

Original Article

Predictors of Postoperative Urinary Retention in Outpatient Minimally Invasive Hysterectomy

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ABSTRACT **Study Objective:** To identify risk factors associated with postoperative urinary retention in patients undergoing outpatient minimally invasive hysterectomy.

Design: A retrospective cohort study.

Setting: An academic medical center.

Patients: All patients undergoing outpatient minimally invasive hysterectomy between January 2013 and July 2018 were considered for inclusion in the study.

Interventions: Outpatient laparoscopic, vaginal, or robotically assisted laparoscopic hysterectomy.

Measurements and Main Results: Four hundred forty-four patients met the inclusion criteria. Postoperative urinary retention occurred in 94 patients, and 347 patients successfully passed their voiding trial in the postanesthesia care unit for a pass rate of 79%. Demographic characteristics were similar, except patients who experienced postoperative urinary retention were less likely to be menopausal (23.4% vs 34.7%, $p = .038$). Those with urinary retention received more perioperative opioids (morphine milligram equivalent of 14.4 mg vs 11.2 mg, $p = .012$), had longer operative times (122.9 ± 55.6 vs 95.7 ± 42.3 minutes, $p < .01$), and experienced more blood loss (105.3 ± 134.4 vs 78.5 ± 86.8 mL, $p = .025$). The rate of urinary tract infections was similar. Logistic regression analysis showed that the route of hysterectomy and age were not associated with an increased risk for urinary retention, whereas a longer operative time and higher doses of perioperative opioid use were.

Conclusion: In patients undergoing minimally invasive outpatient hysterectomy, a longer operative time and increased perioperative narcotic use increases the risk of postoperative urinary retention. *Journal of Minimally Invasive Gynecology* (2020) 27, 681–686. © 2019 AAGL. All rights reserved.

Keywords: Outpatient hysterectomy; Urinary retention; Voiding trial; Minimally invasive hysterectomy

Despite the fact that hysterectomies have been performed since the 18th century, it is only recently with the implementation of enhanced recovery after surgery protocols that hysterectomies have become outpatient procedures [1]. Although same-day discharges are common in gynecologic surgery, hysterectomies have traditionally required an overnight hospital stay [2]. This was largely because of concerns for postoperative pain control and patient safety [2]. However, with the widespread use of minimally invasive surgical procedures and proper patient selection, outpatient hysterectomies are feasible in more than 80% of cases

[3]. Outpatient procedures improve postoperative recovery and reduce institutional cost without increasing the risk for postoperative complications [4,5]. As a result, it is anticipated that the adoption of outpatient hysterectomies as a standard of care will continue to rise [6,7].

The majority of outpatient hysterectomies are performed via a minimally invasive approach including laparoscopic, vaginal, and robotically assisted laparoscopic surgery [8]. The impact of outpatient hysterectomy on bladder function remains unclear [6,9]. There is evidence to show that postoperative urinary retention may be related to the mode of hysterectomy, with vaginal hysterectomy being associated with a higher rate of postoperative urinary retention [10]. Furthermore, the reported rate of urinary retention after laparoscopic gynecologic surgery is variable and may be as high as 20% [9,11]. Other possible risk factors for postoperative urinary retention include urogynecologic procedures, increased intraoperative blood loss, total postoperative narcotic use, and increasing patient age [1,4,10–13]. However,

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factors related to urinary retention in hysterectomy patients undergoing same-day discharge remain unknown.

Bladder dysfunction can be a reason for admission after planned outpatient hysterectomy or presentation to the emergency department after discharge [1,14]. It has been suggested that maintaining an indwelling urinary catheter for at least 1 day after vaginal hysterectomy reduces the risk of urinary retention, especially in older patients [4]. However, discharge with a Foley catheter inflicts undue distress and discomfort to patients [15]. In order to provide better patient counseling, more information is needed on return to baseline bladder function after outpatient hysterectomy, especially those with same-day discharge. Preoperative identification of patients at an increased risk for postoperative urinary retention will improve education regarding expectations and goals. This study sought to determine factors that predict postoperative urinary retention after minimally invasive outpatient hysterectomy, all undergoing same-day discharge.

Materials and Methods

A retrospective cohort study was performed at a single tertiary care academic center with institutional review board approval (IRB #17-009392). Perioperative records of all patients undergoing outpatient minimally invasive hysterectomy from January 2013 through July 2018 were reviewed. Same-day discharge after minimally invasive hysterectomy became the standard of care at the study institution in 2013. Laparoscopic, vaginal, and robotically assisted laparoscopic approaches were included as minimally invasive hysterectomies. All patients undergoing concomitant female pelvic medicine and reconstructive surgery (FPMRS) procedures were excluded (anterior colporrhaphy, posterior colporrhaphy, midurethral sling, and periurethral bulking agent injection). Apical suspension is routinely performed in all vaginal hysterectomies at the study institution and is not reported as an additional procedure.

All minimally invasive hysterectomy patients had a urinary catheter inserted intraoperatively under a sterile technique. A voiding trial was then performed 1 to 4 hours postoperatively in the postanesthesia care unit (PACU). The timing of the voiding trial was based on patient ability to stand and recovery from general anesthesia. Voiding trials were completed by retrograde filling the bladder with 250 to 300 mL normal saline or sterile water, removing the catheter, and then allowing the patient to spontaneously void. After voiding, a postvoid residual (PVR) was assessed using a bladder scanner to ensure adequate emptying. A failed voiding trial was defined as the patient voiding less than 50% of the instilled fluid or a PVR greater than 150 mL. If a patient failed the voiding trial, a urinary catheter was reinserted. No patients in this cohort were offered self-catheterization.

Patients were excluded if they had a history of preoperative urinary retention (defined as a preoperative PVR >

150 mL) or if they had concomitant FPMRS procedures performed at the time of hysterectomy. They were also excluded if an intraoperative urinary tract injury occurred, necessitating discharge with an indwelling urinary catheter. After accounting for the exclusion criteria, all patients with postoperative urinary retention requiring discharge home with an indwelling catheter were included in this study. From the same cohort, all patients with normal postoperative bladder function discharged home without a catheter were also included for analysis in this study.

Hysterectomies were all performed in the usual standard fashion by 7 subspecialty trained gynecologic surgeons. The route of hysterectomy was left to the surgeon's discretion based on the preoperative evaluation. Robotic-assisted laparoscopic hysterectomies were performed with the use of the Da Vinci Si or Xi robotic platform (Intuitive Surgical, Sunnyvale, CA). Laparoscopic hysterectomies were performed via a single-site or multiport approach.

Demographic data and perioperative outcomes were extracted from the patients' medical records. The operative time was defined as the time from incision to closure. Perioperative opioid use, presented as the morphine milligram equivalent (MME), was defined as the amount of opioids received from presentation to the preoperative surgical unit to the time of discharge. Opioids included oral and, if applicable, parenteral administration of oxycodone, morphine, hydromorphone, hydrocodone, tramadol, and fentanyl. A urinary tract infection (UTI) was recorded if a patient called within 2 weeks of surgery complaining of symptoms of a UTI and antibiotics were prescribed with or without a positive urine culture. A 2-week postoperative time period was used to better estimate the rate of UTIs linked to perioperative catheter use.

For analysis, patients with and without postoperative urinary retention were compared using unmatched/unconditional models. These 2 groups were compared on demographic, disease, surgical, and follow-up outcomes of interest using chi-square tests for categorical variables (Fisher exact tests where appropriate) and the Kruskal-Wallis rank sum tests for continuous variables. Variables that were noted to be different on univariate analysis and were thought to possibly affect the outcome of interest were analyzed in logistic regression. These variables included the hysterectomy route (laparoscopic/robotic vs vaginal), patient age (years), MME, estimated blood loss (mL), and duration of operation (minutes). Because there were 94 patients who experienced postoperative urinary retention, this allowed for examination of these variables based on the recommendation of 10 to 15 cases of urinary retention per variable included in the model [16].

Given the overall sample size, the number of cases of urinary retention observed, and that cases with and without urinary retention were not formally matched, we anticipated that sufficient power (>90%) would be achieved for both univariate tests (chi-square, Kruskal-Wallis, etc.) and logistic regression analyses assuming a moderate effect size.

Results

During the study period, 441 outpatient minimally invasive hysterectomies met the inclusion criteria. Postoperative urinary retention occurred in 94 patients, and 347 patients successfully passed their voiding trial in the PACU for a pass rate of 79%.

Table 1 shows the demographic characteristics of both groups. Patients with postoperative urinary retention were less likely to be menopausal (23.4% vs 34.7%, $p = .038$) compared with patients without urinary retention. All remaining demographic variables did not show a clinically meaningful or statistically significant difference in rates or means between the 2 groups.

Table 2 shows the perioperative characteristics of both groups. Looking at the route of hysterectomy, no statistically significant difference was noted between the 2 groups. In patients with postoperative urinary retention, 26.6% had a vaginal hysterectomy, whereas in patients with no urinary retention, 37.9% had a vaginal hysterectomy ($p = .055$).

When looking at the indication for hysterectomy (Table 2), the distribution of patients in both groups was similar. In this patient cohort, 88.1% of hysterectomies were performed for benign indications other than prolapse. These included hysterectomies performed for abnormal uterine bleeding, pelvic pain, and uterine leiomyomas. In the menopausal patient group, indications for hysterectomy included malignancy, risk-reducing surgery for hereditary cancer syndromes, pelvic pain, persistent postmenopausal bleeding, and persistent endometrial hyperplasia.

Patients who had postoperative urinary retention received more perioperative opioids (MME 14.4 mg vs 11.2 mg, $p = .012$), had longer average operative times (mean \pm

standard deviation [SD]: 122.9 ± 55.6 vs $95.7 [42.3]$ minutes, $p < .01$), experienced more blood loss (105.3 ± 134.4 mL vs 78.5 ± 86.8 mL, $p = .025$), and received more intravenous fluids (1169.4 ± 538.3 mL vs 991.4 ± 416.7 mL, $p < .01$) when compared with patients without urinary retention. The rate of UTIs in this patient cohort was 4.3% and was similar between both groups (6.4% vs 3.8%, $p = .267$).

The logistic regression analysis showed that total perioperative MME use and the surgical duration were statistically significant predictors of whether patients would experience postoperative urinary retention (Table 3). After controlling for potential confounders (hysterectomy route, age, and operation duration), each 1-mg increase in MME used increased the odds of the patient experiencing postoperative urinary retention by 3% (odds ratio = 1.03; 95% confidence interval, 1.01–1.05, $p = .015$). For operation duration, after adjusting for possible confounders (hysterectomy route, age, and MME), every 1-minute increase in operative time increased the odds of postoperative urinary retention by 1% (odds ratio = 1.01; 95% confidence interval, 1.01–1.02; $p < .01$).

Discussion

This study shows that risk factors for urinary retention after outpatient minimally invasive hysterectomy are the duration of surgery and total perioperative narcotics used. Age, route of hysterectomy, and the indication for hysterectomy were not found to be associated with the risk of developing postoperative urinary retention.

The rate of postoperative urinary retention in this patient cohort was 21%. Previously published retention rates are

Table 1

Patient Demographic Characteristics				
	Patients without Urinary Retention (n = 347)	Patients with Urinary Retention (n = 94)	Total (N = 441)	p Value
Age (years)				
Median (Q1, Q3)	48.0 (42.0, 54.0)	47.8 (42.8, 53.5)	48.0 (42.0, 54.0)	.763*
Parity				
Median (Q1, Q3)	2.0 (0.0, 2.0)	2.0 (0.0, 2.0)	2.0 (0.0, 2.0)	.896*
Menopause (n, %)				
No	222 (65.3)	72 (76.6)	294 (67.7)	.038 [†]
Yes	118 (34.7)	22 (23.4)	140 (32.3)	
BMI (kg/m ²)				
Median (Q1, Q3)	26.6 (22.8, 31.4)	26.3 (22.8, 31.4)	26.6 (22.8, 31.4)	.773*
Diabetes mellitus (n, %)				
No	335 (98.5)	93 (98.9)	428 (98.6)	.765 [†]
Yes	5 (1.5)	1 (1.1)	6 (1.4)	
Hypertension (n, %)				
No	294 (86.0)	81 (87.1)	375 (86.2)	.779 [†]
Yes	48 (14.0)	12 (12.9)	60 (13.8)	

BMI = body mass index.
 * Linear model analysis of variance.
 † Pearson chi-square test.

Table 2

Perioperative Outcomes				
	Patients without Urinary Retention (n = 347)	Patients with Urinary Retention (n = 94)	Total (N = 441)	p Value
Hysterectomy route (n, %)				.055*
Vaginal	131 (37.9)	25 (26.6)	156 (35.5)	
Laparoscopic	70 (20.2)	17 (18.1)	87 (19.8)	
Robotic-assisted laparoscopic	145 (41.9)	52 (55.3)	197 (44.8)	
Indication for hysterectomy (n, %)				.315*
Prolapse	4 (1.2)	3 (3.3)	7 (1.6)	
Benign	304 (88.1)	80 (87.9)	384 (88.1)	
Malignant	37 (10.7)	8 (8.8)	45 (10.3)	
Estimated blood loss (mL)				.025 [†]
Median (Q1, Q3)	50.0 (25.0, 100.0)	50.0 (50.0, 100.0)	50.0 (30.0, 100.0)	
Mean (SD)	78.5 (86.8)	105.3 (134.4)	84.0 (98.7)	
Morphine milligram equivalent Opioids administered (mg)				.012 [†]
Median (Q1, Q3)	8.4 (2.1, 17.7)	13.6 (4.3, 19.7)	8.9 (2.6, 18.1)	
Mean (SD)	11.2 (10.2)	14.4 (13.1)	11.9 (10.9)	
Duration of operation (minutes)				<.001 [†]
Median (Q1, Q3)	88.5 (68.0, 114.8)	115.0 (89.2, 148.2)	93.0 (70.0, 121.0)	
Mean (SD)	95.7 (42.3)	122.9 (55.6)	101.5 (46.8)	
Urinary tract infection (n, %)				.267*
No	333 (96.2)	88 (93.6)	421 (95.7)	
Yes	13 (3.8)	6 (6.4)	19 (4.3)	
IV fluids received				<.001 [†]
Median (Q1, Q3)	917.5 (700.0, 1200.0)	1000.0 (900.0, 1300.0)	1000.0 (700.0, 1200.0)	
Mean (SD)	991.4 (416.7)	1169.4 (538.3)	1029.8 (451.1)	

IV = intravenous; SD = standard deviation.
* Pearson chi-square test.
[†] Linear model analysis of variance.

variable and largely dependent on the criteria chosen to represent retention [9,11]. In this institution, the diagnosis of adequate bladder emptying is based on strict parameters where patients are expected to void at least 50% of instilled fluid. Also, if patients are unable to void within 30 to 60 minutes of bladder filling, they are diagnosed with retention, and a Foley catheter is reinserted. Voiding trials are performed in the PACU as soon as the patient is able to stand, usually 2 to 3 hours after the completion of surgery. This may be different from other institutions where patients are observed for 24 hours and the voiding trial is performed before discharge.

A prolonged operative time in minimally invasive hysterectomies has been associated with an increased risk of postoperative complications, both medical and surgical [17]. A longer operative time may reflect difficult cases, requiring extensive dissection. This, in turn, may affect bladder function. This study shows that for every 1-minute increase in operative time, patients have a 1% increase in the odds of having urinary retention. This is after accounting for potential confounders. Other studies have shown conflicting results to whether or not prolonged operative time affects voiding dysfunction [9,18]. However, none of the studies have looked exclusively at outpatient

Table 3

Logistic Regression Analysis		
	OR	p Value
(Intercept)	0.05 (.01–.19)	<.001
Hysterectomy route laparoscopic/robotic vs vaginal	1.16 (.68–2.03)	.583
Age (in years)	1.00 (.98–1.03)	.896
Morphine milligram equivalent opioids (in mg)	1.03 (1.01–1.05)	.015
Duration of operation (in minutes)	1.01 (1.01–1.02)	<.001

OR = odds ratio.

hysterectomies with voiding trials performed the same day. Such patients, as represented by this cohort, will likely have different inherent characteristics. Outpatient hysterectomies are usually performed on uncomplicated cases in which same-day discharge is deemed feasible. In this patient group, an increasing operative time does seem to influence the ability to void postoperatively.

In this patient cohort, the perioperative use of oral and parenteral narcotics increased the risk of developing postoperative urinary retention. For each 1-mg increase in MME used, the odds of having urinary retention increased by 3%. This is similar to previously published findings in which the use of postoperative narcotics was found to be a risk factor for postoperative urinary retention after hysterectomy [11]. Although the mechanism of action remains unclear, patients who receive larger doses of narcotics may have more postoperative pain, which may impact their ability to void [19]. There may also be a direct effect of opioids on bladder function, but further studies are required before this association is made [20].

Although the route of hysterectomy has been shown to influence the rate of urinary retention in some studies, it has been disputed in others [10,13,18]. Vaginal hysterectomy has been shown to be associated with urinary retention when compared with laparoscopic hysterectomy in some studies [10]. However, most studies have either included only FPMRS patients or had a diverse cohort of patients including hysterectomies with and without concomitant FPMRS procedures. On the other hand, results obtained from this study show that in patients who do not undergo concomitant FPMRS procedures at the time of hysterectomy, vaginal hysterectomy is not more likely to cause voiding dysfunction compared with laparoscopic or robotically assisted laparoscopic hysterectomies.

The clinical usefulness of small differences in blood loss, operative time, or intravenous fluids may be limited. However, recognizing that these factors influence the rate of postoperative urinary retention will likely make the surgeon more cognizant of their occurrence. It may also help the surgical team identify patients at risk for postoperative retention. Another important finding is the lack of significance of the route of hysterectomy in relation to urinary retention because it has been previously proposed that vaginal hysterectomy may increase the risk.

Strengths of this study include the large sample size and the inclusion of a focused cohort of minimally invasive outpatient hysterectomies with same-day discharge. Patients undergoing concomitant FPMRS procedures were excluded to limit heterogeneity because urinary retention is more common in this group. In addition, we included all 3 minimally invasive routes of hysterectomies and all indications for hysterectomy allowing for the generalizability of results. Limitations include the retrospective nature of the study, which is inherently associated with bias. Although data were collected from 7 different surgeons, the study was limited to a single institution. In addition, some patients may have had

preoperative urinary retention that was not recognized or documented and led to their inadvertent inclusion in the analysis.

In conclusion, risk factors for postoperative urinary retention after minimally invasive outpatient hysterectomy include the duration of surgery and the use of perioperative narcotics. Neither age nor the route of hysterectomy was found to be associated with postoperative urinary retention. Knowledge of the involved risk factors aids in identifying individuals at risk and allows for appropriate counseling of both the patient and the medical team involved.

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