (Underweight)	66	20.76
18-25 (Normal)	204	64.15
25 -30 (Overweight)	48	15.09
>30 (Obesity)	0	0

The Table - 1 shows the distribution of participants according to various demographic characteristics. Among the total 318 subjects, highest number of participants were in the age group of 60-70 years of age i.e. 90(28.30%).

Out of 318 participants, 50.94% were females and 49.06% males. With regard to body mass index, 64.15% were normal.

**TABLE – 2 DISTRIBUTION OF CHARACTERISTICS ACCORDING TO THE PERSONNEL WHO PERFORMED CANNULATION**

**N=318**

VARIABLES	f	%
<b>Educational Qualification Of The Personnel</b>		
Diploma		
Degree	228	71.7
Masters	60	18.87
Others	0	0
	30	09.43
<b>Years Of Experience</b>		
0-5 years	84	26.42
5-10 Years	48	15.09
≥10 Years	186	58.49
<b>Competency Rate</b>		
Highly competent	192	60.38
Moderately competent	114	35.84
Low	6	01.89
Don't know	6	01.89
<b>Self Confidence</b>		
High	222	69.81
Moderate	96	30.19
Low	0	0
<b>Hand washing</b>		
Yes	168	52.83
No	150	47.17
<b>Skin Preparation</b>		
Only Betadine	0	0
Only Spirit	318	100
Spirit then Betadine	0	0
Any others	0	0
<b>Flushing In 24 Hrs</b>		
Yes	78	24.53
No	240	75.47
<b>VARIABLES</b>	<b>f</b>	<b>%</b>

<b>Patient Attitude</b>		
Highly cooperative	168	52.83
Moderately cooperative	150	47.17
Resistant	0	0
<b>Number Of Attempts</b>		
1	252	79.24%
2	60	18.87%
3	6	1.89%
4	0	0
<b>Vein Appearance Before Cannulation</b>		
a) Visible and palpable without applying tourniquet	72	22.64%
b) Not visible but palpable without applying tourniquet.		
c) Visible and palpable by applying tourniquet.	12	3.78%
d) Not visible and palpable by applying tourniquet.		
e) Not visible and Not palpable by applying tourniquet.	234	73.58%
	0	0
	0	0
<b>Documentation Of Cannula Inserted</b>		
Yes	0	0
No	318	100%

The Table - 2 shows the distribution of characteristics according to the personnel who performed cannulation. With regard to educational qualification, among the 318 cannulation, 71.7% were performed by personnel with Diploma and 58.49% had more than or equal to 10 years experience.

Based on the self reported competency rate 60.38% reported highly competent. Based on the self confidence rate 69.81% had high self confidence and 30.19% had moderate self confidence. 52.83% performed hand washing prior to performing cannulation and 47.16% did not. All of the personnel who performed cannulation used spirit swabs for skin preparation. 24.53% of the cannulae were flushed in 24 hours and 75.47% were not. Regarding patients' attitude 52.83% were highly cooperative and 47.17% moderately cooperative. Two Hundred fifty two of the intravenous cannulation was performed with first attempt. Based on the vein appearance before cannulation 73.58% were visible and palpable by applying tourniquet. All the cannulations performed by the personnel were not documented with regard to date and time.

**TABLE- 3 DISTRIBUTION OF CHARACTERISTIC ACCORDING TO CANNULA RELATED DATA N=318**

VARIABLES	f	%
<b>Site of insertion</b>		
Forearm	162	50.94
Antecubital	24	07.55
Hand	78	24.53
Wrist	54	16.98
Upper arm	0	0
Lower limb	0	0
Others	0	0
<b>Location of cannula</b>		
Upper right limb	144	45.28
Upper left limb	174	54.72
Lower right limb	0	0
Lower left limb	0	0
<b>Size of cannula</b>		
18G	48	15.09
20G	156	49.06
22G	114	35.85

VARIABLES	f	%
<b>Material used for stabilization</b>		
Micropore	0	0
Transpore	42	13.21
Dynaplast	222	69.81
Plaster	54	16.98
<b>Types of infusate</b>		
Antibiotics	216	67.92
Non antibiotics	54	16.98
Crystalloids	48	15.1

The Table No. 3 shows the distribution of characteristics according to the cannula related data. Among the total 318 subjects, 162(50.94%) had cannula insertion site in the forearm, 24(7.55%) in Antecubital site, 78 (24.53%) in the hand and 54 (16.98%) in the wrist.

Among the total 318 subjects, 144(45.28%) cannula sites were located in the upper right limb and 174 (54.72%) were located in the upper left limb. Among the total 318 subjects, 48(15.09%) had 18G cannula, 156(49.06%) had 20G cannula, and 114(35.85%) had 22G.

With regard to the material used for stabilization, among the total 318 subjects, 42(13.21%) had transpore, 222 (69.81%) had dynaplast and 54 (16.98%) had plaster.

With regard to the type of infusate infused through the intravenous site, among the total 318 subjects, antibiotics were infused in 216(67.92%) subjects, non antibiotics in 54(16.98%) and crystalloids in 48 (15.1%) subjects.

**TABLE – 4 GRADE OF PHLEBITIS ACCORDING TO DWELL TIME**

GRADE	Within 24 hrs	within 48 hrs
0	234(73.58%)	156(49.06%)
1	0	0
2	42(13.21%)	78(24.53%)
3	18(5.66%)	48(15.09%)
4	24(7.55%)	36(11.32%)
5	0	0

The Table No. 4 shows the distribution of the grade of phlebitis in relation to dwell time. Among the total 318 subjects, within 24 hours, 234(73.58%) subjects developed grade 0 phlebitis, 42(13.21%) subjects developed grade 2, 18(5.66%) developed grade 3 and 24(7.55%) subjects developed grade 4. Within 48 hours, 156(49.06%) developed grade 0, 78(24.53%) developed grade 2, 48 (15.09%) developed grade 3 and 36(11.32%) subjects developed grade 4.

**TABLE – 5 DISTRIBUTION OF INCIDENCE OF THROMPHLEBITIS WITHIN 24 AND 48 HRS RESPECTIVELY**

Dwell time	Present	Absent
Within 24 hrs	84(26.42%)	234(73.58%)
Within 48 hrs	162(50.94%)	156(40.06%)

Among the 318 subjects, 84(26.42%) developed phlebitis within 24 hours whereas 234(73.58%) did not and 162(50.94%) developed phlebitis within 48 hours and 156(40.06%) did not.

**TABLE – 6 DISTRIBUTION OF INCIDENCE OF PHLEBITIS ACCORDING TO VARIOUS CHARACTERISTICS**

Variables	Cannula with phlebitis f (%)	Cannula without phlebitis f (%)	Chi Square X <sup>2</sup>	df	P value
<b>Gender</b> Female Male	90(57.69) 72(44.44)	66(42.31) 90(55.56)	5.581	1	0.18
<b>Hand washing</b> No Yes	96(64) 66(39.29)	54(36) 102(60.71)	19.36	1	0.00
<b>Location</b> Upper left limb Upper right limb	90(51.72) 72(50)	84(48.27) 72(50)	0.94	1	0.759
<b>Site of insertion</b> Forearm Antecubital Hand Wrist	90(55.56) 12(50) 30(38.46) 30(55.56)	72(44.44) 12(50) 48(61.54) 24(44.44)	6.71	3	0.082
<b>Size of cannula</b> 18G 20G 22G	12(25) 96(61.54) 54(47.37)	36(75) 60(38.46) 60(52.63)	20.51	2	0.00
<b>Stabilizing material</b> Transpore Dynaplast Plaster	30(71.43) 90(40.54) 42(77.78)	12(28.57) 132(59.46) 12(22.22)	32.22	2	0.00
<b>Types of infusate</b> Antibiotics Non- antibiotic Crystalloid	126(58.33) 24(44.44) 12(25)	90(41.66) 30(55.55) 36(75)	<b>18.56</b>	2	0.00
<b>Flushing done in 24 hours</b> No Yes	126(52.5) 36(46.15)	114(47.5) 42(53.84)	0.949	1	0.33



**‘P’ value <0.05 is significant,**

**NS- Not Significant**

The Table- 6 shows the distribution of incidence of phlebitis according to various characteristics. Among the females, 90(57.69%) developed phlebitis. With regard to males, 72(44.44%) males developed phlebitis.

The obtained Chi-square test value ( $X^2=0.9$ ) revealed that there was no significant association between gender and the development of phlebitis.

The data also revealed that there was no significant association between hand washing, size of cannula, site of insertion, type of infusate, stabilisation material and the development of phlebitis.

**TABLE- 7 INCIDENCE, RELATIVE RISK AND ODDS RATIO OF PHLEBITIS ACCORDING TO DIFFERENT VARIABLES N=318**

Variables	Cannula with phlebitis f (%)	Cannula without phlebitis f (%)	Relative Risk (95% CI)	Odds Ratio (95% CI)
<b>Gender</b>				
Female	90(57.69)	66(42.31)	1.298	1.70
Male	72(44.44)	90(55.56)	(1.04-1.61)	(1.09-2.65)
<b>Location</b>				
Upper left limb	90(51.72)	84(48.27)	1.03	1.07
Upper right limb	72(50)	72(50)	(0.61-1.76)	(0.68 -1.66)
<b>Site of insertion</b>				
Forearm	90(55.56)	72(44.44)	1.11 (0.72-1.69)	1.250 (0.53-2.948)
Antecubital	12(50)	12(50)		
Forearm	90(55.56)	72(44.44)	1.44 (1.05-1.97)	2.00 (1.15-3.47)
Hand	30(38.46)	48(61.54)		
Forearm	90(55.56)	72(44.44)	1.00 (0.75-1.31)	1.00 (0.53-1.85)
Wrist	30(55.56)	24(44.44)		
Antecubital	12(50)	12(50)	1.30 (0.79 – 2.11)	1.60 (0.63 – 4.01)
Hand	30(38.46)	48(61.54)		
Wrist Antecubital	30(55.56)	24(44.44)	1.11 (0.69-1.77)	1.25 (0.47- 3.27)
	12(50)	12(50)		
Wrist	30 (55.56)	24(44.44)	1.44 (0.99-2.08)	2.00 (0.98-4.04)
Hand	30 (38.46)	48 (61.54)		
<b>Size of cannula</b>				
20G	96(61.54)	60(38.46)	1.29 (1.03-1.63)	1.77 (1.09 – 2.89)
22G	54(47.37)	60(52.63)		
20G	96(61.54)	60(38.46)	2.46 (1.48-4.08)	4.80 (2.31-9.94)
18G	12(25)	36(75)		
22G	54(47.37)	60(52.63)	1.89 (1.11-3.20)	2.70 (1.27-5.71)
18G	12(25)	36(75)		
<b>Types of infusate</b>				
Antibiotics	126(58.33)	90(41.66)	1.31 (0.95-1.80)	1.75 (0.95-3.19)
Non antibiotics	24(44.44)	30(55.55)		

<b>Hand washing</b> No Yes	96(64) 66(39.29)	54(36) 102(60.71)	1.62 (1.30-2.03)	2.74 (1.74-4.33)
<b>Variables</b>	<b>Cannula with phlebitis f (%)</b>	<b>Cannula without phlebitis f (%)</b>	<b>Relative Risk (95% CI)</b>	<b>Odds Ratio (95% CI)</b>
<b>Material for stabilization</b> Plaster Transpore	42(77.78) 30(71.43)	12(22.22) 12(28.57)	1.08 (0.85-1.38)	1.40 (0.55-3.53)
Transpore Dynaplast	30(71.43) 90(40.54)	12(28.57) 132(59.46)	1.76 (1.37- 2.26)	3.66 (1.78- 7.54)
Plaster Dynaplast	42(77.78) 90(40.54)	12(22.22) 132(59.46)	1.91 (1.54- 2.37)	5.13 (2.56- 10.28)
<b>Flushing of cannula</b> No Yes	126(52.5) 36(46.15)	114(47.5) 42(53.84)	1.13 (0.87- 1.48)	1.28 (0.77-2.15)

The Table - 7 depicts the incidence, relative risk and odds ratio of development of phlebitis according to different variables. It shows the comparison between the various factors. On comparing incidence related to gender, female subjects were found to have 1.3 times higher risk of developing phlebitis compared to male subjects and odd ratio is 1.7.

With regard to the location of cannula placement, upper left limb have 1.04 times higher risk of developing phlebitis than upper right limb where the odd ratio is 1.07.

On Comparing forearm and wrist with Antecubital, the risk of developing phlebitis were 1.11 times higher in forearm and wrist than in Antecubital sites and the odds ratio was 1.25. the risk of developing phlebitis was 1.44 times higher in forearm and wrist compared to hand and the odds was 2 respectively. The risk and odds in developing phlebitis in forearm and wrist is equal. Antecubital Has 1.3 times higher risk and 1.6 times higher chances of developing phlebitis than hand.

Comparing the various sizes of cannula gives that 20G has 1.29 times higher risk of developing of developing phlebitis than 22G and odd ratio is 1.78 and 20G has 2.48 times higher risk of developing phlebitis than 18G odd ratio is 4.8. Similarly 22G has 1.88 times higher risk and 2.88 times higher chances of developing phlebitis than 18G.

Comparing antibiotics with non-antibiotics, antibiotic has 1.5 times higher risk and 1.88 times higher chances of developing phlebitis than non-antibiotics. The result also shows that there is 1.64 times higher risk and 2.75 times odds of developing phlebitis when hand washing is not practiced.

On comparing the various stabilizing materials use during cannulation it was found that transpore has 1.73 times higher risk and 3.67 times odds of developing phlebitis than Dynaplast and plaster has 1.9 times higher risk and 5.13 times chances of developing phlebitis than dynaplast. Whereas plaster has 1.1 times higher risk and 1.4 times higher chances of developing phlebitis than transpore.

The risk of developing phlebitis was 1.45 times higher when flushing was not practiced and odds ratio is 1.96.

## II. Discussion

Phlebitis is the most common complication of intravenous catheters and lead to many problems. It is now well established that the etiology of phlebitis is multifactorial.

The objectives of the study was to assess the risk factors contributing to the development of phlebitis among adult patients admitted in General wards, Neigrihms hospital, Shillong.

In this study, it was found that among 318 subjects, the incidence of phlebitis among the study subjects was found to be 50.94% which is comparable with incidence rates reported at other centres around the world. The reported incidence of Peripheral venous phlebitis ranges from 2.5% to 70 %.<sup>(7, 12, 19, 20.)</sup> In some other studies done in other countries, the incidence was higher than what was found in this study.<sup>(21,22)</sup> Uslusoy and Mete<sup>12</sup> reported in their study that the incidence rate of phlebitis was 54.5% which is slightly higher than this study. Yet, these findings are much higher than the Infusion Nurses Society accepted rated of phlebitis less than 5% and the CDC Guidelines.

Majority of the subjects were in the age group of 60-70 years of age i.e. 90 (28.30%).The chance of having phlebitis was also found to be more in the age group of 60-70 years i.e. 73.33% which is in contrast with the findings reported by Singh et al (2008)<sup>23</sup>. They reported that the incidence of phlebitis was higher in the age group of 31-40 years i.e 81.8%.This study found no statistical evidence (p-value >0.05) that the phlebitis incidence is dependent on the age groups.

In this study 50.94% were males and 49.06% were females. The incidence of phlebitis was higher in female subject's i.e 57.69% compared to male subjects i.e. 44.44% which is in contrast to the finding reported by Singh et al (2008)<sup>23</sup>. They reported that the incidence of phlebitis in male was slightly higher than female (OR=1.03, CI:0.60-1.76). In this study, female patient was found to have 1.3 times higher risk of developing phlebitis compared to male patient (OR: 1.7; CI: 0.58-5.06; p <0.05). This result is similar to Maki and Ringer's study<sup>6</sup> where they found an increased risk of 1.88 times higher for females rather than males. Similar findings have been reported by Cicolini and Tagalakis.<sup>(13,24)</sup> Cicolini et al (2009) reported that the frequency of peripheral intravenous cannulae phlebitis was higher in females (OR:1.91; CI:1.20-3.03; p< 0.006). In another study (Nassaji-Zavareh and Ghorbani 2007)<sup>12</sup>, female sex was also a predisposing factor in the development of intravenous PVC-related phlebitis (OR: 1.91; CI: 1.20-3.03); p <o.006) but Uslusoy and Mete (2008)<sup>14</sup> found that sex was not a risk factor. There was no significant association found between gender and the development of phlebitis. One reason for the different rates may be small sample sizes.

Hand washing is the single most important risk reducing factor for development of peripheral vein phlebitis in patients in whom peripheral vein cannulation is done.<sup>(21)</sup> In this study the odds ratio of developing phlebitis was 2.75 (CI:0.9-8.37) when hand washing was not practiced and relative risk is 1.64 (CI:0.94-2.81) with p=3.32 which is similar to a finding reported by Arpana Neopane<sup>(21)</sup> in 2013. They reported that the odds ratio of developing phlebitis in handwashing group was only 0.25 (CI:.07-.82) and relative risk was 0.78 (CI: 0.64-0.94) with p=0.17.This study found no significant association (p>0.05) that the phlebitis incidence is dependent on the hand washing practice.

Location of cannula placement in the upper left limb has more chance of developing phlebitis than the upper right limb (RR 1.04, OR=1.07, CI: 0.61-1.76). We were not able to study the difference in incidence rate between cannula placed in veins of upper and lower limbs as no subjects had cannula placed in the lower limb. It is a standard practice in the hospital to avoid placing cannulae in the lower limb unless indicated.

In this setting cannulae of size 18 gauge, 20 gauges and 22 gauges are commonly used. Like other studies<sup>(3,8)</sup> this study found that cannula size of 20 gauge has more chance of having phlebitis compared to 18G (OR= 4.8, CI: 0.81-28.6 ). 20 G has 2.48 times higher chances for developing phlebitis compared to 18G which is in contrast to the findings of Wilkinson Y J Tan, J W Yeap and Sharifah Aznal<sup>(20)</sup> (2012).They reported in their study that the risk of developing cannula related phlebitis was similar for the three commonly used cannula sizes. Our observations showed that the percentage of developing phlebitis increased with the size of catheter used, although there was no statistical evidence (p-value >0.05) to validate this argument which is similar to Uslusoy and Mete (2008)<sup>14</sup>.

In this study the incidence of phlebitis was almost same for cannulae inserted at the wrist and the forearm. It can be concluded that cannula insertion site and occurrence of phlebitis are independent. We found that relative risk for forearm/wrist when compared to hand was 1.44 times higher for the development of phlebitis (OR=2, CI: 0.52-7.72). This is in contrast to the finding reported by Maki and Ringer (1991) who stated that the risk of developing phlebitis was lower when PIVCs are inserted in hand/wrist than in the forearm. However no statistically significant differences were observed between the specific site used and phlebitis.

Numerous studies have been conducted to investigate the type of dressing that should be applied to the catheter site. In the current study, there was a significant increase in the use of dynaplast but when compared to the use of plaster, the incidence of phlebitis was higher in plaster (77.78%). However there were no statistically significant differences between the type of stabilizing material used and the incidence of phlebitis and this is supported by previous studies.<sup>(26)</sup>

A cannula that is used for infusion has double the risk of developing phlebitis compared to a cannula that has not been used. This may be due to the type of solution infused through the cannula. Certain infusates such as antibiotics, non-antibiotics and crystalloids are associated with increased risk of phlebitis<sup>(11, 27)</sup>. This study confirms the findings of some other studies as well<sup>(4, 8, 28)</sup> that the administration of IV antibiotics substantially increase the risk of developing phlebitis. One of the reason may be related to the fact that the intravenous antibiotics cause chemical reaction of the endothelium with resultant phlebitis. We attempted to observe for an increase incidence of phlebitis when infusate are used in the subjects. However there was no significant difference between type of infusate and the development of phlebitis among the sample population in this study. This may be due to the inadequate size of the study sample and the fact that most of the patients received different infusate through the same intravenous catheter.

In our study we found that phlebitis occurred less frequently in patients with cannulae in situ less than or equal to 24 hours, compared with those in situ more than 24 hours. Anna Lundgren (1996) et al reported the same finding. Whereas Rita Andriyani<sup>(29)</sup> et al (2013) reported that there was no significant difference between <72 hours and ≥ 72 hours duration of peripheral catheter used on the development of phlebitis.

In our study we found that the odds ratio of developing phlebitis was 1.96 times higher when flushing of cannula was not done and relative risk being 1.45. This study found no statistical evidence (p-value >0.05) that the phlebitis incidence is dependent on flushing of cannula.

We would like to recommend that all patients with peripheral venous catheters in situ be screened for complications of peripheral venous catheters at least once daily as recommended by CDC Guidelines on prevention of intravascular catheter related infection<sup>(15)</sup>. This should be performed by visual examination and palpation of the veins for warmth, tenderness, erythema and a palpable venous cord. Patients with these symptoms should have their catheters replaced at a different site. We propose that all units should have an observational chart to document development of signs of phlebitis. The chart should include the signs mentioned as well as proper documentation of the date of cannulation. This would help detect phlebitis much earlier and decrease patients' discomfort and pain. Catheters that are not used should be removed within 72 hours of placement or when signs of developing phlebitis have been detected<sup>(15)</sup>.

This study too had some limitations. The study focused only on assessing the predisposing factors of phlebitis and comparing those factors. The data collected regarding the personnel who performed cannulation were not further analyzed due to ethical consideration and methodology used. Microbiological profiles were not assessed due to limitation of resources (man, money and material). The influence of the dwell time of the cannula more than 48 hours was not evaluated for the development of phlebitis due to time limitations. We did not evaluate the technique of catheter insertion the catheters were inserted by different personnel of different units. The data was collected by four members and efforts were made to standardize the symptoms. In spite of various effort, measures, onset training and validation of skills, there is still a chance of interpreter variability. We also did not evaluate the influence of the patients' clinical diagnosis on the development of phlebitis.

### III. Conclusion

Phlebitis is still an important ongoing problem in medical practice. The study showed that the risk of developing thrombophlebitis is significantly increased in female patients, and also with increased duration of catheterization and use of antibiotics for infusion. In addition to proper insertion and good nursing care, the avoidance of the above risk factors will lead to a lower incidence of thrombophlebitis. In our context, special care is needed on the patient's age, insertion time, and technology information, use of drugs and solutions and rules for documentation.

**Conflict of interest:** None

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