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ESTIMATION OF RISK FACTORS OF PHLEBITIS WITH INTRAVENOUS CANNULATED PATIENTS

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ABSTRACT

Intravenous therapy is the most familiar invasive procedure among hospitalized patients, and is related with phlebitis rate of between 2.3% and 60%. The current study was carried out to estimate the risk factors leading to phlebitis with the peripheral intravenous cannulated patients. The study was done in Emergency OPD of a tertiary care hospital. Using consecutive sampling technique, 200 patients who were planned for intravenous cannulation were considered for our study. The various risk factors includes age, sex, size of cannula, site of insertion, hand washing and use of gloves etc were studied. The Intravenous site was studied prospectively for the presence and absence of phlebitis till the cannula remained in situ. Visual Infusion Phlebitis Scale was used to estimate the grade of phlebitis. Approval to conduct the study was sought from the Institutional Ethics Committee. Mean age (yrs) ± SD of the subjects was 41.38 yrs ±15.71. Mean duration of cannula in situ was 2.66 days±0.75. Out of total 200 subjects 124 (62%) developed phlebitis. There was considerable relationship between the phlebitis and duration of cannula in situ, administration of antibiotics and electrolytes x^2 =21.14, 6.98, 14.16, p<0.01) respectively.

Keywords:Peripheral Intravenous Cannulation, Risk Factors, Phlebitis.

INTRODUCTION

Intravenous (IV) devices are a key and familiar aspect of hospital practice for the administration of medications, nutrients, fluids, blood products and to observe the hemodynamic status of a person [**1**]. Phlebitis is one of the frequent complications of IV therapy. Among the hospitalized patients, 5% to 70% of patients receiving IV therapy develop phlebitis [2].Phlebitis refers to the individual clinical manifestation at an access site with two of the following symptoms viz. redness, pain, palpable venous cord, thrombosis or streak formation, swelling,. It can cause infection or thrombus formation. Symptoms develop in hours to days and resolve over days to weeks[3].There are three different types of phlebitis which includes mechanical, chemical and infectious phlebitis. Mechanical phlebitis occurs when a peripheral intravenous catheter is not held properly, leading the catheter to alter position within the vein [4]. Chemical phlebitis is caused by extremely vesicant irritants such as drugs. Drug irritation was specified as the most important predictor of phlebitis such as antibiotics, blood products, and glucose containing fluids [5-6]. Infectious or bacterial phlebitis is caused when an infectious agent is introduced into the peripheral intravenous cannula. Infectious phlebitis can be caused by contamination of the cannula tip anytime during

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IV insertion. Infectious phlebitis may also occur if a cannula is left in place longer duration than recommended by the center for disease control and prevention (CDC) [1,7,8]. CDC recommends rotating the IV cannula every 72 to 96 hours to diminish the risk of infection and patient discomfort associated with phlebitis.1 The gauze of the IV cannula has also been recognized as another cause of phlebitis. Critically-ill patients require huge bore IV cannula for immediate resuscitation efforts and are therefore at higher risk for developing phlebitis.[9] Some of the other factors such as poor quality peripheral veins, insertion of cannula in the lower extremity, female sex, and the presence of underlying medical disease (immunodeficiency, diabetes mellitus, cancer) also augment the risk of peripheral vein infusion phlebitis [7]. Other factors may include inexperience of the person inserting the cannula, insertion in the emergency room where establishing access quickly is frequently necessary, and other conditions such as peripheral neuropathy, neutropenia, immune-suppression, malnutrition, and care and handling by an experts[7,10,11,12].Phlebitis can causes pain, sepsis, additional diagnostic investigations and treatments and may lead to the increased duration of hospitalization, patient's stress level and financial burden in addition to increasing staff workload. The current study was carried out to find out the risk factors associated to phlebitis with peripheral IV cannula.

MATERIALS AND METHODS

The study was conducted in College of Health Sciences, Dhahran,Kingdom of Saudi Arabia,Out Patient Department of Multispecialty Hospital. The study population includes all patients admitted in emergency who require peripheral IV cannulation. Total 200 patients were studied by using consecutive sampling technique.

A validated questionnaire was used to gather the data. Information was obtained about patient's identification, demography and co-morbid illness of the patient.

Procedure examination sheet was prepared to collect data on the peripheral cannula and practices related to IV cannulation. It includes cannula size, anatomic site of insertion, vein used for cannulation, type of dressing used in securing the cannula, number of attempts, hand washing, use of gloves. It was used at the time of peripheral IV cannulation. Continuing care sheet was arranged to record the successive observation of the patient related to peripheral cannulation. It includes the items as presence or absence of phlebitis, grade of phlebitis present, temperature of patient, and fluids and medication given during follow up. The subjects were daily assessed for the presence and absence of phlebitis Standardized Visual Infusion Phlebitis Scale developed by Andrew Jackson (1998) was used to review the grade of phlebitis [13].

The score range from 0 indicating no symptoms of phlebitis to 5 with signs of purulent drainage, redness, and a palpable cord greater than 3 inches. All peripheral intravenous cannula were studied for the presence of severity of phlebitis as per the visual infusion phlebitis scale on subsequent visits till the cannula remained in situ. A pilot study was conducted to assess the feasibility of the study and relevant modifications were made. Approval to conduct the study was sought from the Institutional Ethics Committee. An informed consent was obtained from each patient. Peripheral IV cannulation was done as per the protocol. Procedure observation sheet was introduced during the peripheral intravenous cannulation. The peripheral IV cannulation was done by the staff nurses according to the protocol. The care sheet was filled during the follow up period for the presence and absence of phlebitis and fluid and medications given to the patients. The patient was studied prospectively for the presence and absence of phlebitis. If the peripheral Intravenous cannula was not present then date, time and reason for removal of the cannula was documented and follow up was terminated. The data was analyzed using descriptive and inferential statistics with the help of Prism Graph Pad.

RESULTS

Total 365 patients were enrolled for the study. 165 study subjects were not studied because of the removal of cannula due to various reasons like insertion of central line, death and LAMA etc. Finally 200 subjects were studied, among them only 124 (62%) developed phlebitis.

Demographic profile of the subjects

The subjects were in the range of 18 to 90 years with the mean age of 42.46 yrs ± 15.

More than half (72%) were male. 51% of the subjects were under matric. Majority (89.5%) were married. 60% belonged to rural area. (Table 1)

Incidence of phlebitis

Fig. 1 shows the incidence of phlebitis amongst the study subjects. Out of 200 study subjects, 124 (62%) developed phlebitis. The various factors were patient's age, sex, size of cannula, site of insertion, practice of hand washing, and use of gloves, etc.

Risk factors of phlebitis amongst the study subjects

Different risk factors associated with phlebitis were studied. As per the patient related factors, the incidence of phlebitis was more with the male (58.33%) compared to female(46.28) . As per the cannula insertion site related risk factors it was observed that phlebitis was more in the patients when the cannula was inserted in the vein of wrist (66.67%) as compared to veins of hand (50.77%) and fore arm (42.5%). Duration of catheter in

situ was directly proportional to the development of phlebitis and this different was statistically significant (P<0.01). Hand washing, use of gloves and the securement device used to fix the cannula did not have any significant impact on the development of phlebitis.

Development of phlebitis as per administration of fluids and medications:
The patients with peripheral IV cannula were studied prospectively for the fluids and medications

administered through the cannula. Out of the total 124 subjects who developed phlebitis, 79.03% and 41.94% of the study subjects had phlebitis where antibiotics and electrolytes were used respectively and was found to be highly significant (p<0.005). 1/3rd of the study subjects had developed phlebitis where three or more other drugs wereb used like analgesics, antipyretics, diuretics, H2 receptor antagonist, etc. 87.6% of the subjects who received crystalloids developed phlebitis (P>0.05). (Table 3).

Table 1. Demographic data of the subjects N=200

Variables	n (%)
* Age(years)	
<20	20 (10.0)
21-40	93 (46.5)
41-60	64 (32.0)
60+	23 (11.5)
Sex	
Male	144 (72)
Female	56 (28)
Education	
Under matric	102 (51)
Undergraduate	92 (41)
Graduate and above	16 (8)
Marital Status	
Unmarried	179 (89.5)
Married	21 (10.5)
Habitat	
Rural	120 (60)
Urban	80 (40)

* Mean Age (yrs)

Table 2. Risk factors of phlebitis amongst the study subjects N=200

Risk Factors	Presence of Phlebitisn (%)	x^2, dfp-value
Patient specific factors		
Age(years)		
<20 (n=20)	10 (50)	1.32, 3
21-40 (n=93)	52(55.91)	0.71
41-60 (n=60)	32(53.33)	
60+ (n=27)	12(44.44)	
Sex		
Male (n=144)	84 (58.33)	0.09,1
Female (n=56)	26 (46.28)	0.74
Cannula Specific Factors		
Cannula Site		
Forearm (n=120)	51 (42.5)	2.08,2
Hand (n=65)	33 ((50.77)	0.33
Wrist (n=15)	10 (66.67)	
Cannula Size		
16G (n=8)	3 (37.5)	2.68, 3
18G (n=79)	41 (63.07)	0.44
20G (n=110)	65 (59.09)	
22G (n=3)	3 (100)	

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Duration of Cannula		
≤2 days (n=84)	30 (35.71)	21.84,2
3-4 Days (n=90)	55 (61.11)	0.00*
> 4 days (n=26)	20 (76.92)	
Other factors		
Hand Washing		
Done (n=9)	5 (55.5)	0.002, 1
Not Done (n=191)	106 (55.49)	0.96
Use of Gloves		
Yes (n=172)	91(52.90)	0.032, 1
No (n=28)	15(53.57)	0.84
Securement device		
Leucoplast (n=37)	21 (56.76)	3.65, 2
Dynaplast (n=140)	81 (57.85)	0.31
Paper tape (n=23)	13 (56.52)	

**statistically significant

Table 3. Development of phlebitis as per administration of fluids and medications n=124**

Variable	Presence of Phlebitisn (%)	x^2, dfp-value
Antibiotics		
Yes	98(79.03)	6.98, 1
No	26(20.96)	0.00*
Electrolytes		
Yes	52 (41.94)	14.16, 1
No	72 (58.06)	0.00*
Ionotropes		
Yes	14 (11.29)	0.42,1
No	110 (88.71)	0.52
Otherdrugs		
No or 1 drug	30 (24.19)	1.54,3
2 drugs	34 (27.42)	0.92
3 drugs	38 (30.65)	
4 or more drugs	22 (17.74)	
Crystalloids		
Yes	113 (91.13)	1.35,1
No	11 (8.87)	0.25
Colloids		
Yes	10 (8.07)	0.001,1
No	114 (91.93)	0.95

*Statistically significant

**Subject who developed phlebitis were taken

Fig. 1. Incidence of phlebitis among the study subjects

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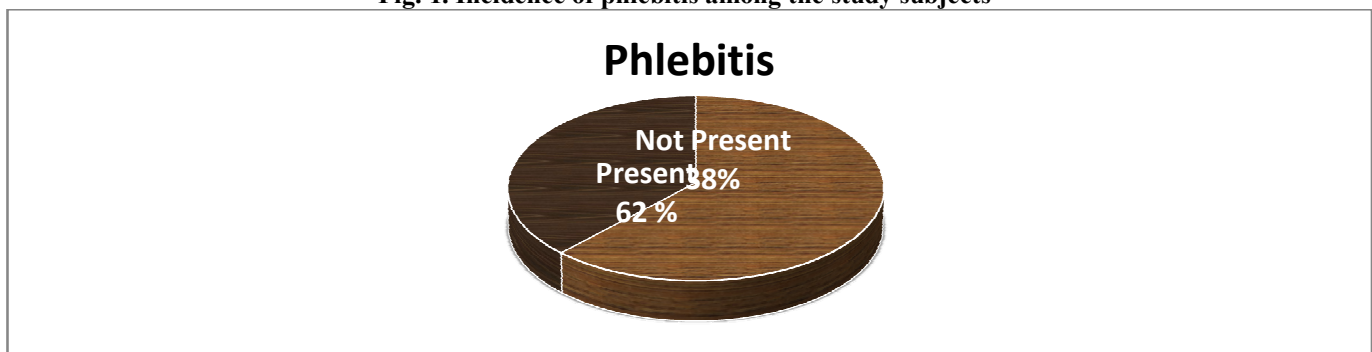
DISCUSSION

Among hospitalized patients, intravenous therapy is the most common invasive procedure and is associated with a phlebitis rate of between 2.3% and 60%.14. It is well established that the etiology of phlebitis is multifactorial. The overall phlebitis rate in the study was 62% which was fond to be equitable with the findings of Zamanzadeh V *et al*., [15].

The incidence of phlebitis in the present study was more in males as compared to females. This may be due to more number of males in our study but Tageret al[16] and Cornely*et al*[17] found that gender is not a risk factor of phlebitis whereas Kegel*et al*., [12] Maki ringer7 and Nassaji M [18]found female gender to be an linked risk factor for the development of these complications. In compare to other studies4, the prevalence of phlebitis in patients > 60 years old was lower than those < 60 years old in both the groups because the inflammatory response in the elderly is often impaired, sign and symptoms of phlebitis may be fine Moreover; the number of elderly was significantly less compared to adult population.

The various practices related to peripheral intravenous cannulation were studied. In the present study there were almost equal number of subjects who washed their hands or not done gloves before cannulation whereas Hirchmann*et al*., [19] had reported that in estimation of simple hand washing, disinfection of hands before the insertion or wearing of gloves resulted in fewer complications related to peripheral venous cannulation.

The catheter specific risk factors studied were cannula size, anatomic site of insertion,Vein used for cannulation, Cannula site dressing, type of medications and fluid administered through cannula. Large bore catheters generally cause more phlebitis due to greater mechanical irritation. The study results were reliable with the findings ofNassaji ZM [18] that didn't show cannula bore as a risk factor for phlebitis in both the groups.

One of the possible reasons may be that very large bore cannula were not used in study subjects whereas in contrast to other studies large bore cannula increased the risk of phlebitis. Poor anchorage of cannula with tape or dressing appears to increase the risk of the development of phlebitis which was contradictory with the present study findings.

Several factors determine the likelihood of developing phlebitis. Chemical phlebitis occurs due to damage to the vein wall by chemical irritants such as infusion fluids both a low pH and high osmolarity of intravenous fluids and medications are reported to be related with chemical phlebitis. Additives such as potassium chloride, antibiotics and cytotoxic agents can produce severe venous inflammation[20,21].

In present study findings, cannulae were used for the rapid administration of large number of fluids and drugs but the study didn't show any significant difference between the administration of antibiotics, electrolytes and ionotropes whereas Catney*et al*., [22] in their report stated that drug irritation as one of the main risk factor for the development of phlebitis and infiltration. There was significant difference between the uses of combination of IV fluids like 0.9% NS, 5% dextrose, Dextrose NS, etc and additive drugs like analgesics, antipyretics, H2 receptor antagonist etc and phlebitis in between the groups which was found to be consistent with findings of Maki and Ringer[6,7].

The present study results revealed duration of cannula in situ and the administration of antibiotics and electrolytes to be the most common risk factors of phlebitis.

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