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Gynecologic Oncology 93 (2004) 137–143
Gynecologic Oncology
www.elsevier.com/locate/ygyno

Selective incorporation of total laparoscopic hysterectomy for adnexal pathology and body mass index

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Received 6 August 2003

Abstract

Objective. We studied patients undergoing adnexectomy with total laparoscopic hysterectomy (TLH) for ovarian pathology, over a 6-year period.

Methods. Chart abstraction, analyzed by ANOVA, Fisher's Exact Test with significance at $P < 0.05$, stratifying by body mass index (BMI, kg/m^2: ideal < 25; overweight 25–29.9; obese 30+).

Results. Of 354 patients undergoing TLH, 90 cases had adnexal pathology: 69 complex masses, 16 BRCA1/2 mutations, 5 unstaged ovarian carcinomas; 48 having ideal BMI, 26 overweight, and 16 obese. Mean age (51 years) and parity (1.2 children) were similar between BMI groups. Thirty-four percent were nulliparous. All 90 underwent TLH, adnexectomy, washings; with 14 appendectomies, 5 lymphadenectomies, 3 node samplings, 6 omentectomies, 8 ureterolyses, and 1 Burch. Mean surgery duration (156 min), blood loss (152cc), and hospital stay (1.9 days) were similar across BMI groups. Mean nodal yield from each lymphadenectomy was 14, and 2.6 from sampling. Mean size of pelvic masses was 8 cm (range 3–19 cm). There were seven cases of ovarian carcinoma: 2 Stage IA, 1 IB, 2 IC, 1 IIC, 1 IIIB; 1 recurrent breast cancer, 16 adenofibromas, 15 endometriomas, 10 dermoids, and 41 serous/mucinous cystadenomas. Mean complication rate was 6.6% (ns): 1 seroma, 1 hematoma, 1 obstructive adhesions, and 3 urological injuries. All urological injuries were within the first third of patients.

Conclusions. TLH appears feasible for women with adnexal pathology regardless of BMI, in an oncological practice. This pilot data can facilitate guidelines for a randomized controlled trial of TLH with TAH and LAVH, and help surgeons avoid our early complications.

Keywords: Total laparoscopic hysterectomy; Adnexal pathology; Body mass index

Introduction

Traditional therapy for complex pelvic mass includes laparoscopic or open laparotomy with salpingo-oophorectomy to rule out malignancy. For many women, a hysterectomy is also performed during this operation if their fertility has been completed, especially when there is concurrent gynecologic dysfunction such as dysmenorrhea or hypermenorrhea, or for the prevention of endometrial and cervical cancer. Hysterectomy is performed along with oophorectomy for women with high-risk family pedigrees for ovarian cancer, including those with BRCA1/2 mutations. Finally, hysterectomy is part of the staging, along with omentectomy, appendectomy, and lymphadenectomy for women with apparent early invasive ovarian cancer who have not had formal staging to rule out metastatic disease.

Laparoscopic-assisted vaginal hysterectomy (LAVH) has been described as an alternative to open incisional laparotomy, associated with shorter inpatient stays and less postoperative pain than traditional abdominal incisional approaches [1,2]. In randomized trials, comparing abdominal hysterectomy vs. LAVH for benign indications, similar overall complications, less blood loss, longer operating times, fewer transfusions, less pain, and shorter hospital stay and disability were observed with the endoscopic procedure [3–7]. However, LAVH is predicated upon the ability to perform the dissection of the cervix and lower uterine segment through

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0090-8258/$ - see front matter © 2004 Elsevier Inc. All rights reserved.
doi:10.1016/j.ygyno.2003.12.020

the vagina. Nulliparous women, who are at increased risk for ovarian cancer, may not qualify for LAVH due to insufficient uterine prolapse and vaginal capacity. The total laparoscopic hysterectomy (TLH) has been described over the last 10 years as a potentially quicker, more efficient method, is associated with less blood loss than LAVH [8,9], and is also more available to nulliparous women.

Obese patients needing hysterectomy have been traditionally managed by open laparotomy with an acceptably higher rate of complications such as wound infection, pelvic abscess, and dehiscence than observed in nonobese patients [10]. Obesity was originally seen as a relative contraindication for advanced laparoscopic procedures, but this has recently come under review [11]. Now, with improved instrumentation and techniques, many advanced laparoscopic procedures have been observed to be safe and feasible in women with high BMI [12,13].

While a randomized clinical trial would be the standard for confirming the indications, safety, efficacy, and complication rates of TLH for women with adnexal pathology, there are, as yet, no large cohort reviews to serve as pilot data focusing on outcomes as they relate to BMI.

In this retrospective report, the patient demographics, preoperative indications, surgical data, and complications are recorded from 5.8 years in a single surgeon's teaching practice, and are analyzed for total laparoscopic hysterectomy for adnexal pathology stratified by BMI categories.

Patients and methods

Retrospective study design

Of 364 cases of total laparoscopic hysterectomy performed over a 72-month period, there were 90 cases of simple total laparoscopic hysterectomy performed for management of pelvic mass, clinically early ovarian Ca, BRCA mutation, or family history of ovarian Ca, which are stratified by body mass index. Body mass index (BMI) was calculated by dividing a person's weight in kilograms by the square of their height in meters. Ideal BMI has been defined as <25 kg/m^2, while overweight is having a BMI between 25 and 29.9 kg/m^2, and obese patients are those with a BMI of 30 kg/m^2 or more [14]. All surgeries were teaching cases, assisted by a categorical Obstetrics and Gynecology resident or, less often, by an attending physician specialized in Obstetrics and Gynecology, who was also actively learning the technique.

TLH means all surgery was performed entirely through the laparoscopic ports, including the closure of the vagina [15]. All patients were scheduled for a laparoscopic approach unless they had prior surgical reports documenting severe abdominal/intestinal adhesions, clinical or radiographic evidence of metastatic ovarian carcinoma, or documented significant cardiopulmonary disease, contraindicating prolonged steep Trendelenburg position.

All pelvic masses were removed intact in a 5 × 8 or 8 × 15 in. ripstop nylon sack with a purse string (Lapsac, Cook Surgical, Chicago, IL). The sack is passed into the abdomen through the 10-mm umbilical trochar. The mass is encased in the sack, and passed out the vagina, draw string first, allowing collapse of the mass inside the sack with controlled spillage from the exteriorized sack opening outside the vagina, avoiding peritoneal spillage. Staging was performed for all invasive ovarian malignancies, and included hysterectomy, pelvic and aortic lymph node dissection, omentectomy, and appendectomy, with peritoneal washings and biopsies. The hysterectomy procedure is described elsewhere [16]. Then, the vaginal apex was closed, fixing the lateral vaginal angle to the uterosacral and round ligaments for suspension.

Patients were given printed information about their bowel prep, and their inpatient postoperative and home recovery. Discharge instructions included resumption of all activities as soon as tolerated and encouraged ambulation and floor exercise. Patients were instructed not to engage in any vaginal penetration until after they received clearance at their 6-week vaginal checkup. All patients were seen initially for an abdominal incision check at 10 days after discharge and again at 6 weeks. Patients were referred for chemotherapy if they had a ≥grade 2or ≥Stage Ib epithelial ovarian carcinoma.

Data management and analysis

Office and hospital charts were reviewed for patient data regarding age, height, weight, parity, preoperative diagnosis, procedure(s), estimated blood loss (EBL), duration of surgery, duration of hospital stay, pathologic data including uterine dimensions, weight, cancer characteristics such as depth of invasion, grade, presence or absence of lymphvascular invasion, cervical invasion, pelvic cytologic washings, number of nodes dissected, and complications. The patients were divided into three standard BMI groups: ideal (<25), overweight (25–29.9), obese (>30.0) [14]. The data was analyzed on a SPSS statistical analysis package, using ANOVA and *t* test for comparison of continuous data, and chi-square analyses including Fisher's Exact Test for nominal data. A value of $P < 0.05$ was accepted as significant.

Results

Among 90 patients identified with pelvic mass, clinically early ovarian Ca, mutation of BrCa 1 or 2, or family history of ovarian cancer, 48 had an ideal BMI with group average of 22.1, 26 were overweight with group average of 26.9, and 16 were obese with mean BMI of 36.3. (Table 1) While the mean age of all three groups was 51 years ($P = 0.406$), patients' ages ranged from 24 to 85 years. The mean parity was 1.2 in all three groups ($P = 0.805$), ranging from 0 to 7. Overall, 34% of the women in each of the three groups were nulligravid.

Table 1
Patient demographics stratified by BMI category[a]

	Ideal (n = 48), M (SD)	Overweight (n = 26), M (SD)	Obese (n = 16), M (SD)	P value
Age (years)	51.7 (9.1)	51.6 (12.6)	48.0 (7.4)	0.406
Parity	1.3 (1.2)	1.3 (1.4)	1.0 (1.0)	0.805
Body mass index	22.1 (1.7)	26.9 (1.3)	36.3 (5.0)	<0.0001[b]

[a] ANOVA.
[b] All three categories significantly different from each other by multiple specific comparisons.

Among them, 69 had preoperative diagnosis of complex pelvic mass, 16 had familial ovarian carcinoma/BrCa 1 or 2 mutation, and 5 had unstaged clinically early ovarian carcinoma (Table 2). Benign lesions comprised the vast majority of cases; however, 6 patients required complete staging when cancer was identified. The final pathologic diagnoses included eight cases of carcinoma in the ovary: 2 Stage IA, 1 granulosa cell tumor, and 1 papillary serous Low Malignant Potential (LMP) tumor (both sampled); 1 IB endometrioid carcinoma; 2 IC carcinomas, of which one was an invasive squamous cell carcinoma of a dermoid and the other was a clear cell carcinoma, all staged; 1 IIC poorly differentiated papillary serous carcinoma; 1 IIIB serous LMP tumor, both staged; and 1 patient with a first recurrence of her prior breast cancer in the ovary, nodes sampled. The remaining pathologies consisted of 16 adenofibromas, 15 endometriomas, 10 dermoids, and 41 benign serous or mucinous cystadenomas. All patients were thoroughly staged except the two patients with clinical Stage IA LMP tumor, and recurrent breast cancer.

Table 2
Preoperative and postoperative diagnoses stratified by BMI category[a]

	Ideal (n = 48), N (%)	Overweight (n = 26), N (%)	Obese (n = 16), N (%)	P value
Preoperative diagnosis				
Complex pelvic mass	33 (68.7)	21 (80.8)	15 (93.7)	
Familial breast/ovarian cancer	12 (25)	3 (11.5)	1 (6.3)	
Ovarian cancer	4 (8.3)	2 (7.7)	1 (6.3)	
Fisher's Exact Test				0.251[a]
Postoperative pathology				
Dermoid	5 (10.4)	3 (11.5)	2 (12.5)	
Adenofibroma	5 (10.4)	9 (34.6)	2 (12.5)	
Benign ser/muc lesions	23 (47.9)	10 (38.5)	8 (50.0)	
Endometrioma	10 (20.8)	1 (3.8)	4 (25.0)	
Carcinoma	4 (8.3)	2 (7.6)	1 (6.2)	0.243[a]
Stage IA papillary serous, LMP[b]	1			
Stage IA granulosa cell tumor[b]	1			
Stage IB endometrioid, G2[c]		1		
Stage IC SCC of dermoid[c]		1		
Stage IC clear cell, G3[c]			1	
Stage IIC papillary serous, G3[c]	1			
Stage IIIB papillary serous, LMP[c]	1			
Breast cancer recurrence[b]	1			

[a] Fisher's Exact Test.
[b] Sampling performed.
[c] Staging performed.

Table 3
Surgical data stratified by BMI category[a]

	Ideal (n = 48), M (SD)	Overweight (n = 26), M (SD)	Obese (n = 16), M (SD)	P value
Duration of surgery (min)	154.3 (46.0)	156.2 (58.7)	162.3 (49.7)	0.859
Estimated blood loss (ml)	167.4 (204.6)	149.0 (183.9)	111.5 (106.6)	0.578
Length of hospital stay (days)	2.2 (1.8)	1.6 (0.6)	1.7 (0.6)	0.183

[a] ANOVA.

While the mean hospital stay was 1.8 days for all BMI groups (P = 0.183), 32 patients stayed only 1 day, while 45 patients stayed 2 days (Table 3). The estimated blood loss averaged 152 ml per case in all BMI groups (P = 0.578), with 38 patients losing 50 ml or less and another 32 losing 75–100 ml. It should be noted that many patients had additional procedures including 14 appendectomies, 5 lymphadenectomies, 3 node samplings, 6 omentectomies, 8 ureterolyses, and 1 Burch (Table 4); however, the specific times required for these procedures were not recorded or subtracted from the duration of surgery. For the patients who had only hysterectomy/adnexectomy with no other proce-

Table 4
Additional procedures stratified by BMI category

Additional procedures	Ideal (n = 48), N	Overweight (n = 26), N	Obese (n = 16), N	P value
Fulgurate endometriosis	3	2	1	
Lysis of adhesions	5	2	1	
Port removal	0	1	0	
Lymphadenectomy	2	2	1	
Node sampling	3	0	0	
Omentectomy	3	2	1	
Burch	0	0	1	
Cystoscopy	17	11	3	
Cystotomy repair	1	0	0	
Ureterolysis	3	3	2	
Moscowitz, posterior repair	1	0	0	
Appendectomy	9	3	3	
Cholecystectomy	0	1	1	
Tumor debulking	1	0	0	
Ventral hernia repair	0	1	2	
Sigmoidoscopy	0	1	0	
Fisher's Exact Test	50	29	16	0.243

Table 5
Pathological data stratified by BMI category (Tukey–Kramer)

	Ideal (n = 48), M (SD)	Overweight (n = 26), M (SD)	Obese (n = 16), M (SD)	P value
Pathology of uterus[a]				
Length (cm)	8.6 (2.1)	8.6 (1.9)	9.4 (2.9)	0.453
Width (cm)	5.6 (1.4)	6.1 (1.4)	6.1 (2.5)	0.33
Depth (cm)	3.9 (1.2)	4.2 (1.7)	4.4 (1.7)	0.489
Weight (g)	131 (101)	204 (179)	171 (141)	0.141
Ovarian mass (cm)[b]	7.2 (3.4)	8.8 (4.6)	8.9 (5.6)	0.371
Number of nodes obtained				
Lymphadenectomy (5 cases)	7.3 (8.9)	16.5 (10.6)		0.127
Lymph node sampling (3 cases)	2.6			

[a] Uterine dimensions available for 89 cases. Uterine weight available for 74 cases.
[b] Ovarian dimensions only recorded for all 52 patients with preoperative diagnosis of pelvic mass.

dure, operating time was 144 min, with 6 completed in 90 min, and 27 completed within 120 min.

The mean uterine weight of 160 g in all groups was not statistically significantly different by BMI category (P = 0.453) (Table 5). Nine women had uteri weighing between 200 and 800 g. The mean adnexal size was 8 cm (range 3–19) in the 52 cases with a complex neoplastic pelvic mass found at surgery, with no significant difference between the three groups of patients (P = 0.371).

Five patients with invasive epithelial ovarian carcinoma underwent pelvic and aortic lymphadenectomy yielding a mean of 13.6 nodes (P = 0.127). Lymph node sampling, not lymphadenectomy, was performed on 3 patients: 1 patient with encapsulated focal Low Malignant Potential Papillary Serous ovarian cancer, 1 granulosa cell carcinoma, and 1 breast cancer recurrence, yielding a mean of 2.6 nodes. The overall complication rate for the series was 6.6% (Table 6) (1 seroma, 1 hematoma, 1 SBO from adhesions, 1 stented ureteral fistula, 1 reimplanted ureteral fistula, 1 vesicovaginal fistula treated by catheter) among 4 patients in the ideal and 2 patients in the overweight BMI categories and no patients in the obese BMI category. All of the urological injuries occurred in the first one third of patients in the clinical series.

Discussion

In the United States, where 26% of the adult population is obese and over half a million hysterectomies are performed yearly, laparoscopic approaches are under study for wider applicability [17]. Many patients needing surgery for a pelvic mass also have indications for hysterectomy. Laparoscopic surgery to prevent [18], diagnose [19], or stage early ovarian cancer [20,21] is useful, but these reports do not specifically include hysterectomy [22,23]. In this report, we have specifically addressed the concerns about performing a hysterectomy as part of the laparoscopic management of women with ovarian pathology, with particular focus on outcomes stratified by BMI.

In all three BMI groups, 34% of the patients were nulliparous. While LAVH has already been advocated for women needing hysterectomy with their adnexectomy, many patients' vaginal anatomy precludes completion of surgery from below [24,25]. We confirm that a total laparoscopic approach is facile and efficient [26–28], and useful for women with unfavorable vaginal anatomy. However, even for women with descensus and vaginal capacity, we still perform the entire surgery from above, in part because vaginal hysterectomies have been associated with higher risk of subsequent urinary incontinence and vault prolapse [29–31]; and because we are routinely able to suture the lateral vaginal apices to the uterosacral ligaments, which gives visible elevation and support of the vaginal apex not achievable from below.

Laparoscopic hysterectomy in the obese woman with an ovarian mass can be technically challenging [12]. While large women tolerate increased intraperitoneal pressure well concerning cardiac function [32], respiratory mechanics can be adversely affected for the duration of the pneumoperitoneum [33]. Higher than usual inspiratory pressures are usually needed with reduced ventilatory compliance, especially in Trendelenburg position [12]. None of the 16 patients with BMI between 30 and 50 needed reversal of Trendelenburg to reduce their carbon dioxide pressures as we were prepared to do. There were no respiratory complications in this series of 90 patients or in the 354 from which it was drawn. The ability to safely perform laparoscopic hysterectomy is especially important for obese women with

Table 6
Complications by weight category Chi-Square Contingency Table

	Ideal (n = 48)		Overweight (n = 26)		Obese (n = 16)		All patients (n = 90)	
	No reoperation	Reoperated	No reoperation	Reoperated	No reoperation	Reoperated	No reoperation	Reoperated
Ureter fistula, reimplanted				1				1
Ureter fistula, stented	1						1	
Bladder fistula	1						1	
Urological subtotal	2			1			2	1
Adhesive bowel obstruction		1						1
Pelvic hematoma		1						1
Pelvic seroma			1				1	
	2 (4.2)	2 (4.2)	1 (3.8)	1 (3.8)	0	0	3 (3.3)	3 (3.3)

adnexal pathology, as they have a higher risk of both ovarian and uterine carcinoma [34–36] in comparison with others.

Many are concerned that there are significantly longer operating times with a laparoscopic approach, especially reported with the LAVH [37]. Our data show no difference in operating times based on size of the patient (about 2.5 h on average). The mean size of the uteri in this case series was 160 g, ranging from 40 to 800 g, some requiring morcellation via vagina or by morcellating instrument. Additionally, the operating times for our patients included 95 additional procedures in 25 patients, such as cholecystectomy, node dissection, Burch colpopexy, omentectomy, appendectomy, and fulgeration of endometriosis. Although inclusion of these cases with additional procedures confounds interpretation of the operating times for hysterectomy/adnexectomy, this retrospective clinical series reflects the spectrum of surgical procedures often performed concomitantly in this setting and patient population.

The operating times have been reported to decrease over time with greater laparoscopic surgical experience [38,39] and with TLH when compared in retrospective analyses with LAVH [9,40]. Our laparoscopic blood loss, surgical duration, and number of days in hospital are all continuing to decrease over time, with 20 of the last 30 patients in the series losing 0–50 ml of blood, and 24 of the last 30 patients going home on postoperative day 1. The node dissections yielded similar numbers of nodes as reported by others [41,42].

With laparotomy, obese patients have been shown to have a higher incidence of wound infection and other complications resulting in extended hospitalizations and additional procedures, directly proportional to the BMI [43]. In one series of 471 patients of any weight undergoing abdominal hysterectomy for benign disease and with small uteri (<280g), the complication rate was 13.3% [44].

In our series, we observed a 6.6% complication rate as observed in other recent laparoscopic series [45–48]. There were no complications in the 16 obese patients.

Overall, 3.3% sustained urological injury, all during the first third of the series. This rate is similar to recent laparoscopic reports ranging from 3.4% to 8.3% [49–51] and gives further evidence to a learning curve effect [27]. Laparoscopic surgeons are urged to learn these techniques with colleagues rather than residents, always with an eye to the location for the ureter. In the first case, a 6-cm paracervical, intraligamentous fibroid obscured the parametrial anatomy. Ureteral transection could have been averted by dissecting out the ureter in its course through the parametrium. Immediate recognition and laparoscopic reanastomosis were performed after removal of the uterus. In the second case, the patient had been forewarned that incidental cystotomy could occur during dissection of the bladder off of the lower uterine segment in women who have had a cesarean section. This was not considered a result of the approach, because thinning of the bladder wall within adhesions from the cesarean section was observed. In the third case, the ureter was heat-injured with the cautery device during ligation of the uterine artery too low on the parametrium. We now keep more meticulous eye on the precise location of the bottom of the cervix by both visual cues and "palpation" with the laparoscopic instruments. These lessons prevented further injuries in the last two thirds of patients.

There are many serious challenges to the utility and validity of this retrospective observational series. First, the nonrandom, clinically based assignment of laparoscopic approach introduces selection bias concerning comorbidities, but no patients were excluded from TLH due to their BMI. Such selection-bias concerning cardiopulmonary disease, metastatic disease, and documented adhesions mimics clinical practice, but hinders in the utility of this data except as a pilot series. In the absence of the needed randomized clinical trials confirming other guidelines for assignment of approach, our pattern of assignment reflects current clinical laparoscopic surgical safety standards [52–54].

Second, this methodology is limited in terms of generalizability, as many other gynecologic surgeons may not yet have the experience reflected in this report. Thus, the complication rates for other surgeons may indeed differ by the patient's body mass index or be higher in the early portion of their surgical series. Complications are minimized with training, experience, and a meticulous approach with colleagues as cosurgeons.

The techniques employed and described herein parallel traditional standard open techniques (except the morcellation), making the procedure more easily performed by abdominal surgeons. One can obtain experience and practice these techniques during open surgery by performing the entire open laparotomy hysterectomy with the CS Harmonic Scalpel, which is the hand-held, shorter version of the 5-mm Laparoscopic LCS Harmonic Scalpel, designed for open cases. Other safety features, similar in both the open and laparoscopic procedures and familiar to every gynecologic surgeon, include frequent identification of the location of the ureters, constant "traction-counter-traction" to lift the uterus away from the ureters with constant upward axial pressure on the uterine manipulator, and frequent palpatory identification of the cervical and parametrial anatomy.

Third, making significant comparisons in this retrospective study is difficult because of the many variables existing between patients (e.g., cancer status, nutritional status, medical comorbidities), which were not abstracted or taken into account in this small observational series.

Lastly, there were over 95 procedures performed with the hysterectomy/adnexectomy, contributing to complications and durations of surgeries. In reality, Gynecologic Oncologists will frequently perform additional procedures at the time of hysterectomy/adnexectomy to address adhesions, pelvic floor dysfunction, and anomalous findings at surgery. Ideally, future randomized clinical study would control for patients' baseline health and for additional procedures.

Conclusions

In our experience, total laparoscopic hysterectomy/adnexectomy appears to be feasible and safe for obese, overweight, and ideal BMI patients who require surgical management of adnexal pathology. When patients are stratified by BMI, no significant differences are observed concerning duration of surgery, blood loss, length of hospital stay, or complication rate. This patient series confirms patient acceptability of the procedure, provides descriptive data regarding surgical and postoperative parameters, and highlights clinical considerations that are important to the design of randomized, clinical trials. Based on this cohort of cases, randomized prospective studies are warranted to compare TLH, TAH, VH, and LAVH in women with the full spectrum of BMI, to validate the utility of each approach, with attention to both short-term and long-term complications.

Acknowledgment

The data in this paper was presented at the Annual Clinical Meeting of the Society of Gynecologic Oncologists in New Orleans, LA, February 2003.

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