Original Article

The Effectiveness of Training for Peripheral Venous Catheter Application in Intensive Care Units of a University Hospital

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Abstract

Background: Peripheral catheter application, which is one of the most important causes of hospital infections caused by invasive procedures, is one of the most applied applications in our country.

Aim: The study was planned to determine the efficacy of structured education on the behavior of nurses in nurses working in intensive care units.

Method: The universe of the research was formed by nurses working in the intensive care units of an educational research hospital. In the study, the sample was not selected and was carried out with a total of 58 nurses, 30 in the study and 28 in the control group. It was used personal iformation formand A 30-question questionnaire which included the peripheral catheter principles in the National Vascular Access Guide-2018. The case group received a 60-minute training, but no transaction was performed in the control group. 15 days after the end of the training, the evaluations were performed simultaneously and the data were analyzed by SPSS 20.0 program using descriptive analysis and chi-square tests. Ethical permission was obtained from hospital's ethics board and administration.

Results: After the catheter detection, the date of insertion, the time and the name-surname of the wearer were applied to the whole case group while the half of the experiment group performed this procedure (p<0.01). Almost all of the nurses in the case group did the dilution of the drugs just before the application and only 57.1% of the control group performed this procedure just before the application (p<0.01).

Conclusion: It has been observed that the education given in structured education for peripheral venous catheter application is highly effective on nurses, but that these trainings should be repeated at regular intervals in order to provide full change in behavior at all stages.

Key Words: Nursing, Nursing Practice, Intensive Care, Peripheral, Catheter

Introduction

Peripheral intravenous catheters (PIVC) are the most commonly used invasive devices in the United States, reported by approximately 150 million PIVCs per year. In Spain, 50% of hospitalized patients have an intravenous catheter and 90% of these catheters are PIVC. In studies where PIVCs and intravenous therapy provide benefits to the patient, complications may occur (Aygun (2008), Dillon et al., (2008), Donk et al., (2009), Hill (2008), INS (2011)). These complications lead to prolonged hospital stay, unnecessary diagnostic procedures and treatment, stress of patients and their relatives, increased workload of health personnel and economic losses (Denat and Eşer 2006). It is reported that more than 300 million PIVCs are purchased in the US per year, but only 150 million of the purchased PIVCs have been successfully implanted. After insertion of PIVC it increases the risk of complications and gradually costs in the relocation stage after a removal (Kelekai et al., 2016). It is stated that peripheral intravenous catheters are the most commonly used invasive applications in the health system with 20 million applications each year in our country (www.tybhd.org.tr/content/kilavuz-2018.pdf). It is reported that nosocomial infections caused by invasive procedures cause more serious

complications in intensive care units and even increase the mortality and morbidity rates of patients in ICU due to infection (Akbayrak and Bagcivan 2010). Infections associated with peripheral intravenous catheters are usually caused by catheter insertion and junction (Hakyemez et al., 2012). These complications are observed when the nurse's skill and placement technique, vessel quality, irritant drug solutions, type or size, prolonged waiting time of PIVC, and inadequate stabilization are not appropriate (Gazda et al., (2010), Alexander et al., (2010)). In addition, catheter-related infections cause morbidity, prolongation on admission, and an additional cost of EUR 3700 per day. 20% of reported PIVK related bacteria are associated with the most important complication, phlebitis. 20% of reported PIVC related bacteria are associated with the most important complication, phlebitis. Catheter-related complications are often associated with length of vascular stay. Routine change of PIVCs is a vague and controversial issue, but when the latest guidelines are reviewed, PIVCs are used indefinitely with follow-up unless   there are signs and symptoms of complications and infections (INS (2011),   www.tybhd.org.tr/content/kilavuz-2018.pdf.

International studies and standards show that the delivery of intravenous (IV) treatment in accordance with standards is a quality indicator of   health   care (www.tybhd.org.tr/content/kilavuz-2018.pdf). The Joanna Briggs Institute (JBI) and the Centers for Disease Control and Prevention (CDC) recommend that health professionals need ongoing training and evaluation of PIVC insertion and management, and preferably that trained personnel for peripheral intravenous catheter insertion and management are required (O'Grady et al., 2011). The Intravenous Nurses Society (INS), an important professional organization for infusion therapy in the United States, advocates the need for a specialized nursing field as 'Infusion Nursing'. Considering that on average 80% of the hospitalized individuals require IV fluid treatment and this rate is higher in intensive care units, PIVC recommends care packages for PIVC care and follow-up and frequent in-service training wherever there is infusion therapy. It is stated that these developed care models are beneficial for the patient and institution, their presence reduces the complications related to infusions,

increases the quality and reduces the cost. The results of PIVC are followed under the name of quality indicators of nursing care and development studies are carried out (INS, (2011)).

The proposal for the PIVC a model in Turkey is in the care and monitoring of Turkish Critical Care Nurses Association in 2018, six associations that came together and formed the National Vascular Access is a 2018 book (www.tybhd.org.tr/content/kilavuz-2018.pdf). In many studies in the literature, it was stated that nurses lack knowledge and skills in PIVC. This is related to the fact that nurses do not have standard practice knowledge of PIVC (O'Grady et al., 2011, Aydın and Arslan 2018). Vascular Access Management and Prevention of Catheter-Related Blood Circulation Infections are issues that should be carried out with a multidisciplinary and holistic approach. In this regard, it will be possible to reach quality health care standards in our country with the widespread use of National Vascular Access Guidelines and evaluation of PIVC practices in order to create a holistic model for nurses to work in collaboration with their colleagues and other occupational members and to establish holistic model for PIVC installation, follow-up and   care (www.hider.org.tr/global/Dernek...HID_Damar%20Erisimi%20Rehberi_2019.pdf). Especially in intensive care units where invasive procedures are very high, these follow-up and applications are of great importance as the complication rates are higher (www.tybhd.org.tr/content/kilavuz-2018.pdf).

While the rate of nasocomial infection is 5-10% throughout the hospital, this rate may increase to 20-25% in intensive care units. Nurses working in intensive care units should be effective in preventing infections that have negative effects on the treatment and care of patients (Akbayrak and Bagcivan 2010). Nurses have responsibilities such as determining the area to be intervened during peripheral intravenous administration, selecting the catheter number to be used, knowing the correct technique regarding peripheral intravenous intervention, maintaining the application by performing the necessary controls, maintaining intravenous catheter care and following the complications. When the knowledge level of nurses about PIVC interventions was examined, it was found that the nurses were in the middle level (Aydın and

Arslan 2018). It is very important to develop nursing competence and technical skills for PIVC application, which is one of the most frequent interventions in hospitalized patients. These skills will be standardized only through the implementation of care packages and frequent trainings and behavioral change. Research shows that training programs should be given periodically in the form of theoretical concepts and practical demonstrations for health professionals, and that the knowledge and skills to be developed should be assessed, the ability to ensure the implementation of procedures, and efficient, effective, intervention skills should be acquired (Avelar et al., 2010).

The aim of this study was to evaluate and gain the principles related to the safe insertion, removal and management of venous catheters in accordance with the national guiding principles in the attempts of peripheral venous catheters in nurses and to minimize the potential complications related to peripheral catheters in inpatients in intensive care units.

Methods

This study was carried out as a quasi-experimental study in order to determine the effectiveness of the training given to the nurses working in intensive care units on the application of peripheral venous catheters to nurses and to provide nurses to apply this application in accordance with the guidelines. The taret population of the study consisting of case and control groups; consists of 83 nurses working in adult intensive care units in the education and research hospital in the province where the study was conducted. In the research, no sample selection was made and it was aimed to reach the whole universe. However, those who were on leave at the time of the study, those with less than 1 year experience and nurses working at night shift were not included in the study. 30 nurses were included in the case group and 30 nurses were included in the control group. As 2 of the nurses included in the control group had rest reports, the study was completed with a total of 58 nurses. In determining the case and control groups, each nurse in the study group was assigned a number and thrown into a bag, the odd numbers withdrawn from the bag were included in the case group and the even numbers were grouped into the control group. The research was conducted between 17/04/2019 and 31/05/2019.

Measures: The data were collected by the researcher using a personal information form and a 30-question questionnaire developed by expert opinion in line with the National Vascular Access Guide-2018. In the three-part form, there are a total of 30 questions, including hand hygiene / glove use, skin antisepsis and medication via venous catheter, among the principles determined for peripheral venous catheter insertion.

Procedures: The researcher gave a 60-minute training to the case group in the classroom and expected 15 days for the effectiveness of the training. The participants were not informed that they had taken this training because they were included in the study and they were informed that it was in-service training. Case and control groups were observed simultaneously by two nurses who were aware of the subject and evaluations were made simultaneously with both groups at any time without the knowledge of the participants with the checklist formed in line with the National Vascular Access Guide-2018. After the data were collected, the same education was applied to the nurses in the control group.

Evaluation: Data were evaluated using SPSS 20.0 package program. Number and percentage were used as descriptive statistics, and Chi-square test was used for comparisons. For statistical significance $p < 0.05$ was accepted.

Ethics: The study was carried out in accordance with the Helsinki Human Rights Declaration, and the written permission of the hospital's central directorate, numbered 79056779-600, was obtained on 16/04/2019 for the implementation of the study. In addition, the permission of the relevant university's scientific research ethics committee was obtained with the permission numbered 09/24 and protocol numbered 2019/214 on 13/05/2019.

Boundedness: The results of this study can be generalized to nurses working in the intensive care units of the hospital where the research is conducted.

Results

Approximately of the study group with a mean age of 25 ± 5, %52 were the case group and 48% were the control group. 80% of the nurses in the case group were female, 53% were in the 20-25 age range, 50% of the nurses in the control group were in the 20-25 age range, 66% were educated at the undergraduate level, 75% of the control

group was female, 50% were in the 20-25 age range, 68% were at undergraduate level. The average ¼ of the nurses in both case and control groups had a high school level of education. 37% of the nurses in the case group had professional experience between 1-5 years and this rate was 32% in the control group. In both groups, the mean duration of the study was between 1-15 years, and there was 1 nurse in the control group with more than 15 years of intensive care experience.

Table 1. Demographic Charasteristics of Nurses in Case and Control Group

		Case Group		Control Group		Total	
		Number	%	Number	%	Number	%
Age	20-25	16	53.0	14	50.0	30	52
	25-30	12	40.0	12	42.8	24	41
	30 and above	2	7	2	7.2	4	7
Sex	Female	6	80.0	21	75.0	27	47
	Male	24	20.0	7	25.0	31	53
Educational Level	High School	8	27	7	25.0	15	26
	2 year Collage	2	7	1	3.5	3	5
	University	20	66	19	68.0	39	67
	Master-Degree	-	-	1	3.5	1	2
Working Year	1-5 year	11	37	9	32	20	35
	6-10 year	10	33	8	28	18	31
	11-15 year	9	30	10	36.5	19	32
	15 year above	-	-	1	3.5	1	2

Table 2. Nurses' Implementation Status

Applied Principles	Case Group N=30		Control Group N=28		p
	Number	%	Number	%	
Patient identity control, information, verbal consent	24	80.0	12	42.9	0.004**
Providing hand hygiene before the procedure	30	100.0	26	92.9	0.136
Wearing a non-sterile glove according to the instructions	30	100.0	26	92.9	0.136
Wash the visible contamination with soap and water	24	80.0	10	35.7	0.001**
Non-palpable intervention after skin antisepsis	27	90.0	18	64.3	0.019**
Putting a pillow under the extremity	16	53.3	7	25	0.035**
Shaving hairs on the skin when necessary	22	73.3	13	46.4	0.036**
Checked the expiry date of the peripheral catheter	20	66.6	22	78.5	0.311
Checked before introducer and needle tip	22	73.3	24	85.7	0.245
Fixation time-date-paraph was written on	30	100.0	14	50.0	0.000**
Checked for 1-2 hours after insertion of peripheral catheter	29	96.7	20	71.4	0.008**

8 correct principles were followed in drug delivery	30	100.0	26	92.8	0.136
Checked expiration date before drug administration	23	76.6	25	89.2	0.204
Reconstitution of medicines just before application	29	96.7	16	57.1	0.000**
Asepsis-antisepsis rules in drug preparation	30	100.0	24	85.7	0.032**
Separate injectors were used for each injection	30	100.0	21	75.0	0.003**
The septum portion of the vial / ampoule was disinfected	4	13.3	7	25.0	0.257
Washing the catheter after drug infusion	26	86.7	17	60.7	0.024**
Catheter removal time-date recording	25	83.3	13	46.4	0.003**
Catheter connection surfaces disinfected (injectionport, etc.)	16	53.3	18	64.3	0.397
Non-sterile gloves worn, safety glasses worn	7	23.3	8	28.5	0.649

While 80% of the nurses in the case group received patient consent, verbal consent from the patient for informing the patient about the procedure and the procedure to be performed, more than half of the nurses in the control group did not perform this application. 80% of the nurses in the case group performed the process of washing the visible contaminations with water-soap before palpating the peripheral catheter port, while this rate was 35.7% in the control group. 53.3% of the nurses in the case group supported the bottom of the extremity with a pillow or the like to facilitate the intervention, but only 25% of the nurses in the control group performed this application. After the catheter was detected, the date, time and the name and surname of the wearer were applied in the case group and half of the control group did not perform this procedure. While almost all of the nurses in the case group performed the drug reconstitution immediately before application, it was seen that 57.1% of the nurses in the control group performed this procedure before application. All of the nurses in the case group used a separate injector for each injection but 25% of the nurses in the control group neglected this practice. 83.3% of the nurses in the case group recorded the date and time the catheter was removed, but 46.4% in the control group performed this application. While most of the nurses included in the case group observed the peripheral catheter for 1-2 hours after insertion of the peripheral catheter, more than ¼ of the nurses in the control group did not perform this application.

All of the nurses in the case group had the basic requirements for hand hygiene and glove use, 8 correct principles for drug and infusion treatment by venous catheter, the integrity of the drug, infusion fluid, or blood product packaging bag to be applied, the sterility, leakage, discoloration and sediment status has checked. Although this rate was high in the control group, it was observed that only leakage, discoloration and sediment control were achieved completely. In both case and control groups, it was found that hand hygiene after the procedure and sterile necessity of fixation were 100%.

Nurses in the case group; checking the identity of the patient, informing the patient, obtaining verbal consent from the patient (p <0.05), cleaning the visible contamination of the catheter with water and soap (p <0.01), not re-palpating the area cleaned with antiseptic solution, under the pillow of the extirpene to facilitate the intervention. (p <0.05), shaving the hairs on the skin when necessary (p <0.05), the person wearing the catheter after the fixation process, and the name and surname of the person on the fixation (p <0.01), peripheral 1-2 hours after catheter insertion (p <0.05), dilution of drugs to be used (p <0.01), adherence to asepsis-antisepsis rules during preparation of drugs, use of a new syringe for each injection, infusion of drugs etc. catheter flushing and catheter removal date, time, intact-but It was found that there was a statistically significant difference compared to the control group. The disinfection of septum part of the vial and neck part of the vial was very low in both case and control groups. (Case 13.3%, Control 25%)

While 78.6% of the nurses in the control group controlled the expiry date of the catheter, the application status of the nurses in the case group was found to be 66.7%. While 64.3% of the nurses in the control group disinfected the connection surfaces before the peripheral venous

catheter flushing and locking procedures, this rate was 53.3% in the case group. However, the difference was not statistically significant (p=0.397).

Discussion

It was seen that the training given in accordance with the guideline for the application of peripheral venous catheters was an effective way for intensive care nurses to do this correctly, but the trainings had to be repeated in certain periods in order to ensure complete behavior change.

Intensive care units; It is a field of nursing that requires special training and applications for nursing professionals who are an indispensable member of the health team (Kavaklı et al., 2009). Nursing care and practices are very important in these units. Therefore, intensive care nurses have very important roles. Advances in practice for PIVC insertion, care, management and removal are an integral part of the role of nurses (Aziz 2009). One of the most common invasive procedures in intensive care units is PIVC (Yüceer and Demir 2009). Since the patients hospitalized in the intensive care units have the most severe diseases in the hospital, they are the patients with the most invasive procedures and are the most susceptible to infection. Infections in intensive care units may be more dangerous than other clinics (Aytac et al., 2008).

In the study, it was seen that education positively affected the behavior of nurses to correctly apply many stages of PIVC application. In the study, it was observed that all nurses in the case and control group fulfilled the basic responsibilities required by all practices such as hand hygiene, use of gloves, hand hygiene after the procedure during PIVC insertion, however, it was seen that the case group performed many more procedures to be performed during PIVC insertion, which was substantially more than the control group. Verification of patient identity and obtaining verbal consent, washing visible contamination with water and soap, writing date-time-paraf writing on fixation, observing 1-2 hours after implanting peripheral catheter, observing asepsis-antisepsis rules for drug preparation, using bear injector for each injection and The difference between the case group and the control group was statistically significant when recording the catheter removal time-date. (p<0.05). This result shows that education has a statistically significant effect on behavior change.

Similar to our study; In a study conducted by Keleekai et al. (2016) in order to determine the effect of a comprehensive curriculum (3 hours in the classroom), which includes the knowledge, confidence and skills of nurses regarding PIVC procedural practice, the 28-item PIVC application skills-based checklist included in the assessments in PIVC application, it was seen that nurses' knowledge, confidence and skills improved with the curriculum. (Total score for the 94 observations is 0.98) (Keleekai et al., 2016).

In the study of Lyons and Kasker (2012), in order to improve the skills of nurses experienced in intravenous (IV) catheter placement, their knowledge about trust and IV catheter placement, care and infection prevention, the training was conducted with 33 experienced nurses and participants were given 1 day A course was provided. In the skill checklist consisting of 14 questions; The patient's identity was verified using at least two independent identifiers, and specific criteria for PIVC administration were used, such as "hand hygiene was applied and gloves were worn, a cutaneous antiseptic agent was applied to the intended site". Similar to the findings in our study, the continuing education IV course showed that the knowledge and skills of experienced nurses improved. The pre-test score was 77.88 and the post-test score was 96.67 (p <.0001), which was statistically significant with an increase of 18.79 (Lyons and Kasker 2012).

In another study with similar results, two groups A and B showed a similar agreement in 3-period comparisons to improve compliance with PIVC management, the procedure of dressing appropriate gloves, goggles, etc. during PIVC insertion after intervention was significantly improved for group A (case). It was found to be 58.6% before the intervention and 36.2% before the intervention. In the evaluation, 94.4% of the PIVCs were placed aseptically. In the same study, the duration of PIVC use was significantly increased for group A when compared with the pre-intervention time (t test), and no improvement was observed for group B (p=.002) (Fakih et al., 2012). In the study performed by Arslan et al. to evaluate the nurses' knowledge in peripheral, central and port catheter care and complications; In a questionnaire consisting of 3 sections and 55 questions, 151 nurses working in nephrology intensive care, emergency and oncology clinics and 32 questions were asked to

measure peripheral and sanralvenous catheter information, evaluations were made by chi-square test. According to the education level of nurses, 62.5% of high school graduates, 72.9% of associate degree graduates and 79.1% of undergraduate graduates were found successful for peripheral and central venous catheter care and complications (p=0.03) (arslan et al., 2014). Aziz in his study in 2009; From June 2008 to June 2009, nurses were evaluated in 12 months and compliance with peripheral catheter control increased from 70% to 90-100%. It was concluded that nurses had the most difficulty in wearing gloves (Aziz 2009).

In contrast to the results of our study, Morse and Mcdonald (2009) conducted a study in a simple poster-based training program in a hospital setting to improve the time and date of placement of PIVCs, and found that the difference before and after the study was not statistically significant. (P=0.27). Poster-based training alone has been reported to have little impact on improving the situation (Morse and McDonald 2009). The form of training can also be effective in the results.

As a result;

It was found that the training given in accordance with the national guideline for peripheral venous catheter application was very effective on nurses, but it was not enough to provide one-time training in order to ensure complete behavior change at all stages. For this reason, it is recommended that the institution support nurses with in-service trainings and guidelines at regular intervals, and that similar studies are conducted with larger groups and repeated with nurses working in different units.

In addition, the studies to be carried out considering the national guidelines for PIVC implementation are important for the development of national standards as well as improving the knowledge and skills of the nurses who are a professional profession group for PIVC implementation.

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