VOLUME 8 • NUMBER 2 • JUNE 2017

JOURNAL OF CLINICAL AND EXPERIMENTAL INVESTIGATIONS

ORIGINAL ARTICLE

The Effect of Periuretral Care and Follow-Up on Bacteriuria in Patients with Urinary Catheter: A Comparison of Three Solutions

Ayfer Kara[1], Pakize Ozyurek[2]

[1]Afyon Kocatepe University, Afyonkarahisar, Turkey
[2]Department of Nursing, School of Health, Afyon Kocatepe University, Afyonkarahisar, Turkey

Corresponding author:
Pakize Ozyurek,
Afyon Saglik Yuksekokulu A Blok, Ali Cetinkaya Kamp. Izmir Karayolu 8. Km. Afyonkarahisar 03400 Turkiye.
Email: pozyurek@aku.edu.tr

DOI:10.5799/ahinjs.01.2017.02.0624
Received: 31 May 2017
Accepted: 28 June 2017

ABSTRACT

Objective: The aim of this study was to compare urinary colonization rates in subjects whose periurethral area was cleaned with sterile water or tap water versus povidone-iodine before and after urinary catheter insertion.
Patients and Methods: The study was conducted in intensive care, surgery and medical wards of a university hospital. The study assessed a total of 207 adult patients requiring urinary catheterization for bacteriuria. They were screened for eligibility by the supervising physician. 110 patients were excluded from the study. The study sample included a total of 97 patients. The only difference among the three groups was that sterile, tap water and povidone-iodine were used to clean the periurethral area. A urine specimen was collected immediately before and 72 hours after catheter insertion.
Results: The povidone-iodine group patients had a mean age of 67.9±12 years, the mean of the sterile group patients was 66.3±14 years, and the mean of the tap water group patients was 63.5±12 years. The Chi-Square test revealed no inter-group difference for age groups (P=0.483). Urinary tract infections occurred in 18% of the total sample. The percentage of infection for povidone-iodine, sterile water and tap water groups was 22.2%, 38.9%, and 38.9% respectively.
Conclusion: There were no significant differences in the rate of bacteriuria or urinary tract infections in the sterile water, tap water and povidone-iodine groups. Traditionally, povidone-iodine solutions have been used to clean the periurethral area is probably not useful than water solutions.
Key words: Periuretral care, urinary tract infection, urethral catheter, antiseptic solution

INTRODUCTION

Today, despite constituting a significant portion of medical care, urethral catheters are devices, which still disrupt defense mechanisms of hosts and allow microorganisms to enter sterile areas and reproduce [1,2]. It is known that in the past two decades, 15%-25% of hospitalized patients have been inserted urethral catheters at least once in the period they were in the hospital [3,4]. Therefore, it is critical that practices and procedures are in place to minimize the risk of infection [5]. Urethral catheters are responsible for approximately 80% of nosocomial urinary tract infections in the acute care setting, and many of these catheters are used for inappropriate reasons [6]. It is reported that upon first insertion of urethral catheter, there is a risk of infection at the rates of 1% and 20% [3]. As urethral catheters are inserted in all hospital clinics, urinary tract infection (UTI) due to catheter is encountered in each clinic [1,7]. Conducted studies show that over 50% of patients who had the catheter for four days or above have bacteriuria prevalence [8]. Approximately 15% - 20% of patients who had urethral catheter inserted develop symptomatic UTI [4,9]. UTI causes prolonged hospitalization, mortality and morbidity [10,11,12]. In addition, increased cost of treatment may cause psychological distress in the patient [4, 9].

The periurethral region is also where pathogen microorganisms colonize [5,13]. Bacteria which

colonize in the periurehral region enters the urinary system (tract) during catheter insertion via catheter lumen and between the catheter and mucosal surface. These bacteria are transported to the bladder when the catheter is inserted [1]. Using the correct technique in urinary catheterization and providing appropriate care to patients are the patient care applications which prevent or reduce possible complications. Infection risk in catheterization is exceptionally high, even when adhering to the sterile aseptic technique [14]. It is generally accepted that in urinary catheterization 10% povidone-iodine has been traditionally used to clean the periurethral area [4]. In addition, in previous studies, no significant increase in urinary tract infections has been reported with regard to the use of tap water or povidone-iodine in cleansing the periuretheral area [4,15-17]. There are disadvantages to using antiseptic solutions such as its cost, and the risk of skin irritation, burning, and anaphylactic reactions [18]. There is uniform opinion about the need to reduce existing urinary meatus flora prior to introduction of the urinary catheter, but the subject remains controversial. Preventing of contamination of the entry site of the catheter after urinary catheterization is important. Cleaning the periurethral area with 10% povidone-iodine before urinary catheterization is a common procedure in most institutions, including our own. However, as the patient population and application protocols vary between hospitals, each hospital is different from one another. Participants in previous studies on periurethral cleansing prior to catheter insertion were selected to be the same sex, of similar age, to have had elective surgery and to have been relatively healthy. This study was designed to additionally investigate bacteriuria of all hospitalized patients, and of patients of different ages and sex. There are no published studies comparing the effects of using sterile water, tap water and povidone-iodine solution cleansing agents for periurethral cleaning of the insertion site prior to catheterization in adult patients, and this study is the first to explore this subject in Turkey. The aim of this study was to compare urinary colonization rates in subjects whose periurethral area was cleaned with different types of water (sterile or tap) or povidone-iodine before and after the insertion of an indwelling urinary catheter.

PATIENTS AND METHODS

Patients

The study was conducted in intensive care, surgery and medical wards of a university hospital. Data was collected between December 2011and March 2012. The study assessed a total of 207 adult patients requiring urinary catheterization for bacteriuria. They were screened for eligibility by the supervising physician. 110 patients were excluded from the study (Table 1). The study sample thus totaled 97 patients. Study consisted of patients who are of age 18 and older, who don't have any mental problems and who are to be inserted a catheter for the first time (Figure 1).

Table 1. Distribution of patient who were not included in the study

Exclusion criteria	n	%
Catheter was removed within 72 hours	67	60.9
Indwelling catheter was changed	32	28.0
Bacteriruia in the first urine sample	6	6.6
Urine sample not taken	5	4.5
Total	110	100

Patients eligible for the study were informed of the study and informed consent was obtained in writing. Following consent, patients were randomly assigned to three groups. The groups were 10% povidone-iodine (group 1), sterile water (group 2), tap water (group 3). The standard protocol for urinary catheter insertion was followed in all three groups. Patient characteristics were collected for each subject, including age, number of catheters, the location where catheterization took place, and the patient's diagnosis (Table 2). The only difference among the three groups was that sterile and tap water was used to clean the periurethral area in the experimental group, while povidone-iodine was used in the control group. The routine sterile hospital procedure was followed during insertion of the catheter for all patients.

Technique in the study group patients

Apart from the solution used (sterile water or tap water or 10% povidone-iodine) the standard protocol for catheter insertion in a ward setting was followed. This protocol involved routine handwashing with antiseptic solution, use of sterile gloves, use of a sterile pack, use of a non-contact technique, and exposing only the tip of the catheter from its plastic sheath when inserting the catheter. In female patients the labia minora were separated with the fingertips of one hand. The perineal area was swabbed from front to back, and center outwards 3 times with sterile gauze soaked in either 10% povidone-iodine or sterile water or tap water. In males, the tip of the penis was cleaned from the urethral opening backwards toward the body 3 times with sterile gauze soaked in either 10% povidone-iodine, sterile water or tap water. After a minute for drying, the lubricated end of the catheter was gently inserted into the urethra until urine flow appeared. Closed drainage system was preserved and a urine drainage bag was carefully placed in a level which is below the bladder. The date and time that the indwelling catheter was inserted was documented. One principal researcher collected urine specimens at baseline, performed all catheterizations and collected urine specimens again at the end of 72 hours. Prior to the data collection the researchers examined the study procedures and performed the catheterizations in the standard way.

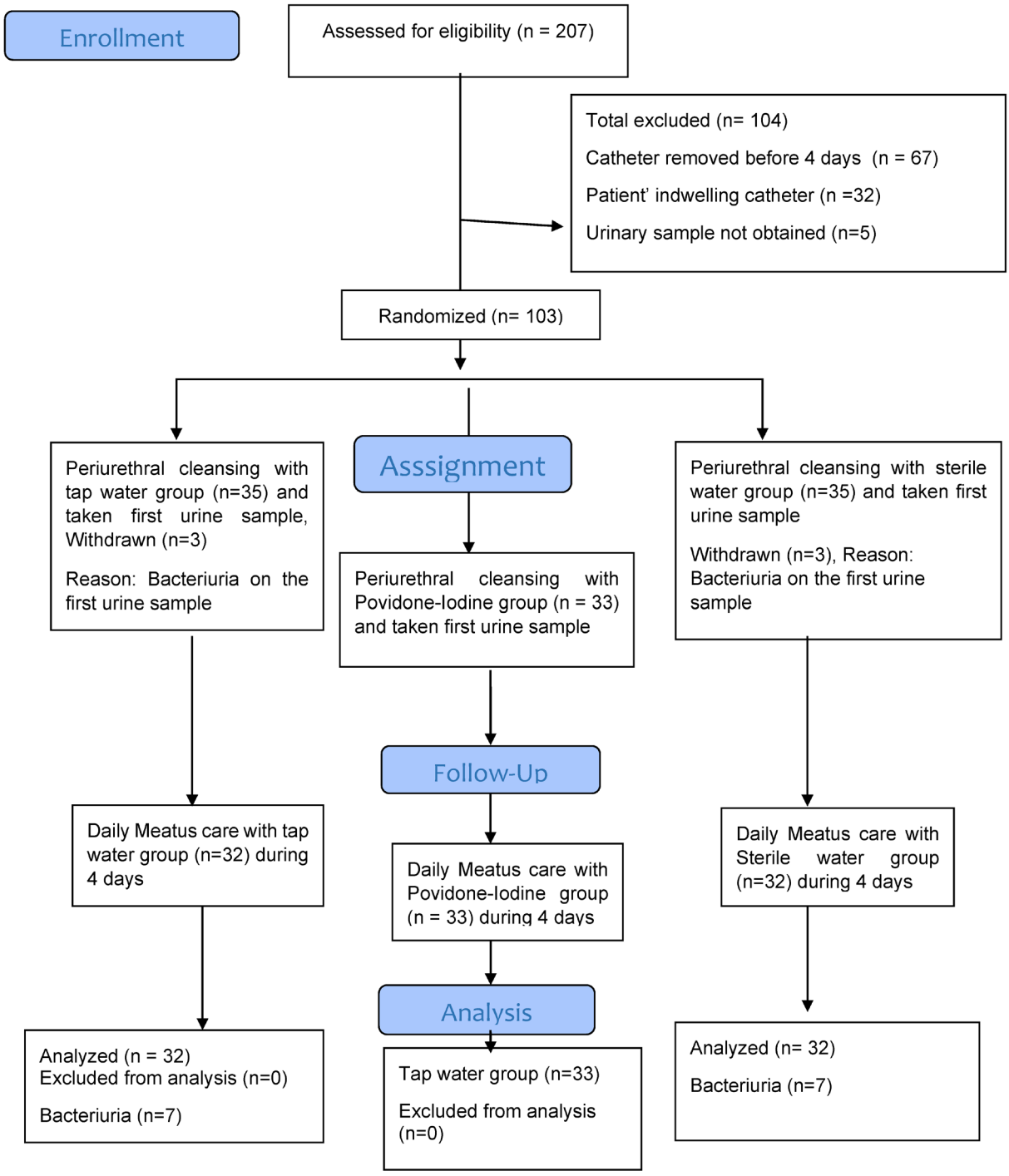

Figure 1. Flow of Patients through the Trial

Patient details were entered on a data sheet along with the type of catheter, number of Foley catheter used, and the time and date of catheter insertion. Approximately 30 minutes after insertion of the catheter, 10 mL of urine was collected into a small sterile cup through a sterile side port. Urine samples were sent immediately to the microbiology lab to be processed for urine culture. Patients who had microorganisms in their urine samples were excluded from the study.

The study was conducted according to the hospital microbiology protocol for processing urine cultures. Culturing was conducted by using 0.01-0.001 disposable plastic loop and superficial culturing.

Eosine Methylene Blue (EMB) and Brain Heart Infusion with 5 sheep blood (BHI) agar Heart İnfusion (BHI) agar used.4 Culturing was conducted by using CFU (detecting 1 colony in each millimeters). Non diluted urine was spread evenly in the agar with sheep blood. Cultures were incubated aerobically at 37°C for 24 to 48 hours. Cultures showing a pure growth >105 organisms per liter were subject to full identification. Types of microorganisms were identified. Probable bacteria pathogens were considered to be *E. coli*, *Klebsiella* spp., *Enterobacter* spp., *Enterococcus* spp., *Proteus* spp., and *Pseudomonas* spp.

After applying the urethral catheter, each male and female patient in experimental groups were provided daily catheter care. Urethral catheter care was carried out as follows: Hands were washed prior to catheter care. Disposable gloves were worn. Meatus and perineum of patients were cleaned by using sterile distilled water, tap water or povidone iodine, according to groups. The cleaning process was carried out by wiping from interior of perineum to the exterior and from up to down in female patients. In male patients, the tip of the penis was cleaned with soaked sterile gauze. This was repeated by cleaning once from entry to meatus to the outer region and disposing the gauze bandage until the dirt was eliminated. Catheter care was conducted once a day for every four days where patients had the catheter.

In order to examine the effects of provided catheter care (with three different solutions) on bacteriuria rates, another urine sample was collected from the patients in the fourth day after urethral catheter was inserted. Hands were washed before and after taking urine samples from urethral catheters. In order to take urine samples from urethral catheters, first the urine in the catheter was drained, than the catheter was clamped. Within 10-30 minutes, the distal portion of the urethral catheter (the part where urinary culture was to be sampled) was cleaned with povidone iodine. After povidone iodine was dry, catheter was entered by sterile syringe and fresh urine sample was taken without much aspiration. Urine samples taken were put into urine culture containers labeled with patient's name and surname. They are then sent to a microbiology laboratory.

Ethical Considerations

The study was approved by the Ethical Research Committee (Number: B302FTH/2621) and the Hospital Management. All participating patients were provided with necessary information about purpose of the study and its implementation, after which their oral and written consent was obtained.

Statistical Analyses

The Statistical Package for the Social Sciences for Windows 15.0 (SPSS Inc., Chicago, IL, USA) was used for statistical analyses. Data was expressed as number, percentage, mean and standard deviation. The Chi-square test was applied to examine the homogeneity of the groups and to examine the patients' urinary infection (Table 2).

RESULTS

The research nurses were available for only 207 catheterizations, of which 110 were excluded as the patients did not meet inclusion criteria. There were thus 97 consenting patients, and all of them were enrolled (33 in the povidone-iodine group, 32 in the sterile water group, and 32 in the tap water group) (Figure 1).

The povidone-iodine group patients had a mean age of 67.96±12, the mean of the sterile group patients was 66.34±14, and the mean of the tap group patients was 63.5±12. The chi-Square test revealed no inter-group difference for age groups (P=0.483). Demographic data and clinical presentation were similar in both groups, as shown in Table 2. None of the groups withdrew from the study.

Table 3. Comparison of the frequency of bacteriuria in groups in urine specimens collected at the time of catheter removal

Groups	Bacteriuria						*P*
	Yes		No		Total		
	n	%	n	%	n	%	
Povidone-iodine group	4	22.2	29	36.7	33	34	0.504
Sterile water	7	38.9	25	31.6	32	33	
Tap Water	7	38.9	25	31.6	32	33	
Total	18	18.6	79	81.4	97	100	

There were no significant differences in the rates of bacteriuria among the three groups (Table 3). Bacteriuria was diagnosed in 18% of the subjects [4 (22.2%) in the povidone-iodine group; 7 (38.9%) in the water group and 7 (38.9%) in the tap water group] (Table 3).

Table 4. Pathogens isolated from urine taken from indwelling catheters 4 days after delivery

Microorganism	Povidone-Iodine	Sterile water	Tap Water	Total
Escherichia coli	3	4	4	11
Enterococcus	0	2	1	3
Candida spp.	1	0	1	2
Klebsiella spp.	0	1	0	1
Klebsiella pneumonia	0	0	1	1
Total	4	7	7	18

None of the patients in any group met the criteria for bacteriuria (a colony count greater than 105 cfu/L). There were 18 positive urine cultures, of which 4 were in the povidone-iodine group and 7 were in each of the sterile water and tap water group (Table 4). No inter-group difference was found for positive cultures. The most common microorganism in among three groups were *Escherichia coli* (n=11), *Enterococcus* (n=3), and *Candida spp*. (n=2). (Table 4)

Table 2. Characteristics of study sample

Characteristics	Povidone-iodine group (n = 33)		Sterile water group (n=32)		Tap water group (n=32)		*P*
	n	%	n	%	n	%	
Age group							
25-59	5	15.2	7	21,9	10	31.3	0.483
60-74	19	57.6	14	43.8	15	46.9	
75 and >	9	27.3	11	34.4	7	21.9	
Gender							
Female	16	48.5	16	50.0	16	50.0	0.990
Male	17	51.5	16	50.0	16	50.0	
Had undergone surgery							
Yes	19	57.6	19	59.4	21	65.6	0.785
No	14	42.4	13	40.6	11	34.4	
Catheterization location							
Operating room	20	60.6	17	53.1	21	65.6	0.101
Intensive care unit	6	18.2	9	28.1	1	3.1	
Medical/surgical clinic	7	21.2	6	18.8	10	31.3	
Patient diagnosis							
Malignancy	14	42.2	13	40.6	12	37.5	0.777
Neurological	4	12.1	3	9.4	1	3.1	
Surgical	7	21.2	7	21.9	11	34.4	
Metabolic diseases	8	24.2	9	28.1	8	25.0	
Catheter number							
16 French	26	78.8	23	71.9	17	53.1	0.073
18 French	7	21.2	9	28.1	15	46.9	
Total	33	100	32	100	32	100	

DISCUSSION

UTIs are the most common nosocomial infections and nosocomial UTIs account for up to 40% of all hospital-acquired infections. Urinary catheters are responsible for approximately 80% of hospital-acquired urinary tract infection [19]. The current study compared bacteriuria rates when periurethral cleaning was carried out before and after urinary catheterization with sterile water or tap water versus a 10% povidone-iodine solution.

The prevalence rate of bacteriuria in this study is 18%. The reported overall incidence of bacteriuria among catheterized patients was 15 % to 25% during their hospital stay. Bacteriuria infection incidence rates have been reported as follows in these studies: 11% in Nasiriani et al. [4]; 8.7% in Webster et al. [17]; 17% in Al-Farsi et al. [20], and 20.7% in Kosgeroglu et al. [8]. The findings of this study are consistent with the literature.

Previous same research has compared the effects of using water and povidone-iodine solution for periurethral cleaning prior to catheterization. But in this study, 3 different solutions were used: (1) sterile water, (2) tap water, (3) povidone-iodine solution. Research comparing the use of a different liquid solution product for cleaning prior to catheter insertion is limited.

Nasiriani et al. compared rates of bacteriuria and UTIs when water and a povidone-iodine solution were used for periurethral cleaning prior to catheterization in women who had indwelling catheters inserted prior to gynecologic surgery [4]. Of 60 women undergoing inpatient gynecology surgery for whom complete data was supplied (water group, 30; antiseptic group, 30), a total of 11(18.3%) had urinary tract bacteriuria greater than 103 organisms per mL. The rates of bacteriuria were similar in both groups.

Cheung et al. compared rates of symptomatic UTIs when 0.05% chlorhexidine gluconate or water was used for periurethral cleaning prior to insertion of an indwelling catheter in a sample of home care patients (sterile water group, 20; CHG group, 12) [15]. This study similarly found that the relationship between the bacteriauria rates in the two groups was not statistically significant. Webster et al. compared bacteriuria rates in pregnant

women whose periurethral area was cleaned with water versus chlorhexidine 0.1% prior to insertion of urinary catheter [17]. Overall, 8.7% of the 436 subjects had bacteriuria at the time of catheter removal, but the rates were not statistically significantly different in the water (8.2%) and antiseptic (9.2%) groups (odds ratio 1.13; 95% confidence interval 0.58 to 2.21) [4,17]. Ibrahim and Rashid compared local povidone-iodine antisepsis with parenteral antibacterial prophylaxis for prevention of infective complications of transurethral resection of the prostate (TURP) in a prospective randomized controlled study [16]. They reported that there was no statistical difference in the rate of bacteriuria between the 2 groups in terms of cleaning performed or disinfection of the meatus [18].

Our findings are thus consistent with the literature. In this study it was similarly found that there was no statistically significant relationship between sterile water, tap water and povidone-iodine solution groups in terms of the rate of bacteriauria. Bacteria are just present, whereas bacterial infections ocur. Therefore the urethral meatus should be carefully cleaned prior to catheterization [3,5]. In order to prevent contamination, it is suggested that meatus to be cleaned with soap and water. However, the subject of using sterile water instead of an antiseptic solution for the preparation of the meatus before catheterization is still a matter of discussion. The findings of the current research suggest that there is no advantage in using antiseptic preparations for disinfecting the urethral meatus prior to catheter insertion prior and that it does not significantly reduce the incidence of bacteriuria [4,5]. On the other hand, some expert opinion has argued that compared to water, the use of topical antiseptics for cleaning the periurethral area prior to catheter insertion has the advantage of disinfecting the urethral meatus [5]. The literature suggests that a decision on which solution to apply could be made according to the personal hygiene requirements with regard to cleansing the urethral meatus [3].

After applying the urethral catheter, each male and female patient in experimental groups were provided daily catheter care. This study found that there were no significant differences in using an antiseptic solution for meatal cleaning and care of the insertion site compared with sterile water or tap water. The guidelines for the prevention of catheter-associated UTI (2011) advise that there is no advantage in using antiseptic preparations for meatal care compared with routine bathing or showering. The guidelines reported that washing the meatus with soap and water during daily routine bathing or showering is all that is required. In this study, various patient and procedural characteristics were compared: different ages, sex, presence of chronic diseases, catheter size, staff who carried out catheterizations and bacteriuria rates. In conclusion, no significant differences in the rates of bacteriuria were found.

Urinary pathogens were similar among three groups. The majority of bacteriuria were *Escherichia coli* accounting per group. Most common factors of catheter related infections are Enterobacteriaceae pathogens such as Escherichia coli, Klebsiella spp. and Enterobacter [19]. Escherichia coli is the most frequently isolated gram negative microorganism [19]. Conducted studies show that Esherichia coli accounts for 22%-37%, *Enterococcus* spp. accounts for 3%-15% and *Candida* spp. accounts for 12%-27% among factors of urethral catheter infections [4,21]. This research's finding on microorganism growth was found to be in accordance with the scientific literature.

This study has several limitations. First, the results are valid only for the institution and subjects included in this study and the findings may not be applicable to other hospitalized patients. A multicenter study might help expand our understanding of the efficacy of water or antiseptic solutions in the prevention of bacteriuria. Second, a major limitation of this study was that it had a small sample size with a limited number of participants. Researchers should have the largest number of participants possible for any study to increase the strength of the study and to decrease the possibility of error.

CONCLUSION

Based on the results of the study, there was no significant difference in the effective prevention of bacteriuria in cleaning with tap water or sterile water compared to antisepsis of the urinary meatus before and after the introduction of urinary catheter. Tap water, sterile water and povidone-iodine are almost equally effective in cleaning or disinfecting the meatus. However, the cleaning of the meatus and general care of the insertion site to maintaining the disinfection of the urinary meatus was more advantageous with povidone-iodine than sterile water and tap water. Based on the results of the study, we assert that this analysis should not be ignored.

All health professionals should apply meatus care in the hospital, and inform patients about this meatus care prior to catheterization. In this study is shown that there was no statistically significant relationship between sterile water, tap water and povidone-iodine solution groups in rates of bacteriuria, we suggest the development and implementation of a new protocol for professionals in all health institutions with regard to the cleaning of the meatus and the care of the insertion site. Hospital management should provide staff with training manuals to facilitate prevention of bacteriuria. Further development of guidelines may be of use as it may aid doctors' or nurses' decision-making regarding meatus care prior to the use of catheters and minimize the risks associated with urinary catheters.

Acknowledgments

The authors wish to thank the nursing service management and all clinical nurses for helping with data collection.

Conflict of interest: The authors declared no conflicts of interest.

Funding: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

REFERENCES

1. Bakir M. Prevention of catheter-related urinary tract infection. Turk J Hospital Infect. 2004;8:86-100.
2. Beduk Y. Nosocomial urinary tract infections. Klimik J. 2000;13:19-20.
3. Aygun P. Prevention of catheter-related urinary tract infection. Hospital Infections: Prevention and Control Symposium. 2008;60:131-3.
4. Nasiriani K, Kalani Z, Farnia F, et al. Comparison of the effect of water versus povidone-iodine solution for periurethral cleaning in women requiring an indwelling catheter prior to gynecologic surgery. Urol Nurs J 2009;29:118-31.
5. HSE/HPSC.Guidelines for the prevention of catheter-associated urinary tract infection. HSE Health Protection Surveillance Centre Report. 2011;11-6.
6. Blodgett TJ. Reminder systems to reduce the duration of indwelling urinary catheters: a narrative review. Urol Nurs. 2009;29:592-4.
7. Gastmeir P. Nosocomial urinary tract infections: many unresolved questions. Clin Microbiol Infec. 2001;7:521-2.
8. Koskeroglu N, Durmaz G, Bahar M, et al. The role of meatal disinfection in preventing catheter-related bacteriuria in an intensive care unit: a pilot study in Turkey. J Hosp Infect. 2004;56:236-8.
9. Schiotz HA and Guttu K. Value of urinary prophylaxis with methenamine in gynecologic surgery. Acta Obstet Gynecol Scand. 2005;81:743-6.
10. Esen S. Preventing of catheter-related urinary tract infection. Turk J Hosp Infect. 2005;9: 129-35.
11. Erben N, Alpat SN, Kartal ED, et al. Analysis of the risk factors in nosocomial urinary tract infections and effect of urinary catheter use on distribution of the causative agents. Bull Microbiol. 2009;43:77-82.
12. Gray M. What nursing interventions reduce the risk of systematic urinary tract infection in the patient with an indwelling catheter? J Wound Ostomy Continence Nurs. 2004;31: 3-13.
13. Falkiner FR. The insertion and management of indwelling urethral catheters minimizing the risk of infection. J Hosp Infect. 1993;25:79-90.
14. Akpinar RB, Yurttas A, Karahisar F. Nurse role in prevention of urinary catheter related infection. Int J Human Sci 2004;1:2-8.
15. Cheung K, Leung P, et al. Water versus antiseptic periurethral cleansing before catheterization among homecare patients: a randomized controlled trial. Am J Infect Control 2008;35:375-80.
16. Ibrahim A, Rashid M. Comparison of local povidone-iodine antisepsis with parenteral antibacterial prophylaxis for prevention of infective complications of TURP: a prospective randomized controlled study. Eur Urol 2002;41:250-6.
17. Webster J, Hood RH, Burridge CA, et al. Water or antiseptic for periurethral cleaning before urinary catheterization: a randomized controlled trial. Am J Infect Control 2001;29: 389-94.
18. Cunha M, Santos E, Andrade A, et al. Effectiveness of cleaning or disinfecting the urinary meatus before urinary catheterization: a systematic review. Revista da Escola de Enfermagem da USP 2013;47:1410-6.
19. Kalsi J, Arya M, Wilson P, Mundy A. Hospital-acquired urinary tract infection. Int J Clin Pract 2003;57:388-91.
20. Al-Farsi S, Oliva M, Davidson R, et al. Periurethral cleaning prior to urinary catheterization in children: sterile water versus 10% povidone-iodine. Clin Pediatr 2009;48:656-60.
21. Leblebicioglu H, Esen S. Hospital-acquired urinary tract infections in Turkey: a nationwide multicenter point prevalence study. J Hosp Infect 2003;53:207-15.