The Investigation of the Efficiency of Fixation Set in the Performing Peripheral Intravenous Catheter

Periferik İntravenöz Kateter Uygulamasında Tespit Seti Etkinliğinin İncelenmesi

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ABSTRACT Objective: In this prospective randomised and comparative study, we aimed to investigate the efficiency of fixation set with two fixation techniques including tape and catheter fixation set (statlock) for emergency department patients. **Material and Methods:** The universe of the study was consisted of all patients who have admitted to Emergency Department of a University Hospital and peripheral catheter was inserted in one year period. And the sampling of study was consisted of 128 patients who have admitted between November 2008 and April 2009. Both experimental group and control group were including 64 patients. The catheters were fixed with tape in control group and fixed with fixation set in experimental group. The special form was established by investigator to collect data depending on literature review and experts suggestions. **Results:** Nearly half of the patients were given fluids and blood, and were taken blood via antecubital vein related with the application of catheter. The half of patients' catheters stayed in the vessel between 1 and 24 hours. The catheters were deliberately removed from the vessel in half of the patients of experimental group. However, the catheters were removed from the vessel due to complications or unwilling conditions occured one third of all patient. The rate of complications was lower in the experimental group. Furthermore the rate of catheter-related complications increased with how long the catheter stayed. **Conclusion:** The results of the study sugested that the fixation set can be used for the catheter stabilisation in the parts of the body which are less sweaty and hairly particularly for the patient of Emergency Department.

Key Words: Catheterization, peripheral; catheter-related infections; emergency nursing

ÖZET Amaç: Bu prospektif, randomize ve karşılaştırmalı çalışmada, acil servis hastalarında kateter fiksasyon seti ve bant yöntemlerini içeren iki tespit yönteminin etkinliğini araştırmayı amaçladık. **Gereç ve Yöntemler:** Çalışmanın evrenini bir yıl içerisinde bir üniversite hastanesinin acil servisine müracaat eden ve periferal kateter yerleştirilen tüm hastalar örneklemini ise Kasım 2008 ve Nisan 2009 tarihleri arasında müracat eden 128 hasta oluşturmuştur. Deney ve kontrol grubunun her birinde 64 hasta vardı. Kateterler kontrol grubunda tespit bandıyla, deney grubunda ise tespit seti kullanılarak tespit edildi. Verilerin toplanmasında, literatür incelemesi ve uzman görüşüne dayalı olarak araştırmacı tarafından geliştirilen veri toplama formu kullanıldı. **Bulgular:** İntravenöz kateter uygulamasına ilişkin olarak, hastaların yarısına yakınında antekübital fossa venleri; sıvı ve elektrolitlerin verilmesi ve kan örneği alınması amaçları için kullanılmıştır. Hastaların yarısında intravenöz kateter, damar yolunda 1-24 saat kalmıştır. Deney grubu hastaların yarısından fazlasında kateter damar yolundan istemle, çıkarılmıştır ancak araştırmada tüm hastaların hemen hemen üçte birinde IV kateter ile ilgili istenmeyen durum ve komplikasyon gelişmiştir. Deney grubu hastalarda komplikasyon gelişme oranı, kontrol grubu hastalara göre daha düşük bulunmuştur. Buna ek olarak kateter damar yolunda ne kadar uzun süre kalırsa, kateter ile ilişkili komplikasyon gelişme oranının da o kadar arttığı görülmüştür. **Sonuç:** Elde edilen bulgular acil servis hastalarında tespit setinin cildin tüy ve terden fakir ven bölgelerinde IV kateterin tespitinde kullanılabileceğini desteklemektedir.

Anahtar Kelimeler: Kateterizasyon, periferik; kateter kaynaklı enfeksiyonlar; acil hemşireliği

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Intravenous (IV) administration is the most common invasive method for the diagnosis and treatment of patients who are received to emergency department.[1] It is existing a connection between circulatory system and external environment in IV administration. Peripheric IV cathaters are commonly performed through cehpalic, basalic, cubital or superficial vens on the dorsal hand.[1-3]

It increases the complication rate of patients who are the candidates for IV administration under emergency and critical situation. Therefore the catheter should be inserted under aseptic condition, quickly and should be fixed safely to the skin.

There are various causative factors in the occurance of IV catheter-related complications.[4-6] These factors are related with the patients, catheters, hospital and health workers. Catheter-related complications usually occur due to uneffective fixation of the catheter.

If the catheter did not fix safely, it should be labil into the vascular lumen and the microorganisms of the skin flora infiltrate to cardiovascular circulation. The catheter motion contributes to many catheter-related problems including catheter infection, phlebitis, extravasation, disconnection of IV set and catheter and skin injury.[6]

The tecnique of IV catheter fixation is very important in order to avoid motion of catheter and the occurance of catheter-related complications. The accurate and appropriate tecnique of IV catheter fixation will decrase the occurance of complications related with IV catheter insertion, will increase the satisfaction rate of patients and will prevent the waste of time for emergency department nurse.

The prospective randomised trial of security of fixation of peripheral cannulae with gauze and two polyurethane dressings are present in the literature.[4,7,8] In this prospective randomised and comparative study, we aimed to invastigate the efficiency of fixation set with two fixation techniques for emergency department patients.

MATERIAL AND METHODS

THE SAMPLE AND UNIVERSE OF THE INVESTIGATION

The universe of this prospective randomised trial was consisted of 128 patients who have admitted to Emergency Department of a University Hospital and peripheral catheter was inserted between November 2008 and April 2009. The size of the sample was determined by the biostatistic expert via G*Power Ver. 3.0.10 programe (G*Power Ver. 3.0.10, Franz Faul, Universität Kiel, Germany). After the calculation, the study groups were consisted of 64 patients. The patients were determined according to willingness.

DATA COLLECTION

The data of the investigation were collected with a form which was designed according to literature findings and view of experts by the investigators. The data collection form was consisted of two parts. The first part includes sociodemographic features of patients and IV catheter securement features. The second part includes the catheter-related complications and satisfaction rate of nurse which was measured via visual analog scale (VAS). A total of 52 nurses who were the staff of emergency department were included to study.

PROCEDURE

The study was performed simultaneously. In control group, the IV catheter was placed into the vessel with standart tecnique and it was secure of fixation with tape which is still using in daily practice (Figure 1a). In experimental group, the IV catheter was placed into the vessel with standart tecnique and it was secured with catheter fixation set (statlock catheter- securement device: sterile, latex free, hypoallergenic, semi-permeable, impervious to bacteria, promote moisture vapour transmission and should last for the duration of the cannula) (Figure 1b). The IV catheter was placed into the vessel and was secured to the skin by emergency department nurse. However, it was followed by the investigator during it was into the vessel. The care of the catheters was not performed due to under emergency condition for groups. All

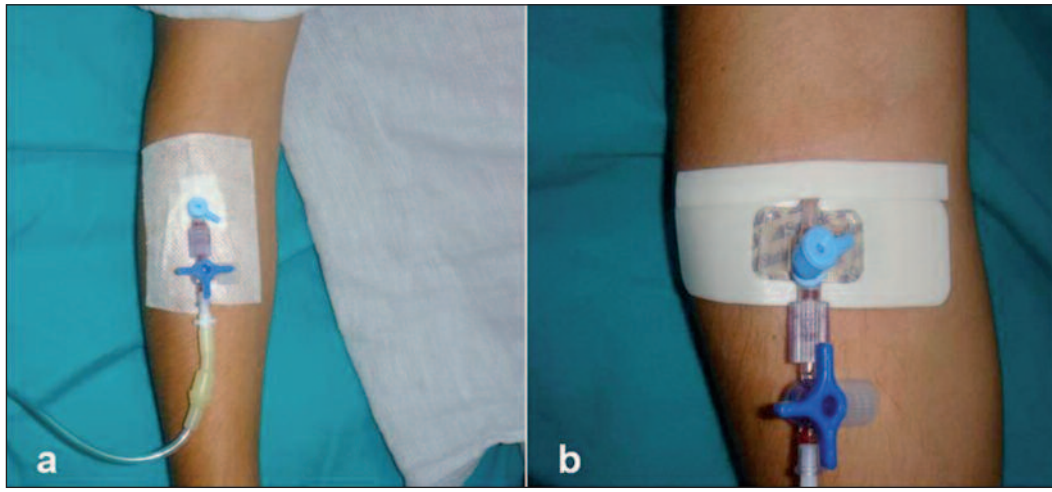

FIGURE 1: Photography of catheter fixation type for control group patients **(a)**, and photography of catheter fixation set for experimental group patients **(b)**.

of the catheters for two groups were sent to the microbiologic culture after they were drown up.

THE ANALYSIS OF DATA

The variables such as sex and Body Mass Index (BMI) were analysed with parametric test including Student's t and with non-parametric test including chi-square, Mann-Whitney U and Kruskal-Wallis.

The comparement of unwilling situations and complications according to groups were achieved with chi-square test. The VAS value of nurses who placed and removed the catheters were analysed with Kolmogorov-Smirnov and Student's t tests. All the statistical analysis were achieved with SPSS for Win. Ver. 15.00 (SPSS Inc., Chicago, IL., USA). The values of $p \leq 0.05$ were received statistically different.

ETHICAL CONSIDERATIONS

This study was performed in an emergency department of a university hospital after it was approved by institutional ethics committee. Informed constat was obtained from all patients.

RESULTS

The demographic features of patients were summarized at Table 1. It was determined that the IV catheters were placed at antecubital fossa in 52 patients (40.6%), at dorsal hand in 38 patients (29.7%), at antebrachial region in 34 patients (26.6%) and at other regions of the body in 4 patients (3.1%). The difference of IV catheter site between the control and experimental groups was significant statistically (X^2=5.406,p=0.020). The difference was caused by the catheter which was placed at the antecubital region. It was determined that the catheter was placed at the antecubital fossa in 33 patients of the experimental group (51.6%) and in 19 patients of control group (29.7%).

It was determined that there were difficulties in performing catheter placement in 35 of the patients (27.3%). The reasons of the difficulties were the thin structure of vein (31.4%, n=11), rigidity of the vein due to older age (28.6%, n=10), the treatment of the patients (chemotherapy, potasium, i.e) (8.6%, n=3) and other reasons (31.4%, n=11). The difference of difficulty of performing catheter placement between the control and experimental groups was not statistically significant (X^2=0.039, p=0.666).

The reasons of removal of the catheters were including completing of treatment in 64 patients (50%), catheter-related complications, such as phlebitis and infiltration in 33 patients (25.8%), the movement of the catheter due to inadequate fixation of catheter because of swelling or hear of the skin in 10 patients (7.8%) and other reasons in 21 patients (16.4%). The reasons of removal of the catheter from vessel between the control and ex-

TABLE 1: Demographic features of control and experimental groups.

		Control		Experimental		Total		
Demographic features		**n**	**%***	**n**	**%***	**n**	**%****	**p value**
Age (Year)	18-33	8	12.5	9	14.1	17	13.2	X^2=2.248***
	34-49	8	12.5	7	10.9	15	11.7	p=0. 522
	50-65	8	12.5	14	21.9	22	17.1	
	66 and more	40	62.5	34	53.1	74	57.8	
Sex	Female	29	45.3	36	56.3	65	50.8	X^2=1.532***
	Male	35	54.7	28	43.8	63	49.2	p=0.216
BMI (kg/m^2)	18.5 and less	2	3.1	2	3.1	4	3.1	X^2=2.216***
	18.5-24.9	25	39.1	20	31.2	45	35.1	p=0.696
	25-29.9	29	45.3	28	43.8	57	44.5	
	30-39.9	5	7.8	9	14.1	14	10.9	
	40 and more	3	4.7	5	7.8	8	6.2	
Conscious	Awake and conscious	49	76.6	55	85.9	104	81.3	X^2=1.902***
	Response to voice stimuli	11	17.2	7	10.9	18	14.1	p=0.593
	Response to painful stimuli	2	3.1	1	1.6	3	2.3	
	No response	2	3.1	1	1.6	3	2.3	
Medical importance degree of patients	Categoria 1	17	26.6	17	26.6	34	26.5	X^2=0.814***
	Categoria 2	35	54.7	31	48.4	66	51.5	p=0.666
	Categoria 3	12	18.8	16	25.0	28	21.8	
The existance of chronic illness of patients	Yes	44	68.7	44	68.7	88	68.7	
	No	20	31.3	20	31.3	40	31.3	-
Total		64	100.0	64	100.0	128	100.0	-

*per cent of the line, **per cent of the column, ***chi-square test.
BMI: Body mass index.

perimental groups was statistically significant (X^2=10.635, p=0.014). The difference was caused by the catheter, which was ended by the medical doctor, were more in experimental group.

When we looked at the duration of staying catheter in the vessel, the staying time was 0-24 hours in 64 patients (50%), 25-48 hours in 40 patients (31.2%), 49-72 hours in 13 patients (10.1%) and more than 73 hours in 11 patients (8.5%). The difference between the control and experimental groups according to the staying time of catheter was not statistically significant (X^2=4.200, p=0.241).

The catheter-related complications and unwilling situation such as catheter motion according to groups were summarized at Table 2. We found the occurrence of catheter-related complications and unwilling situation in 49 patients (38.3%). Additionally, we found that the difference between the control and experimental groups according to the catheter-related complications and unwilling situation was statistically significant (X^2=5.588, p=0.018). When we looked at the occurrence of catheter-related complications and unwilling situation according to age (p=0.039), sex (p=0.050), BMI (p=0.020) and existing chronic disease (p=0.006), we found that all these variables were statistically significant.

The occurrence of catheter-related complications and unwilling situation according to the staying time of catheter was summarized at Table 3.

The microbiologic investigation was achieved for the catheters which was left in the vessel more than 48-hour (n=24). The results were found negative for microbiologic investigation (41.7%, n=10 control group; 58.3%, n=14 experimental group).

DISCUSSION

It is important the preference of vein for IV administration. It is well known that the situation of the patients, age, diagnosis, the type and duration of the

TABLE 2: The unwilling situations and complications according to patients' groups.

	Control		Experimental		Total		
Features	**n**	**%****	**n**	**%****	**n**	**%***	**p value**
The occurrence of unwilling situations and complications							-
Yes	31	63.3	18	36.7	49	38.3	X2=5.588*** p=0.018
No	46	58.2	33	41.8	79	61.7	
Unwilling situations and complications (n=49)							-
Withdraw of the catheter	9	29.0	5	27.7	14	28.6	-
The need of catheter placement again	1	3.2	5	27.7	6	12.3	
Infiltration	8	25.9	4	22.3	12	24.4	
Phlebitis	11	35.5	1	5.5	12	24.4	
Skin damage	1	3.2	1	5.5	2	4.1	
Unplanned change of fixation bant	1	3.2	2	11.3	3	6.2	
Total	31	63.2	18	36.8	49	100.0	

*per cent of the line, **per cent of the column, ***chi-square test.

infusion therapy, the course of the veins and the movement ability of extremity of the patients should be taken care of when placing the IV catheter.[3,9,10]

Antecubital fossa veins are the most appropriate veins for the placement of catheter quickly in emergency situation. While performing supportive care for critical patients in an emergency situation, antecubital fossa veins will make easy the IV administration of drugs and fluids with large-measured IV catheter.[3,10,11] In our study, antecubital fossa veins were used for IV catheter placement in 52 patients (40.6%). The difference of placement of IV catheter between the control group and experimental group was statistically significant (X^2=5.406, p=0.020). This difference was resulting from the hairness, dry and easy inspection and palpation features of the antecubital fossa regions which made the preference of nurses for placement of statlock catheter-securement device.

IV catheter placement can not be succesful because of the difficult inspection and palpation of the veins due to scare tissue and echimosis in the vein regions. In our study, the number of patients in the control and experimental groups were approximately equal according to difficulty of placement of IV peripheric catheter (27%, n=17 in control gorup, 28%, n=18 in experimental group). The cause of difficulties were including the thin structure of vein and rigidity of the vein due to older age (28.6%, n=10 in control gorup, 31.4%, n=11 in experimental group). And also the difference was not statistically significant (X^2=0.039, p=0.666).

The type of method used to secure peripheral IV catheter is the most important criteria for the staying time of IV catheter in the venous structure. According to literature findings, there is a right rate between the staying time of IV catheter in the venous structure and the occurrence of catheter-related complications and unwilling situation particularly in more than 24 hours.[7,12-14] It has been reported that the IV peripheric catheters which were secured to the skin with fixation set (such as statlock catheter- securement device) decreased the catheter-related complications about the rate of 69% and increased the staying time of catheter in the vein about the rate of 61% and prevented the movement of catheter about the rate of 95%.[14-17] Smith carried out a study in order to compare of two securement techniques; one was steril tape and the other was fixation set. They performed a protocole, which determined the staying time of catheter in the vein as 96 hours, to 411 patients in order to investigate effect of securement type of peripheral cannulae on the staying time of catheter. They reported that the fixation set increased the staying time of peripheric catheter.[18] Catheter-related complications increase when the staying time of

TABLE 3: The occurrence of unwilling situations and complications according to staying time of catheter into the vessel.

Staying time of catheter into the vessel	Unwilling situations and complications: Yes n	Yes %*	No n	No %*	Total n	Total %**	p value
0-24 hours	18	28.1	46	71.9	64	50.0	X2=3.745** p=0.04
25-48 hours	18	45.0	22	55.0	40	31.3	
49-72 hours	9	69.2	4	30.8	13	10.2	
73 and more hours	4	36.4	7	63.6	11	8.6	
Total	49	38.3	79	61.7	128	100.0	-

*per cent of the line, **per cent of the column, ***chi-square test.

catheter is longer. In our study, we found that the rate of catheter-related complications increased when the staying time increased (Table 3). The catheter-related complications and unwilling situations such as phlebitis, disconnection of IV set and catheter, extravasation have occurred more in control group than experimental group (control group; 35.5%, 29.0%, 25.9% respectively, experimental group; 5.5%, 27.7%, 22.3% respectively).

The safety and the satisfaction rate of medical staff are as important as the patients' when placing the peripheric IV catheter. Additionally, we invastigated the satisfaction rate of all the nurses while they were placing and drawing up the peripheric IV catheter in our study. We did not find any significant difference while they were placing the peripheric IV catheter. However, the difference was statistically significant while drawing up the peripheric IV catheter (t=1.489, p=0.139; t=3.118, p=0.002). The difference was related with removel of IV catheter easily after administration of 70% alcohol to the skin in experimental group.

CONCLUSION

According to our study, the safety and effective fixation of the catheter to the skin is very important particularly in preventing of unwilling situations and complications in an emergency department. The catheter fixation set (statlock) should be used particularly in long-term IV catheterization.

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