A Comparison of Open Surgery, Robotic-Assisted Surgery and Conventional Laparoscopic Surgery in the Treatment of Morbidly Obese Endometrial Cancer Patients

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ABSTRACT

Background and Objectives: The intent of this retrospective study was to assess the operative outcomes of morbidly obese endometrial cancer patients who were treated with either open surgery (OS) or a minimally invasive procedure.

Methods: Morbidly obese (body mass index [BMI] > 40 kg/m^2) patients with endometrial cancer who underwent OS, robotic-assisted laparoscopic surgery (RS), or conventional laparoscopic surgery (LS) were eligible. We sought to discern any outcome differences with regard to operative time, perioperative complications, and hospital stay.

Results: Sixteen patients were treated with LS (BMI = 47.9 kg/m^2), 13 were managed via RS (BMI = 51.2 kg/m^2), and 24 underwent OS (BMI = 53.7 kg/m^2). The OS (1.35 hours) patients had a significantly shorter operative duration than the LS (1.82 hours) and RS (2.78 hours) patients ($P < .001$); blood loss was greater in the OS (250 mL) group in comparison with the RS (100 mL) and LS (175 mL) patients ($P = .002$). Moreover, the OS (4 days) subjects had a significantly longer hospital stay than the LS (2 days) and RS (2 days) patients ($P = .002$).

Conclusion: In the present study, we ascertained that minimally invasive surgery was associated with longer operative times but lower rates of blood loss and shorter hospital stay duration compared with treatment comprising an open procedure.

Key Words: Minimally invasive surgery, Open surgery, Morbid obesity, Endometrial cancer.

INTRODUCTION

Obesity, a condition wherein excessive body fat results in increased health complications and reduced life expectancy, is a preeminent, international health dilemma that continues to worsen as countries progressively adopt a westernized lifestyle.[1] Europe and North America have the highest prevalence rates, and in particular, the incidence of obesity in westernized countries has more than doubled over the past decade.[2]

Clinical obesity is defined by a body mass index (BMI) of >30 kg/m^2. Women with a BMI that is 9 to 22 kg/m^2 above their appropriate classification have a 3-fold increased risk for developing endometrial cancer.[3,4] Moreover, for patients who are >22 kg above their appropriate BMI, obesity confers a nearly 10-fold relative risk.[3,5]

Because obesity is significantly associated with attendant health consequences, this comorbidity has been further categorized in an attempt to elucidate the condition's sequelae. According to Canadian health guidelines, class I obesity is characterized by a BMI of 30 to 35 kg/m^2, class II refers to a BMI of 35 to 40 kg/m^2, and class III refers to a BMI > 40 kg/m^2.[6] Thereafter, studies have indicated that the proportion of women representing either class II or III has approached 42%.[7]

Endometrial cancer has frequently been associated with obesity.[3,4,8] Hence, contending with an endomorphic body habitus presents significant challenges because of the increased risk for intra- and postoperative complications.[1,10–12] Forunately, laparoscopy has mitigated some of the surgical difficulties inherent in managing morbidly obese patients.[4,6,9,10]

Studies have documented the outcomes associated with obese patients with endometrial cancer treated with minimally invasive (robotic-assisted surgery [RS] or conventional laparoscopic surgery [LS]) or open surgery (OS),[4,5,9,10] although scant operative data involving exclusively morbidly obese endometrial cancer populations are available. Accordingly, we sought to compare the impact of minimally invasive surgery with an open surgical ap-

proach in a population of morbidly obese patients with endometrial cancer. We hypothesized that when treating these subjects, minimally invasive surgery would be associated with reasonable operative times but a lower incidence of complications and favorable readmission rates compared with an OS approach.

MATERIALS AND METHODS

Patients and Study Criteria

The following retrospective study initially identified all patients with endometrial cancer who were managed at a single tertiary health care institution from September 2008 through December 2011. From this group, only morbidly obese (BMI > 40 kg/m^2) patients with endometrial cancer who were diagnosed and managed via OS, RS, or LS by a single group of gynecologic oncologists (A.A.M., L.N.A., M.A.R., J.V.B., J.P.M.) were considered eligible. An institutional review board approved this study before any patient chart data were evaluated.

Exclusionary Criteria

Any morbidly obese patient who was diagnosed with a gynecologic condition other than endometrial cancer was omitted from study inclusion. Furthermore, any subject not initially managed with a hysterectomy, bilateral salpingo-oophorectomy, and pelvic lymphadenectomy was excluded. In patients for whom comprehensive patient surveillance data were unavailable, study inclusion was also precluded.

Surgical Procedure

For each patient, extensive pathologic evaluation was ascertained; a bowel preparation, intraoperative prophylactic antibiotics, and routine thromboprophylaxis were administered for every subject. All patients underwent a hysterectomy, bilateral salpingo-oophorectomy, and pelvic lymphadenectomy via LS, RS, or OS; the decision to perform a specific surgical approach was based on physician discretion, although in general, the group's standard of practice is to incorporate a pelvic lymphadenectomy in all patients with uterine cancer. With regard to the pelvic lymphadenectomy, the procedure encompassed the resection of the common, external, internal iliac, and obturator nodes at the level of the inguinal ligament. All staging was performed in accordance with the 1998 International Federation of Gynecology and Obstetrics staging procedure.[13]

Clinical Outcomes

The following variables were evaluated: patient demographics, BMI, surgical history, comorbid conditions, pathologic characteristics, surgical approach, operative time, estimated blood loss (measured in accordance with the fluid contents from the extraction device), number of blood transfusions, intraoperative (eg, conversion to laparotomy) and postoperative complications, number of pelvic lymph nodes removed, hospital duration, and number of hospital readmissions.

Statistical Analyses

All statistical analyses were conducted using MedCalc statistical software for biomedical research version 9.5.1 for Windows (MedCalc Software, Mariakerke, Belgium). The initial data analysis was evaluated with a descriptive statistical approach that further incorporated analysis of variance with 2-sided P values and 95% confidence intervals. In the event of significance, post hoc tests were conducted to determine differences among the various scores.

RESULTS

There were 590 patients with endometrial cancer initially identified, 53 of whom were morbidly obese and satisfied the established inclusionary criteria for this study. The LS (n = 16) patient group's median age was 59 years (range, 35–78 years), the RS (n = 13) group's median age was 54 years (range, 37–65 years), and the median age of the OS (n = 24) patients was 58 years (range, 30–71 years) (P = .10).

With regard to surgical history, the most common, notable operations among the study patients were dilation and curettage (28.3%) and cholecystectomy (17%). The two most commonly occurring comorbidities among all patients were hypertension (64.1%) and diabetes (37.7%). **Table 1** illustrates the patients' clinical outcomes and pathologic characteristics according to operative procedure.

The median BMI was 47.9 kg/m^2 (range, 40.1–62.0 kg/m^2) for the LS patients, 51.2 kg/m^2 (range, 40.9–63.9 kg/m^2) for the RS group, and 53.7 kg/m^2 (range, 40.8–64.7 kg/m^2) for the OS group (P = .32). The median operative time was 1.82 hours (range, 1.1–3.92 hours) for the LS group, 2.78 hours (range, 1.42–4.42 hours) for the RS group, and 1.35 hours (range, 0.92–2.67 hours) for the OS group; the operative time for the OS patients was significantly shorter (P < .001) than for the 2 minimally invasive surgery groups, both of which were similar (P = .17).

Table 1.
Pathologic stage, grade, and histology according to surgical approach

Conventional Laparoscopy (n = 16)			Robotic-Assisted Laparoscopy (n = 13)			Open Procedure (n = 24)		
Stage	Grade	Histology	Stage	Grade	Histology	Stage	Grade	Histology
IA	2	Mixed	IB	1	Endometrioid	IIIA	2	Mixed
IA	3	Endometrioid	IB	3	Endometrioid	IB	1	Adenocarcinoma
IA	2	Endometrioid	IC	1	Serous	IB	2	Adenocarcinoma
IA	2	Mixed	IA	1	Mixed	IB	3	Serous
IIa	1	Endometrioid	IA	1	Endometrioid	IA	2	Endometrioid
IA	2	Endometrioid	IB	1	Mixed	IA	2	Endometrioid
IA	2	Endometrioid	IA	1	Endometrioid	IB	1	Endometrioid
IA	2	Endometrioid	IA	1	Endometrioid	IIA	1	Mixed
IA	1	Endometrioid	IA	1	Adenocarcinoma	IIIA	2	Mixed
IB	I	Endometrioid	IA	I	Endometrioid	IIIC	I	Endometrioid
IC	2	Endometrioid	IA	2	Endometrioid	IIA	1	Endometrioid
IA	1	Mixed	IB	2	Endometrioid	IA	1	Endometrioid
IA	1	Endometrioid	IA	2	Endometrioid	IB	1	Endometrioid
IB	2	Mixed				IC	2	Endometrioid
IB	2	Endometrioid				IB	2	Endometrioid
IA	1	Endometrioid				IA	1	Endometrioid
						IA	1	Endometrioid
						IA	1	Endometrioid
						IA	1	Endometrioid
						IB	1	Endometrioid
						IB	2	Endometrioid
						IA	1	Endometrioid
						IIIC	1	Endometrioid

Estimated blood loss was 175 mL (range, 25–700 mL) for the LS group, 100 mL (range, 50–150 mL) for the RS group, and 250 mL (range, 50–1000 mL) for the OS group (P = .002). The blood loss in the OS group was significantly greater than in the LS and RS groups; there were no differences between the two minimally invasive surgery groups with regard to estimated blood loss (P = .39); only 1 patient in the LS group required a blood transfusion. The median number of pelvic lymph nodes removed was 4 (range, 2–13) in the LS group, 5 (range, 2–21) in the RS group, and 3 (range, 2–19) in the OS group (P = .23).

There were no intraoperative complications, although 1 patient in each minimally invasive surgery group underwent a conversion to laparotomy because of an enlarged uterus. Postoperatively, 1 patient in the LS group developed a wound dehiscence at 2 weeks and was readmitted; in the RS group, 1 patient developed an ileus, and another experienced desaturation attributed to sleep apnea, although neither patient was readmitted. Finally, in the OS group, 2 patients had a postoperative ileus, another had hypoxemia, and a different subject developed sepsis; the septic patient was readmitted. See **Table 2** for a list of the patients' postoperative complications.

The median duration of hospital stay was 2 days (range, 1–4 days) for the LS group, 2 days (range, 1–3 days) for the RS group, and 4 days (range, 2–25 days) for the OS group (P = .002). The patients in the OS group had a significantly longer hospital stay compared with those in the RS and LS groups; however, there were no significant differences between the 2 minimally invasive surgery

Table 2.
List of surgery patients' postoperative complications (n = 7)

Number	Surgery Group	Postoperative Complication	Readmission
1	Conventional laparoscopy	Wound dehiscence	Yes
2	Robotic-assisted laparoscopy	Ileus	No
3	Robotic-assisted laparoscopy	Sleep apnea–induced desaturation	No
4	Open surgery	Ileus	No
5	Open surgery	Ileus	No
6	Open surgery	Hypoxemia	No
7	Open surgery	Sepsis	Yes

groups with regard to hospital stay ($P = .057$). The median overall patient follow-up duration was 57 months (range, 22–156 months).

DISCUSSION

In 2008, >1.4 billion adults (≥20 years of age) were overweight or obese.[2,14] Obesity is strongly correlated with several maladies, namely, coronary artery disease, type 2 diabetes, and endometrial cancer.[12,15] Because the incidence of obesity in endometrial cancer is increasing, gynecologic cancer surgeons should anticipate the comorbidity when surgically managing this malignancy.[16,17]

In endometrial cancer, the treatment of an obese patient may be significantly compromised, as these patients are at significant risk for hemodynamic instability, tension pneumothorax, wound infection, healing, and thrombosis.[12,16] Fortunately, with the advent of laparoscopic surgery, many of these concerns are potentially addressed.[4,11,12]

In the present retrospective investigation, we ascertained that an open procedure (1.35 hours) was significantly shorter in duration than the minimally invasive surgery procedures (LS, 1.82 hours; RS, 2.78 hours), which was in accordance with prior studies concurrently evaluating these techniques.[4,9] We speculate that the significantly decreased time associated with an open procedure was at least partially attributed to the extensive surgical experience acquired by physicians who frequently use this approach; in contradistinction, minimally invasive procedures are relatively novel, although the physicians in the present investigation are all very experienced, high-volume endoscopic surgeons.

Intraoperatively, blood loss was minimal for the RS (100 mL) and LS (175 mL) groups and significantly less than in the patients treated with an open procedure (250 mL); clinically, however, we appreciate that the differences among the groups were unremarkable. Similarly, Geppert et al[9] reported blood loss of 100 mL in their obese population of patients who underwent robotic-assisted hysterectomy and 300 mL for those who were treated with OS; however, their study incorporated both obese and morbidly obese patients (ie, BMI > 30 kg/m²). Yu et al[4] documented a similar trend (ie, 700 mL for the open technique and 325 mL in laparoscopic patients).

In the current study, both minimally invasive procedures had 1 patient undergo a conversion to laparotomy. Analogously, in the O'Gorman et al[12] laparoscopic hysterectomy study involving the treatment of obese patients with endometrial cancer, 1 conversion to laparotomy was reported. However, their varied population included patients with a BMI ranging from 30 to 60 kg/m².

Beyond the conversions to laparotomy, we did not encounter any significant intraoperative complications in association with the 3 surgery groups; this was in contrast to the Yu et al[4] and Geppert et al[9] studies, which reported a higher incidence of complications (eg, wound infections) following OS. One might speculate that our extremely low incidence of wound infections was attributed to a meticulous approach to using drains and antibiotics; nevertheless, we recognize that our wound infection rate is particularly low in comparison with prior studies involving morbidly obese endometrial cancer patients that have documented a 48.4% incidence.[10] We also suspect that our reasonably low complication rate was attributed to extensive surgeon experience and that these surgical procedures are essentially feasible and safe, even within the context of a morbidly obese patient population.[18]

In accordance with our hypothesis, the OS patients exhibited a significantly longer hospital stay than both minimally invasive surgery groups. These results coincide with the Geppert et al[9] study (3.8 days for the OS patients vs 1.6

days for the laparoscopic patients) and Yu et al[4] study (11.5 vs 4 days). We also predicted that the minimally invasive surgery patients would exhibit a more auspicious readmission rate compared with the subjects in the OS group. Postoperatively, there were more patient complications in the OS group (n = 4) than in the 2 minimally invasive surgery groups (n = 3), although the readmission rates for the 3 study groups were similar.

There are several limitations that preclude us from deriving substantial conclusions regarding the discrepancies between minimally invasive surgery and an open procedure in the management of morbidly obese endometrial cancer patients. Specifically, we recognize that the number of resected pelvic lymph nodes in this study was rather low. In fact, the nodal count indicates that in nearly all of the cases, only node sampling occurred; one can also suggest that an analysis involving para-aortic lymph nodes should have been included in the study data, but we regret that this surgical variable was not adequately evaluated. Furthermore, quality of life is an integral component in surgical outcomes studies, and we did not capture any data related to this field.

Our study patients were retrospectively evaluated, and thus, selection bias may have influenced the outcomes; moreover, the final results would have further benefited from a randomized methodology. We also recognize that the subject groups were not only limited in size but were disproportionate. Additionally, we did not comment on the potential impact of a learning curve associated with RS, nor did we account for surgeon approach or variability. We contend, nevertheless, that because our patient cohorts were composed exclusively of morbidly obese subjects, these patients can be safely managed by an experienced gynecologic surgeon, irrespective of surgical approach. A further study comparing OS, LS and RS outcomes in a larger, randomized population of morbidly obese endometrial cancer patients is warranted.

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