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Impact of obesity on outcomes of hysterectomy

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Abstract

Study Objectives—To evaluate the impact of obesity on complications of hysterectomy

Study Design—Retrospective cohort study

Design Classification—Canadian Task Force II-2

Setting—Department of Obstetrics and Gynecology, Women and Infants Hospital of Rhode Island (WIH)

Patients—Patients who had a hysterectomy at WIH between July 2006 and January 2009

Intervention—Hysterectomy by any mode

Measurements and Main Results—We collected data from medical records of all laparoscopic hysterectomies during the time period and collected data from a random subset of abdominal and vaginal hysterectomies. The independent variable, body mass index, was grouped according to World Health Organization guidelines. A composite of surgical complications was generated. Multivariable logistic regression was used to estimate adjusted odds ratios and 95% confidence intervals. We collected data from 907 hysterectomies and 29.9% (n=267) of the population was obese. Eighteen percent of patients (n=154) had at least one complication. Compared to non-obese women, obese women were at increased odds of having any complication (OR 1.62, 95% CI 1.12-2-34). Performing subgroup analyses by mode of hysterectomy and controlling for confounding factors, we were unable to detect differences odds of complications between obese and non-obese women who underwent either an abdominal, vaginal, or laparoscopic hysterectomy.

Conclusion—In our study, we found that among women who had a hysterectomy, obese women had a higher rate of complications than non-obese women.

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Keywords

complications; hysterectomy; obesity

Introduction

Approximately 600,000 hysterectomies are performed annually in the United States, making hysterectomy the second most common surgery for women.[1,2] The approach to hysterectomy can be abdominal, laparoscopic, or vaginal. Because of its advantages over abdominal and laparoscopic approaches for benign disease, vaginal hysterectomy, when feasible, is the mode of hysterectomy recommended by both the American College of Obstetricians and Gynecologists and the American Association of Gynecologic Laparoscopists.[3,4] Laparoscopic hysterectomy is suggested as an alternative to the abdominal approach because of advantages such as faster return to normal activity and shorter hospitalization. However, these advantages must be weighed against longer operating times and possible higher rates of lower urinary tract injuries.[3,5] These recommendations and suggestions are based on balancing the risks of mode of hysterectomy against the potential benefits that mode affords for women in general.

The effect of obesity on the safety and feasibility of surgical approaches and techniques is an issue gynecologic surgeons routinely face in practice. The prevalence of obesity has increased dramatically over the past few decades with the most recent population data indicating that 35% of American women meet criteria for obesity with a body mass index (BMI) greater than 30 kilograms per meters squared. [6] With the increasing prevalence of obesity, more and more obese women will undergo hysterectomy each year. While many clinicians may consider obesity as a risk factor for surgical complications of hysterectomy, the effect of obesity on the complication rates of hysterectomy has not been clearly delineated.

Currently results of studies on obesity and hysterectomy surgical complications are inconsistent. [7, 8, 9, 10] Clarifying the association between obesity and surgical complications could assist gynecologic surgeons in most appropriately counseling obese women about the risks of hysterectomy. The objective of this study was to compare complication rates of obese to non-obese patients undergoing hysterectomy.

Materials and Methods

We conducted a retrospective cohort study of hysterectomies performed at Women & Infants Hospital (WIH) between July 2006 and January 2009. This study was approved by the WIH IRB (09-0064, 10/7/2009). Using International Classification of Diseases, 9th Revision codes, Health Information Management generated a list of all patients who underwent a hysterectomy during the time period. For the purposes of this study, laparoscopic hysterectomy was defined as any hysterectomy performed with the guidance of laparoscopy and included total laparoscopic hysterectomy (TLH), laparoscopic supracervical hysterectomy (LASH), and laparascopically-assisted vaginal hysterectomy (LAVH). We collected data from all laparoscopic hysterectomies performed at our institution during the

time period and collected data from a random subset of abdominal and vaginal hysterectomy, matched to the laparoscopic cases by year of surgery.

We reviewed both electronic and paper-based medical records and collected data on standardized forms. Data included height and weight, co-morbid conditions, previous surgeries, indications for surgery, length of surgery, estimated blood loss, intra-operative findings, uterine weight, surgical length, conversion to laparotomy, length of hospital stay, and surgical complications. We generated variables for estimated blood loss greater than the 90^{th} percentile, length of surgical procedure greater than the 90^{th} percentile, and length of hospital stay greater than the 90^{th} percentile based on the distribution of each variable among all patients.

We collected data on surgical complications which occurred within 3 months of surgery. These complications included urologic injury, intestinal injury, blood vessel injury, trocar site hernia, sepsis, venous thromboembolism, pulmonary embolism, myocardial infarction, and need for re-operation, pelvic hematoma, vaginal non-healing, vaginal bleeding, pelvic infection, wound cellulitis, transfusion, ileus, pneumonia, urinary tract infection, or estimated blood loss greater than the 90^{th} percentile. “Other” possible major and minor complications not otherwise listed were recorded by investigators on the data collection sheet.

The main independent variable, body mass index (BMI), was calculated by dividing the patient's weight in kilograms by the square of height in meters. For analyses, normal weight was defined as BMI less than 25 kilograms per meters squared, overweight was defined as BMI equal to 25 kilograms per meters squared up to 30 kilograms per meters squared, and obese was defined as BMI greater than 30 kilograms per meters squared. Mode of hysterectomy was classified as abdominal (total abdominal and abdominal supracervical), vaginal, and laparoscopic (TLH, LASH, and LAVH). We also performed subgroup analyses of complications by stratifying the population into the following groups: hysterectomy for benign disease with no concomitant staging or prolapse procedure, hysterectomy with suspected malignancy and/or staging procedures, hysterectomy with concomitant prolapse procedures. For the purposes of this study, “prolapse procedures” were defined as any surgical procedure for urinary incontinence, fecal incontinence, or pelvic organ prolapse at the time of hysterectomy. For these analyses we compared the incidence of complications (composite) between obese women and non-obese women who underwent hysterectomy.

For our power and sample size calculations, we assumed an alpha of 0.05 and a beta of 0.20. Assuming that 30% of patients would be obese and estimating a 10% incidence of major complications in non-obese women and setting our minimal detectable difference at 10%, we needed 438 women for these analyses.[1] Because we were interested in looking specifically at the subgroup who underwent a simple laparoscopic hysterectomy and planned to control for concomitant staging or prolapse procedures in our analyses, we collected data from all hysterectomies that were coded by health information management as laparoscopic (n=541). From the list of all other hysterectomies identified by health information management using ICD-9 codes, we selected at a ratio of 3 laparoscopic hysterectomies (n=541) to one vaginal hysterectomy (n=183) and one abdominal hysterectomy (n=183), a

random subset matched to the laparoscopic hysterectomies by year of surgery. Final sample numbers could differ from our original projected sample because mode of hysterectomy as defined by our study could differ from mode of hysterectomy coded by health information management.

Categorical variables were analyzed using Fisher's exact test. Continuous variables were summarized by means, medians, and ranges. We tested differences between groups using analysis of variance or the Kruskal-Wallis test. Multivariable logistic regression was performed to estimate the association between obesity and surgical complications. Models were used to adjust for variables considered to be confounders in the relationship between obesity and complications. Exact 95% confidence intervals were calculated when the number of outcomes was small. Data were analyzed using SAS 9.2.

Results

We collected data from a total of 907 hysterectomies conducted between July 2006 and January 2009. For all analyses we removed patients with BMI not recorded (n=10) and patients with a major non-gynecologic procedure concomitantly performed (n=4). A total of 893 patients who had undergone hysterectomy were included in the original analyses; This sample included 546 laparoscopic hysterectomies, 171 abdominal hysterectomies, and 176 vaginal hysterectomies. Of these patients, 38% (n=341) were normal weight, 31.9% (n=285) were overweight, and 29.9% (n=267) were obese. The mean BMI of obese women was 35.7 kilograms per meters squared.

First we compared all hysterectomies by category of BMI. (Table 1) We found that, compared to normal weight women, obese women were older (51 years versus 48 years, p=0.01) and were less likely to have an operative diagnosis of pain (11.6% versus 19%, p=0.0002) or endometriosis (0.7% versus 7.6%, p<0.0001). We also found that obese women were more likely to have a diagnosis of suspected malignancy (22.8% versus 17.3%, p=0.01), have had previous abdominal surgery (71.5% versus 61.3%, p=0.003), have medical co-morbidities including coronary artery disease or hypertension (44.6% versus 20.2%, p<0.0001) and diabetes mellitus (11.2% versus 1.8%, p<0.0001).

Looking at characteristics of the surgery, obese women had a longer duration of surgery, greater estimated blood loss, longer duration of hospitalization, and larger uteri. Mode of hysterectomy did not differ between obese, overweight, and normal weight women.

The overall rate of complications in our study population was 18%. Comparing rates of complications by body mass index, we found that obese women had higher rates of any complication than non-obese women (23.6% versus 15.6%, p=0.007). (Table 2) After adjusting for previous cesarean section, previous abdominal surgery, post-operative diagnosis of malignancy, concomitant staging procedure, and concomitant prolapse procedure, obese women had 1.66 times the odds of non-obese women of having a complication (95% CI 1.12 to 2.34).

We stratified these analyses by mode of hysterectomy and found that the rate of complications for abdominal hysterectomy was 32.9%, vaginal hysterectomy 15.3%, and

laparoscopic hysterectomy 14%. Among obese women, the rates of complications were 33.8% for abdominal hysterectomies, 22% for vaginal hysterectomies, and 19.2% for laparoscopic hysterectomies. Performing subgroup analyses by mode of hysterectomy, we were unable to detect differences in rates or odds of complications between obese and non-obese women who underwent either an abdominal hysterectomy or vaginal hysterectomy. Looking at women who had a laparoscopic hysterectomy, obese women had a slightly increased rate of complications compared to non-obese women (19.2% versus 12.2%, p=0.04). However, once we controlled for previous surgery, malignancy, and concomitant procedures, obese women who underwent laparoscopic hysterectomy were not at increased odds of having a complication compared to non-obese women (OR=1.67, 95% CI 0.98-2.83)

We collected data on specific complications experienced by women who underwent hysterectomy. (Table 3) The overall incidence of urologic injury was 1.5%, bowel injury was 0.6%, blood vessel injury was 0.2%, and need for re-operation was 1.6%. Comparisons of individual complications were underpowered to detect differences between obese and non-obese women and the only significant finding was that compared to non-obese women, obese women had an increased risk of surgical blood loss > 500 ccs (OR=2.15, 95% CI 1.34-3.47).

We then stratified the analyses to look specifically at hysterectomies performed for benign disease with no staging or prolapse procedure, hysterectomies with suspected malignancy and/or concomitant staging, and hysterectomies with concomitant prolapse procedures. (Table 4) In the subpopulations of women who had hysterectomies without concomitant staging or prolapse procedures and women who had hysterecomies with concomitant staffing procedures only, we found no difference in incidence of complications between normal weight, overweight, and obese women. Among women who had hysterectomies with concomitant staging or prolapse procedures, we found that obese women had increased odds of minor complications (OR= 2.48, 95% CI 1.12-5.48) when compared to non-obese women. For all three strata, major complications, surgery duration greater than the 90th percentile, and hospital stay greater than the 90th percentile did not differ by category of BMI.

Comments

Given approximately 600,000 hysterectomies are performed in the United States each year and up to 35% of American women are obese, likely over 200,000 hysterectomies are performed annually for obese women. In our study, we found that among women who had a hysterectomy, obese women had a higher rate of complications than non-obese women. When we stratified by mode of hysterectomy and controlled for potential confounders, there were no statistically significant differences in complications between obese and non-obese women within each mode of hysterectomy sub-group. However, similar to other studies on complications of hysterectomy and obesity, our failure to detect differences in complication rates in these subgroup analyses may either represent a true lack of differences between groups or a lack of statistical power. [7]

Previous studies which have looked at the effect of obesity on the complication rates of hysterectomy have produced conflicting results. Similar to the findings of our study, two large studies of hysterectomies performed for benign indications showed that obesity was associated with increased risk of surgical complications. [8, 9] A recent study on laparoscopic hysterectomy showed increasing risk of complications with increasing BMI. [10] However, Chopin et al found in a retrospective cohort study of 1400 women who underwent laparoscopic hysterectomy for benign indications, that there was no difference in complication rates between obese and non-obese women.[7] Other studies specifically investigating complications of laparoscopic hysterectomy for benign indications,[11, 12] laparoscopic hysterectomy for uterine cancers,[13] abdominal hysterectomy, [14, 15] and vaginal hysterectomy[16] reported no difference in complications between obese and non-obese women. Though given the rarity of individual complications and small sample sizes in several of these studies, failure to detect a difference in complications between obese and non-obese women does not necessarily mean that there is no difference in complication rates and results of these studies should be reviewed carefully. [7]

Differences in study findings may be secondary to differences in definitions of complications, differences in study populations, or lack of statistical power to adequately determine differences between groups. In contrast to most previous studies, we did not focus only on simple hysterectomies performed for benign indications and we did not focus solely on one mode of hysterectomy. We included hysterectomies performed for any indication, including malignancy, and performed concomitantly with other gynecologic procedures, including complex prolapse procedures. Because of this, our results may differ from other studies. Another reason for differences is that the recording of complications across studies is inconsistent. Studies in general surgery literature and recent studies in the gynecologic literature have classified complications using the validated Clavien-Dindo system, which ranks complication severity based on the therapy used to treat the complication. [15, 17, 18] We would consider using this validated system in future studies on complications of hysterectomy, as it may lead to more consistent reporting of complications across studies, facilitate combination of data across study centers, and facilitate utilization of data for meta-analyses

Generating data on risks of hysterectomy complications may assist with realistic pre-operative counseling of surgical risk. We found that obese women who had a laparoscopic hysterectomy were not at increased odds of complications when confounding factors, including concomitant procedures, malignancy, history of prior abdominal surgery, were taken into consideration. Given the retrospective study design we are limited in our ability to appropriately compare complications rates by mode of hysterectomy. However, based on our findings it appears that among obese women, laparoscopic hysterectomy, at the least, does not appear to have increased complications than abdominal hysterectomy. Though studies specifically examining the safest mode of hysterectomy for benign indications in obese women have been limited, David-Montefiore et al. found that the abdominal route was associated with increased complications in obese women.[8] These findings suggest that vaginal and laparoscopic hysterectomy, when appropriate and feasible, may be preferable to abdominal hysterectomy for obese women.

Strengths of this study include the comprehensive nature of electronic medical records, the reliability of accurate recording of BMI in anesthesia records for all surgical patients, and the collection of data from a broad spectrum of hysterectomies (mode, indication, concomitant procedures) at our institution. Our study is limited by the fact that it is a retrospective study conducted at a single institution. Although it would be very interesting to look at the subset of obese women and determine risk factors among these women for surgical complications (such as suboptimal antibiotic use, indwelling catheter practices, and method of venous thromboembolism prophylaxis), it is not possible within the context of the data we collected. If indeed some of these other practices that could be associated with complications (such as infections and blood loss) are influenced by the patient's BMI, it is still the body mass index/obesity affecting clinical practice which then may affect the complication rate.

Also, route of hysterectomy was chosen by the surgeon and is often influenced surgeon experience and by factors that can make a procedure more difficult such as prior surgeries, possibility of malignancy, suspected adhesions, and uterine size.[8] Hysterectomies which were anticipated to be more difficult may have been more likely to be performed abdominally and more difficult cases are more likely to have complications. Because of this, we controlled for several confounders in our regression and chose not to directly compare complications by mode of hysterectomy. Though not used in this study, a validated surgical complexity score could have assisted with the analyses of these data. We did not collect data on surgeon experience for this study. How surgeon experience may have affected our results is uncertain. One consideration is that it is possible that more experienced surgeons, who, in fact have lower complications rates, would be more likely to be the individuals performing hysterectomies on complicated or obese patients. That would actually bias our results toward the null and make our study less likely to find a difference in complication rates between obese and non-obese women.[19]

Another limitation is that complications that were recognized and treated at outpatient visits and not at the hospital (such as a urinary tract infection or uncomplicated wound cellulitis) may not have been recorded in the electronic medical record and our rates of complications may be underestimated. It is also possible that patients could seek care for a surgical complication at another institution. However, in our experience, the majority of patients continue to seek care at our institution because of its accessible gynecologic services. Patients who receive a hysterectomy at our institution are instructed to seek post-operative care with their gynecologist or seek emergency care at our women's emergency room, which has coverage by obstetricians-gynecologists 7 days per week, 24 hours per day. It is unlikely that patient follow-up at outside institutions or offices would affect the main results of this study, the affect of body mass index on complication rate, because site of care for complications was likely not affected by whether or not a patient was obese.

Truly understanding the risks obesity poses to hysterectomy procedures could assist surgeons in clearly discussing realistic risks of complications with their patients. Despite its limitations, this study makes an important contribution to the literature. Obese women undergoing hysterectomy may be at higher risk for minor complications than non-obese women. The impact that mode of hysterectomy has on this relationship between obesity and

complications is uncertain, though this study adds evidence that laparoscopic hysterectomy is safe for obese women and may be preferable to abdominal hysterectomy given the other advantages it affords. However, more research is necessary to definitively compare the safety of modes of hysterectomy for obese women.

Acknowledgments

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Precis

Compared to non-obese women, obese women undergoing hysterectomy have increased odds of complications.

Table 1

Demographic, patient, and surgical characteristics by category of body mass index (n=893)

		Body Mass Index[a]			
Variable	***Total***	***Normal***	***Overweight***	***Obese***	***P value***
Total, row %	893	341 (38.2)	285 (31.9)	267 (29.9)	
BMI					
Mean (SD)	27.9 (6.4)	22.2 (1.9)	27.4 (1.4)	35.7 (5.1)	<0.0001
Age (y)					
Mean (SD)	49.3 (11.9)	48.2 (11.9)	49.2 (11.7)	51.0 (12.1)	0.01
Parity					
Median (IQR)	2 (1-3)	2 (1-2)	2 (2-3)	2 (1-3)	<0.0001
Insurance					
Private	701 (79.3)	274 (80.8)	213 (75.5)	214 (81.4)	0.4
Public	170 (19.2)	60 (17.7)	65 (23.0)	45 (17.1)	
None	13 (1.5)	5 (1.5)	4 (1.4)	4 (1.5)	
Documented Diagnosis					
AUB	324 (36.3)	119 (34.9)	105 (36.8)	100 (37.5)	0.8
Pain	167 (18.7)	64 (18.8)	72 (25.3)	31 (11.6)	0.0002
Symptomatic fibroids	209 (23.4)	81 (23.8)	66 (23.2)	62 (23.2)	1.0
Prolapse	169 (18.9)	70 (20.5)	60 (21.1)	39 (14.6)	0.09
Suspected malignancy	158 (17.7)	59 (17.3)	38 (13.3)	61 (22.8)	0.01
Endometriosis	49 (5.5)	26 (7.6)	21 (7.4)	2 (0.7)	<0.0001
Previous abdominal surgery	599 (68.1)	206 (61.3)	205 (73.0)	188 (71.5)	0.003
Medical comorbidities					
CAD/HTN	255 (28.6)	69 (20.2)	67 (23.5)	119 (44.6)	<0.0001
Pulmonary disease	149 (16.7)	44 (12.9)	49 (17.2)	56 (21.0)	0.03
DM	55 (6.2)	6 (1.8)	19 (6.7)	30 (11.2)	<0.0001
Duration of surgery (min)					
Median (Range)	123 (21-420)	120 (28-369)	122 (21-420)	130 (34-321)	0.02
Type of hysterectomy*					
Abdominal	171 (19.1)	63 (18.5)	43 (15.1)	65 (24.3)	0.1
Vaginal	176 (19.7)	69 (20.2)	55 (19.3)	52 (19.5)	
LAVH	294 (32.9)	106 (31.1)	100 (35.1)	88 (33.0)	
TLH/LASH	252 (28.2)	103 (30.2)	87 (30.5)	62 (23.2)	
EBL (cc)					
Median (Range)	200 (10-2700)	200 (20-1500)	200 (25-1700)	300 (10-2700)	<0.0001

		Body Mass Index[a]			
Variable	***Total***	***Normal***	***Overweight***	***Obese***	***P value***
Duration of hospitalization (days)					
Median (Range)	2 (0-17)	2 (1-17)	2 (0-7)	2 (1-15)	<0.0001
Other procedures					
USO or BSO	419 (46.9)	154 (45.2)	130 (45.6)	135 (50.6)	0.4
Prolapse	197 (22.1)	71 (20.8)	62 (21.8)	64 (24.0)	0.6
Staging	131 (14.7)	50 (14.7)	27 (9.5)	54 (20.2)	0.002
Lysis of adhesions	60 (6.7)	21 (6.2)	25 (8.8)	14 (5.2)	0.2
Uterine size (g)					
Median (Range)	106 (2-1542)	100 (19-1111)	105.5 (18-1060)	116 (2-1542)	0.02

Abbreviations: AUB= abnormal uterine bleeding; BSO= bilateral salpingo-oophorectomy; CAD/HTN=coronary artery disease/hypertension' DM = diabetes mellitus; EBL= estimated blood loss; IQR= Interquartile range; LAVH = laparoscopically-assisted vaginal hysterectomy; SD= standard deviation; TLH/LASH = total laparoscopic hysterectomy/laparoscopic supracervical hysterectomy; USO= unilateral salpingo-oophorectomy

[a]Data are number (column %) unless otherwise indicated. Percentages may not sum to 100 due to rounding

Table 2

Surgical complication analyzed by body mass index, stratified by mode of hysterectomy (n=854)[a]

Procedure and complications	N	Non-Obese	Obese	P	Crude OR (95% CI)	Adjusted OR (95% CI)[b,c]
All patients	854	595	259			
	154 (18.0)	93 (15.6)	61 (23.6)	0.007	1.66 (1.16-2.39)	1.62 (1.12-2.34)
Abdominal	170	102	68			
	56 (32.9)	33 (32.4)	23 (33.8)	0.9	1.07 (0.56-2.05)	0.82 (0.40-1.69)
Vaginal	163	113	50			
	25 (15.3)	14 (12.4)	11 (22.0)	0.2	2.00 (0.83-4.77)	1.98 (0.83-4.75)
Laparoscopic	521	380	141			
	73 (14.0)	46 (12.1)	27 (19.2)	0.04	1.72 (1.02-2.89)	1.67 (0.98-2.83)

[a] Data are N (column %)

[b] The “all patients”, “abdominal”, and “laparoscopic” subgroup analyses were adjusted for previous cesarean section, previous abdominal surgery, post-operative diagnosis of malignancy, concomitant staging procedure, and concomitant prolapse procedure.

[c] The “vaginal” subgroup analyses were adjusted only for concomitant prolapse procedures; Other variables with a zero count

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Table 3

Specific complications analyzed by Body Mass Index (n=893)

		Body Mass Index				
Variable	***Total***	***Normal <25***	***Overweight 25-<30***	***Obese 30+***	***P value***	***OR (95% CI); p Obese vs. non-obese***
Total, row %	893	341 (38.2)	285 (31.9)	267 (29.9)		
Any complication[a]	161 (18.0)	58 (17.0)	39 (13.7)	64 (24.0)	0.007	1.72 (1.21-2.45); p=0.003
Urologic/Cystotomy	13 (1.5)	6 (1.8)	6 (2.1)	1 (0.4)	0.2	0.19 (0.005-1.31)[b]; p=0.1
Bowel injury	5 (0.6)	1 (0.3)	2 (0.7)	2 (0.8)	0.6	1.57 (0.13-13.76)[b]; p=0.6
Blood vessel injury	2 (0.2)	1 (0.3)	0	1 (0.4)	0.8	2.35 (0.03-184.73)[b]; p=0.5
Need for reoperation	14 (1.6)	5 (1.5)	2 (0.7)	7 (2.6)	0.2	2.38 (0.83-6.86); p=0.1
Pelvic hematoma	7 (0.8)	1 (0.3)	3 (1.1)	3 (1.1)	0.4	1.77 (0.26-10.52)[b]; p=0.4
Vaginal bleeding	13 (1.5)	7 (2.1)	2 (0.7)	4 (1.5)	0.3	1.04 (0.23-3.78)[b]; p=1.0
Pelvic infection	4 (0.5)	1 (0.3)	2 (0.7)	1 (0.4)	0.8	0.78 (0.01-9.78)[b]; p=1.0
Pneumonia	2 (0.2)	1 (0.3)	1 (0.4)	0	1.0	n/a
Urinary tract infection	10 (1.1)	3 (0.9)	1 (0.4)	6 (2.3)	0.1	3.57 (0.84-17.34)[b]; p=0.07
Wound cellulitis	8 (0.9)	3 (0.9)	0	5 (1.9)	0.05	3.96 (0.76-25.66)[b]; p=0.06
Need for transfusion	16 (1.8)	9 (2.6)	4 (1.4)	3 (1.1)	0.4	0.54 (0.15-1.90); p=0.4
Ileus	9 (1.0)	6 (1.8)	1 (0.4)	2 (0.8)	0.2	0.67 (0.07-3.54)[b]; p=1.0
Other[c]	21 (2.4)	7 (2.1)	5 (1.8)	9 (3.4)	0.5	1.78 (0.74-4.29); p=0.2
Estimated blood loss >90th % (>500cc)	76 (8.5)	22 (6.5)	19 (6.7)	35 (13.2)	0.008	2.16 (1.34-3.47); p=0.002

[a] No cases of trocar site hernia, sepsis, VTE, PE, MI

[b] exact 95% CI.

[c] Other included respiratory acidosis, small bowel obstruction, mild congestive heart failure, adrenal insufficiency, atelectasis, heart block, trocar site hematoma, urinary retention, new onset atrial fibrillation, re-admission (but no re-operation) nerve palsy from positioning, unintended removal of an ovary, uterine perforation with manipulator, vaginal laceration, vaginal cuff seroma

Table 4

Complication rate, surgery duration, and hospitalization duration for hysterectomies analyzed by body mass index, stratified by malignancy and/or concomitant staging and for concomitant prolapse procedures (n=893)

		BMI				
Variable	***Total***	***Normal <25***	***Overweight 25-<30***	***Obese 30+***	***P value***	***OR (95% CI); p Obese vs. non-obese***
Benign, no staging, no prolapse, total	535	210 (39.3)	183 (34.2)	142 (26.5)		
Any complication	85 (15.9)	35 (16.7)	22 (12.0)	28 (19.7)	0.2	1.45 (0.88-2.39); p=0.2
Surgery duration >90th %[a]	14 (2.6)	6 (2.9)	5 (2.7)	3 (2.1)	0.9	0.76 (0.13-2.93)[b]; p=1.0
Hospital stay >90th %[c]	8 (1.5)	3 (1.4)	2 (1.1)	3 (2.1)	0.8	1.67 (0.26-8.73)[b]; p=0.4
Malignancy and/or Staging only, total	161	60 (37.3)	40 (24.8)	61 (37.9)		
Any complication	45 (28.0)	14 (23.3)	10 (25.0)	21 (34.4)	0.4	1.66 (0.83-3.35); p=0.2
Surgery duration >90th %[a]	18 (11.2)	6 (10.0)	5 (12.5)	7(11.5)	0.9	1.05 (0.38-2.87); p=1.0
Hospital stay >90th %[c]	24 (14.9)	11 (18.3)	3 (7.5)	10 (16.4)	0.3	1.20 (0.50-2.91); p=0.8
Prolapse only, total	190	68 (35.8)	61 (32.1)	61 (32.1)		
Any complication	30 (15.8)	8 (11.8)	7 (11.5)	15 (24.6)	0.09	2.48 (1.12-5.48); p=0.03
Surgery duration >90th %[a]	50 (26.5)	16 (23.5)	15 (24.6)	19 (31.7)	0.5	1.47 (0.74-2.88); p=0.3
Hospital stay >90th %[c]	2 (1.1)	0	0	2 (3.3)	0.2	---[d]

[a] Surgery duration >90th %ile = >213 minutes

[b] Hospital stay >90th %ile = > 4 days

[c] Exact 95% CI for odds ratio.

[d] Unable to calculate finite value with confidence interval given zero count in a cell