

Robotic-Assisted Laparoscopic Hysterectomy: Outcomes in Obese and Morbidly Obese Patients

Taryn Gallo, MD, Shabnam Kashani, MD, Divya A. Patel, PhD, Karim Elshawi, MD, Dan-Arin Silasi, MD, Masoud Azodi, MD

ABSTRACT

Objective: To describe patient characteristics and perioperative outcomes among women undergoing robotic-assisted laparoscopic hysterectomy and to evaluate the characteristics of nonobese, obese, and morbidly obese patients.

Methods: A retrospective review was conducted of 442 cases of women who underwent robotic-assisted laparoscopic hysterectomy for benign and malignant conditions over a 4-y period at an academic and community teaching hospital. Patient demographics, surgical indications, operative outcomes, and complications were evaluated for patients with a body mass index (BMI) <30 kg/m², 30 kg/m² to 39.9 kg/m², and ≥ 40 kg/m².

Results: Of the 442 patients, 257 (58%) were obese or morbidly obese, with a BMI of ≥ 30 kg/m². Overall, the median estimated blood loss was 100 mL (range, 10 to 800), the operative time was 135 min (range, 40 to 436), and the length of stay was 1 d (range, 0 to 22). These did not differ significantly by BMI group. Overall, 11.9% of patients experienced complications (7.9% minor, 4.1% major), and this did not differ significantly across BMI groups.

Conclusion: Robotic hysterectomy can be performed safely in obese and morbidly obese patients, with surgical outcomes and complications similar to those in nonobese patients.

Yale New Haven Health/Bridgeport Hospital, Department of Obstetrics & Gynecology, Minimally Invasive Gynecologic Surgery Fellowship Program, Bridgeport, CT, USA (Drs. Gallo, Kashani).

Yale University School of Medicine, Department of Obstetrics, Gynecology & Reproductive Sciences, New Haven, CT, USA (Dr. Patel).

Yale University School of Medicine, Department of Obstetrics, Gynecology & Reproductive Sciences, Gynecology Oncology Section, New Haven, CT, USA (Drs. Elshawi, Silasi, Azodi).

The Minimally Invasive Surgical Fellowship Program at Bridgeport Hospital has received an educational grant from Intuitive Surgical.

Address correspondence to: Masoud Azodi, MD, Dept. of OB/GYN, Section of Gyn-Oncology, Yale University School of Medicine, 333 Cedar Street, New Haven, CT 06510, USA., Telephone: (203) 785-4013, Fax: (203) 785-6782, E-mail: Masoud.azodi@yale.edu

DOI: 10.4293/108680812X13462882735890

© 2012 by JSLS, *Journal of the Society of Laparoendoscopic Surgeons*. Published by the Society of Laparoendoscopic Surgeons, Inc.

Key Words: Robotic hysterectomy, Laparoscopic hysterectomy, Obesity, Morbid obesity.

INTRODUCTION

According to the World Health Organization, over one-third of women in the United States are considered obese.¹ Obesity and its comorbidities are well-known risk factors that affect surgical outcomes. With over half a million hysterectomies performed annually in the United States, the importance of investigating minimally invasive techniques remains paramount.²

Several studies have assessed outcomes in obese patients (BMI >30 kg/m²) undergoing laparoscopic hysterectomy and have shown it to be safe.³⁻¹³ However, several of these studies have noted that for the obese patient there are longer operative times, increased risk of hemorrhage, and higher laparotomy conversion rates.^{3,7-9,12}

Few gynecologic studies have addressed the role of robotic surgery in the treatment of the morbidly obese patient.^{8,10,12} Robotic surgery has addressed some of the difficulties surgeons encounter with laparoscopy. With the functional use of a stable platform, 3-dimensional views, motion scaling, and wristed instruments, some surgeons believe it has lowered the learning curve for laparoscopic hysterectomy with its intuitive operating capabilities.

In our experience, computer-assisted robotic surgery allows for easier laparoscopic maneuvering, especially in the obese and morbidly obese patients. Due to the increased thickness of subcutaneous tissue in obese patients, cases can be physically demanding for the surgeon. The robotic system diminishes surgeon strain. It also can potentially reduce trauma to the subcutaneous tissue by utilizing appropriate port placement.

The objective of our study was to describe patient characteristics and perioperative outcomes among women undergoing robotic-assisted laparoscopic hysterectomy (RALH) for benign and malignant conditions, and to determine whether these varied among patients who were nonobese, obese and morbidly obese.

METHODS

This study was approved by the Institutional Review Board at our institutions. A retrospective review of short-term clinical outcomes was performed for all patients who underwent RALH for both benign and malignant indications from September 2006 to October 2010 in a single surgeon's teaching practice. All procedures were teaching cases, assisted by a categorical obstetrics and a gynecology resident or fellow at both an academic and community-based teaching hospital. The data were extracted from a database of all the surgeon's patients who underwent robotic-assisted surgery. The database was created using data from the electronic medical record, including records from the operating room, anesthesia and pathology, and supplemented with information from the outpatient clinical records when necessary. Abstracted information included patient demographics, surgical indication and procedure, the duration of the procedure, laparotomy conversion rate, intraoperative and postoperative complications, readmissions, and reoperations. Detailed case reviews were performed for any patient who experienced a complication, readmission, or reoperation.

Patients were included in the study if they underwent RALH for benign gynecologic indications, occult ovarian cancer, early cervical cancer, or early endometrial cancer. Patients were excluded if there was metastatic disease, visibly apparent ovarian cancer, endometrial cancer beyond surgical stage 2A, or cervical cancer beyond surgical stage 1B1. No patients were refused the robotic approach based on BMI. Primary outcomes were length of procedure, rate of conversion to laparotomy, length of hospital stay, and complication rates.

The primary indicator for surgery is listed as the preoperative diagnosis. The postoperative diagnosis was obtained from the final pathology report. General gynecology indications for hysterectomy included abnormal bleeding, pelvic mass, pelvic pain, genetic predisposition (including BRCA mutation and Lynch syndrome), pelvic organ prolapse, and cervical dysplasia. Patients with a BRCA gene mutation are offered elective hysterectomy at the time of bilateral salpingo-oophorectomy secondary to the possible increased risk of cancer in the cornual fallopian tube. Oncologic indications included endometrial hyperplasia, early endometrial cancer, early cervical cancer, and occult ovarian cancer.

Body mass index (BMI) was calculated by a person's weight in kilograms divided by their height in meters squared. Using World Health Organization criteria, the

obese group consisted of patients with a BMI >30 kg/m². The morbidly obese group consisted of patients with a BMI ≥ 40 kg/m². Operative time was defined as time from skin incision to skin closure. Although some patients had additional procedures, such as lysis of adhesions, pelvic floor repair, lymph node dissection, treatment of endometriosis, ureterolysis, and cystoscopy, the specific times for these procedures were not recorded. Therefore, the operative time includes the time for these additional procedures. Blood loss measurements were obtained from anesthesia and surgical records. Intraoperative blood loss was estimated by the surgeon and the anesthesia team by calculating the difference between the amount of fluid irrigated and aspirated during the case. The length of stay was calculated by subtracting the date of surgery from the date of discharge.

Complications were defined as any adverse events occurring intraoperatively or within 3 mo of original procedure date. Complications were categorized as bacteremia, blood transfusion, bowel injury, fever, hemorrhage, ileus, pelvic abscess, pulmonary or urinary complication, urinary tract infection, vaginal cuff cellulitis, vaginal cuff dehiscence, or vessel injury. These complications were classified as major if they required hospital readmission or reoperation. Minor complications were classified as those that did not require readmission or reoperation. Bacteremia was diagnosed for any patient with positive blood cultures and signs or symptoms of sepsis. Fever was defined by a body temperature of 38°C (101°F) or higher on 2 separate occasions at least 6 h apart. Urinary complications included injuries to the ureters or bladder. Hemorrhage was defined as estimated blood loss >500 mL.

All robotic operations were performed using the 4-arm Da Vinci Surgical System (Intuitive Surgical, Mountain View, CA) model S or Si with a 5-port technique. The variations in surgical technique were minimal. In most patients, a sponge stick with the Colpo-pneumo Occluder balloon was inserted in the vagina. In the first 30 patients, a Koh Colpotomizer System (CooperSurgical, Trumbull, CT) in conjunction with a RUMI Uterine Manipulator (CooperSurgical, Trumbull, CT) and a Colpo-pneumo Occluder balloon were inserted prior to port placement. The ports were placed in a sunrise distribution centered around the camera port. After insertion of the laparoscopic ports, the patients were tilted in a steep Trendelenburg position to mobilize the bowel out of the pelvis. The Trendelenburg position was then reversed to the minimum amount needed to keep the bowel out of the pelvis. The robot was positioned between the patient's legs; once the robot was docked, the surgeon sat at the console and performed the

operation. The surgery was performed either by the teaching surgeon, fellow, or the rotating gynecology resident with the teaching surgeon's direct supervision. EndoWrist instruments were attached to each arm. The usual robotic instruments used were Hot Shears (monopolar curved scissors) with tip cover accessory and power setting 40W for arm 1, fenestrated bipolar forceps with power setting 40W for arm 2, and Prograsp forceps for arm 3. Vascular pedicles were coagulated and transected by the scrubbed assistant with a 5 mm or 10 mm LigaSure sealer/divider (Valleylab, Boulder, CO). The assistant also performed suction and irrigation (Suction Irrigator, Vital Concepts, Grand Rapids, MI) and retraction to expose the operative field.

Statistical Analysis

Patient demographics, surgical indications, operative outcomes, and complications were described across the 3 BMI groups (nonobese, obese, and morbidly obese). First, the distributions of continuous variables (patient and operative characteristics) were assessed for normality using the Shapiro-Wilk test. As these variables were found to be non-normally distributed (all Shapiro-Wilk test P-values <0.05), patient and operative characteristics were reported as medians and ranges. Their distributions were then compared across BMI groups using the nonparametric Kruskal-Wallis test. Distributions of perioperative (preoperative and postoperative) diagnoses and complications were compared across BMI groups using the χ^2 test or Fisher's exact test where appropriate. P-values <0.05 were considered statistically significant. All statistical analyses were performed using SAS 9.2 (SAS Institute, Inc., Cary, NC). Post power calculations were performed using nQuery Advisor (Statistical Solutions Ltd, Cork, Ireland). For the primary outcome, operative time, a total of 4322 women would be needed to detect the differences across BMI groups with 80% power.

RESULTS

During the study period, 442 women underwent RALH and met inclusion criteria. Of these patients, 257 (58%) were obese with a BMI of ≥ 30 kg/m² and 101 (23%) were morbidly obese with a BMI ≥ 40 kg/m². Overall, the median BMI was 31.7 kg/m² (range, 16.5 to 63). The median BMI for the nonobese group was 25.1 kg/m² (range, 16.5 to 29.9). For the obese group, it was 34.3 kg/m² (range, 30 to 39.9), and the value for the morbidly obese group was 44.3 kg/m² (range, 40 to 63). The median age for all patients was 52 y (range, 28 to 89). There were no significant differences among BMI groups with respect to age or height (**Table 1**).

Preoperative and postoperative diagnoses are shown in **Table 2**. There was a significant difference among BMI groups in the proportion of patients with endometrial hyperplasia ($P = .001$) and endometrial cancer ($P = .002$). As expected, the proportion of patients with endometrial hyperplasia and endometrial cancer was higher in the obese and morbidly obese BMI groups. There was also a difference noted in the number of patients with cervical cancer among the BMI groups ($P < .0001$), with the nonobese group having a higher proportion of patients with cervical cancer. Although there is no clear explanation for this difference among the groups, the high prevalence of cervical cancer in our population should be noted.

Overall, the median estimated blood loss was 100 mL (range, 10 to 800), the operative time was 135 min (range, 40 to 436), and the length of stay was 1 d (range, 0 to 22). Operative characteristics by BMI group are shown in **Table 3**. There were no statistically significant differences in estimated blood loss, operative time, or length of stay across BMI groups. Although there was a difference noted across BMI groups in the proportion of patients with a postoperative diagnosis of uterine myomata ($P = .03$),

Table 1.
Patient Characteristics by Body Mass Index

	BMI <30 (n=185) Median (Range)	BMI 30-39.9 (n=156) Median (Range)	BMI ≥ 40 (n=101) Median (Range)	P-value ^{ab}
Age (years)	51 (28-59)	55 (32-81)	54 (35-84)	0.25
Height (cm)	163 (135-178)	161 (130-183)	163 (150-183)	0.12
Weight (kg)	64 (44-137)	89 (69-122)	118 (59-179)	<0.0001

^aKruskal-Wallis test P-value for comparison of patient characteristics across BMI categories.

^bP values <.05 are considered statistically significant.

Table 2.
Perioperative Diagnoses by Body Mass Index

	BMI <30 (n=185) n (%)	BMI 30-39.9 (n=156) n (%)	BMI ≥40 (n=101) n (%)	P-value ^{ab}
Preoperative Diagnosis				
Endometrial cancer	38 (20.5)	49 (31.4)	40 (39.6)	.002
Symptomatic myomata	34 (18.4)	31 (19.9)	9 (8.9)	.05
Pelvic mass	41 (22.2)	21 (13.5)	16 (15.8)	.1
Abnormal bleeding	20 (10.8)	16 (10.3)	16 (15.8)	.4
Endometrial hyperplasia	7 (3.8)	22 (14.1)	15 (14.9)	.001
Pelvic pain	12 (6.5)	7 (4.5)	3 (3.0)	.4
Cervical cancer	19 (10.3)	1 (0.6)	1 (1.0)	<.0001 ^c
Genetic predisposition	6 (3.2)	4 (2.6)	1 (1.0)	.6 ^c
Cervical dysplasia	5 (2.7)	5 (3.2)	0 (0)	.2 ^c
Pelvic organ prolapse	3 (1.6)	0 (0)	0 (0)	.3 ^c
Ovarian cancer	0 (0)	0 (0)	0 (0)	—
Postoperative Diagnosis				
Endometrial cancer	38 (20.5)	50 (32.1)	38 (37.6)	.004
Uterine myomata	38 (20.5)	31 (19.9)	9 (8.9)	.03
No pathology noted	24 (12.9)	16 (10.3)	13 (12.9)	.71
Benign ovarian lesion	28 (15.1)	12 (7.7)	10 (9.9)	.09
Endometrial hyperplasia	7 (3.8)	23 (14.7)	18 (17.8)	.0002
Endometriosis	16 (8.9)	8 (5.1)	6 (5.9)	.4
Cervical cancer	19 (10.3)	2 (1.3)	1 (1.0)	<.0001 ^c
Adenomyosis	5 (2.7)	6 (3.9)	5 (5.0)	.6 ^c
Cervical dysplasia	5 (2.7)	4 (2.6)	0 (0)	.26 ^c
Ovarian cancer	3 (1.6)	4 (2.6)	1 (1.0)	.7 ^c
Pelvic organ prolapse	3 (1.6)	0 (0)	0 (0)	.3 ^c
Genetic predisposition	0 (0)	0 (0)	0 (0)	—

^aChi-square test P-value for comparison of diagnoses across BMI categories.

^bP-values <.05 are considered statistically significant.

^cFisher's exact test P-value.

Table 3.
Operative Characteristics By Body Mass Index

	BMI <30 (n=185) Median (Range)	BMI 30-39.9 (n=156) Median (Range)	BMI ≥40 (n=101) Median (Range)	P-value ^a
Operative time ^c (minutes)	141 (54-420)	135 (67-436)	124 (40-365)	.54
Estimated blood loss (mL)	100 (20-800)	100 (10-800)	100 (30-600)	.55
Length of stay (days)	1 (0-9)	1 (0-22)	1 (1-15)	.34
Uterine weight (grams)	157.5 (45-1900)	151 (55-2675)	156 (50-3543)	.73

^aKruskal-Wallis test P-value for comparison of operative characteristics across BMI categories.

^bP-values <.05 are considered statistically significant.

^cOperative times were only available for surgeries occurring during 01/2009 to 10/2010.

there was no difference in median uterine weight noted. Over 15% of patients in our cohort were treated for uterine myomata. Twenty-one (4.8%) patients had a uterine weight between 500g and 1000g, and 18 (4.1%) had a uterine weight over 1000g. When possible, our preferred approach for morcellation was vaginal.

In all, 53 (11.9%) surgical complications occurred among study patients, including 18 (4.1%) major and 35 (7.9%) minor complications. Surgical complications by BMI group are shown in **Table 4**. Urinary complications were most common in this study group with an occurrence of 11 (2.5%). Four (0.9%) were injuries to the bladder that were recognized and repaired intraoperatively, and 7 (1.6%) were ureteral injuries that required reoperation (3 patients were treated with cystoscopic ureteral stenting, and 4 required ureteral reimplantation laparotomy).

A total of 6 (1.4%) bowel injuries occurred in this study population. Four (0.9%) of these injuries were recognized and repaired intraoperatively, 3 were secondary to Veress

needle or trocar insertion, and 1 occurred during extensive adhesiolysis. Two (0.5%) of the bowel injuries were unrecognized intraoperatively and required reoperation laparotomy with bowel resection. Other complications occurred infrequently in this study population (<1.2%).

DISCUSSION

In this study of women undergoing RALH for both benign and malignant indications, perioperative outcomes were similar across BMI groups. Our findings reiterate the safety of RALH for the obese and morbidly obese patients.

In a study by Heinberg et al.⁷ obese patients undergoing total laparoscopic hysterectomy were found to have a 4-fold increased risk for conversion to laparotomy, longer operative times, and greater risk for estimated blood loss >500 mL than the nonobese patients. Similarly, Eltabbakh et al.³ found a statistically significant increase in the rate of conversion to laparotomy in the obese compared to the nonobese patient (14.9% 5.6%). Our study did not show

Table 4.
All Complications by Body Mass Index

Complications	BMI <30 (n =185) n (%)	BMI 30-39.9 (n=156) n (%)	BMI ≥40 (n=101) n (%)	P-Value ^{ab}
Urinary	7 (3.8)	3 (1.9)	1 (1.0)	
Bowel injury	0 (0)	4 (2.6)	2 (2.0)	
Hemorrhage	2 (1.1)	1 (0.6)	2 (2.0)	
Transfusion	1 (0.5)	2 (1.3)	2 (2.0)	
Wound Infection	1 (0.5)	1 (0.6)	2 (2.0)	
Pelvic abscess	2 (1.1)	1 (0.6)	1 (1.0)	
Vaginal cuff cellulitis	2 (1.1)	0 (0)	1 (1.0)	
Bacteremia	1 (0.5)	1 (0.6)	1 (1.0)	
Pulmonary	1 (0.5)	1 (0.6)	1 (1.0)	
Fever	2 (1.1)	1 (0.6)	0 (0)	
Ileus	1 (0.5)	1 (0.6)	0 (0)	
Urinary tract infection	1 (0.5)	1 (0.6)	0 (0)	
Vaginal cuff dehiscence	1 (0.5)	0 (0)	0 (0)	
Vessel injury	1 (0.5)	0 (0)	0 (0)	
Minor Total	16 (8.6)	10 (6.4)	9 (8.9)	.76
Major Total ^c	7 (3.8)	7 (4.5)	4 (4.0)	.95
Total	23 (12.4)	17 (10.9)	13 (12.9)	.87

^aChi-square test P-value for comparison of minor, major and any complications across BMI categories.

^bP-values <.05 are considered statistically significant.

^cMajor complications included those requiring readmission or reoperation.

differences in laparotomy conversion rates or blood loss among nonobese, obese, and morbidly obese patients. The laparotomy conversion rate for our study was 0.7%, with one conversion in each BMI group. These results are comparable to those in several published studies addressing laparoscopic and/or robotic hysterectomy for the obese patient, which reported laparotomy conversion rates ranging from 1.5% to 3.7%.^{4,7,10} Our experience has been that computer-enhanced laparoscopy allows for better precision and finer dissection, which decreases the risk of hemorrhage and conversion to laparotomy.

Several studies have also shown increased operative times among obese patients undergoing laparoscopic hysterectomy.^{7,9,11-12} Our study did not show longer operative times for the obese or morbidly obese patients compared to the nonobese patients. In our study, median operative times for the obese and morbidly obese groups were 135 min and 124 min, respectively. These operative times are comparable to those in several published studies pertaining to laparoscopic hysterectomy and obesity.^{4,8-10,12} Our experience shows that with surgeon experience and proficiency, RALH can be completed in a reasonable timeframe with operative times comparable to those of conventional laparoscopy.

There was also no difference in length of stay across BMI groups. Overall, the median length of stay was 1 d, which is comparable to most studies pertaining to laparoscopic hysterectomy in the United States. Of the patients, 334 (76%) of the 442 patients were discharged home on postoperative day 1 or sooner. The benefits of minimizing hospital stay in the obese and morbidly obese patient are noteworthy.

Another potential risk factor for the obese and morbidly obese patient is complications associated with prolonged Trendelenburg position. In our experience with RALH in the obese patient, we did not have any cases with complications related to patient positioning. Our method is to place the patient in a steep Trendelenburg, mobilize the bowel in a cephalad direction, and then lessen the Trendelenburg to the minimum amount needed before docking. Another concern in the gynecologic community has been the rate of vaginal cuff dehiscence associated with robotic surgery, with recent reports showing cuff dehiscence rates ranging from 0.98% to 4.1%.^{5,14} Only 0.2% of patients in our study experienced vaginal cuff dehiscence. Our technique entails closing the vagina in anterior to posterior direction after adequate bladder mobilization anteriorly, and suspending the posterior vagina to both uterosacral ligaments. Our experience, similar to many

other institutions, has not shown vaginal cuff dehiscence to be an issue of significant concern with appropriate vaginal closure techniques.

Although our study is the largest series of RALH addressing outcomes in obese and morbidly obese patients, we acknowledge that our study has several limitations. Our study was not powered to detect the small differences across BMI groups in the primary outcomes of interest. Our study would require over 4,300 patients to detect a difference in operative time between the BMI groups. Moreover, the observed numbers of complications were low, so we did not have adequate sample size to assess the distributions of complications across BMI groups. However, the primary goal of this study was to describe the characteristics and outcomes of our cohort, and secondly to observe for differences among the BMI groups. In addition, this retrospective study relied on data recorded in patient medical records so there is potential for misclassification; however, we do not have reason to believe that information was systematically collected or recorded differently for nonobese, obese, and morbidly obese patients.

Despite these limitations, we believe our study offers clinically relevant information pertaining to the growing number of obese patients who will undergo minimally invasive surgery. The value of providing a minimally invasive technique in the obese and the morbidly obese patient cannot be overestimated. The ability to discharge these patients in the first 24 h of the postoperative period and their quick resumption to normal activities can prevent significant morbidity.

CONCLUSION

Overall, we found that nonobese, obese, and morbidly obese patients can undergo RALH for both benign and malignant indications with similar outcomes. With surgical team experience and proficiency, the operative time, laparotomy conversion rate, and complication rates do not have to increase with increased patient body mass index.

References:

1. Flegal KM, Carroll MD, Ogden CL, Curtin LR. Prevalence and trends in obesity among US Adults, 1999–2008. *JAMA*. 2010;3:235–241.
2. Wu JM, Wechter ME, Geller EJ, Nguyen TV, Visco AG. Hysterectomy rates in the United States, 2003. *Obstet Gynecol*. 2007;110:1091–1095.

3. Eltabbakh GH, Piver MS, Hempling RE, Recio FO. Laparoscopic surgery in obese women. *Obstet Gynecol.* 1999;94:704–708.
4. O'Hanlan KA, Lopez L, Dibble SL, Garnier AC, Huang GS, Leuchtenberger M. Total laparoscopic hysterectomy: body mass index and outcomes. *Obstet Gynecol.* 2003;102:1384–1392.
5. Camanni M, Bonino L, Delpiano E, Migliaretti G, Berchiolla P, Deltetto F. Laparoscopy and body mass index: feasibility and outcome in obese patients treated for gynecologic diseases. *JMIG.* 2010;17:576–582.
6. Pasic R, Levine RL, Wolf WM Jr. Laparoscopy in morbidly obese patients. *J Am Assoc Gynecol Laparosc.* 1999;6:307–312.
7. Heinberg EM, Crawford BL 3rd, Weitzen SH, Bonilla DJ. Total laparoscopic hysterectomy in obese versus nonobese patients. *Obstet Gynecol.* 2004;103:674–680.
8. Rebeles SA, Muntz HG, Wieneke-Broghammer C, Vason ES, McGonigle KF. Robotic-assisted total laparoscopic hysterectomy in obese and morbidly obese women. *J Robotic Surg.* 2009;3:141–147.
9. Chopin N, Malaret JM, Lafay-Pillet MC, Fotso A, Foulot H, Chapron C. Total laparoscopic hysterectomy for benign uterine pathologies: obesity does not increase the risk of complications. *Hum Reprod.* 2009;24:3057–3062.
10. Nawfal AK, Orady M, Eisenstein D, Wegienka G. Effect of body mass index on robotic-assisted total laparoscopic hysterectomy. *JMIG.* 2011;18:328–332.
11. Holub Z, Jabor A, Kliment L, Fischlova D, Wagnerova M. Laparoscopic hysterectomy in obese women: a clinical prospective study. *Eur J Obstet Gynecol Reprod Biol.* 2001;98:77–82.
12. Geppert B, Lönnerfors C, Persson. Robot-assisted laparoscopic hysterectomy in obese and morbidly obese women: surgical technique and comparison with open surgery. *Acta Obstet Gynecol Scand.* 2011;90:1210–1217.
13. Brezina P, Beste T, Nelson K. Does route of hysterectomy affect outcome in obese and nonobese women? *JSLs.* 2009 Jul-Sep;13(3):358–363.
14. Kho R, Akl M, Cornella J, Magtibay P, Wechter M, Magrina J. Incidence and characteristics of patients with vaginal cuff dehiscence after robotic procedures. *Obstet Gynecol.* 2009 Aug; 114(2 Pt 1):231–235.
15. Robinson BL, Liao B, Adams F, Randall C. Vaginal cuff dehiscence after robotic total laparoscopic hysterectomy. *Obstet Gynecol.* 2009 Aug;114(2 Pt 1):369–371.