Original Article

Effect of Nursing Interventions on Prevention and Management of Postoperative Urinary Retention for Patients with Orthopedic Surgery under Spinal Anaesthesia

Zuleyha Yaban Simsek, RN, PhD
Research Assistant in Surgical Nursing, Kocaeli University School of Health Department of Nursing, Kocaeli, Turkey

Sureyya Karaoz, RN, PhD
Professor in Surgical Nursing, Istanbul Bilgi University School of Health Sciences Department of Nursing, Dolapdere Campus, İstanbul, Turkey

Correspondence: Zuleyha Simsek Yaban, Research Assistant in Surgical Nursing, Kocaeli University School of Health Department of Nursing, Umuttepe Campus, 41380 Kocaeli, Turkey. E-mail: zuleyha_simsek@hotmail.com

Abstract

Background: Urinary retention is a frequently observed as a postoperative complication that may lead to bladder damage, chronic nephropathy, urinary system infection and sepsis. Such complications can increase patient length-of-stay in a hospital and decrease quality of life.
Aims: This study aimed at evaluating the effect of nursing interventions on prevention and management of Postoperative Urinary Retention (PUR) for patients that undergo orthopaedic surgery under spinal anaesthesia.
Methodology: This study is a randomised controlled clinical experimental study. This study was implemented at the orthopedics and traumatology clinic of a public hospital in Kocaeli between September 2013 and June 2014 with 132 patients fulfilling the research criteria and 66 patients each in the control and the intervention groups. Data were collected by using "Postoperative Urinary Retention Risk Factors Evaluation Form – I and II", "Postoperative Retention Management Protocol for Control and Intervention Groups" and a "Portable Bladder Ultrasound Device". Nursing interventions were performed in accordance with the "postoperative urinary retention management protocol" in intervention group, on the contrary patients in the control group were observed by the researcher without performing any nursing interventions.
Results: This work found that PUR is developed in almost all of the patients in the control group. Catheterization was not applied to almost all patients from the intervention group. Meanwhile, a catheter was placed for approximately 1/3 of the patients in the control group.
Conclusion: Nursing interventions were effective in decreasing PUR incidence and consequently also reduced urinary catheterization incidence. Nursing interventions can be effective in the prevention and management of PUR. The results of this study will contribute to the improvement of patient care provided by nurses.

Key words: Postoperative urinary retention, nursing intervention, Portable Bladder Volume Instrument (BVI), urinary catheterization.

Introduction

Currently, although surgical interventions have improved along with developments in anesthesia and surgical techniques, various complications can still develop in the postoperative period and affect many systems. Urinary retention is one such predictable complication during the postoperative period. The American Medical Association defines urinary retention as, "the most frequent complication that is seen between the 2nd and 4th hour after surgery" (2004 quotation Palese et al., 2010, p. 2971).

Although there are various definitions for Postoperative Urinary Retention (PUR), a commonality in all these definitions is being unable to urinate with a full bladder (Changchien et al., 2007; Smith & Albazzaz, 1996).

In studies related to PUR, researchers mainly focused on urine volume in the bladder. While some researchers define 300 ml and over as a

urine volume indicating PUR in the postoperative period (Olsen & Nilsen, 2007), some studies define this as ≥400 ml (Warner et al., 2000), while others set the mark at ≥500 ml (Feliciano et al., 2008; Joelsson-Alm et al., 2012) and some even apply ≥600 ml in their definitions (Dreijer, Morten, Jens, 2011; Pavlin et al., 1999).

The frequency of PUR incidence vary depending on differences in diagnosis criteria and because there are many factors that play a role in the etiology of PUR related to surgery or the patient (Dreijer, Morten, Jens, 2011; Lee et al., 2011). PUR incidence is 38% after hip fracture surgery (Johansson & Christensson, 2010), 10% after THP (Total Hip Prosthesis) and TKP (Total Knee Prosthesis) (Dutta, 2008), 14% after general surgeries, 25% after otolaryngology surgeries (Warner et al., 2000), 32.8% after hemorrhoidectomy surgeries (Lin, Liu, Chen, 2010) and 26.7% after anorectal surgery (Lau & Lam, 2004).

Urinary retention frequently develops after orthopedic surgeries where spinal and epidural anesthesia is applied (Balderi et al., 2011). Apart from the direct effect of the spinal/epidural anesthesia, reasons for such complications include older orthopedics patients, utilization of opioid medicines for pain management, immobility and lying in a supine position, which increases PUR incidence (Balderi et al., 2011; Joelsson-Alm et al., 2009).

Urinary retention may result in damage to the bladder, chronic nephropathy, urinary system infection and sepsis. All of these can increase patient length-of-stay in the hospital and decreases quality of life (Baldini et al., 2009; Burger et al., 1997; Changchien et al., 2007; Dreijer, Morten, Jens, 2011; Palese et al., 2010; Ringdal, Borg, Hellstrom, 2003). Additionally, there can be general complications such as pain, discomfort, zonesthesia, disturbance in the heart rhythm, increase/decrease in blood pressure and fatigue (Cayir, Beji, Yalçın, 2007; Dreijer, Morten, Jens, 2011; Olsen & Nielsen, 2007).

Nurses have important responsibilities in sustaining patient functions, including excretion. Specifically, these responsibilities include: determining risk groups, prevention of postoperative urinary retention development, early realization about development and management of urinary retention by using appropriate nursing interventions. Urinary catheterization should be utilized as a last resort in the diagnosis and treatment of urinary retention. Caution is warranted because of the possiblity of urinary system infections.

Aim

This study aimed at evaluating the effect of nursing interventions on prevention and management of Postoperative Urinary Retention (PUR) for patients that undergo orthopaedic surgery under spinal anaesthesia.

Method

This study evaluated the effect of nursing interventions on postoperative urinary retention developement and incidence of applying a urinary catheter by using a portable ultrasound device in patients that underwent spinal anesthesia and orthopedic surgery. The study was performed at the orthopedics and traumatology clinic of a public hospital in Kocaeli, Turkey.

When spinal anesthesia applied patients come to the clinic after an operation, it is allowed for them to drink a glass of weak tea. Liquid is started to be given after two hours and liquid food is started to be given four hours later than the operation. Minimum 1000 ml liquid in the intraoperative period and 1500-2000 ml liquid in the postoperative period is given to the patients by doctors will and no liquid is administered by IV after it ends. Liquids are given as 150 to 170 drops in the average in a minute. The patients are usually mobilized eight hours after the operation. When patients want to urinate but cannot, sense too much pain and if the physical examination results favor, a nurse might use catheterization without taking any nursing initiatives at this clinic.

Participants and setting

The sample of the study consisted of orthopedic patients that underwent spinal anesthesia. Patients with following features were allowed to participate in the study: over 18-years-old, no applied catheterization during the perioperative period, able to communicate and collaborate, conscious and oriented and consented to participation. The $[n=Nt^2pq/[d^2(N-1)+t^2pq]$ formula was used to detect an appropriate the sample size (Sumbuloğlu & Sumbuloğlu, 1997). The sample size was calculated as 131 with 95% reliability and ±5% deviance. In order to obtain an equal distribution between the control and intervention groups, 66 patients were assigned to each group. The study took place between

September 2013 and June 2014. During the study, six patients were given general anesthesia instead of the planned spinal anesthesia during surgery, and three patients who did not comply with the nursing interventions were excluded from the study (Figure 1).

Patients were equivalent for randomization in the intervention and control groups in terms of age, sexuality and medical diagnosis. The administered spinal anesthetics (Marcain Heavy 12.5 mg and 15 mg involving bupivacaine) and sedatives (dormicum) during the intraoperative period were similar for all participants. Nevertheless, various other medicines were used according to changes in patient conditions (antihypertensive, antihistaminic drugs).

Data collection tools

Data was gathered thru the Evaluation Form of Postoperative Urinary Retention Risk Factors-I (This form contains 16 questions related to patient: age, sexuality, cigarette usage, alcohol usage, anxiety, precreatinine level and defecation frequency etc.), Evaluation Form of Postoperative Urinary Retention Risk Factors-II (This form contains 10 items related to surgery: surgery time, anesthesia time, amount of fluid that was given during and after surgery etc.),

Management Protocol of The Postoperative Urinary Retention for The Control Group (Figure 2), Management Protocol of The Postoperative Urinary Retention for The Intervention Group (Figure 3) which were developed by the author from the literature survey. A portable bladder ultrasound device was used in evaluations. The urinary retention management protocol includes nursing interventions that would be applied in the control and intervention groups, according to the measurement results obtained from the portable ultrasound device. Some have proposed that catheter application ratios (Stevens, 2005) and urinary system infections might decrease by using a bladder ultrasonography method (Lee et al., 2007; Palese et al., 2010). A Bladder Scan 6100 (Verathon, Bothell, WA, USA) ultrasound device was utilized in the study. This device is a light weight, easy-to-use, easy-to-learn and handheld device. The device measures urine volume in the bladder from 0 ml to 999 ml.

Data collection

The researcher obtained a list of patients that would undergo spinal anesthesia and who were not expected to need a catheter. This data was collected from the nurse/clinic secretary one day before the surgery. The researcher met with the patient before they went into the surgery room and filled out the "Evaluation Form of Postoperative Urinary Retention Risk Factors I" after obtaining written and verbal permission from the patient. Patient data about who accepted to participate in the study, were gathered from the patients themselves and patient folders.

Patient bladder volume for those in the control group were measured with a portable ultrasound device just before the patient went into the surgery room and the data was noted. Patients in the control group were observed by the researcher after the surgery without performing any nursing interventions and the observations continued after the patient went back to service from the surgery room. The measurement was done every hour until the patient urinated or if necessary until a catheter was utilized (Figure 2).

Patients in the intervention group were sent to the surgery room after a preoperative evaluation and given the same protocol as in the control group. However, different from the control group, patients were asked to "urinate" before going into the surgery room. Since there is no recovery room in the hospital, patients are sent directly to service after the surgery. The amount of urine of a patients was measured and noted when they were accepted to the service and at every hour until the patient urinated or until a urinary catheter was inserted. Female patients were provided with underpads and male patients were informed that they could use urinals when they came back to service.

When the amount of urine in the bladder was over 300 ml, nursing interventions were performed in accordance with the management protocol. This process ended with either patient urination or application of a catheter (Fig. 3). Although there is no clear consensus about a bladder volume, 500 ml was chosen as the upper limit based on the literature review and if the patient could not urinate when urine volume exceeds 500 ml. At this point patients were considered to have "PUR".

Ethical considerations

Permission was obtained from the Ethical Committee for Human Research of Kocaeli University and Kocaeli Public Hospitals Association General Secretary.

Figure 1: Flow Chart of The Study

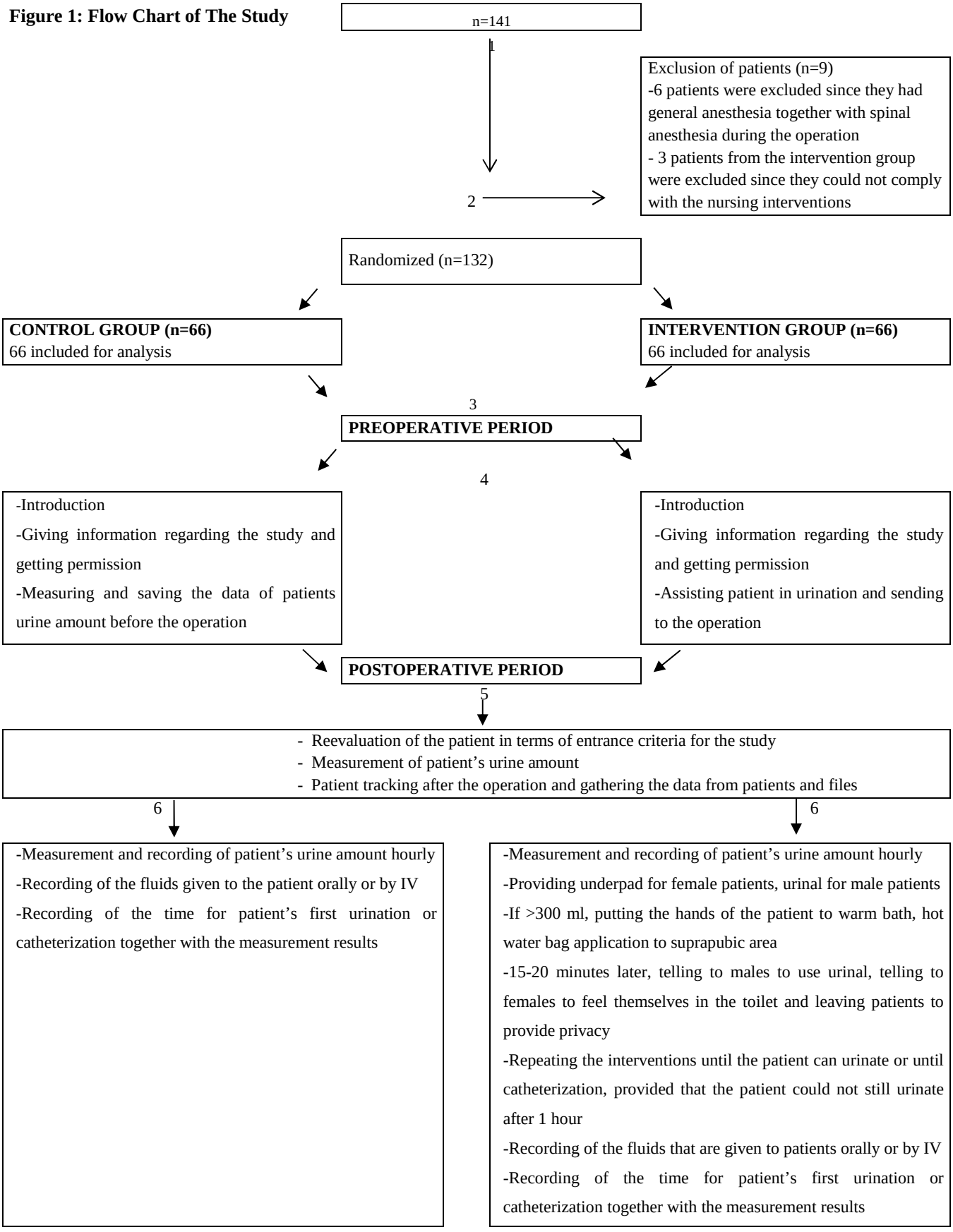


Figure 2: Management Protocol of The Postoperative Urinary Retention For The Control Group

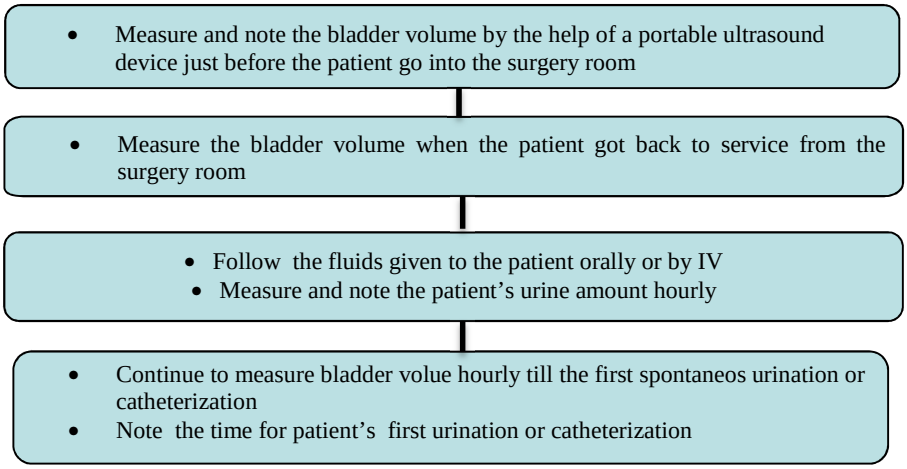
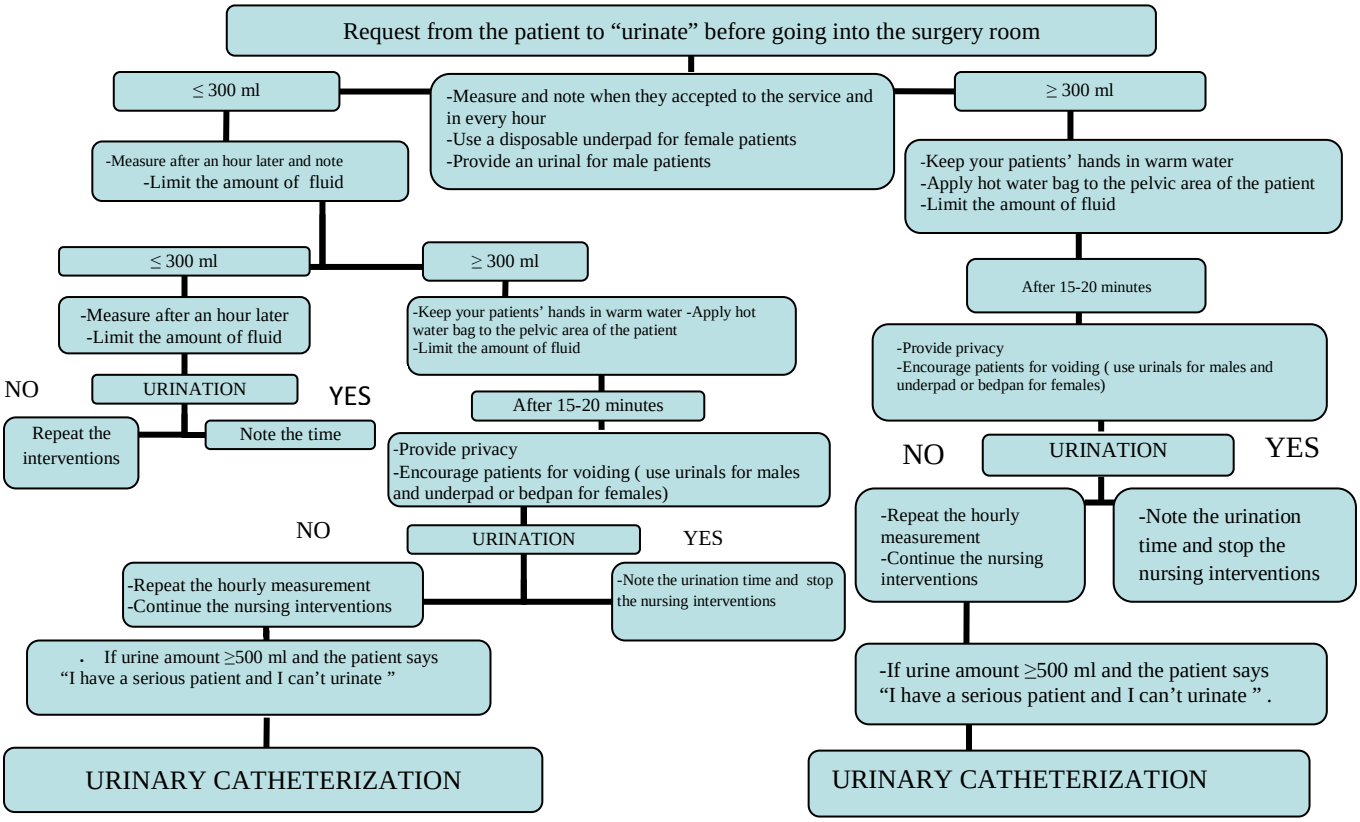


Figure 3: Management Protocol of The Postoperative Urinary Retention For The Intervention Group



Data Analysis

Data analysis was done with the software package IBM SPSS 20.0 (SPSS Inc., Chicago, IL, USA). Since the difference between the groups does not comply with a normal distribution, the Mann Whitney U Test was evaluated by the categorical variables Pearson Kikare, Fisher's Exact Kikare, Continuity Correction. If any of the expected frequency in the analysis of a 2×2 order is smaller than 5; Fisher's Exact Kikare is ≤5, Continuity Correction is >25 and Pearson Kikare is ≥25, Monte Carlo Kikare values are utilized in the tables in a n×2 order. The confidence interval was chosen to be 95% and the level of error p=0.05 in the study. p<0.05 is accepted statistically to be sufficient for significance. The data was evaluated for relative efficiency, assumed efficiency and efficiency protection ratio in order to evaluate the efficiency of the intervention.

Results

Age, sexuality and medical diagnoses were kept similar in order to ensure homogeneity between the groups. In both of the groups, 53% of the patients were under the age of 50 and were women, 72.7% of the patients had arthroscopic knee surgery because of meniscus. In both groups, 66.7% of the patients had at least a single previous surgery due to any kind of medical problem. A majority of the patients in the control and intervention groups had a primary education and were married. The patients in the intervention and control groups did not differ in terms of age, sexuality, medical diagnosis, having a surgical history, educational status, marital status and frequency of urination. This situation reflects the thought that both groups having similar features (p>0.05) (Table 1).

PUR developed in a majority of the intervention group patients (77.3%) and in almost all of the control group patients (97.0%). The rate of patients who urinate before PUR development was 22.7% in the intervention group and 3% in the control group (Table 2). The development of PUR indicates a meaningful statistically significant difference between intervention and control groups (p<0.05). While a catheter was inserted in only 3.9% of the patients in intervention group, a urinary catheter was inserted in 31.3% of the patients in the control group (p<0.05) (Table 3). This difference between the groups was statistically meaningful.

Discussion

Patients in the intervention and control groups did not differ in terms of age, sexuality, medical diagnosis, having a surgical history, educational status, marital status and frequency of urination. This situation indicates that both groups having similar attributes (p>0.05) (Table 1).

Among the 132 patients who participated in our study, 87.1% (n=115) developed PUR (Table 2). This ratio was very high when compared with similar studies in the literature. PUR developed in almost all of the patients in the control group and in the majority of the patients in the intervention group. The ratio of the patients that urinate before the development of PUR was 22.7% in the intervention group and 3% in the control group. The difference between the two groups was found to be statistically meaningful. This result was significant in terms of observing the effects of the nursing interventions.

Different approaches are utilized in urinary catheterization applications for PUR. Urinary catheterization is applied to 80% of the patients in the recovery room that could not urinate, even if they had a urine amount of more than 400 ml (13%) (Hansen et al., 2011). In Lamonerieri's study, a urinary catheter is applied to patients who could not urinate within 30 minutes when the urine amount was over 500 ml urine, even if patients had an urge to urinate, discomfort and bladder contraction. In this study, the nurses applied a urinary catheter to the patients in the control group when they complained about the pain from being unable to urinate. In the intervention group, when measurement results for urine amount were lower than 999 ml or over 999 ml, urinary catheterization was applied if patients said they had pain. However, if the patients did not complain about pain, even though they had a urine amount of over 999 ml, nursing interventions were applied at most for two more hours and then catheterization was applied. This result was very important in terms of testing and supporting the emphasis by Pavlin et al. (1999).

Pavlin et al. stated that if temporary excessive contraction of the bladder can be detected early and treated in one or two hours, the situation will not be harmful.

Table 1: Characteristics of the Sample

Characteristics		Intervention group		Control group		Total		X^2	p
		n	%	n	%	n	%		
Age	<50	35	53	35	53	70	53	0.00	1.000*
	≥50	31	47	31	47	62	47		
Sexuality	Female	35	53	35	53	70	53	0.00	1.000*
	Male	31	47	31	47	62	47		
Medical diagnose	Meniscus	48	72,7	48	72,7	96	72,7	0.00	1.000£
	Others[đ]	18	27,3	18	27,3	36	27,3		
History of surgery	Yes	44	66,7	44	66,7	88	66,7	0.00	1.000*
	No	22	33,3	22	33,3	44	33,3		
Educational status	Illiterate	10	15,2	4	6,1	14	10,6	7.462	0.186££
	Literate	2	3,0	5	7,6	7	5,3		
	Primary Education	33	50,0	27	40,9	60	45,5		
	Secondary Education	6	9,1	8	12,1	14	10,6		
	High school	10	15,2	10	15,2	20	15,2		
	Higher education	5	7,6	12	18,2	17	12,9		
Marital status	Single	5	7,6	11	16,7	16	12,1	1.778	0.182£
	Married	61	94,4	55	83,3	116	87,9		
Frequency of urination	3-5 times	23	34,8	29	43,9	52	39,4	1.574	0.479££
	6-8 times	26	39,4	25	37,9	51	38,6		
	≥9	17	25,8	12	18,2	29	22,0		

*=Chi square test.
[đ=] Other surgeries such as; hallux valgus, tibial fractures, foot deformities.
[£]= Yates correction.
££=Monte Carlo.

Table 2: Incidence of PUR in Intervention and Control Groups

PUR	Intervention group(n=66)		Control group(n=66)		Total (n=132)		X^2	p
	n	%	n	%	n	%		
Developed	51	77,3	64	97,0	115	87,1	9.723	0.002£
Undeveloped	15	22,7	2	3,0	17	12,9		

£= Yates Correction.

Table 3: Urinary Catheterization in Intervention and Control Groups Who Developed PUR

Urinary catheter	Intervention group		Control group		Total		X^2	p
	n	%	n	%	n	%		
Yes	2	3,9	20	31,2	22	19,1	11.992	0.001£
No	49	96,1	44	68,8	93	80,9		

£= Yates Correction.

Our observations in the control group indicated that the patients can wait in the clinics with a urine amount over 999 ml urine, however, these observations could not be supported by numerical means since measurements were not obtained. As a result, patients in both the control group and the intervention group waited 1 or 2 hours at most, were not harmed from this intervention.

While a catheter was inserted for only 3.9% of the patients in our intervention group, a urinary catheter was inserted for 31.3% of patients in the control group. This difference between the groups were statistically meaningful ($p<0.05$) (Table 3). Just as in our case with the control group's results, it was determined in another study that while 2/3 of patients could spontaneously urinate after an arthroscopic surgery, 1/3 needed urinary catheterization (Luger et al., 2008). In a different study, 39% of 174 patients who had surgical intervention were catheterized after the surgery since they could not spontaneously urinate (Ringdal, Borg, Hellstrom, 2003).

The effectiveness of the application in applied studies is measured by relative effectiveness, attributed effectiveness and effectiveness protection ratio together with the incidence rate. The effectiveness of the intervention increases, depending on how much the relative effectiveness is greater than 1. Attributed effectiveness is an epidemiologic measure to calculate how many people will benefit from an intervention, which is performed in order to address a disease, and is observed in particular rates in a society. Effectiveness protection ratio indicates how many healthy people will be protected from acquiring a disease and how many patients will be protected from death or treated completely (Sumbuloğlu & Sumbuloğlu, 1997). The relative effectiveness was 1.25, attributed effectiveness was 19.7 and effectiveness protection ratio was 20.3 for PUR. PUR development incidence decreased to 77.3% from 97% in our study and relative effectiveness was 1.25. In our study, the nursing interventions are 1.25 times more effective in decreasing PUR incidence. In our study the relative effectiveness for urinary catheterization was 8.025, attributed effectiveness was 29.4 and effectiveness protection ratio was 93.9. If nursing interventions were to be performed for patients in the control group, it was possible to say that 20.3% (efficiency protection ratio for PUR) of them could have been protected by the development of PUR and 93.9% (efficiency protection ratio for

urinary catheterization) of them could have been protected by urinary catheterization. According to the epidemiologic calculations, it is possible to say that the nursing interventions in our study were effective in the prevention and management of PUR.

Study limitation

- Another one of the nursing interventions was to make the patients sit on a portable commode and therefore, enable early mobilization. However, these nursing interventions were removed from the list since the doctors did not provide permission and in consideration of patient safety.

- Another limitation of the study was not being able to interfere in the amount of fluid given in the surgery.

Conclusions and recommendations

This study investigated the prevention of PUR development in patients who had orthopedic surgery by spinal anesthesia and the effect of nursing interventions in the management of PUR. Having practical and simple to apply nursing interventions when PUR develops is very important in preventing PUR, for early detection of risk factors, for decreasing PUR incidence, and proper management to decrease the incidence of urinary catheterization. According to our study, the ratio of PUR development and urinary catheterization was very low in the intervention group and this ratio is very high in the control group when compared with the intervention group. This result showed that nursing interventions can be very effective in the prevention and management of PUR.

Based on the study results, we propose the following recommendations:

1- Further investigation regarding the effects of the nursing interventions in prevention and management of PUR with a broader sample, different surgery types and different anesthesia types.

2- Control of urinary retention requires a multidisciplinary approach, and early mobilization should be supported by doctors and anesthetists. Nurses are expected to take a systematic approach and provide a care in collaboration with physicians.

3- If the patient can not urinate despite all nursing interventions and if catheterization is necessary as a last resort, discontinuous catheter usage is preferred over permanent. If a permanent catheter is necessary, then catheterization time should be as short as possible.

4- A consensus should be developed by reviewing indications for inserting a catheter in patients with PUR.

References

Balderi T, Mistraletti G, D'angelo E & Carlı F. (2011) Incidence of Postoerative Urinary Retention (POUR) After Joint Arthroplasty and Management Using Ultrasound –Guided Bladder Catheterization. Minerva Anestesiologica 77: 1050-1057.

Baldini G, Bagry H, Aprikian A & Carli F. (2009) Postoperative Urinary Retention. Anesthesiology 110: 1139-57.

Burger DHC, Kappetein AP, Boutkan H & Breslau PJ. (1997) Prevention of Urinary Retention After General Surgery: A Controlled Trial of Carbachol/Diazepam Versus Alfusozine. Journal of the American College of Surgeons 185: 234-236.

Changchien CR, Yeh CY, Huang ST, Hsieh ML, Chen JS & Tang R. (2007) Postoperative Urinary Retention After Primary Colorectal Cancer Resection Via Laparotomy: A Prospective Study of 2355 Consecutive Patients. Diseases of The Colon & Rectum 50: 1688- 1696.

Cayir G, Beji NK & Yalçın O. (2007) Effectiveness of Nursing Care After Surgery for Stres Urinary Incontinence. Urologic Nursing 27 (1): 25-33.

Dreijer B, Moller MH & Bartholdy J. (2011) Post Operative Urinary Retention in A General Surgical Population. European Journal of Anaesthesiology 28 (3) : 190-194.

Dutta S. (2008) Postoperative Urinary Retention in Elective Total Hip and Knee Replacement Surgery. British Journal of Medical Practitioners 1(2): 28-32.

Feliciano T, Montero J, McCarthy M & Priester M. (2008) A Retrospective, Descriptive, Exploratory Study Evaluating Incidence of Postoperative Urinary Retention After Spinal Anesthesia and Its Effect on PACU Discharge. Journal of PeriAnesthesia Nursing 23 (6) (December): 394-400.

Hansen BS, Soreıde E, Warland AM & Nilsen OB. (2011) Risk Factors of Postoperative Urinary Retention in Hospitalised Patients. Acta Anesthesiologica Scandinavica 55: 545-548.

Joelsson-Alm E, Nyman CR, Lindholm C, Ulfvarson J & Svensén C. (2009) Perioperative bladder distension: a prospective study. Scandinavian Journal of Urology and Nephrology, 43: 58-62.

Joelsson-Alm E, Ulfvarson J, Nyman CR, Divander MB & Svensén C. (2012) Preoperative Ultrasound Monitoring Can Reduce Postoperative Bladder Distension: A Randomized Study. Scandinavian Journal of Urology and Nephrology 46: 84-90.

Johansson RM & Christensson L. (2010) Urinary Retention in Older Patients in Connection With Hip Fracture Surgery. Journal of Clinical Nursing 19: 2110- 2116.

Lamonerie L, Marret E, Deleuze A, Nembert N, Dupont M & Bonnet F. (2004) Prevalence of Postoperative Bladder Distension and Urinary Retention Detected by Ultrasound Measurement. British Journal of Anesthesia 92(4): 544–546.

Lau H & Lam B. (2004) Management of Postoperative Urinary Retention: A Randomized Trial of In-Out Versus Overnigt Catheterization. Australian and Newzealand Journal Surgery 74: 658-661.

Lee YY, Tsay WL, Lou MF & Dai YT. (2007) The effectiveness of implementing a bladder ultrasound programme in neurosurgical units. Journal of Advanced Nursing 57(2): 192–200.

Lee KS, Lim KH, Kim SJ, Choi Hj, Noh DH, Lee HW& Cho MC. (2011) Predictors of Successful Trial Without Catheter For Postoperative Urinary Retention Following Non- Urological Surgery. International Neurourology Journal 15: 158-165.

Lin YH, Liu KW & Chen HP. (2010) Haemorrhoidectomy: Prevalance and Risk Factors of Urine Retention Among Post Recipients. Journal of Clinical Nursing 19: 2771- 2776.

Luger JT, Garoscio I, Rehder P, Oberladstätter J & Voelckel W. (2008) Management of Temporary Urinary Retention After Arthroscopic Knee Surgery in Low-Dose Spinal Anesthesia: Development of A Simple Algorithm. Archives of Orthopaedic and Trauma Surgery 128:607-612.

Olsen SW & Nielsen J. (2007) A Study Into Postoperative Urine Retention in The Recovery Ward. British Journal of Anesthetic & Recovery Nursing 8(4): 91-95.

Palese A, Buchini S, Deroma L & Barbone F. (2010) The Effectiveness of The Ultrasound Bladder Scanner in Reducing Urinary Tract İnfectons: A Meta-Analysis. Journal of Clinical Nursing 19: 2970-2979.

Pavlin DJ, Pavlin EG, Gunn HC, Gunn HC, Taraday JK & Koerschqen ME. (1999) Voiding in Patients Managed With or Without Ultrasound Monitoring of Bladder Volume After Outpatient Surgery. Anesthesia and Analgesia 89: 90–7.

Ringdal M, Borg B & Hellstrom AL. (2003) A Survey on Incidence and Factors That May Influence First Postoperative Urination. Urologic Nursing 23 (5): 341-354.

Smith NKG & Albazzaz MK. (1996) A Prospective Study of Urinary Retention and Risk of Death After Proximal Femoral Fracture. Age and Ageing 25: 150-154.

Stevens E. (2005) Bladder ultrasound: avoiding unnecessary catheterizations. MEDSURG Nursing August 14(4): 249-253.

Sumbuloğlu K & Sumbuloğlu V. (1997) Biyoistatistik (7th edn). Hatipoğlu Publisher. Ankara, 263-267.

Warner AJ, Philips S, Rıske K, Haubert MK & Lash N (2000) Postoperative Bladder Distension: Measurement With Bladder Ultrasonography. Journal of Perianesthesia Nursing 15 (1): 20-25.