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The Study of Effective Factorson the Severity of Phlebitis Related to Peripheral Venous Catheters for Hospitalized Patientsin the Imam Khomeini Hospital of Kerman Shah, 2015

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Abstract: Phlebitis is one of the serious complications of catheter which is still one of the most important problems in hospitalized patients. Therefore, the present study has been conducted to determine the factors associated with the severity of phlebitis due to peripheral venous catheters in hospitalized patients of Imam Khomeini hospital in Kermanshah, 2015.This study is a descriptive cross-sectional study. The case study was all admitted patients (who had peripheral venous catheter and phlebitis) of the infectious diseases, ICU and internal sectors of Imam Khomeini hospital in Kermanshah for the time period of April to September 2015. Jackson'sevaluating checklist has been applied asa criterionto recognize phlebitis based on touch and observation of the researchers. Therequired collecting data has been appliedin SPSS v.21 Software. All analyzes have been examined at a significance level of 5%.In this study, 201 cases of phlebitis were identified. Phlebitis type IIwas observed in 54.2%of cases and other cases were phlebitis type. The variables of age and gender had no significant relationship with the phlebitis ($p>0.05$).The results of logistic regression analysis showed that hospitalization in the ICU sector (in comparison with the internal sector), receiving ceftriaxone and non-ceftriaxone type ofantibiotics (in comparison with patients who did not receive antibiotics) and angiocath installation time of 48-72 h (in comparison with patients who had angiocath installation timeless than 24 h) had higher chance to get severe phlebitis. Furthermore, the risk of severe phlebitis is lower in patients who were ininfection sector in comparison with internal sector.The results of this study showed that the risk of severe phlebitis has been increased by hospitalized patients in ICU, receiving antibiotics and increased duration of angiocath installation.

Key words: Phlebitis, inflammation of a vein, peripheral venous catheters, angiocath, logistic regression

INTRODUCTION

Installation of intravenous catheter (angiocath) is one of the most common forms of invasive treatment in hospitals for fluids supply, electrolyte supply, having a venous line used for emergency situations and other essential needs (Maki and Ringer 1991; Soifer, 1998; Tomford and Hershey 1985). Angiocath was installed almost for 80% of all admitted patients in the hospital (Rego and Furtado, 2011). Although this method had the tremendous value, it was one of the most common causes of nosocomial infections caused by group therapists (Maki and Ringer 1991).The phlebitis is considered as a major complication of venous catheterization (White, 2001). These complications can be observed by inflammation of the superficial veins with the specific symptoms of inflammation such as pain, warmth, redness, swelling and stiffness in that spot and also the injection through a relevantvein can be impossible (Nassaj and Ghorban, 2007). In most studies, the prevalence of phlebitis was reported to be 18-35% (Brandt, 2000; Choi, 2003; Ghadami, 2001). Phlebitis effects should be

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considered seriously, because they can cause buildup of bacteria, infections, increased length of hospital stay and medical expenses, loss of intravenous lines and sometimes patient mortality (Redelmeier and Liverley 1999, Foster *et al*., 2002). Several factors are involved to the prevalenceof phlebitis such as the diameter, length, sex, location, duration time of sing a catheterand type of injected solution (Maki and Ringer 1991; Soifer *et al*., 1998; Tomford and Hershey, 1985). The results of conducted studies showed that phlebitis due to angiocath remained a significant problem in hospitalized patients (especially patients with diabetes and infectious) and the differences in the previous results require more researches in this areaby progressingmedical facilitiesand improving nursing care (Kalani *et al*., 2015). Doing the etiology studies, is one of the first steps in order to design effective interventions (Alavijeh *et al*., 2016; Alavijeh *et al*., 2015). Therefore, the present study has been conducted to determine the factors associated with the severity of phlebitis due to peripheral venous catheters in hospitalized patients in Imam Khomeini hospital of 2015. The results of this study can be applied by managers and authorities of health care and education in preventive measures and reduction of the prevalence of this complication.

MATERIALS AND METHODS

This study was a cross sectional descriptive-analytical study. The study population included all patients admitted to the infectious diseases ward, ICU and internal sectorsof Imam Khomeini hospital in Kermanshah for the time period of April to September 2015. The patients have been diagnosed with peripheral venous catheterand phlebitis. According tothe importance of the risk and severity of phlebitis catheter duration of the installation, patientswith a physician or personal satisfaction fromother sectors of the hospital (who were discharged in<24 h) were excluded.Information of patients have been collected in the checklist such as age, sex, level of consciousness (GCS), length of stay, type and location of the catheter, the catheter insertion number of days, type of serum and receiving antibiotics. In this study, patients undergoing chemotherapy and Total Parenteral Nutrition (TPN) were excluded. Diagnosis criteria and grading of phlebitis have been done by Jackson'sevaluating checklistaccording to the researchers observed signs and symptoms and it can be divided into three grade categories based on phlebitis (Longo *et al*., 2012). However, all cases of phlebitis in the study were grade one and grade two. Therefore, these two groups have been comparedby the main factors affecting the severity of phlebitis and phlebitis type 2 was considered as severe phlebitis to facilitate interpretation of the results. Angiocaths also are categorized in seven groupsbased on size, application andcolor. Angiocaths with brown (orange), gray, green, pink, blue, yellow and purple colorare known as the angiocath numbers of 14, 16, 18, 20, 22, 24 and 26,respectively. The collected data was applied in SPSS v.16 Software.

T-test has been utilized to examine the relationship between independent variables and the dependent variable for the approved default of parametric tests including a normal distribution, variance and independence of observations from each other. In the case of non-approved defaults, nonparametrictests were used abnormal v and qualitative variables such as Kruskal-Wallis, Mann-Whitney, chi-square and Fisher's exact test. Scheffe post hoc test has been applied to determine significant couples for one-way ANOVA test.Logistic regression test (as a test that can be caused by any of the factors identified by controlling other factors) was usedto determine factors associated with severity of phlebitis with respect to establishing defaults of logistic regression test such as the type of binary phlebitis, quantitative or qualitative type of independent variables and not correlated variables. All analyzes with the significance level of 5% have been investigatedusing SPSS v.16 Software.

RESULTSAND DISCUSSION

In this study, 201 cases of phlebitis were identified in the time period of April to September 2015. The type of phlebitisfor 109 patients (54.2%) was type 2 and for other cases was type 1. 119 (59.2%) of patients were male and 82 (40.79%) of them were female. The mean and median age of patients were 49.95 (17.21±) and 51 year, respectively. 75 (37.3%) cases were related to the internal sector, 76 cases (37.8%) were from the infectious diseases sector and 50 patients (24.9%) were in ICU. Most cases of identified phlebitis have been recorded in morning (49.8%) and evening (42.3%) shifts andthe most occurred inJanuary with an abundance 20.9% by narrowly higher than March (19.9%) and December (19.4%). 170 (84.6%) of the casesreceived intravenous antibiotics and 164 patients (81.6%) received serum type 1.3-2.3. Angiocath installation time for 85% of cases was 24-48 h. The location of the majority of angiocathswas left forearmwith an abundance of 54.2% (n = 109) and the most angiocath color types (77.1%) was pink type. 82.6% of patients were sober, 10.9% were in a state of confusion and 13% of them were unconscious during hospital stay. Average and median length of hospitalization among cases were 5.81 and 3 day, respectively. The minimum and maximum

Table 1: Characteristics of patients with phlebitis in internal, infections and ICU sectorsof Imam Khomeini hospital for the time period of April to September 2015

	The phlebitis type					
	I		II		Total	
Variables	Number	Percent	Number	Percent	Number	Percent
Sex						
Man	49	53.3	70	64.2	119	59.2
Female	43	46.7	39	53.8	82	40.8
Sector						
Internal	36	39.1	39	35.8	75	37.3
Infectious	54	58.7	22	20.2	76	37.8
ICU	2	2.2	48	44	50	24.9
GCS value						
13-15	91	98.9	75	68.8	166	82.6
9-12	1	1.1	21	19.3	22	10.9
<9	0	0	13	11.9	13	5/6
Injecting antibiotics						
Yes	67	72.8	103	94.5	170	84.6
No	25	27.2	6	5.5	31	15.4
Angiocath type						
Blue	6	6.5	1	9.0	7	3.5
Pink	85	93.4	70	64.2	155	77.1
Green	0	0	37	33.9	37	18.4
Angiocath installation time (h)						
<24	14	15.2	6	5.5	20	10
24-48	73	79.3	98	89.9	171	85.1
48-72	5	5.4	5	4.6	10	5
Months						
October	11	12	16	14.7	27	13.4
November	11	12	18	16.5	29	14.4
December	17	18.5	22	20.2	39	19.4
January	26	28.3	16	14.7	42	20.9
February	6	6.5	18	16.5	24	11.9
March	21	22.8	19	17.4	40	19.9
Angiocath location						
Right wrist	17	18.5	11	10.1	28	13.9
Right forearm	16	17.4	12	11	28	13.9
Right elbow	2	2.2	0	0	2	1
Right arm	0	0	1	9.0	1	0.5
Left wrist	13	14.1	3	2.8	16	8
Left forearm	31	33.7	78	71.6	109	54.2
Left elbow	2	2.2	3	2.8	5	2.5
Left arm	1	1.1	0	0	1	0.5
Right foot	4	4.3	0	0	4	2
Left foot	4	4.3	1	9.0	5	2.5
Other	2	2.2	0	0	2	1

inpatient days were 1 and 89 day, respectively. The characteristics of the study have been reported in Table 1.

As can be seen in Table 2 the average age of people using the blue angiocathwas significantly different with the mean age of the patients using green and pink angiocaths. The results showed that the average age of patients to whomangiocath installed more than 48 hours had a significant difference with other groupsby the angiocath installation time of<24 h and 48-72 h. However, the variables of age and gender had no significant relationship with the prevalence of phlebitis ($p>0.05$). Finally, several variables had significant relationship with phlebitis such as type of sector, hospital stay, the GCS, antibiotic injections, angiocath type, time, location and installation body parts andreceived serum type ($p<0.05$).

A 1: They will be determined by Scheffe test which the average age of patients using blue angiocathis significantly different from the other two groups.

A 2: It based on Scheffe test shows that the mean age of patients with more than 48 h of angiocath installation time is significantly differentfrom the other two groups. According to Table 3 the results of logistic regression analysis showed that the risk of phlebitis type II was higher than phlebitis type I in hospitalization in the ICU sector (in comparison withthe internal sector), receiving the antibiotics of ceftriaxone and non-ceftriaxone type (in comparison with patients who did not receive antibiotics) and the angiocath installation time of 48-72h (in comparison with patients by angiocath installation time of <24h) and itwasstatistically significant.Moreover, the risk of phlebitis type 2 washigher than type 1 in the patient

Table 2: Relevant factors specified to phlebitis type in patientswith phlebitis in internal, infections, andICUsectorsofImam Khomeini hospitalfor the time period of April to September 2015

Subgroups (N)	Age (years)			Sex			(days) of stay			GCS value			Phlebitis type		
	Average	SD	P	Male	Female	p	Average	SD	p	13-15	9-12	< 8	p	One	Two	p
Sex																
Male (119)	48.14	16.26	*0.844	-	-	-	5.93	11.7	M0.716	98	12	9	0.690	49	70	0.115
Female (82)	47.66	18.39					5.66	9.28		68	10	4		43	39	
Injecting Antibiotics																
Yes (170)	48.37	17.94	*0.272	105	65	084/0	17/6	6/11	M153/0	136	34	F027/0	67	103	0.000	
No (31)	45.61	11.53		14	17		87/3	93/1		30	1		25	6		
Sector																
Internal (75)	48.72	13.49	-515/0	42	33	759/0	16/3	27/1	009/0-	138	35	F003/0	36	39	0.000	
Infectious disease (76)	45.62	8.20		47	29		25/10	2/16		28	0		54	22		
ICU (50)	50.32	16.98		30	20		06/3	82.0					2	48		
Installation location of angiocath																
Wrist (44)	47.18	7.19	-995/0	18	26	006/0	41/8	4/16	001/0-	43	1	002/0	30	14	0.000	
Forearm (146)	48.56	15.69		93	54		22/4	7.6		112	34		52	94		
Feet (9)	48.22	25.79		8	1		11/15	4/18								
Installation organs of angiocath																
Right hand (59)	44.44	17.33	-145/0	29	30	047/0	81/4	3.6	001/0-	52	7	117/0	35	24	002/0	
Left hand (131)	95/49	15.87		81	50		36/5	3/11		103	28		47	84		
Feet (9)	22/48	25.79		8	1		11/15	4/18								
Angiocath type																
Blue (7)	86/18	12.77	A1001/0	93	70	230/0	71/12	6/10	007/0-	151	11	0.000	91	71	F000/0	
If (155)	48.68	16.39					93/5	5/11								
Green (37)	50.93	44/16		25	12		97/2	87/0		13	24		0	37		
Angiocath instal lation time																
0-24 h (20)	46.90	59/19	A2004/0	14	6	287/0	05/4	08/4	001/0-	156	35	F 281/0	14	6	065/0	
24-48 h (171)	49.06	8.16		101	70		64/5	3/11					73	98		
48-72 h (10)	30.90	64/21		4	6		3/12	31.8		10	0		5	5		
Serum type																
3 / 2-3 / 1 (173)	48.02	50/17	-894/0	103	70	811/0	22.5	37/9	027/0-	138	35	F 006/0	70	103	0.000	
n / s (24)	47.08	90/14		161	12		93/7	8/13		28	0		22	6		
3 / 2-3 / 1 n / s(4)	49.75	38/16					25/19	5/30								
Phlebitis type																
I (93)	46.08	82/17	*155/0	49	43	115/0	65/8	3/15	M024/0	91	1	0	001/0			
II (109)	49.52	41/16		70	39		42.3	02/2		75	21	13				
All (201)	47.94	12/17		119	82		82/5			166	22	13		93	109	

* Independent t-test,-Kruskal-Wallis test,MMann-Whitneytest,F.Fisher's exact test, other analyzes are withchi-square tests

with angiocath installation time of 24-48 h (in comparison with patients with angiocath installation time of less than 24 h), the location of the angiocath installation on forearm (in comparison with the location of the angiocath installation on the wrist) and in patients who have been admitted non-morning shift (in comparison with patients who have been admitted in the morning shift). However, the relationship was not statistically significant. Logistic regression analysis showed that although the angiocath installation on the foot decreased the risk of severe phlebitis compared to angiocath installation on wrist, this relationship was not statistically significant. The risk of severe phlebitis in admittedpatients in infectious was lower than the internal sector and the obtained relationship was statistically significant. This study aimed to investigate factors associated with severity of phlebitis due to peripheral venous catheters of hospitalized patients in the infectious diseases, ICU and internal sectors ofImam Khomeini hospital inKermanshah for the time period of April to September 2015. It should be noted that this study compared the effects of various factors on the risk of phlebitis while most of studies were conducted to investigate the complication of phlebitis for patients with angiocath in hospital sectors.

It can be observed in this study that 54.2% of cases were phlebitis type 2. Fadakar *et al*., 2009 studied the majority of cases with phlebitis type 2 by frequency of 62 %. However, Aslani showed that the majority of reported cases had phlebitis type 1 with frequency of 62% (Aslani, 2000). The studies of Fadakar Suqe and Aslani also showed that the factors of age and sex had no significant relationshipwith theprevalence of phlebitis (like the results of this study). Furthermore, the study of Kalani *et al.* also concluded that the difference

Table 3: Comparison of Odds Ratios (OR) for factorsaffecting phlebitis intensity using logistic regression test in patients with phlebitis in internal, infections, andICUsectorsofImam Khomeini hospitalfor the time period of September 2015-April 2016

Variable	(exp β) or	95%	p-value
Sex			
Male (reference)			
Female	15.5	---	---
Age	11.1	2.0	0.75
Shift			
Morning (reference)			
No morning	2.350.	95-5.82	0.066
(days) of stay			
1 day (reference)			
2 days	1.27	0.624	---
3 days	1.08	0.782	---
4 days	17.25	0.091	---
>4 days	2.5	0.339	---
Sector			
Internal (reference)			
Infectious	0.29	0.11-82.0	0.019
ICU	24.16	2.23-261.4	0.009
GCS*			
13-15 (reference)			
9-12	1.8	0.443	---
Angiocath type*			
Blue (22g) (Reference)			
Pink (20g)	9.24	9.46-183.71	0.145
Injecting antibiotics			
Do not receive antibiotics (reference)			
Non-ceftriaxone	38.79	7.29-206.45	0.000
Ceftriaxone	45.61	8.59-242.08	0.000
Angiocath installation time			
<24 h (reference)			
24-48h	1.12	0.34-3.70	0.849
48-72h	31.78	2.09-484.21	0.013
The location of angiocath			
Wrist (Reference)			
Forearm	1.43	0.55-3.75	0.461
Leg	0.07	0.200-2.05	0.122
The organs of angiocath			
Right hand (reference)			
left hand	1.49	0.528	---
Serum type			
1.3-2.3 or normal saline (reference)			
Normal Saline	9.5	0.134	---

*The sub-group ofgreen angiocath and GCS<9 are excluded in logistic regressiontest, becausesome values ??are zero. Variables withless confidence intervals were depleted by the backward methodof regre

of phlebitis for both males and females was not statistically significant and the prevalence of this complication wasn't associatedwith age (it did not follow a specific pattern and wasn't statistically significant inthe different age groups); (Kalani *et al*., 2015). Finally, the studies of Rego Furtado and Choialsoconfirmed these results (Choi *et al*., 2003, Rego Furtado, 2011).

There was no significant relationship between the working shifts of angiocath installer personnel and the length of hospital stay in Aslani's study. In this study, although admitted patients in morning shifthad higher the risk of severe phlebitis in comparison with other patientsby logistic regression analysis, this relationship was not statistically significant. Unlike Aslani's study, the length of hospital stayand the prevalence of phlebitis had a significant relationship (Aslani, 2000).

Most of phlebitis cases in this study received intravenous sugar solution (2.1-3.3) and serum injection had significant relationship with phlebitis type by the chi-square test. However, this variable showed no effect on increasing or decreasing the risk of severe phlebitis bylogistic regression test. This implied thatreceiving intravenous sugar solution did not have an effect on the severity of phlebitis by controlling the effects of other variables. The results of Aslani's study also confirmed that there was no significant relationship between receiving serum and the prevalence of phlebitis (Aslani, 2000).

In this study, Fisher's exact test showed a significant relationship between angiocath type and the type of infection and phlebitis. Although the installation of pink angiocath in comparison with blue angiocath increased phlebitis based onlogistic regression test, this relationship was not statistically significant. According to Kalani's study, phlebitis was occurred in patients with green angiocath and the difference in the prevalence of phlebitis among the usedtypes of angiocath wasn't statistically significant. However, the effect of these variables on the severity of phlebitis was not mentioned in this study (Kalani *et al*., 2015). Ali Ramaei also stated in his study that green angiocath hadmore prevalentin patients withsevere phlebitis. But there was no significant relationship between the severity of phlebitis and angiocathtype. Based on the results of this study and similar studies, it can be said that thicker angiocaths had more effects on the prevalence of severe phlebitis. Therefore, there was no significant relationship between them. Finally, there searchers of this study believe that conducting a study with a larger sample size mayclarify the results.

In this study, the results of chi-square test showed that the angiocath installation time had a significant relationship with the risk of phlebitis. Likewise, according to the logistic regression test results, patients with angiocath installationtime of 2-3 day had higher the risk of severe phlebitis compared to patients with less than a day and it was statistically significant. Fadakar Suqeh *et al*. also concluded in their study that the length of usingangiocath had a significant relationship with the prevalence of phlebitisso that 39, 43 and 18% of phlebitis

cases were identified in the first, second and third day after injection, respectively (Fadakar *et al*., 2009). The studies of Kalani, Aslani, Ali Rmaei, Tomford and Madeoshowed that higherconnection time of angiocath led to higher prevalence of phlebitis. The difference between one day and two (and three) days was statistically significant. (Tomford, 1985; Aslani, 2000; Kalani *et al*., 2015; Ali, 2008; Madeo *et al*., 1997).

In this study the majority of cases of phlebitis occurred in the forearm and logistic regression analysis showed that the risk of severe phlebitis for the location of angiocath in forearm was higher thanthe installation location onwrist 4 but this relationship wasn't statistically significant. Forearm was the most used part for angiocath in patients of the Kalani's *et al*., 2005 study but the highest prevalence of phlebitis has been observed in the arm. Thelowest prevalence of phlebitishas been occurred in wrist and this difference was statistically significant (Kalani *et al*., 2015). Singh also reported that the most common location of thrombophlebitis was the forearm (Singh *et al*., 2008). It appears that studies with more samples are needed, because studies havethe contradictoryresults about the effect ofangiocath locationon the risk of phlebitis.

The results of tests from the first part of study showed that the state of consciousness (score of GCS) and the prevalence of phlebitis had a significant relationship. However, the effect of this variable on the severity of phlebitis wasn't significant in the logistic regression model and it is excluded from model. Sincethe majority of patients with satisfactory level of consciousness suffering from mildphlebitis, this result may be due to patient motion controls on the location of angiocath installation (reduce the possiblephysical damage).

In this study, it was observed that received injections of antibiotics ceftriaxone and non-ceftriaxoneincreasedthe risk of severe phlebitis in comparison with patients not receiving antibiotics. Aslani also concluded that antibiotics werethe most common injection and intravenous drug administration in particular refers to a mixture of several drugssignificantly increased the risk of severe phlebitis (Aslani, 2000).This result may be due to the fact that some of intravenous antibiotics can be irritating and increasing the risk of venous injuries such as phlebitis. Since, admittedpatients in infectious sector may be further treated with antibioticsaccording to certain conditions, it was expected that the risk of severe phlebitis would be higher in this sector.However,the results of logistic regression test showed that the risk of severe phlebitis in patients hospitalized in this sector has been internal sectorby controlling the effects of other variables.

CONCLUSION

The results of this study showed that patients receiving the antibioticfor admitted patients of the ICU sectorhad higher angiocath installation time (especially between 48-74h) in comparison with the internal sector whichincreases the risk of severe phlebitis. It can be suggested based on these results thatnursing staff should have essential training about how to inject and the importance of replacing catheters at a shorter timein addition to refrain from prescribing unnecessary antibiotics and stimulatedrugs intravenous.

The risk of a severe phlebitis in admitted patients of the ICU sector was higher than the internal sector as one of the results of this study. It should be noted that phlebitis can be getting under controlin the ICU sector by considering otheraffectingvariables.While this study was cross-sectional and all samples had phlebitis without control group, it is necessary for future studies that they have a wide and prospective case with the control group by considering the important variablessuch as smoking, diabetes, underlying disease, serum volume received, the status of patient mobility.

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