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Spinal Anesthesia Is Associated With Postoperative Urinary Retention In Women Undergoing Urogynecologic Surgery

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ABSTRACT

We hypothesized that spinal anesthesia could lead to impairment in bladder function and consequently, to postoperative urinary retention (POUR), particularly in patients undergoing urogynecologic surgery. This study was aimed to compare the rate of the POUR between the subjects receiving spinal and general anesthesia who underwent urogynecologic surgery.

One hundred and eighty subjects who underwent urogynecologic surgery between June 2016 and May 2019 were retrospectively analyzed to evaluate the risk of POUR after general versus spinal anesthesia. All subjects underwent a standardized voiding trial subsequent to surgery, which was performed by backfilling the bladder with 300 ml of saline. The presence of > 100 ml volume in the post-void bladder scan was defined as POUR. The primary outcome was to compare rates of POUR between spinal and general anesthesia. Identifying the risk factors for POUR was the secondary outcome of this study.

Spinal anesthesia group included 80, and the general anesthesia group consisted of 100 patients. The overall rate of the POUR was %22.8. The proportion of the patients with POUR was significantly higher in the spinal anesthesia group compared to that of the subjects in the general anesthesia group (%33.8vs%14, P=0.002). Multivariate logistic regression analysis revealed that the adoption of spinal anesthesia (Odds ratio: 3.172, 95%CI: 1.383-7.275, P=0.006) and presence of diabetes (Odds ratio: 5.840, 95% CI:2.325-14.666, P< 0.001) were independent predictors for the development of POUR.

The rate of the POUR is significantly higher in patients receiving spinal anesthesia than those receiving general anesthesia among women undergoing urogynecologic surgery.

Key Words: Spinal anesthesia, pelvic organ prolapsed, urinary incontinence, postoperative urinary retention

Introduction

Pelvic floor disorders (PFD), including urinary or fecal incontinence, pelvic organ prolapse, and other lower urinary tract dysfunction, are frequent, particularly in older women. The prevalence of PFD varies in different series, probably due to the delicate nature of the components of this disorder, such as urinary incontinence (1). Nevertheless, the number of women seeking treatment of the PFD has been increased in recent years, and the surgical procedures targeting the treatment of the PFD are increasingly performed (2). However, postoperative urinary retention (POUR) is a major problem in women undergoing urogynecologic surgery, especially with surgical correction of urinary incontinence and pelvic organ prolapsed (3). The estimated rate of the POUR after urogynecologic surgery ranges between 2.5 % to 43 % (4, 5). Insufficiency in recognizing the POUR may lead to devastating sequelae such as urinary tract infection, detrusor dysfunction, and jeopardize the surgical repair as a result of the prolonged bladder distention (6). The risk of the morbidity resulting from the POUR is least when the required attention is given, and the appropriate management is delivered. Age > 50 years, female gender, lower body mass index, preexisting bladder dysfunction, previous incontinence surgery, pelvic surgery, excessive intraoperative fluid administration, increase in estimated blood loss, and the type of the anesthesia have been identified as the risk factors for the POUR in previous studies (7-9).

The consideration underlying the rationale that spinal anesthesia impairs the bladder function comes from

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the blockage of the afferent bladder stimuli to the pontine micturition center, which has been suggested to lead to urinary retention in women in the postpartum period (10). Experimental studies in animals and human studies have revealed that spinal anesthesia can lead to bladder dysfunction and urinary retention (11). However, there are also reports, which found no difference in POUR rates among women undergoing pelvic organ prolapse surgery (12).

We hypothesized that spinal anesthesia could lead to impairment in bladder function and consequently, to POUR, particularly in patients undergoing urogynecologic surgery. The present study, therefore, is aimed to compare the rate of the POUR between the subjects receiving spinal and general anesthesia who underwent urogynecologic surgery for urinary incontinence or pelvic organ prolapse. This study also is aimed to identify the role of the anesthesia type and other risk factors in the development of the POUR following urogynecologic surgery.

Materials and Methods

This was a retrospective review of the database of all consecutive subjects who underwent pelvic organ prolapse and incontinence surgery in a university hospital between June 2016 and May 2019. All required information was retrieved from the institutional digital database and the patient charts. Exclusion criteria were as follows: American society of anesthesiologists (ASA) classification of > 3, a preexisting neurologic disorder that might influence urinary retention (Parkinson's disease, multiple sclerosis), previous incontinence surgery, injury to the bladder or the nerve fibers innervating bladder during the surgery, need for prolonged bladder decompression or self-catheterization and presence of a Foley catheter prior to surgery. Written informed consent was obtained from all subjects included in the study. The study was approved by the Institutional Ethical Committee and was performed in accordance with the recent version of the Helsinki Declaration. Patients were divided into two groups according to the anesthetic strategy chosen for the surgery as spinal or general anesthesia.

Anesthesia Procedure: General anesthesia was induced using propofol or sodium thiopental, fentanyl, and midazolam and maintained with isoflurane with or without nitrous oxide. Ventilation was performed in a volume-controlled mode at a tidal volume of 7–9 mL/kg. IV morphine, fentanyl, hydrocodone, or hydromorphone and occasionally with meperidine or sufentanil were utilized to manage perioperative analgesia. Spinal anesthesia was performed with a spinal needle inserted through the L3–L4 interspace. Following the return of 3ml clear cerebrospinal fluid, 0.5% levobupivacaine (15 mg) was injected over 20–30 s through 24 G Whitacre/Quincke spinal needle. When required, additional doses of levobupivacaine were administered during surgery. For postoperative analgesia, patients received 4000 mg of paracetamol (in four separate doses of 1000 mg). If necessary, diclofenac 150 mg in three doses of 50 mg and morphine substitutes were also given.

Voiding Trial: Following the completion of the surgery, all subjects were placed a vaginal packing with metronidazole to reduce the risk of hematoma formation. After removal of the vaginal packing in the recovery area by the nursing staff, each subject underwent a standardized voiding trial two hours after the surgery. The bladder was backfilled with the maximum amount of the saline the patient could tolerate. The post voiding residual urinary bladder volume was documented with a bladder scan. A post-void residual volume >150 ml was defined as postoperative urinary retention. A Foley catheter was placed to prevent the adverse sequelae of prolonged bladder overdistention when bladder volume exceeded 600 ml.

Primary Outcome: The primary outcome was to compare rates of POUR between spinal and general anesthesia. Identifying the risk factors for POUR was the secondary outcome of this study. Factors analyzed as risk factors for POUR were age, body mass index, and parity, presence of diabetes, hypertension, chronic obstructive pulmonary disease, ASA class, blood loss, and type of the underlying defect.

Statistical Analysis: All analyses were performed on SPSS v21. Kolmogorov-Smirnov test was used for the normality check. Data were presented as mean ± standard deviation or median (minimum-maximum) for continuous variables regarding normality. Normally distributed variables (Δ Hemoglobin) were analyzed with the Student's t-test. Non-normally distributed variables were analyzed with the Mann-Whitney U test. The chi-square test was used to compare categorical data. The impact of different variables on the development of POUR was calculated using univariate analyses. The variables for which the unadjusted P was < 0.10 in the logistic regression analysis were identified as potential risk markers and included in the full model. A two-sided $p < 0.05$ was accepted as statistically significant.

Results

A total of 180 patients [median age 58 (28-80)] who underwent urogynecologic surgery were included in

Table 1. Comparison of the laboratory measurements in the two groups

	Spinal anesthesia n= 80	General anesthesia n= 100	P value
Age, years	51 (36-80)	55 (28-78)	0.057
BMI, kg/m²	30 (23-38)	29 (21-41)	0.296
Parity, n	3 (1-8)	3 (1-11)	0.591
ASA Class			
I	52 (66%)	58 (58%)	
II	23 (28%)	38 (38%)	0.319
III	5 (6%)	4 (4%)	
Diabetes, n	10 (12.5%)	20 (20%)	0.228
Hypertension, n	12 (15%)	11 (11%)	0.502
COPD, n	8 (10%)	9 (9%)	0.820
Indication for the surgery			
Urinary incontinence, n	48 (60%)	59 (59%)	0.892
Cystocele, n	13 (16%)	14 (14%)	0.681
Rectocele, n	6 (8%)	8 (8%)	0.901
Pelvic organ prolapse, n	13(16%)	19 (19%)	0.631
Operation time, min	101 (74-218)	108 (62-220)	0.740
Preoperative hemoglobin, g/dl	12.8 ± 1.0	13.1 ± 1.1	0.237
Postoperative hemoglobin, g/dl	11.2 ± 1.1	11.4 ± 1.2	0.307
Δ Hemoglobin, g/dl	1.6 ± 0.8	1.6 ± 1.1	0.914
POUR, n	27 (33.8%)	14 (14%)	0.002

Data are presented as mean ±standard deviation for normally distributed variables and median (minimum-maximum) for non-normally distributed variables.
ASA = American society of anesthesiologists, BMI = Body mass index, COPD = Chronic obstructive pulmonary disease, POUR = Postoperative urinary retention
Δ Hemoglobin = The change in the hemoglobin from the preoperative period to the postoperative period

this retrospective study. The spinal anesthesia group included 80 patients, and the general anesthesia group consisted of 100 patients. As shown in Table 1, the two groups were similar with respect to age, body mass index, ASA class, pre-and postoperative hemoglobin, presence of diabetes, hypertension and chronic obstructive pulmonary disease, and indications for the pelvic floor surgery. The operation time was also similar in the two groups. However, the proportion of the patients with postoperative urinary retention was significantly higher in the spinal anesthesia group compared to that of the subjects in the general anesthesia group (33.8 % vs. 14%, P = 0.002).

The overall rate of the POUR was 22.8 %. Multivariate logistic regression analysis revealed that adoption of spinal anesthesia (Odds ratio: 3.172, 95% CI: 1.383-7.275, P =0.006) and presence of diabetes (Odds ratio: 5.840, 95% CI: 2.325-14.666, P < 0.001) were independent predictors for the development of POUR (Table 2).

Discussion

We had hypothesized that spinal anesthesia would lead to an increased rate of POUR in patients undergoing urogynecologic surgery. The present retrospective study demonstrates that patients receiving spinal anesthesia more frequently experience POUR compared to the patients receiving general anesthesia. Our findings also indicate that spinal anesthesia and the presence of diabetes are significantly associated with the development of POUR following the urogynecologic surgery.

Urinary retention is defined as the inability to empty the bladder completely. Postoperative urinary retention may cause a detrimental impact on postoperative healing due to the prolonged bladder distention, which is in close relationship with the development of urinary tract infections and failure of the surgical repair (13). The incidence of the POUR following pelvic organ prolapse or incontinence surgery varies between 5% to 70% depending on the study population recruited and the description used to define POUR (14). Identifying the factors associated

Table 2. Multivariate logistic regression for postoperative urinary retention

	OR	95 % CI	P value	Adjusted OR	95 % CI	P value
Age	1.055	1.006-1.107	0.027	1.038	0.998-1.080	0.062
Diabetes	7.579	2.439-23.544	<0.001	5.840	2.325-14.666	<0.001
Hypertension	1.626	0.355-7.445	0.663			
COPD	0.283	0.031-2.545	0.119			
ASA	1.096	0.447-2.684	0.851			
Parity	1.013	0.813-1.263	0.717			
Body mass index	1.000	0.899-1.112	0.930			
Spinal anesthesia	4.295	1.630-11.314	0.015	3.172	1.383-7.275	0.006
Operation time	1.003	0.991-1.015	0.842			
Δ Hemoglobin	0.941	0.575-1.541	0.888			
Urinary incontinence	1.635	0.400-6.689	0.182			
Cystocele	0.365	0.055-2.403	0.566			
Rectocele	2.205	0.297-16.389	0.749			
Pelvic organ prolapse	0.358	0.064-1.995	0.340			

ASA = American society of anesthesiologists, COPD = Chronic obstructive pulmonary disease
Δ Hemoglobin = The change in the hemoglobin from the preoperative period to the postoperative period

with the development of the POUR is, therefore, critical in the perioperative care of the patients undergoing urogynecologic surgery. In the present study, the overall POUR rate was 22.8 %, which is somewhat lower than that reported in previous studies (15). A possible explanation for this is that the median age of the subjects recruited in our study was lower than the mean age of the participants enrolled in the previous studies. When the impact of the age on POUR was taken into account, we consider that the lower median age of our subjects might have affected the rate of the POUR in this study.

Several trials have been carried out to identify the preoperative risk factors of the POUR in patients undergoing urogynecologic surgery. Increasing age, previous incontinence surgery, lower BMI, and excessive blood loss have been shown to increase the rate of the POUR following urogynecologic surgery (16, 17). Type of the anesthesia and the impact of the spinal anesthesia on the development of POUR has also been an area of research in recent years (18-21). The rationale behind this consideration was the potential of the spinal anesthesia to cause significant bladder denervation in the perioperative period (22). The dysfunction resulting from the POUR varies from mild urinary retention characterized with incomplete bladder emptying to severe urinary retention with bladder overdistension. Local anesthetics used in spinal anesthesia block the afferent and efferent bladder stimuli to the pontine micturition center, which further results in detrusor dysfunction and the inability to sense a full bladder, and consequently impair micturition (14).

Casati and colleagues compared intrathecal, general or peripheral nerve block anesthesia in outpatients undergoing elective lower limb surgery in terms of time to micturition and failed to demonstrate any difference among these techniques in time to return of spontaneous micturition (23). Similarly, the study of Schmittner et al., which compared spinal saddle block with general anesthesia in perianal surgery, found that time to micturition was not significantly different between the two anesthetic techniques (24). However, the use of spinal anesthesia was indicated as an independent predictor of urinary retention, which was defined as the inability to void after surgery in a cohort of 376 men undergoing total hip arthroplasty (25).

Nevertheless, the number of trials comparing spinal and general anesthesia in urogynecologic procedures is limited. In a recent retrospective review, which was written by Alas et al., spinal and general anesthesia were compared in outpatients undergoing vaginal surgery for pelvic organ prolapse (26). The authors reported that the rate of POUR was similar in the two groups, and the type of the anesthesia was not a risk factor for POUR in multivariate analysis. However, the study population was outpatients, who primarily underwent surgery for pelvic organ prolapse. Therefore, we consider that the results of that study cannot be generalized to the majority of the urogynecologic procedures. When compared to the study group of that study, we enrolled incontinence patients in addition to the patients with pelvic organ prolapse. We also recruited subjects who were scheduled for gynecologic surgery in the in-patient setting. In contrast to the findings of the Alas et al.,

we found a higher rate of POUR in patients receiving spinal anesthesia compared to those receiving general anesthesia. We also found that the adoption of spinal anesthesia is an independent risk factor for the development of POUR in women undergoing urogynecologic surgery. The role of the spinal anesthesia may partly be explained by the blockage of the afferent and efferent limbs of the micturition reflex. This blockage not only influences detrusor function but also leads to an inability to sense a full bladder and thus impairs micturition and causes urinary retention.

The present study also revealed that the presence of diabetes is another independent predictor of the development of POUR following urogynecologic surgery. Previous studies in various surgical settings including total hip arthroplasty, minor thoracic surgery, unselected orthopaedic surgery, anorectal surgery, and laparoscopic-assisted vaginal hysterectomy have shown that diabetes is a major risk factor for POUR in subjects undergoing the aforementioned surgical procedures. (25, 27-30). It is well recognized that patients with diabetes are prone to the development of urinary problems caused by diabetic neuropathy, which can affect all types of nerve fibers, including the autonomic nervous system that innervates the bladder (31, 32). We consider that diabetes leads to POUR through the autonomic neuropathy, which disrupts innervation of the bladder and urethral sphincter function.

To the best of our knowledge, the present study is the first to demonstrate the impact of spinal anesthesia and diabetes on the development of the POUR in patients undergoing urogynecologic surgery. The surgical team should take preventative measures against POUR before urogynecological surgery in individuals with diabetes and in subjects for whom spinal anesthesia was considered, as these factors were found to independently increase the risk of POUR.

There are also some limitations that need to be mentioned. Due to the retrospective design of the study, we were limited to data in the database. In addition, subjects were relatively younger in this study compared to the previous studies. Given the increasing incidence of POUR with aging, the younger study population might have influenced the lower rate of POUR we observed. Finally, patients undergoing laparoscopic surgery were not recruited in this study. Thus, our findings cannot be generalized to whole urogynecologic procedures.

The rate of the POUR is significantly higher in patients receiving spinal anesthesia than those receiving general anesthesia among women undergoing urogynecologic surgery. Adoption of spinal anesthesia and the presence of diabetes are independent predictors for the development of POUR in this patient population. Based on these findings, we recommend cautious use of spinal anesthesia in diabetic patients undergoing urogynecologic surgery.

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