A Retrospective Study of Risk Factors for Small Bowel Obstruction After Hysterectomy

Moona Arabkhazaeli, MD, Julia Keltz, MD, Ruth Eisenberg, MS, Mark Levie, MD, Holly Yettaw Luts, MD

ABSTRACT

Background and Objectives: The purpose of this study was to evaluate the incidence of small bowel obstruction (SBO) following hysterectomy and to identify factors that may increase the risk of SBO by route of hysterectomy.

Methods: A retrospective review of the electronic medical records of all hysterectomies completed between January 2011 through July 2013 at our institution was performed. Information on patient demographics, comorbid conditions, and surgical characteristics were collected. All cases were reviewed for documentation of SBO in the immediate or remote postoperative period, up to 5 years post-hysterectomy.

Results: Between January 2011 and July 2013, 1630 hysterectomies were performed at Montefiore Medical Center. A minimally invasive technique was employed for 49.8%, including 15.7% vaginal and 33.9% laparoscopic hysterectomies. Of these 1630 cases, 40 SBO's were documented; 30 after an abdominal approach and 10 after a minimally invasive approach. The overall incidence of SBO was 2.4%. A multivariable analysis adjusting for potential confounders demonstrated lower odds of SBO for the minimally invasive approaches combined, compared to abdominal hysterectomy (0.44, 95% confidence interval, 0.20, 0.98, p = .0444). Additional variables independently associated with development of SBO included intra-operative bowel injury and malignancy, whereas intra-operative blood loss and lysis of adhesions were not independently associated with SBO.

Conclusions: After adjusting for confounders including malignancy, abdominal hysterectomy was associated with a significantly higher risk for SBO when compared to minimally invasive hysterectomy. Our study adds to the body of literature supporting a minimally invasive approach to hysterectomy when feasible.

Key Words: Hysterectomy, Small Bowel Obstruction, Minimally Invasive Hysterectomy.

INTRODUCTION

A minimally invasive approach to hysterectomy offers many proven advantages including faster recovery, shorter hospital stays, and fewer infections.[1] Both the American Congress of Obstetricians and Gynecologists and the American Association of Gynecologic Laparoscopists endorse a minimally invasive hysterectomy when appropriate and these approaches are being increasingly utilized even in challenging cases.[1–4]

Mechanical small bowel obstruction (SBO), defined as intrinsic or extrinsic compression disrupting intraluminal flow, is an important surgical morbidity. Post-surgical SBO burdens both patients and the health care system, causing 345,000 admissions and costing 1.3 billion dollars annually.[5,6] Post-surgical adhesions are an established etiology for SBO and are suspected to account for 60 to 70% of cases.[7] This is particularly relevant for major gynecologic surgery, as postoperative adhesions have been reported in up to 90% of cases.[8]

Abdominal hysterectomy has been associated with SBO; however, there is conflicting data on whether a minimally invasive hysterectomy incurs the same risk.[9] Al-Sunaidi et al. concluded that the risk of SBO was significantly higher after abdominal hysterectomy compared to vaginal or

Department of Obstetrics and Gynecology, Montefiore Medical Center/Albert Einstein College of Medicine, Bronx, NY. (Drs. Arabkhazaeli, Levie, and Yettaw Luts)

Department of Obstetrics and Gynecology, Westchester Medical Health Center, Valhalla, NY. (Dr Keltz)

Department of Epidemiology and Population Health, Montefiore Medical Center/Albert Einstein College of Medicine, Bronx, NY. (Dr Eisenberg)

Disclosure: none.

Conflicts of Interest: none.

Funding/Financial Support: none.

Informed consent: Dr. Moona Arabhazaeli declares that written informed consent was obtained from the patient/s for publication of this study/report and any accompanying images.

Address correspondence to: Dr. Moona Arabhazaeli, Department of Obstetrics and Gynecology, Montefiore Medical Center, 3332 Rochambeau Ave, Bronx, NY, 10467, Telephone: 718-920-5157, E-mail: moona1325@gmail.com

DOI: 10.4293/JSLS.2020.00070

laparoscopic modalities,[10] though the results were limited by a small laparoscopic sample size. In comparison, Sheyn et al. had a larger sample size of minimally invasive hysterectomies and concluded that route of hysterectomy was not a significant risk factor for SBO.[11]

Our primary objective is to compare the incidence of SBO after abdominal, vaginal, and laparoscopic hysterectomies. Secondarily, we aim to identify other surgical factors that may contribute to the development of SBO.

METHODOLOGY

Institutional review board approval was obtained to review the medical records of all females who underwent hysterectomy at Montefiore Medical Center in a 30-month period from January 2011 through July 2013. The time period was a convenience sample, and the cases were identified using operating room schedules. All data for this study were de-identified in a database.

Patient demographic data and clinical factors such as comorbid conditions and surgical history were obtained from the medical record. Surgical characteristics including route of hysterectomy, uterine weight and pathology, presence of bladder or bowel injury, length of surgery, and intraoperative blood loss (EBL) were recorded. The route of hysterectomy was chosen at the discretion of the primary surgeon, and was identified as abdominal, vaginal, or laparoscopic, which included laparoscopic-assisted vaginal hysterectomy, laparoscopic supracervical hysterectomy, total laparoscopic hysterectomy, and robotic-assisted hysterectomies. In cases of conversion, the converted route was the documented hysterectomy route for this study. The medical record was reviewed for any documentation of SBO in the immediate or remote postoperative period up to five years post-hysterectomy. The diagnosis of SBO was defined radiographically or surgically. Finally, we documented whether the patient followed up at our institution for any indication up to 5 years post-hysterectomy.

A descriptive summary of demographic and clinical characteristics of patients is presented as mean or median for continuous variables and frequencies (%) for discrete variables. Comparison of demographic and clinical characteristics of patients by route of hysterectomy was carried out using analysis of variance or non-parametric equivalent for continuous variables and Chi-squared or Fisher's exact tests for categorical variables. A logistic regression model was employed to assess the association between SBO and route of hysterectomy, while adjusting for a priori specified potential confounders. Adjustments were made for age, body mass index (BMI), tobacco use, diabetes, bowel injury, malignancy, EBL, prior cesarean section, and lysis of adhesions. Results are presented as an odds ratio (OR) and associated 95% confidence interval (CI). An additional multivariable logistic regression model examined route of hysterectomy as laparoscopic or vaginal combined compared to abdominal. Statistical significance is claimed at a computed p-value ≤ 0.05 (two-sided). Statistical analysis was performed using the SAS 9.4 software package (SAS Institute Inc., Cary, NC, USA).

RESULTS

A total of 1630 hysterectomies by 84 surgeons were performed at the Montefiore Medical Center in the 30-month period investigated. In our study population, the approach to hysterectomy was abdominal in 50.2%, vaginal in 15.7%, and laparoscopic in 33.9%. Patient demographics and surgical characteristics are described in **Table 1**. The mean age of our study population was 50.0, and patient age was significantly higher among the cohort of women who underwent a vaginal hysterectomy (mean age 52.0 ± 11.5 versus 48.5 ± 10.3 in the laparoscopic group and 50.3 ± 10.0 in the abdominal group, $p < .0001$) (**Table 1**). The mean BMI was 31.2 and did not significantly differ across the three modalities. With respect to operative time, vaginal hysterectomy was the shortest and laparoscopic hysterectomy was the longest ($p < .0001$). An abdominal route of hysterectomy was associated with malignant pathology ($p < .0001$), greater uterine weight ($p < .0001$), lysis of adhesions ($p < .0001$), prior surgical history ($p < .0001$), a higher EBL ($p < .0001$), and need for transfusion ($p < .0001$).

Of the 1630 cases in our cohort, 40 SBOs were documented, accounting for 2.4% of hysterectomies. The median number of days from surgery to time of diagnosis of SBO was 7. Of these 40 cases of SBO, 30 occurred after an abdominal approach and 10 were after a minimally invasive approach (1 after vaginal, 9 after laparoscopic). Our primary objective, risk of SBO with respect to route of hysterectomy, is described in **Table 2**. When patient and surgical characteristics were accounted for, there was no significant difference in the incidence of SBO when comparing laparoscopic ($p = 0.14$) or vaginal ($p = .10$) approaches to abdominal (**Table 2**). However, when looking at composite minimally invasive modalities, we found a significantly lower risk of SBO after laparoscopic and vaginal hysterectomy combined as compared to abdominal (OR = 0.33, 95% CI: (0.16, 0.68), $p = 0.0025$). In the multivariable model, after adjusting for age, BMI,

Table 1.
Demographics and Operative Characteristics by Route of Hysterectomy

Variable	Total (n = 1630)	Vaginal (n = 257)	Laparoscopic (n = 554)	Abdominal (n = 819)	*p*-Value
Age, mean (SD)	50.0 (10.4)	52.0 (11.5)	48.5 (10.3)	50.3 (10.0)	< .0001
BMI, mean (SD)	31.2 (7.0)	30.7 (6.8)	31.0 (6.6)	31.5 (7.2)	.2169
Tobacco use, n (%)	152 (9.5)	19 (7.6)	54 (9.9)	79 (9.8)	.5234
Diabetes, n (%)	209 (12.9)	38 (14.8)	62 (11.2)	109 (13.4)	.2927
Bladder injury, n (%)	18 (1.1)	2 (0.8)	8 (1.4)	8 (1.0)	.6195
Bowel injury, n (%)	23 (1.4)	1 (0.4)	8 (1.4)	14 (1.7)	.2926
Uterine weight (grams), median (IQR)	275.0 (134.5, 642.5)	136.0 (67.0, 210.0)	206.0 (125.0, 365.0)	566.0 (229.0, 1064.0)	< .0001
Malignancy, n (%)	243 (14.9)	11 (4.3)	68 (12.3)	164 (20.0)	< .0001
Surgery length (minutes), median (IQR)	285.0 (200.0, 389.0)	210.0 (173.0, 299.0)	319.0 (266.0, 430.0)	252.0 (188.0, 369.0)	< .0001
Estimated blood loss, median (IQR)	200 (100, 400)	150 (100, 250)	150 (100, 250)	300 (200, 500)	< .0001
Received transfusion, n (%)	124 (7.6)	9 (3.5)	19 (3.4)	96 (11.7)	< .0001
Prior laparotomy, n (%)	604 (37.1)	63 (24.5)	213 (38.4)	328 (40.1)	< .0001
Number of prior laparotomy, median (IQR)	0.0 (0.0, 1.0)	0.0 (0.0, 0.0)	0.0 (0.0, 1.0)	0.0 (0.0, 1.0)	< .0001
Prior cesarean section, n (%)	375 (23.1)	28 (11.0)	144 (26.1)	203 (24.9)	< .0001
Number of prior cesarean sections, median (IQR)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 1.0)	0.0 (0.0, 0.0)	< .0001
Underwent lysis of adhesions, n (%)	312 (19.1)	8 (3.1)	109 (19.7)	195 (23.8)	< .0001
Presented to the institution 5 years post-op, n (%)	1048 (64.3)	160 (62.3)	381 (68.8)	507 (61.9)	.0255

IQR, interquartile range; SD, standard deviation.

tobacco use, diabetes, bowel injury, malignancy, EBL, prior cesarean section, and lysis of adhesions, the significant difference in incidence of SBO for a minimally invasive route compared to abdominal persisted (adjusted odds ratio [AOR] = 0.44, 95% CI: (0.20, 0.98), p = 0.0444).

We additionally sought to identify any other patient or surgical factors that may be associated with SBO. In the multivariable analysis, there was a statistically significant association between SBO and intraoperative bowel injury, with markedly higher odds for development of SBO after bowel injury (AOR = 10.14, 95% CI: 3.09, 33.27, p = 0.0001) (**Table 2**). Notably, there was no difference in rate of bowel injury across the three hysterectomy approaches (p = .29). There was also a significant association between SBO and malignant uterine pathology, which remained after adjusting for potential confounders (AOR = 2.81, 95% CI: 1.14, 6.90, p = 0.02).

DISCUSSION

Our data suggests that SBO after hysterectomy is not uncommon, occurring after 2.4% of cases. The risk of SBO

Table 2.
Association of Small Bowel Obstruction with Route of Hysterectomy and Additional Risk Factors: Logistic Regression Models

	Univariable Analysis			Multivariable Model			Multivariable Model 2		
	OR	95% CI	*p*-Value	AOR	95% CI	*p*-Value	AOR	95% CI	*p*-Value
Route of hysterectomy (reference = abdominal)									
Laparoscopic	0.43	(0.20, 0.92)	**.0299**	0.54	(0.23, 1.23)	.1410			
Vaginal	0.10	(0.01, 0.76)	**.0255**	0.18	(0.02, 1.37)	.0968			
Laparoscopic + Vaginal	0.33	(0.16, 0.68)	**.0025**				0.44	(0.20, 0.98)	**0.0444**
Age	1.03	(1.00, 1.05)	**.0477**	1.01	(0.97, 1.04)	.6856	AOR's, 95% CI's and p-values very similar to multivariable model 1 and not shown		
BMI	1.01	(0.97, 1.06)	.5398	1.00	(0.95, 1.05)	.9179			
Tobacco use*	1.09	(0.38, 3.11)	.8705	1.09	(0.37, 3.20)	.8741			
Diabetes*	1.20	(0.50, 2.90)	.6816	0.79	(0.30, 2.08)	.6356			
Bowel injury*	12.48	(4.38, 35.51)	**<.0001**	10.14	(3.09, 33.27)	**.0001**			
Malignancy*	4.00	(2.09, 7.65)	**<.0001**	2.81	(1.14, 6.90)	**.0241**			
Estimated blood loss	1.11	(1.05, 1.18)	**.0002**	1.06	(1.00, 1.14)	.0678			
Prior cesarean section*	0.83	(0.38, 1.81)	.6347	0.84	(0.37, 1.92)	.6812			
Lysis of adhesions*	2.34	(1.20, 4.53)	**.0120**	1.82	(0.85, 3.89)	.1206			

CI, confidence interval; OR, odds ratio; AOR, adjusted odds ratio; BMI, body mass index.
n = 1630; 40 (2.4%) with small bowel obstruction.
*reference = no.

was significantly higher after abdominal hysterectomy when compared to minimally invasive hysterectomy.

In our study, after controlling for other variables, an abdominal approach to hysterectomy was significantly associated with SBO. Our findings contradict a similar study by Muffly et al., who demonstrated that hysterectomy route does not affect risk of SBO.[12] Their power analysis determined that 907 cases of SBO would need to occur in each group to achieve 80% power, a much greater number than they detected. While our study also had a relatively small number of SBO cases, our higher incidence of SBO makes detecting differences more attainable and may explain our conflicting results. This also likely accounts for why a difference was detected when the laparoscopic and vaginal cases were combined into one minimally invasive category.

In our sample, SBO occurred after 2.4% of hysterectomies. This is higher than the cited rate in the literature, which ranges from 0.12% to 1.1%.[10–13] Our higher rate of SBO is likely due to the inclusion of hysterectomies performed for malignant pathology, which is an established risk factor for SBO and was reflected in our results. Including malignant pathology was done as an effort to increase our power, as prior studies demonstrated that the low incidence of SBO limited the ability to investigate specific risk factors.[12] Given that malignancy may be an independent risk factor, it was adjusted for in the multivariate model, and we found that the increased risk of SBO after abdominal hysterectomy compared to the minimally invasive hysterectomy persisted.

Our results have several limitations. A potential flaw in our methodology was that we categorized converted cases as the final route rather than the intended route, which may have altered our results. Additionally, our baseline characteristics differed among the three groups; however, this is expected in observational studies and was adjusted for in the multivariable analysis.

An additional limitation inherent in our study design is that detecting our primary outcome, rate of SBO, is reliant on patient follow-up. There was a disparate rate of follow-up among the three modes of hysterectomy (p = .0255), and we may have underestimated the rate of SBO, as patients who were seen at other hospitals would not be captured. We demonstrated that 63% of patients continued to receive care at our institution up to 5 years postoperatively. Further, even if our rate of SBO is an underestimation, this strengthens our conclusion that SBO is an important surgical morbidity.

CONCLUSION

The present study adds to the body of literature demonstrating that hysterectomy incurs risk for SBO. After adjusting for confounders, abdominal hysterectomy was associated with a significantly higher risk for SBO when compared to minimally invasive hysterectomy. These findings provide additional support for a minimally invasive hysterectomy approach when feasible.

References:

1. Committee Opinion No 701. Choosing the route of hysterectomy for benign disease. *Obstet Gynecol.* 2017;129(6):e155–e159.

2. Orhan A, Ozerkan K, Kasapoglu I, et al. Laparoscopic hysterectomy trends in challenging cases (1995–2018). *J Gynecol Obstet Hum Reprod.* 2019;48(10):791–798.

3. AAGL position statement: route of hysterectomy to treat benign uterine disease. *J Minim Invasive Gynecol.* 2011;18(1):1–3.

4. Cohen SL, Vitonis AF, Einarsson JI. Updated hysterectomy surveillance and factors associated with minimally invasive hysterectomy. *JSLS.* 2014;18(3).

5. Foster NM, McGory ML, Zingmond DS, Ko CY. Small bowel obstruction: a population-based appraisal. *J Am Coll Surg.* 2006; 203(2):170-176.

6. Scott FI, Osterman MT, Mahmoud NN, Lewis JD. Secular trends in small-bowel obstruction and adhesiolysis in the United States: 1988-2007. *Am J Surg.* 2012;204(3):315–320.

7. Menzies D. Peritoneal adhesions. Incidence, cause, and prevention. *Surg Annu.*1992;24 Pt.1:27–45.

8. Monk BJ, Berman ML, Montz FJ. Adhesions after extensive gynecologic surgery: clinical significance, etiology, and prevention. *Am J Obstet Gynecol.* 1994;170(5 Pt. 1):1396–1403.

9. ten Broek RP, Issa Y, van Santbrink EJ, et al. Burden of adhesions in abdominal and pelvic surgery: systematic review and met-analysis. *BMJ.* 2013;347:f5588.

10. Al-Sunaidi M, Tulandi T. Adhesion-related bowel obstruction after hysterectomy for benign conditions. *Obstet Gynecol.* 2006;108(5):1162–1166.

11. Sheyn D, Bretschneider CE, Mahajan ST, Ridgeway B, Davenport A, Pollard R. Incidence and risk factors of early post-operative small bowel obstruction in patients undergoing hysterectomy for benign indications. *Am J Obstet Gynecol.* 2018.

12. Muffly TM, Ridgeway B, Abbott S, Chmielewski L, Falcone T. Small bowel obstruction after hysterectomy to treat benign disease. *J Minim Invasive Gynecol.* 2012;19(5):615–619.

13. Miller G, Boman J, Shrier I, Gordon PH. Etiology of small bowel obstruction. *Am J Surg.* 2000;180(1):33–36.