

Risk factors for urinary retention after vaginal hysterectomy for pelvic organ prolapse

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Objective

To evaluate the risk factors for postoperative urinary retention in women who underwent vaginal hysterectomy for symptomatic pelvic organ prolapse.

Methods

The medical records of 221 women who underwent vaginal hysterectomy with anterior and posterior colporrhaphy were reviewed. Urinary retention after catheter removal was defined as the presence of at least one of the following three conditions: 1) failure of first voiding trial necessitating catheterization, 2) first residual urine volume after self-voiding ≥ 150 mL, and 3) Foley catheter re-insertion.

Results

Urinary retention occurred in 60 women (27.1%). Multivariate and receiver operating characteristic curve analysis revealed that age (>63 years) and early postoperative day of catheter removal (day 1) was independent predictor for postoperative urinary retention. The incidence of urinary retention was significantly higher in women who removed indwelling catheter at day 1 (35.2%) than those at day 2 (12.0%, $P=0.024$), or day 3 (21.3%, $P=0.044$), but was similar to those at day 4 (25.0%, $P=0.420$). In women ≤ 63 years, urinary retention rate was not associated with the time of catheter removal after surgery; however, in women >63 years, the rate was significantly higher in day 1 removal group than day 2 to 4 removal group.

Conclusion

Age and postoperative day of catheter removal appear to be associated with postoperative urinary retention in women undergoing vaginal hysterectomy for pelvic organ prolapse. Keeping urinary catheter in situ at least for one day after vaginal prolapse surgery could be recommended, especially, in women older than 63 years.

Keywords: Hysterectomy, vaginal; Pelvic organ prolapse; Postoperative period; Urinary catheterization; Urinary retention

Introduction

Pelvic organ prolapse is a common disease in women's later life and surgical procedure is needed for correcting most of the symptomatic and/or severe prolapse. Vaginal hysterectomy (VH) with or without colporrhaphy has been one of the most common surgical procedures for the treatment of symptomatic pelvic organ prolapse.

Postoperatively, some patients experience voiding difficulty after urinary catheter removal although the exact cause is not fully understood yet. In the literatures, the incidence of postoperative urinary retention (UR) following any type of vaginal

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prolapse surgery was reported 6% to 29% [1-3], which appears to be higher than that after VH for other benign diseases [4]. Old age of the patients undergoing vaginal prolapse surgery may be associated with higher incidence of postoperative UR [5]. Other risk factors which has been hitherto known for postoperative UR following vaginal prolapse surgery include high grade cystocele, severe intraoperative blood loss, application of levator and Kelly plication, postoperative pelvic hematoma, and short postoperative day of catheter removal [3,6]. However, there is no specific guideline regarding the appropriate time for urinary catheter removal after vaginal prolapse surgery.

Relevant studies indicated that there was no significant difference of the incidence of UR in patients of which the urinary catheter was removed in first day versus third day after vaginal prolapse surgery [7]. However, a randomized study demonstrated that first-day catheter removal group had a significantly higher incidence of UR than fifth-day catheter removal group [8]. Re-catheterization event was significantly more frequent in 1-day catheter-use group than 4-day or 5-day catheter-use group [3,9]. On the other hand, the longer the catheter indwelling time, the higher the incidence of urinary tract infection and longer duration of hospital stay [10]. Therefore, early catheter removal for preventing urinary tract infection has been recommended. Recently, immediate catheter removal has been recommended because the frequency of complications between immediate and first-day catheter removal was similar [11]. Although there are several studies evaluating the appropriate time for catheter removal, there are no consensus on this issue [12]. Moreover, there is no report regarding the incidence of UR according to the postoperative day of catheter removal.

The aim of the present study was to identify the risk factors for postoperative UR in a retrospective cohort of patients who underwent VH for pelvic organ prolapse.

Materials and methods

A total of 561 women who underwent VH for symptomatic pelvic organ prolapse at Seoul National University Bundang Hospital from May 2003 through April 2013 were retrospectively reviewed. Inclusion criteria were all patients who underwent VH with anterior and posterior colporrhaphy. Exclusion criteria were VH only, VH with either anterior or posterior

colporrhaphy, suspension surgery, and other anti-incontinence surgery. Patients with diagnosis of malignancy were also excluded. All surgeries performed before 2008 were also excluded due to the previous routine practice of longer catheterization (maximum 7 days) during that period. Thus, 221 women were finally eligible for the analysis. This study was approved by the institutional review board of Seoul National University Bundang Hospital (no. B-1402-240-110).

Included variables were age, body mass index, degree of prolapse, diabetes mellitus, type of anesthesia, type of surgery, operation time, surgeon, postoperative day of catheter removal, postoperative hemoglobin drop, and postoperative pyuria (defined as white blood cell 2+ or more at urine analysis).

Prophylactic antibiotics (usually intravenous cefazolin) were administered to all patients at the time of surgical incision. At the time of completion of surgery, a sterile transurethral Foley catheter was placed at the operation room. All operations were performed by one of four surgeons.

Indwelling Foley catheter was removed in the morning of postoperative day 1 to day 4 as part of routine postoperative care. The timing of catheter removal solely depended on the physician's preference. We did not perform bladder training routinely before catheter removal. After catheter removal, post-void residual urine volume was routinely measured in all patients either by catheterization or bladder scanner (Biocon-700, Mcube Technology, Seoul, Korea). Urinary retention after catheter removal was defined as the presence of at least one of the following three conditions: 1) failure of first voiding trial necessitating catheterization; 2) first residual urine volume after self-voiding ≥ 150 mL, a criterion of incomplete voiding; and 3) Foley catheter re-insertion.

Statistical analysis was performed with IBM SPSS ver. 20.0 (IBM Corp., Armonk, NY, USA). Two-tailed significance was set at 0.05. The means of continuous variables were compared with the Student's *t*-test. The chi-square test was used for comparison of proportions. Variables with *P*-value in univariate analyses < 0.25 were incorporated into multiple regression analysis for identifying independent risk factors. The odds ratio (OR) estimates and their 95% confidence interval (CI) were calculated from the multivariable logistic regression model with forward conditional selection method. Receiver operating characteristic curve analysis was performed using MedCalc ver. 15.4 (MedCalc Software, Ostend, Belgium) to yield cut-off values for each significant predictor.

Results

Postoperative UR occurred in 27.1% of the study subjects (60/221). Patients with postoperative UR (n=60) were older (mean age, 69.5 vs. 66.9 years) and had urinary catheter longer postoperatively (day 1 vs. day 2 to 4, $P=0.010$) than those without postoperative UR (n=161) (Table 1). However, old age had no significant correlation with late postoperative day of catheter removal (Spearman rho 0.011) (Supplemental Table 1). Most of postoperative catheter removal (81.1%) was performed at day 1 and 3. In detail, Foley catheter was removed at postoperative day 1, 2, 3, and 4 in 105 (47.3%), 25 (11.3%), 75 (33.8%), and 17 (7.7%), respectively. According to the de-

gree of prolapse, incidence of UR was similar: 25.9% in mild, 30.4% in moderate, and 24.6% in severe form. There was no statistical difference in the incidence of UR according to individual surgeon ($P=0.105$). Multivariate regression analysis showed that age and postoperative day of catheter removal (day 1 vs. day 2 to 4) were independent predictors for postoperative UR (Table 2).

Receiver operating characteristic curve demonstrated that the best cut-off values of age and postoperative day of catheter removal to predict occurrence of postoperative UR were 63 years and postoperative day 1, respectively (Table 3, Fig. 1). Women older than 63 years had a significantly higher incidence of postoperative UR than those of 63 years or younger

Table 1. Preoperative and postoperative characteristics between women with and without postoperative UR after vaginal hysterectomy with anterior posterior colporrhaphy for pelvic organ prolapse

	No. (%)	UR (+) (n=60)	UR (-) (n=161)	P-value
Age (yr)		69.5±7.4	66.9±8.6	0.043
Body mass index (kg/m ²)		25.2±2.6	24.9±2.9	NS ^{a)}
Diabetes mellitus				NS ^{b)}
Yes	31 (14.0)	9 (29.0)	22 (71.0)	
No	190 (86.0)	51 (26.8)	139 (73.2)	
Degree of prolapse				NS ^{b)}
Mild	81 (36.7)	21 (25.9)	60 (74.1)	
Moderate	79 (35.7)	24 (30.4)	55 (69.6)	
Severe	61 (27.6)	15 (24.6)	46 (75.4)	
Type of anesthesia				NS ^{c)}
Spinal	209 (94.6)	56 (26.8)	153 (73.2)	
General	12 (5.4)	4 (33.3)	8 (66.7)	
Surgeon				0.105 ^{b)}
A	126 (57.0)	41 (32.5)	85 (67.5)	
B	44 (19.9)	11 (25.0)	33 (75.0)	
C	34 (15.4)	4 (11.8)	30 (88.2)	
D	17 (7.7)	4 (23.5)	13 (76.5)	
Postoperative day of catheter removal		1.8±1.1	2.1±1.0	0.052
Day 1	105 (47.5)	37 (35.2)	68 (64.8)	0.010
Day 2 to 4	116 (52.5)	23 (19.8)	93 (80.2)	
Operation time (min)		60.6±15.9	59.3±18.1	NS ^{a)}
Postoperative Hb drop (g/dL)		1.4±0.9	1.4±1.0	NS ^{a)}
WBC ≥2+ at postoperative UA		0	4	NS ^{c)}
Duration of hospital stay (day)		3.0±1.6	3.0±1.0	NS ^{a)}

Values are presented as number (%) or mean±standard deviation.

UR, urinary retention; NS, not significant as $P>0.25$; Hb, hemoglobin; WBC, white blood cell; UA, urine analysis.

^{a)}Student's *t*-test; ^{b)}Chi-square test; ^{c)}Fisher's exact test.

(31.9% vs. 15.3%, $P<0.05$). Table 4 showed the incidence of UR according to age and postoperative day of catheter removal. Overall incidence of UR was significantly higher in women who removed indwelling catheter at day 1 (35.2%) than those at day 2 (12.0%, $P=0.024$) or day 3 (21.3%, $P=0.044$), but was similar to those at day 4 (25.0%, $P=0.420$). In women of 63 years old or younger, the incidence of UR was not associated with the time of catheter removal after surgery; however, in women older than 63 years, the incidence was significantly

higher in day 1 removal group than day 2 to 4 removal group.

Because univariate analysis according to the surgeon demonstrated that several characteristics including body mass index, degree of prolapse, postoperative day of catheter removal, operation time, pyuria, and duration of hospital stay showed significant difference between surgeons (Supplemental Table 2), we performed a subgroup analysis only for the patients of surgeon A ($n=126$) to exclude the possible confounding effect of surgeon on the postoperative UR incidence. We still found that old age was associated with postoperative UR ($P=0.019$). However, the association between postoperative day of catheter removal and UR did not reach a statistical

Table 2. Multivariate logistic regression analysis for prediction of postoperative urinary retention

Characteristics	Odds ratio (95% CI)
Age	1.042 (1.002–1.084) ^{a)}
Surgeon (A vs. others)	1.079 (0.359–3.245)
Postoperative day of catheter removal (day 2 to 4 vs. day 1)	0.455 (0.248–0.834) ^{a)}

CI, confidence interval.

^{a)} $P<0.05$.

Table 3. Receiver operating characteristic curve analysis for age and postoperative day of catheter removal

	Age	Postoperative day of catheter removal
Cut-off	>63	≤1
AUC	0.585 ^{a)}	0.583 ^{a)}
95% CI	0.517–0.651	0.515–0.649
Sensitivity	85.0	61.7
Specificity	32.3	58.0
PPV	31.9	35.2
NPV	85.2	80.2
LR+	1.26	1.46
LR-	0.46	0.66

AUC, area under the curve; CI, confidence interval; PPV, positive predictive value; NPV, negative predictive value; LR, likelihood ratio.

^{a)} $P<0.05$.

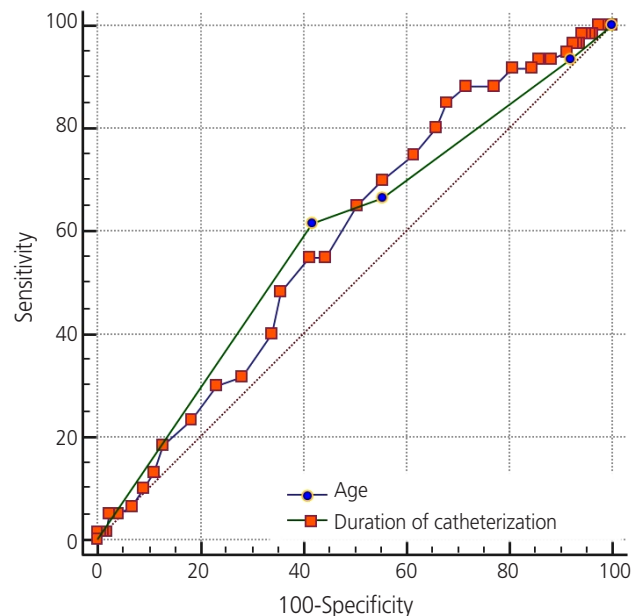


Fig. 1. Receiver operating characteristics curve to demonstrate the predictability of age and postoperative day of catheter removal for occurrence of postoperative urinary retention after vaginal prolapse surgery. Area under the curve (95% confidence interval) of age>63 and postoperative day of catheter removal ≤1 was 0.585 (0.517 to 0.651) and 0.583 (0.515 to 0.649), respectively.

Table 4. Incidence of postoperative UR according to age group and postoperative day of catheter removal

Postoperative day of catheter removal	Overall UR incidence	Age		P-value ^{a)}
		≤63	>63	
Day 1	35.2% (37/105)	14.3% (4/26)	42.9% (33/77)	0.022
Day 2	12.0% (3/25) ^{b),c)}	0% (0/8) ^{b)}	17.6% (3/17) ^{b),c)}	NS
Day 3	21.3% (16/75) ^{c)}	18.2% (4/22)	22.6% (12/53) ^{c)}	NS
Day 4	25.0% (4/16) ^{b)}	33.3% (1/3) ^{b)}	23.1% (3/13) ^{b),c)}	NS

UR, urinary retention; NS, not significant.

^{a)}Comparison of incidence between two age groups; ^{b)}Fisher's exact test; ^{c)} $P<0.05$ when compared with day 1 incidence in each column.

Table 5. Preoperative and postoperative characteristics between women with and without postoperative UR after vaginal hysterectomy with anterior posterior colporrhaphy for pelvic organ prolapse by surgeon A (n=126)

	UR (+) (n=41)	UR (-) (n=85)	P-value
Age (yr)	69.95±7.30	66.01±9.82	0.019 ^{a)}
Body mass index (kg/m ²)	24.80±2.65	25.15±2.52	NS ^{a)}
Diabetes mellitus			NS ^{b)}
Yes	6 (40.0)	9 (60.0)	
No	35 (31.5)	76 (68.5)	
Degree of prolapse			NS ^{b)}
Mild	19 (29.7)	45 (70.3)	
Moderate	15 (41.7)	21 (58.3)	
Severe	7 (26.9)	19 (73.1)	
Type of anesthesia			NS ^{c)}
Spinal	38 (32.8)	78 (67.2)	
General	3 (30.0)	7 (70.0)	
Postoperative day of catheter removal	1.2±0.5	1.3±0.7	0.157 ^{a)}
Day 1	37 (35.9)	66 (64.1)	0.086 ^{b)}
Day 2 to 3	4 (17.4)	19 (82.6)	
Operation time (min)	55.07±12.3	53.71±13.82	NS ^{a)}
Postoperative Hb drop (g/dL)	1.35±0.93	1.30±1.01	NS ^{a)}
WBC 2+ or more at postoperative UA	0	0	NS ^{c)}
Duration of hospital stay (day)	2.39±0.63	2.40±0.79	NS ^{a)}

Values are presented as mean±standard deviation or number (%).

UR, urinary retention; NS, not significant as $P>0.25$; Hb, hemoglobin; WBC, white blood cell; UA, urine analysis.

^{a)}Student's *t*-test; ^{b)}Chi-square test; ^{c)}Fisher's exact test.

significance ($P=0.086$) (Table 5). Multivariate analysis showed that old age was an independent risk factor for postoperative UR (OR, 1.059; 95% CI, 1.008 to 1.112; $P=0.022$), but postoperative day of catheter removal was not. More frequent UR in patients of early catheter removal ≤day 1 than in those of delayed removal >day 1 was found in older age >65 years, a new cut-off value of surgeon A subgroup (42.0% vs. 8.3%, $P=0.027$) (data not shown).

Discussion

Postoperative UR is defined as the inability to void with a full bladder during the postoperative period, but the definition in terms of residual urine volume is inconsistent. In several studies, UR was defined as the failure of first voiding or residual urine volume exceeding 100 to 200 mL. In an another report, residual urine volume >500 mL by portable ultrasound device was defined as UR [13]. Therefore, the incidence of UR may

vary depending on the definition.

In the present study, indwelling catheter for no longer than one day led to a significant increase of UR compared to those with catheterization for two and three days. Our results are discordant with the findings of previous reports, in which no significant difference of UR was found between day 1 and day 3 catheter removal after vaginal prolapse surgery [7]. However, our results are consistent with those of Kamilya et al. [9], in which a significant increase of UR incidence was demonstrated in 1-day catheter group than 4-day catheter group.

In some studies [9,14,15], age does not appear to be a risk factor for perioperative complications. In the present study, however, age was an independent risk factor. In women of 63 years old or less, the incidence of UR was not associated with the day of catheter removal; however, in women older than 63 years, the incidence was significantly higher in day 1 removal group. Our results support that early catheter removal (i.e., one-day) in older women result in a higher incidence of UR.

Prolonged catheterization may increase the risk of urinary tract infection [8]. For either short- or long-term catheterization, urinary tract infection rate has been reported to be approximately 5% [10]. Such infection prolongs hospital stay; therefore, earlier removal of catheter may be reasonable after vaginal prolapse surgery. However, day 1 removal appears to increase the risk of UR. Thus, appropriate time of catheter removal should be decided based on the balance between the incidence of UR and urinary tract infection. Bacteriuria can arise from contamination of a urine specimen during collection, colonization of the urine, or urinary tract infection. We did not perform a routine urine culture, but pyuria can be used as the surrogate for urinary tract infection. Fortunately, no urinary tract infection was observed in our study subjects and the incidence of significant pyuria was quite low (1.8%).

In the present study, we identified two independent risk factors for postoperative UR: age and duration of indwelling catheter. The results might be a guideline for surgeons to decide when to remove Foley catheters after vaginal prolapse surgery. In two randomized studies, no association was found between age and perioperative complications after pelvic reconstructive surgery [3,15]. Strength of our study is to reveal that age is an independent risk factor for postoperative UR after VH with anterior and posterior colporrhaphy. Plausible explanation for the association of old age with postoperative UR is age-related progressive neuronal degeneration leading to bladder dysfunction. The aging process can increase urethral rigidity and decrease detrusor contractility, thus more prone to postoperative UR [5,16,17].

We found that postoperative UR happened quite frequently (42.9%) in women older than 63 years when indwelling catheter was removed as early as one day after VH with anterior and posterior colporrhaphy. Additional multivariate analysis in women of which indwelling catheter was removed at day 1 ($n=105$) showed that age was the only independent risk factor (OR, 0.002; 95% CI, 1.015 to 1.165). Therefore, it could be recommended that indwelling catheter is removed later than first postoperative day in women older than 63 years.

Limitation of our study was that a crude definition of uterine prolapse (mild/moderate/severe) was used, rather than an anatomically quantitative classification such as pelvic organ prolapse quantification system. In addition, preoperative evaluation of voiding problem was poor, which could potentially influence the incidence of postoperative UR. Because we included only patients received VH with anterior and posterior

colporrhaphy, incidence of postoperative UR after VH without colporrhaphy should be further investigated. Lastly, the potential surgeon factor, if any, might make the generalization of the results difficult. Statistical insignificance of the association of early postoperative day of catheter removal with UR in a single surgeon group may be ascribed to the small number of surgeon A patients keeping the catheter ≥ 2 days.

In conclusion, the present study demonstrated that age and postoperative day of catheter removal are significant risk factors to predict the occurrence of postoperative UR in women who underwent VH with anterior and posterior colporrhaphy for the treatment of pelvic organ prolapse. Women older than 63 years had higher incidence of postoperative UR than those of 63 years or less, and day 1 catheter removal could put older patients at higher risk of postoperative UR.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

Supplementary materials

Supplemental Table 1. Correlation analysis of age, operation time, postoperative day of catheter removal and duration of hospital stay (Spearman rho: ρ)

This material can be found via <http://ogscience.org/src/sm/ogs-59-137-s001.pdf>.

Supplemental Table 2. Comparisons of clinicopathologic characteristics between surgeons for the patients undergoing vaginal hysterectomy with anterior posterior colporrhaphy for pelvic organ prolapse

This material can be found via <http://ogscience.org/src/sm/ogs-59-137-s002.pdf>.

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