Peripheral Intravenous Cannula Location and the Effect of the Antiseptic Solution on the Development of Thrombophlebitis: A Quasi-Experimental Study

Araştırma
Research

Periferik İntravenöz Kanül Yeri ve Antiseptik Solüsyonun Tromboflebit Gelişimi Üzerindeki Etkisi: Yarı Deneysel Bir Çalışma

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Abstract

Aim: Peripheral Intravenous Cannulae (PIVC) are an indispensable tool in modern medical treatment; however, their misapplication may lead to preventable complications such as thrombophlebitis. The location of the cannula and the antiseptic solution utilised have been hypothesised to exert an influence on the development of thrombophlebitis. The present study was conducted with the objective of investigating the effects of PIVC site and antiseptic solution on the development of thrombophlebitis.

Methods: The present study adopts a quasi-experimental design, employing a pre- and post-test model. PIVC was applied to the veins of the dorsum of the hand, forearm and cubital fossa, which were determined according to the patient's condition, using 70% alcohol, 10% povidone iodine or 2% chlorhexidine antiseptic solutions sequentially. The cannula site was observed at 24-hour intervals post-application using the Visual Phlebitis Scale, with the results documented on the designated form. In this study, a total of 341 PIVC were observed for a maximum of 96 hours.

Results: Following the conclusion of the study, it was determined that the optimal cannula location for the prevention of thrombophlebitis was the dorsum of the hand, and that the most efficacious antiseptic solution was 10% povidone iodine.

Conclusion: Thrombophlebitis has been an important complication in the context of PIVC applications from past to present. The present study determined that the location of the PIVC and the aseptic solution used are effective in the development of thrombophlebitis. It is thought that performing cannula applications in this direction may prevent the complication of thrombophlebitis.

Keywords: antiseptics; thrombophlebitis; peripheral catheterization

Özet

Amaç: Periferik İntravenöz Kanüller (PIVK), modern tıbbi tedavide vazgeçilmez bir araçtır; ancak yanlış kullanımı, tromboflebit gibi önlenebilir komplikasyonlara yol açabilir. Kanülün yerleştirildiği bölge ve kullanılan antiseptik solüsyonun tromboflebit gelişimini etkilediği bilinmektedir. Bu çalışma, PIVK yerleştirilen bölge ve antiseptik solüsyonun tromboflebit gelişimine etkisini araştırmak amacıyla yapılmıştır.

Yöntemler: Bu çalışma, ön test ve son test modelini kullanan yarı deneysel bir tasarımdadır. PIVK uygulaması, hastanın durumuna göre belirlenen el üstü, önkol ve antekübital bölge damarlarına, sırasıyla %70 alkol, %10 povidon iyot ve %2 klorheksidin antiseptik solüsyonları kullanılarak gerçekleştirilmiştir. Kanül bölgesi, uygulama sonrası 24 saatlik aralıklarla Görsel Flebit Ölçeği kullanılarak gözlemlenmiş ve sonuçlar kaydedilmiştir. Bu çalışmada, toplam 341 PIVK maksimum 96 saat boyunca gözlemlenmiştir.

Bulgular: Çalışmanın sonunda, tromboflebitin önlenmesi için en uygun kanül yerinin el üstü olduğu ve en etkili antiseptik solüsyonun %10 povidon iyot olduğu belirlenmiştir.

Sonuç: Tromboflebit, geçmişten günümüze PIVK uygulamaları bağlamında önemli bir komplikasyon olmuştur. Bu çalışma, PIVK'nın yeri ve kullanılan antiseptik solüsyonun tromboflebit gelişiminde etkili olduğunu belirlemiştir.

Anahtar Sözcükler: antiseptik; trombofilebit; periferik kateter

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Introduction

Peripheral Intravenous Cannulation (PIVC) is one of the most commonly performed nursing practices in the clinic (1–4). It has been reported that approximately 67-90% of hospitalized patients receive PIVC, and more than 150 million PIVCs are used each year in health centers in the USA and approximately 4.5–5 million in Sweden (4–6), 2023 however, no studies represent Turkey in this regard (7). There is insufficient literature regarding the infection rates due to PIVC; however, it has been reported to be 0.4% as compared with 4.0% for central venous cannulas (CVCs) (3). Although the numbers of PIVC-related infections appear low, considering the increases in the frequency of application and infections in recent years, it is necessary to pay more attention to PIVC. In recent studies, thrombophlebitis is stated as one of the most common complications of PIVC, with an incidence rate ranging from 4.5% to 67.0% (2,4,5). Accordingly, it should be evaluated more carefully in terms of preventing causes of infection.

PIVC application and complication controls are the responsibility of nurses (8,9). PIVC application, a difficult skill, is used to maintain or correct the fluid-electrolyte balance of patients, administer intermittent or continuous medication, give blood and blood products, help meet the nutritional needs of patients who cannot take food orally, facilitate long-term vascular use, make hemodynamic impressions and help diagnosis (2,5,7,9–11). When PIVC is not applied correctly, it can cause life-threatening but preventable complications such as infiltration, circulatory overload, hematoma, nerve damage, air embolism, thrombophlebitis, and septicemia (2,9,12,13). These complications lead to prolonged hospital stays, unnecessary diagnostic and treatment procedures, stress for patients and their relatives, increased workload for healthcare professionals, and economic losses (4,7,10).

The most common complication in PIVC practice is thrombophlebitis which is inflammation of the vein wall that develops as a result of chemical irritation by drugs and fluids given by PIVC (2,5,9). It manifests as redness, warmth, pain, edema, and stiffness at the cannula insertion site and along the vein. The development of thrombophlebitis depends on the patient's age, gender, presence of a chronic disease such as diabetes mellitus or hypertension, proximity to the focus of infection, type and size of the cannula material (Teflon-polyurethane), location of the cannula, applied treatment, duration of cannula placement, the chosen antiseptic solution, and compliance with aseptic techniques (2,4,5,7,9,14,15). Different results have been reported regarding the rate of thrombophlebitis due to PIVC (4,7,9,16).

PIVC practice, maintaining continuity, and preventing complications are among the most important roles and responsibilities of nurses (8,10,17). To prevent complications, it is important that well-skilled nurses evaluate the patient, choose the correct cannula site, apply the correct antiseptic solution, and apply peripheral intravenous cannulation (18). This study was conducted to examine the effects of peripheral intravenous cannula (PIVC) location and the selected antiseptic solution on the development of thrombophlebitis.

Investigation hypothesised

Is cannula location important in the occurrence of thrombophlebitis complications in PIVC application?

Is antiseptic solution important in the occurrence of thrombophlebitis complication in PVC application?

Material and Methods

1. Research type and aim

The present study was conducted to examine the effects of the PIVC location and chosen antiseptic solution on the development of thrombophlebitis. This is a quasi-experimental study conducted using pre-test and post-test models in a single group.

2. Data Collection Tools

2.1. Patient Information Form

The Patient Information Form was developed by the researchers and comprises the following data: age, gender, smoking status, existence of chronic diseases, surgical operation status, and the arm and location of cannula application.

2.2. Phlebitis scale

Phlebitis is a condition characterised by pain, redness, edema, induration, palpable vein and

pus drainage at the cannula entry site as a result of perforation of the vein. It is a grading scale ranging from 0 to 4.-In general, the phlebitis scale is based on observation. (8,10,19)

2.3. Research Population

The present study was carried out by observing PIVCs, applied to patients hospitalized in the surgical clinic of a hospital, for a maximum of 96 hours at 24 hours intervals. No sample selection was made and the antiseptic solutions determined for the patients admitted to the clinic were used sequentially. The cannula site was determined on a patient-by-patient basis. Patients who were admitted to the clinic, who accepted the PIVC application, who were older than 15 years and who were not receiving anticoagulant treatment were included in the study, and 341 PIVCs were included.

2.4. Data Collecting Process

PIVC application was performed by the researchers (ÖA) and the application area was evaluated and recorded by the researchers every 24 hours from application of the cannula, in accordance with the Visual Phlebitis Scale developed by Andrew Jackson (Table 1) (19,20).

Antiseptic solutions specified for cannula application; 70% alcohol, 10% povidone iodine or 2% chlorhexidine were used respectively. To ensure that the antiseptic was effective, the solution containing 70% alcohol was left for 15 seconds, the solution containing 10% povidone iodine was left for 30 seconds, and the solution containing 2% chlorhexidine was left for 15 seconds. After use of the antiseptic solution, PIVC was applied according to the standards without palpating the area again and fixed with a sterile transparent cover. The cannula location was determined according to the patient's vein status; one of the hand, forearm, or cubital fossa veins was selected.

When the degree of thrombophlebitis due to PIVC reached grade 3 on the scale at the observed site, the cannula was removed, irrespective of the day of application. The management of standard thrombophlebitis (i.e. the application of antiseptic solution and wet warm water) was applied to the cannula removal location. If necessary, a new cannula was applied. It was kept in the application area for a maximum of 96 hours, and was subsequently removed even in the absence of phlebitis, and a new one was applied. Many hospital policies state that PIVCs should be changed every 96 hours, to which we adhered. The research data were collected using a data form and the Visual Phlebitis Scale created in accordance with the literature (19,20).

2.5. Data Analysis

The SPSS package was used for statistical analysis of the data. For descriptive data, percentages, means and standard deviations were used. A chi-squared test was utilised to analyse the impact of cannula location and the selected antiseptic solution on thrombophlebitis development.

2.6. Ethical consideration

This study was carried out after obtaining written and verbal consent from the University Ethics Committee, the hospital where the study was conducted, and the patients participating in this practice. During the research, the guidelines of the Helsinki Declaration of Human Rights were complied with.

Results

In the present study, the effects of cannula

Table 1. Phlebitis scale

Phlebitis grade	Symptoms and findings
Grade 0	No symptoms
Grade 1	Erythema at access site with or without pain
Grade 2	Pain at access site with erythema and/or edema
Grade 3	Pain at access site with erythema and/or edema, streak formation, palpable venous cord
Grade 4	Pain at access site with erythema and/or edema, streak formation, palpable venous cord greater than 1 in length; purulent drainage.
((INS), 2011; Pery & Potter 2011; Taylor et al 2011; Cicolini et al., 2009: Jackson, 2003)	

location and chosen antiseptic solution on the development of thrombophlebitis in 341 PIVCs were investigated. The results of our study are presented in tables.

Descriptive information about the patients is given below (Table 2). It can be seen 49.3% of the patients were female, 51.6% were between the ages of 36-60, 71.3% were non-smokers; it was found that the left arm was preferred in 71.6% of the patients, diabetes mellitus was present in 5% of the patients, hypertension was present in 13.2%, both diabetes and hypertension were present in 0.6%, and number 20 cannula was applied in 85.1%. The study found that defining characteristics such as age, gender and smoking status had no effect on the development of thrombophlebitis.

Table 2. Characteristics participants (n=341)

Characteristics	n	%
Sex		
Female	168	49.3
Male	173	50.7
Age groups		
15-35	101	29.6
36-60	176	51.6
≥61	64	18.8
Status of smoking		
Yes	98	28.7
No	243	71.3
Arm		
Right	97	28.4
Left	244	71.6
Other diagnosed diseases		
None	277	81.2
Diabetes Mellitus	17	5.0
Hypertension	45	13.2
Diabetes Mellitus and Hypertension	2	0.6
Surgical interventions		
Yes	290	85.0
No	51	15.0
PIVC size		
22 (Blue)	51	14.9
20 (Pink)	290	85.1
Total	341	100.0

When PIVCs with thrombophlebitis grade 3 were examined at the end of the 24th hour; it was determined that thrombophlebitis developed in the forearm veins with 8.5% in the use of 70% alcohol antiseptic solution, in the forearm veins with 26.5% in the 2% chlorhexidine solution, and that there was no thrombophlebitis development at any cannula site with the use of 10% povidone-iodine antiseptic solution. (Table 3). In addition, a 4.0% incidence of thrombophlebitis was observed in cases where 70% alcohol was utilised as an antiseptic solution. Conversely, no instances of thrombophlebitis were recorded when 10% povidone-iodine and 2% chlorhexidine were employed. The most common development of thrombophlebitis within the first 24 hours was in PVICs using 70% alcohol solution. In terms of cannula location, it was determined that the highest rate of thrombophlebitis occurred in the forearm, while the lowest rate occurred in the cubital fossa ($p<0.05$).

At the end of the 48th hour; it was determined that thrombophlebitis developed in the forearm veins with 30.2% in the 70% alcohol antiseptic solution, in the veins dorsum of the hand with 26.3% in 10% povidone-iodine antiseptic solution and in the forearm veins with 47.1% in the 2% of chlorhexidine solution. (Table 4). In addition, thrombophlebitis was observed at a rate of 16.7% in the 70% alcohol group, 20.9% in the 10% povidone-iodine group, and 22.7% in the 2% chlorhexidine group. It was observed that the antiseptic solution that most frequently caused thrombophlebitis in PIVCs evaluated at the end of 48 hours was 10% povidone iodine. In terms of cannula location, it was determined that the highest rate of thrombophlebitis occurred in the forearm, while the lowest rate occurred in the cubital fossa ($p<0.05$).

When PIVCs with thrombophlebitis grade 3 were examined at the end of the 72nd hour, it was determined that thrombophlebitis development occurred mostly in the forearm veins with 63.3% in the antiseptic solution containing 70% alcohol, in the cubital fossa veins with 51.6% in the antiseptic solution containing 10% povidone-iodine,

Table 3. Thrombophlebitis incidence in the 24 hours (n=341)

Solution	Cannula site		Thrombophlebitis grade				Total	χ^2	p
			0	1	2	3			
70% of alcohol	Dorsum of the hand	n	7	28	2	1	38	12.15	0.059
		%	18.4	73.7	5.3	2.6	100.0		
	Forearm	n	3	32	8	4	47		
		%	6.4	68.1	17.0	8.5	100.0		
	Cubital fossa	n	2	34	4	-	40		
		%	5.0	85.0	10.0	-	100.0		
	Total	n	12	94	14	5	125		
		%	9.6	75.2	11.2	4.0	100.0		
10% of povidone iodine	Dorsum of the hand	n	21	13	4	-	38	4.12	0.390
		%	55.3	34.2	10.5	-	100.0		
	Forearm	n	20	14	8	-	42		
		%	47.6	33.3	19.0	-	100.0		
	Cubital fossa	n	17	16	2	-	35		
		%	48.6	45.7	5.7	-	100.0		
	Total	n	58	43	14	-	115		
		%	50.4	37.4	12.2	-	100.0		
2% of chlorhexidine	Dorsum of the hand	n	15	17	1	-	33	**9.63**	**0.047**
		%	45.5	51.5	3.0	-	100.0		
	Forearm	n	11	14	9	-	34		
		%	32.4	41.2	26.5	-	100.0		
	Cubital fossa	n	18	10	6	-	34		
		%	52.9	29.4	17.6	-	100.0		
	Total	n	44	41	16	-	101		
		%	43.6	40.6	15.8	-	100.0		

Table 4. Thrombophlebitis incidence in the 48 hours (n=336)

Solution	Cannula site		Thrombophlebitis grade				Total	χ^2	p
			0	1	2	3			
70% of alcohol	Dorsum of the hand	n	4	8	21	4	37	**13.19**	**0.040**
		%	10.8	21.6	56.8	10.8	100.0		
	Forearm	n	1	10	19	13	43		
		%	2.3	23.3	44.2	30.2	100.0		
	Cubital fossa	n	1	9	27	3	40		
		%	2.5	22.5	67.5	7.5	100.0		
	Total	n	6	27	67	20	120		
		%	5.0	22.5	55.8	16.7	100.0		

10% of povidone iodine	Dorsum of the hand	n	12	9	7	10	38	6.29	0.392
		%	31.6	23.7	18.4	26.3	100.0		
	Forearm	n	9	11	12	10	42		
		%	21.4	26.2	28.6	23.8	100.0		
	Cubital fossa	n	10	7	14	4	35		
		%	28.6	20.0	40.0	11.4	100.0		
	Total	n	31	27	33	24	115		
		%	27.0	23.5	28.7	20.9	100.0		
2% of chlorhexidine	Dorsum of the hand	n	8	14	8	3	33	**23.40**	**0.001**
		%	24.2	42.4	24.2	9.1	100.0		
	Forearm	n	4	3	11	16	34		
		%	11.8	8.8	32.4	47.1	100.0		
	Cubital fossa	n	8	9	13	4	34		
		%	23.5	26.5	38.2	11.8	100.0		
	Total	n	20	26	32	23	101		
		%	19.8	25.7	31.7	22.8	100.0		

Table 5. Thrombophlebitis incidence in the 72 hours (n=269)

Solution	**Cannula site**		**Thrombophlebitis grade**				**Total**	χ^2	**p**
			0	**1**	**2**	**3**			
70% of alcohol	Dorsum of the hand	n	4	3	13	13	33	7.02	0.32
		%	12.1	9.1	39.4	39.4	100.0		
	Forearm	n	1	1	9	19	30		
		%	3.3	3.3	30.0	63.3	100.0		
	Cubital fossa	n	1	2	17	17	37		
		%	2.7	5.4	45.9	45.9	100.0		
	Total	n	6	6	39	49	100		
		%	6.0	6.0	39.0	49.0	100.0		
10% of povidone iodine	Dorsum of the hand	n	6	10	3	9	28	4.78	0.57
		%	21.4	35.7	10.7	32.1	100.0		
	Forearm	n	2	11	4	15	32		
		%	6.3	34.4	12.5	46.9	100.0		
	Cubital fossa	n	3	9	3	16	31		
		%	9.7	29.0	9.7	51.6	100.0		
	Total	n	11	30	10	40	91		
		%	12.1	33.0	11.0	44.0	100.0		
2% of chlorhexidine	Dorsum of the hand	n	3	10	12	5	30	**19.77**	**0.003**
		%	10.0	33.3	40.0	16.7	100.0		
	Forearm	n	1	3	-	14	18		
		%	5.6	16.7	-	77.8	100,0		
	Cubital fossa	n	3	6	10	11	30		
		%	10.0	20.0	33.3	36.7	100.0		
	Total	n	7	19	22	30	78		
		%	9.0	24.4	28.2	38.5	100.0		

and in the forearm veins with 77.8% in the 2% chlorhexidine solution (Table 5). Thrombophlebitis occurred in 49.0% of cases when using 70% alcohol, 44.0% when using 10% povidone-iodine and 38.4% when using 2% chlorhexidine. The most common antiseptic solution that caused thrombophlebitis in PVICs evaluated at the end of 72 hours was 70% alcohol solution. In terms of cannula location, it was determined that the highest rate of thrombophlebitis occurred in the forearm, while the lowest rate occurred in the dorsum of the hand ($p<0.05$).

When PIVCs with thrombophlebitis grade 3 were examined at the end of the 96th hour, it was determined that thrombophlebitis development occurred in the hand dorsum veins with a rate of 42.9% in the 70% alcohol antiseptic solution, in the cubital fossa veins with a rate of 26.7% in the 10% povidone-iodine solution, and in the acubital fossa veins with a rate of 47.4% in the 2% chlorhexidine solution (Table 6). Thrombophlebitis was observed in 40.4% of cases with 70% alcohol use, 19.6% of cases with 10% povidone-iodine use and 35.4% of cases with 2% chlorhexidine use. The antiseptic solution that caused thrombophlebitis at the end of 96 hours was determined to be 70% alcohol solution. In terms of cannula location, it was determined that the highest rate of thrombophlebitis occurred in the forearm, while the lowest rate occurred in the dorsum of the hand ($p<0.05$).

Table 6. Thrombophlebitis incidence in the 96 hours (n=151)

Solution	Cannula site		Thrombophlebitis grade				Total	χ^2	p
			0	1	2	3			
70% of alcohol	Dorsum of the hand	n	-	4	8	9	21	8.38	0.212
		%	-	19.0	38.1	42.9	100.0		
	Forearm	n	1	-	6	4	11		
		%	9.1	-	54.5	36.4	100.0		
	Cubital fossa	n	1	-	11	8	20		
		%	5.0	-	55.0	40.0	100.0		
	Total	n	2	4	25	21	52		
		%	3.8	7.7	48.1	40.4	100.0		
10% of povidone iodine	Dorsum of the hand	n	4	4	8	3	19	9.24	0.161
		%	21.1	21.1	42.1	15.8	100.0		
	Forearm	n	-	3	11	3	17		
		%	-	17.6	64.7	17.6	100.0		
	Cubital fossa	n	1	6	4	4	15		
		%	6.7	40.0	26.7	26.7	100.0		
	Total	n	5	13	23	10	51		
		%	9.8	25.5	45.1	19.6	100.0		
2% of chlorhexidine	Dorsum of the hand	n	-	5	13	7	25	2.39	0.665
		%	-	20.0	52.0	28.0	100.0		
	Forearm	n	-	1	2	1	4		
		%	-	25.0	50.0	25.0	100.0		
	Cubital fossa	n	-	4	6	9	19		
		%	-	21.1	31.6	47.4	100.0		
	Total	n	-	10	21	17	48		
		%	-	20.8	43.8	35.4	100.0		

Discussion

Thrombophlebitis is one of the most common complications in PIVC practice (5,10,21). Many factors are effective in the development of complications in PVCs used (7,14,15). In this study, which was conducted to examine the effects of PIVC location and the selected antiseptic solution on the development of thrombophlebitis; no effect of factors such as age, gender, or smoking status was found on the development of thrombophlebitis.

More than half of our study population were male. Studies have found that more than half of his patients were women (6,22). In a study conducted in 2021, male patients constituted the majority (5). Several studies have shown no statistically significant difference between genders in terms of thrombophlebitis development (7,11,14,23), which was accordance with our study. On the contrary, another study determined that women were more likely to develop thrombophlebitis than men (5,10).

In our study, most individuals were in the 36–60 age group (51.6%). In a study conducted in 2018, the average age was 65 (22). In a study conducted in 2021, the average age was found to be 42 years.(5) It has been reported that there is no statistically significant association between age and the development of thrombophlebitis (7,11,23), These results support our study. However, some studies have also found that thrombophlebitis occurs more frequently in patients aged 60 and over (14,16). Moreover, other studies have demonstrated that the development of thrombophlebitis is more common in individuals aged 31–60 as compared with those under 30 (10). Thrombophlebitis that develops due to PIVC in individuals of advanced age is thought to be the result of an increased high rate of venous thrombosis.

In the present study, the rate of non-smoking patients was 71.3%. In a study conducted in 2019, 77% of patients were non-smokers (16). It has been demonstrated that there is no statistically significant correlation between smoking and the development of thrombophlebitis (7).

Here, the most preferred cannula was the number 20 (pink) at a rate of 85.1%, and the left arm was the most preferred application area at a rate of 71.6%. This is due to the fact that the study was performed in a surgical clinic and in accordance with hospital policy, the PIVC must be applied in the left arm if possible. The right arm was only chosen due to other patient factors. Previous studies have suggested that the cannula number may have an effect on the development of thrombophlebitis (24), with it being more common with the use of cannula number 22. In a study, the maximum number of 18 cannula was used as the peripheral catheter size (5). In some studies, the number 20 cannula was used the most. This is consistent with our study result (6,21). On the other hand, some studies did not find a significant relationship between the cannula number and the development of thrombophlebitis (7,21). Some studies have shown that there is no significant relationship between catheter location or size and the development of thrombophlebitis (21,23). In a study, the dorsum of the hand was preferred more in IV cannula application, but no significant difference was found between the dorsum of the hand and the antecubital region in terms of thrombophlebitis development (23). The dorsum of the hand is the most preferred area by nurses for its ease of application.

One of the factors affecting the development of thrombophlebitis is the chosen antiseptic solution. In the present study, the effect of the antiseptic solution used in PIVC application on the development of thrombophlebitis was examined. It was determined that thrombophlebitis occurred mostly following the use of an antiseptic solution containing 70% alcohol, occurred less often following the use of an antiseptic solution containing 2% chlorhexidine, and occurred the least often following the use of an antiseptic solution containing 10% povidone iodine. In a study conducted, the rate of thrombophlebitis was found to be 28% following the use of 70% alcohol solution, and 23.8% following the use of 10% povidone-iodine solution (7). In studies were a statistically significant difference between the use of antiseptic solutions containing 70% alcohol, a mixture of 70% alcohol and 10% povidone iodine, and 10% povidone iodine and the development of thrombophlebitis,

with the lowest level of thrombophlebitis seen following the use of 10% povidone iodine (7,15). These reports are consistent with the results of our study. Results of one study showed that antiseptic solution did not make a significant difference in the development of thrombophlebitis (25).

The U.S. Food and Drug Administration (FDA) has approved the use of antiseptic solutions containing 2% chlorhexidine (12), which has been found to be successful in recent years (24). In a study conducted in newborns, antiseptic solutions containing 0.5% chlorhexidine or 10% povidone iodine were compared, and it was reported that the antiseptic solution containing 0.5% chlorhexidine provided a significant reduction in PIVC colonization (7). In another study conducted in 2019, 2% chlorhexidine and povidone-alcohol solutions were used as antiseptics in cannula application and 2% chlorhexidine solution was found to be more effective in preventing bacterial growth (26). It has also been demonstrated that using 70% alcohol and 5% chlorhexidine solutions in skin preparation for central venous cannula application is more effective than a solution containing povidone iodine (27). The antiseptic solution containing chlorhexidine gave better results than the commonly used antiseptic solution containing 70% alcohol, which is similar to the results of our study. Further studies are needed regarding the use of antiseptic solutions containing 2% chlorhexidine. In a review study, using chlorhexidine for the prevention of thrombophlebitis was determined as the greatest evidence (28).

Here, the most preferred areas for PIVC application were the forearm, hand dorsum, and cubital fossa. In previous studies, the forearm and hand dorsum were the most preferred (16,22,29), which is similar to the results of our study. Moreover, it has been shown that nurses mostly prefer the cubital fossa vein (10). Here, it was found that the development of thrombophlebitis most commonly occurs in the forearm and least often in the dorsum of the hand. Since the forearm is the cannula site with the most pain sensitivity, this can be considered the reason for the development of thrombophlebitis in this region (29). There exist conflicting results in the literature regarding this subject. In a study, it was reported that thrombophlebitis was most frequently seen in the forearm (10), which is in accordance with the results of our study. However, other study has demonstrated that thrombophlebitis most often develops in the dorsum of the hand (30) or in the cubital fossa vein (7). In other studies, there were no statistically significant relationship found between the incidence of thrombophlebitis and the regions selected for PIVC (31).

Study limitations

The limitations of the present study are: the inability of the PIVC practitioner to be in the hospital for 24 hours a day; removal of PIVC by the night-shift nurse; accidental positional changes of the cannula while the patient is sleeping; the presence of a chronic disease affecting the development of thrombophlebitis in some patients; variables such as treatments taken and the amount and type of fluid taken. Another limitation is that the study was conducted with a total of 341 inpatients, aged 15 years and over, who were undergoing PIVC, not receiving anticoagulant therapy, and who voluntarily agreed to participate in the research while hospitalized in the surgical ward, without any sample selection.

Conclusion

The results of the study show that thrombophlebitis has been an important problem from the past to the present. In the present study, it was found that the development of thrombophlebitis due to PIVC occurs at a lower rate following the use of an antiseptic solution containing 10% povidone iodine. Moreover, the most suitable cannulation site is the dorsum of the hand. As a result, it was determined that the location of PIVC application and the chosen aseptic solution have an effect on the development of thrombophlebitis. It is thought that this study will improve the understanding of the occurrence of thrombophlebitis as a complication of PIVC, which is the most common practice, and may help to formulate strategies to prevent it.

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