Turkish Nurses' Knowledge About Application, Care, and Complications of Peripheral and Central Venous Catheters and Port Catheters

Muzeyyen Arslan[1], Serkan Yalçın[2], Fatma Kesik[3], Bahar Demirci[2], Özlem Şahin Balçık[2]
[1]Turgut Ozal University School of Nursing, Ankara, Turkey, [2]Turgut Ozal University Hospital, Ankara, Turkey, [3]Dışkapı Education and Research Hospital, Ankara, Turkey

Key Words: *catheter; nurses; knowledge; Turkey.*

Summary. *Background. Peripheral and central arterial/venous or port catheters are used widely in clinical practice. Nursing care and management of catheters is complex, and many controversial practice issues challenge nursing practitioners. Central arterial or venous catheters are associated with a risk of infections that can increase morbidity and mortality and the cost of care.*

The aim of the study was to assess the nurses' knowledge about the application and care of peripheral and central venous and port catheters focusing on prevention of complications that may occur.

Methods. Nurses (n=151) working in the intensive care-nephrology unit, the emergency service, and the oncology clinic in Dışkapı Yıldırım Beyazıt Education and Research Hospital and Turgut Ozal University Medicine Faculty Hospital in Turkey were enrolled in the study. The data were collected using a specially developed questionnaire. The 3-part questionnaire consisted of 55 questions.

Results. The response rates obtained were 79.1% and 62.5% for university graduate nurses and college graduate nurses, respectively; there was a significant difference in knowledge between those 2 groups. The knowledge of the nurses about peripheral and central venous catheters significantly differed considering the length of their professional experience and the working place. The information about port catheterization was extraordinarily low, as 91% (n=138) of the nurses failed during the test or had no idea about this procedure.

Conclusion. The knowledge of nurses about the application, care, and complications of central and peripheral catheters and port catheters differs in relation to their education, duration of practical experience, and working site. The lack of knowledge about port catheters was the greatest. In-service training of nurses is required to improve their knowledge and skills on the topic of safe nursing practice.

Introduction

Peripheral and central arterial or venous catheters are used for various purposes (1) and may cause serious complications like infections or thrombosis. For this reason, health personnel that use these devices should prevent patients from catheter-related complications (2, 3). Catheter-related bloodstream infection (CRBSI) is an important indicator of care quality. Nurses and other health personnel play an important role in dressing of catheter insertion, placing closures, and giving fluids periodically (4). In case of long-term central venous liquid or drug therapy, nurses could be helpful in choosing the most suitable vein and catheter (5).

The most appropriate distal vein must be selected for peripheral venous catheterization (PVC) (6). Central venous catheters could be used in patients with gastrointestinal system-related disorders requiring fluid therapy for several days or acute hemodialysis or chemotherapy (7, 8). Central venous catheterization (CVC) is performed by a physician, but preservation and follow-up is done by nurses (9).

Port catheters are preferred in oncology patients for the prevention of recurrent venous intervention, long-lasting conservation of daily living activities (10). They could be used for intravenous medication, replacement of blood products, or total parenteral nutrition as well as fluids may be given by this way. Port catheters may also be useful in taking blood samples for laboratory tests. Port catheterization (PC) has advantages as only minimal discomfort to the patient is caused. Placement of a port catheter might be achieved under local anesthesia and patients probably would be discharged within hours after operation (11, 12). In addition, the risk of infection in case of port catheters is lower in comparison with external catheters (13, 14).

Correspondence to M. Arslan, School of Nursing, Turgut Ozal University, No: 16/A Anadolu Bulvarı Yenimahalle, Ankara, Turkey. E-mail: muzeyyen24@hotmail.com

Adresas susirašinėti: M. Arslan, School of Nursing, Turgut Ozal University, No: 16/A Anadolu Bulvarı Yenimahalle, Ankara, Turkey. El. paštas: muzeyyen24@hotmail.com

Nursing care and management of catheters is complex, and many controversial practice issues challenge nursing practitioners. The insertion of central venous catheters by registered nurses is a relatively new adventure in the nursing practice, increasing their professional responsibility, accountability, and liability. Such practice and nurses' decisions for and during the procedure should follow scientific principles and research (15).

Central arterial or venous catheters are life-sustaining devices; however, they are associated with a risk of infections that can increase morbidity and mortality and the cost of care. Infections associated with intravascular catheters account for 10% to 20% of all nosocomial infections. The mean rate of CVC-related bloodstream infections in the intensive care unit (ICU) is 5.3 per 1000 catheter days (16, 17). From 10% to 70% of all CVC-related infections are preventable (18).

The guidelines for the prevention of intravascular catheter-related infections, published by the US Centers for Disease Control and Prevention, provide recommendations for catheter care whose preventive value is supported by scientific research (19). Although the recommendations are evidence based, no adherence to them has been reported (20, 21). This lack of adherence may be due to the lack of knowledge of the guidelines. Research has indicated that education of health care workers, preferably as part of a multifaceted quality improvement program, can reduce the rate of CVC-related infections (18, 22, 23).

The aim of the study was to assess the nurses' knowledge about the application and care of peripheral and central venous and port catheters focusing on prevention of complications that may occur.

This would help to identify practical aspects that need an improvement in nurses' knowledge in order to minimize the errors in application of catheter devices.

Material and Methods

The study was carried out in Turgut Ozal University Hospital and Ankara Dışkapı Yıldırım Beyazıt Hospital in Turkey. This was a descriptive study involving 151 nurses from the intensive care-nephrology unit, the emergency unit, and the oncology clinic. All the nurses from those 3 working places were expected to participate in the study; however, the response rate achieved was 84%.

The questionnaire to assess the knowledge of nurses was based on the investigated literature. The questionnaire consisted of 3 sections and 55 questions in total. There were 12 questions related to sociodemographic data and 32 questions related to the nurses' knowledge about the application, care, and risk of complications of peripheral and central venous catheters; the other 11 questions were related to the nurses' knowledge about the use of port catheters. Each question about the application and care of peripheral and central venous catheter was weighted by a score of 3.125 (in total, a score of 100); each question about port catheters was weighted by a score of 9.1 (in total, a score of 100). The critical score of 70 (a lower limit of academic success scores in Turkey) was used to evaluate the nurses' knowledge: the nurses who scored 70 and above were considered successful with the test and those who scored below 70 were considered unsuccessful.

Statistical Analysis. The statistical analysis was performed using the SPSS program, version 15. The difference between the groups was analyzed by the chi-square test; a P value of <0.05 was considered statistically significant.

Results

According to age, 31.8% (n=48) of the nurses were 18–25 years old, 42.4% (n=64) were 26–35 years old, and 25.8% (n=39) were aged 36 years and more. All the participants were women. University graduate nurses accounted for 41.7% of the study sample; associate degree nurses, 31.8%; and 26.5% were college-educated graduates.

The knowledge of the nurses about implementation, maintenance, and complications of peripheral venous catheters and central venous catheters was assessed in university and college graduate respondents. The success rate was higher (79.1%) for university-educated nurses in comparison with college graduate nurses (62.5%) ($P<0.05$). There was no significant difference in the knowledge about PC between the groups in relation to their education (Table 1).

The knowledge about PVC and CVC was different between the nurses when considering the duration of their professional experience and working site ($P<0.05$). However, there was no significant difference in the nurses' knowledge about PC according these social characteristics ($P>0.05$) (Tables 2 and 3).

The nurses' achievement scores, as an objective measure, were analyzed in relation to their personal satisfaction with the level of knowledge they had (subjective measure), but no significant differences were found (Table 4).

One-third of the participants (36.4%; n=55) were unsuccessful with their knowledge assessment about the application and care of PVC and CVC. In case of PC, 91% (n=138) of the nurses failed or had no idea about the subject asked. As a result, the mean questionnaire score was 72.3 (max, 100; min, 43.75).

Table 1. Nurses' Knowledge About Peripheral Venous Catheterization, Central Venous Catheterization, and Port Catheterization According to Their Education

		Level of Education			Total	
		College	Associate Degree	University		
PVC and CVC	Unsuccessful	15 (37.5)	13 (27.1)	11 (18.9)	39 (26.4)	χ^2=6.984; ***P*=0.03**
	Successful	25 (62.5)	35 (72.9)	52 (79.1)	112 (73.6)	
Total		40 (100.0)	48 (100.0)	63 (100.0)	151 (100.0)	
PC	Unsuccessful	37 (92.5)	43 (89.6)	58 (92.1)	138 (91.4)	χ^2=0.298; *P*=0.861
	Successful	3 (7.5)	5 (10.4)	5 (7.9)	13 (8.6)	
Total		40 (100.0)	48 (100.0)	63 (100.0)	151 (100.0)	

Values are number (percentage). PVC, peripheral venous catheterization; CVC, central venous catheterization; PC, port catheterization.

Table 2. Nurses' Knowledge About Peripheral Venous Catheterization, Central Venous Catheterization, and Port Catheterization According to Length of their Professional Experience

		Professional Experience			Total	
		0–5 years	6–10 years	>11 years		
PVC and CVC	Unsuccessful	34 (53.1)	9 (36.0)	12 (19.4)	55 (36.4)	χ^2=15.411; ***P*=0.000**
	Successful	30 (46.9)	16 (64.0)	50 (80.6)	96 (63.6)	
Total		64 (100.0)	25 (100.0)	62 (100.0)	151 (100.0)	
PC	Unsuccessful	61 (95.3)	21 (84.0)	56 (90.3)	138 (91.4)	χ^2=3.077; *P*=0.215
	Successful	3 (4.7)	4 (16.0)	6 (9.7)	13 (8.6)	
Total		64 (100.0)	25 (100.0)	62 (100.0)	151 (100.0)	

Values are number (percentage). PVC, peripheral venous catheterization; CVC, central venous catheterization; PC, port catheterization.

Table 3. Nurses' Knowledge About Peripheral Venous Catheterization, Central Venous Catheterization, and Port Catheterization According to Their Working Site

		Working Site			
		In-patient Service	Emergency Service	Total	
PVC and CVC	Unsuccessful	20 (18.1)	8 (32.0)	28 (23.8)	χ^2=11.821; ***P*=0.007**
	Successful	97 (81.9)	17 (68.0)	114 (76.2)	
Total		117 (100.0)	25 (100.0)	142 (100.0)	
PC	Unsuccessful	107 (91.5)	22 (88.0)	129 (91.4)	χ^2=1.037; *P*=0.817
	Successful	10 (8.5)	3 (12.0)	13 (8.6)	
Total		117 (100.0)	25 (100.0)	142 (100.0)	

Values are number (percentage). PVC, peripheral venous catheterization; CVC, central venous catheterization; PC, port catheterization.

Discussion

Peripheral and central venous catheters are widely used by nurses for medication and fluid replacement therapy. The placement of the catheter to the patient should be determined according to patient's condition and needs.

The majority of nurses in Turkey are graduates of health vocational high schools. Some of them have obtained an associate degree via distant education programs. In this study, the university-educated nurses demonstrated the best knowledge about the application and care of peripheral and central venous catheters. University nursing education provides great convenience to nursing students for getting sufficient knowledge and technical skills. Nursing students have a possibility to apply their knowledge in practice and develop their technical skills during 4 years of theoretical and clinical learning. Different levels of training adversely affect standardization of nursing education in the country. Therefore, nurses

Table 4. Nurses' Knowledge (Objective Testing) About Peripheral Venous Catheterization, Central Venous Catheterization, and Port Catheterization According to Their Satisfaction (Subjective Measure) Level

		Satisfaction with Their Knowledge			
		Satisfied	Not Satisfied	Total	
PVC and CVC	Unsuccessful	26 (23.0)	10 (26.3)	36 (23.8)	χ^2=0.711; P=0.699
	Successful	87 (77.0)	28 (73.7)	115 (76.2)	
Total		113 (100.0)	38 (100.0)	151 (100.0)	
PC	Unsuccessful	102 (90.3)	36 (94.7)	138 (91.4)	χ^2=3.077; P=0.215
	Successful	11 (9.7)	2 (5.3)	13 (8.6)	
Total		113 (100.0)	38 (100.0)	151 (100.0)	

Values are number (percentage). PVC, peripheral venous catheterization; CVC, central venous catheterization; PC, port catheterization.

should be trained on important issues, such as the use of catheters prior to the clinical training period, as it may affect their success in clinical practice. Evidence reports that simulation-based training significantly decreases the rate of CRBSI in the ICU (24, 25). Reports spanning the past 4 decades have consistently demonstrated that the risk of an infection declines following standardization of aseptic care and that insertion and maintenance of intravascular catheters by inexperienced staff might increase the risk of catheter colonization (23, 26-28). Well-organized programs that enable nursing students and nurses to become educated and to provide, monitor, and evaluate care are critical to quality nursing care.

The nurses from the inpatient service were more successful with their knowledge assessment than the emergency service nurses. Inpatient service nurses are able to observe long-term complications because of follow-up of patients, while emergency service nurses take care of urgent patients with short-term follow-up and quick discharge. This may explain their poor knowledge about complications after catheterization. For this reason, we suggest additional training should be given to emergency nurses about catheter applications and long-term complications of catheterization.

The study revealed no significant differences in the level of the nurses' knowledge about the application and care of port catheters between the groups. Port catheters are not used commonly, in exception of oncology nurses, but all the nurses had the same, mostly poor, level of knowledge.

Nurses' age had no relationship with their knowledge about catheters. However, increasing experience in years of practice had a positive relationship with success in testing. Another study reported on the variables that correlated with higher scores of knowledge, i.e., Critical Care Nursing certification, attendance at a pulmonary artery catheter class, years of critical care experience, and frequent use of pulmonary artery catheters (29). The research conducted by Johnston et al. (2004) revealed similar findings to our study (30): the scores of knowledge were significantly higher among the nurses with longer ICU experience, a higher nursing grade, and a higher self-assessed level of knowledge.

What concerns improvement measures, we recommend to include the guidelines for the use of venous catheters in educational curricula of nursing students and to refresh knowledge of nurses in practice on a continuous basis. Nurses should follow new developments regarding the application of catheters, their care, and risk of complications during scientific meetings and training.

Conclusions

Knowledge of Turkish nurses about peripheral and central venous catheters relates to their education level, duration of professional experience, and working place. The lowest level of the nurses' knowledge is about port catheters and it does not relate to any nurses' characteristics. Nurses' knowledge assessment scores, as an objective measure, correlate with their personal satisfaction about the level of knowledge they have. Research is needed on a larger scale to validate these findings and to determine if nurses' knowledge of catheters is sufficient to maintain quality standards of safety and optimal patient care.

Statement of Conflict of Interest

The authors state no conflict of interest.

Turkijos slaugytojų žinios apie periferinių ir centrinių venų bei poodinių (porto) kateterių įstatymą, priežiūrą, komplikacijas

Muzeyyen Arslan[1], Serkan Yalçın[2], Fatma Kesik[3], Bahar Demirci[2], Özlem Şahin Balçık[2]
[1]Turgut Ozal universiteto Slaugos mokykla, Ankara, Turkija, [2]Turgut Ozal universiteto ligoninė, Ankara, Turkija, [3]Dışkapı klinikinė ligoninė, Ankara, Turkija

Raktažodžiai: kateteriai, slaugytojai, žinios, Turkija.

Santrauka. Periferinių ir centrinių arterijų / venų bei poodiniai (porto) kateteriai yra plačiai naudojami klinikinėje praktikoje. Kateterių priežiūra ir ligonio slauga yra sudėtinga, todėl slaugytojams kyla nemažai iššūkių. Centrinių arterijų / venų kateteriai susiję su infekcijos rizika, o tai didina mirštamumo ir mirtingumo dažnį bei ligonio priežiūros kaštus. *Tyrimo tikslas* – įvertinti slaugytojų žinias apie periferinių ir centrinių venų bei poodinių (porto) kateterių įstatymą ir priežiūrą skiriant didesnį dėmesį komplikacijų profilaktikai.

Medžiaga ir metodai. Tyrime dalyvavo 151 slaugytojas iš dviejų Turkijos ligoninių nefrologijos intensyviosios terapijos skyriaus, skubios pagalbos tarnybos ir onkologijos klinikos. Naudota autorių parengta anketa, sudaryta iš 55 teminių klausimų ir klausimų apie respondentą.

Rezultatai. Universitetinį išsimokslinimą įgiję slaugytojai (79,1 proc.) sėkmingai atsakė į anketos klausimus, o tarp išsimokslinimą kolegijose įgijusių slaugytojų teisingai atsakė 62,5 proc. Skirtumas statistiškai reikšmingas. Slaugytojų žinios apie periferinių ir centrinių venų kateterius reikšmingai skyrėsi atsižvelgiant į jų praktinės patirties trukmę ir darbo vietą. Žinios apie poodinį (porto) venų kateterizavimą buvo ypač prastos, nes 91 proc. (n=138) neišlaikė testo arba iš viso nieko nežinojo apie šią procedūrą.

Išvados. Slaugytojų žinios apie periferinių ir centrinių venų bei poodinių (porto) kateterių įstatymą, priežiūrą, komplikacijas yra skirtingos vertinant jų išsimokslinimo lygį, praktinės patirties trukmę ir darbo vietą. Mažiausiai slaugytojai žinojo apie poodinius (porto) kateterius. Slaugytojų žinioms ir kateterizavimo įgūdžiams gerinti būtina organizuoti saugiosios slaugos praktikos mokymą darbo vietose.

References

1. Shah H, Bosch W, Thompson KM, Hellinger WC. Intravascular catheter-related bloodstream infection. Neurohospitalist 2013;3(3):144-51.
2. Manian FA. IDSA guidelines for the diagnosis and management of intravascular catheter-related bloodstream infection. Clin Infect Dis 2009;49(11):1770-1; author reply 1771-2.
3. Hollenbeak CS. The cost of catheter-related bloodstream infections: implications for the value of prevention. J Infus Nurs 2011;34(5):309-13.
4. Dinc L, Erdil F. The effectiveness of an educational intervention in changing nursing practice and preventing catheter-related infection for patients receiving total parenteral nutrition. Int J Nurs Stud 2000;37(5):371-9.
5. Lundgren A, Ek AC, Wahren L. Handling and control of peripheral intravenous lines. J Adv Nurs 1998;27(5):897-904.
6. Woody G, Davis BA. Increasing nurse competence in peripheral intravenous therapy. J Infus Nurs 2013;36(6):413-9.
7. Schiffer CA, Mangu PB, Wade JC, Camp-Sorrell D, Cope DG, El-Rayes BF, et al. Central venous catheter care for the patient with cancer: American Society of Clinical Oncology clinical practice guideline. J Clin Oncol 2013;31(10):1357-70.
8. McCann M, Einarsdottir H, Van Waeleghem JP, Murphy F, Sedgewick J. Vascular access management III: central venous catheters. J Ren Care 2010;36(1):25-33.
9. Alexandrou E, Spencer TR, Frost SA, Mifflin N, Davidson PM, Hillman KM. Central venous catheter placement by advanced practice nurses demonstrates low procedural complication and infection rates – a report from 13 years of service. Crit Care Med 2014;42(3):536-43.
10. Biffi R, de Braud F, Orsi F, Pozzi S, Mauri S, Goldhirsch A. Totally implantable central venous access ports for long-term chemotherapy. A prospective study analyzing complications and costs of 333 devices with a minimum follow-up of 180 days. Ann Oncol 1998;9(7):767-73.
11. Gonda SJ, Li R. Principles of subcutaneous port placement. Tech Vasc Interv Radiol 2011;14(4):198-203.
12. Perdikakis E, Kehagias E, Tsetis D. Common and uncommon complications of totally implantable central venous ports: a pictorial essay. J Vasc Access 2012;13(3):345-50.
13. Suslu H, Arslan G, Tural K. Venous port implantation in adult patients: retrospective evaluation. Agri 2012;24(1):32-6.
14. McKee J. Future dimensions in vascular access – peripheral implantable ports. J Intraven Nurs 1991;14(6):387-93.
15. Ngo A. Murphy S. A theory-based intervention to improve nurses' knowledge, self-efficacy, and skills to reduce PICC occlusion. J Infus Nurs 2005;28(3):173-81.
16. Mermel LA. Prevention of intravascular catheter-related infections. Ann Intern Med 2000;132(5):391-402.
17. O'Grady NP, Alexander M, Burns LA, Dellinger EP, Garland J, Heard SO, et al.; Healthcare Infection Control Practices Advisory Committee (HICPAC). Guidelines for the prevention of intravascular catheter-related infections. Clin Infect Dis 2011;52(9):e162-93.
18. Pearson ML. Guideline for prevention of intravascular-device-related infections. Hospital Infection Control Practices Advisory Committee. Infect Control Hosp Epidemiol 1996;17(07):438-73.
19. Sherertz RJ, Ely EW, Westbrook DM, Gledhill KS, Streed SA, Kiger B, et al. Education of physicians-in-training can decrease the risk for vascular catheter infection. Ann Intern Med 2000;132(8):641-8.
20. Warren DK, Yokoe DS, Climo MW, Herwaldt LA, Noskin

GA, Zuccotti G, et al. Preventing catheter associated bloodstream infections: a survey of policies for insertion and care of central venous catheters from hospitals in the prevention epicenter program. Infect Control Hosp Epidemiol 2006;27(1):8-13.
21. Rubinson L, Wu AW, Haponik EE, Diette GB. Why is it that internists do not follow guidelines for preventing intravascular catheter infections? Infect Control Hosp Epidemiol 2005;26(6):525-33.
22. Lobo RD, Levin AS, Gomes LM, Cursino R, Park M, Figueiredo VB, et al. Impact of an educational program and policy changes on decreasing catheter-associated bloodstream infections in a medical intensive care unit in Brazil. Am J Infect Control 2005;33(2):83-7.
23. Warren DK, Zack JE, Mayfield JL, Chen A, Prentice D, Fraser VJ, et al. The effect of an education program on the incidence of central venous catheter-associated bloodstream infection in a medical ICU. Chest 2004;126(5):1612-8.
24. Barsuk JH, Cohen ER, Feinglass J, McGaghie WC, Wayne DB. Use of simulation-based education to reduce catheter-related bloodstream infections. Arch Intern Med 2009; 169(15):1420-3.
25. Cohen ER, Feinglass J, Barsuk JH, Barnard C, O'Donnell A, McGaghie WC, et al. Cost savings from reduced catheter-related bloodstream infection after simulation-based education for residents in a medical intensive care unit. Simul Healthc 2010;5(2):98-102.
26. Coopersmith CM, Rebmann TL, Zack JE, Ward MR, Corcoran RM, Schallom ME, et al. Effect of an education program on decreasing catheter-related bloodstream infections in the surgical intensive care unit. Crit Care Med 2002; 30(1):59-64.
27. Pronovost P, Needham D, Berenholtz S, Sinopoli D, Chu H, Cosgrove S, et al. An intervention to decrease catheter-related bloodstream infections in the ICU. N Engl J Med 2006;355(26):2725-32.
28. Eggimann P, Harbarth S, Constantin MN, Touveneau S, Chevrolet JC, Pittet D. Impact of a prevention strategy targeted at vascular-access care on incidence of infections acquired in intensive care. Lancet 2000;355(9218):1864-8.
29. Burns D, Shively M. Critical care nurses' knowledge of pulmonary artery catheters. Am J Crit Care 1996;5(1):49-54.
30. Johnston IG, Jane R, Fraser JF, Kruger P, Hickling K. Survey of intensive care nurses' knowledge relating to the pulmonary artery catheter. Anaesth Intensive Care 2004;32(4): 564-8.

Received 14 February 2014, accepted 7 July 2014
Straipsnis gautas 2014 02 14, priimtas 2014 07 07