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SCIENTIFIC PAPER JSLS

Total Laparoscopic Hysterectomy Versus Total Abdominal Hysterectomy: Cohort Review of Patients With Uterine Neoplasia

Katherine A. O'Hanlan, MD, Gloria Shining Huang, MD, Anne-Caroline Garnier, BS, Suzanne L. Dibble, DNSc, RN, Mirjam L. Reuland, MD, Lisbeth Lopez, BS, Rebecca L. Pinto, PA-C

ABSTRACT

Objective: Retrospective analysis of surgico-pathologic data comparing total laparoscopic hysterectomy (TLH) with total abdominal hysterectomy (TAH) patients with uterine neoplasia

Methods: We conducted a chart abstraction of all patients undergoing hysterectomy for uterine neoplasia from September 1996 to November 2004. Patients were assigned to undergo the abdominal or laparoscopic approach based on established clinical safety criteria.

Results: The study included 105 patients, 29 with TAH and 76 with TLH. TAH patients were older (68 vs. 61, $P=0.021$); however, both groups had similar body mass indexes (31) and parities (1.6). Controlling for age, surgical duration was similar (152 minutes). Average blood loss was higher for TAH, (504 vs.138 mL, $P<0.001$). Hospital stays were significantly longer for patients with TAH than for those with TLH (5.4 vs. 1.8 days, $P<0.0001$). Uterine weight was greater (197 vs. 135 g, $P=0.008$) and myometrial invasion deeper in the TAH group (48% outer half vs. 17%, $P=0.001$). More patients had Stage II or higher disease in the TAH group (35% vs. 17%, $P=0.038$). More TAH patients needed node dissection (79% vs. 28%, $P<.001$). Node yields from dissections of 23 TAH cases and 21 laparoscopic cases were similar (17 nodes). Total and reoperative complications from TAH versus TLH were not statistically different in our small sample (14.3 vs. 5.2% total, NS; 10.3 vs. 2.6% reoperative). One conversion was necessary from laparoscopy to laparotomy for unsuspected bulky metastatic disease.

Conclusion: Based on clinical selection criteria, TLH performed for endometrial pathology has few complications and is well tolerated by select patients. The advantages are less blood loss and a shorter length of hospital stay for qualified patients.

Key Words: Total laparoscopic hysterectomy, Total abdominal hysterectomy, Uterine neoplasia.

Gynecologic Oncology Associates, Palo Alto, California, USA (Dr O'Hanlan, Ms Pinto).

Albert Einstein College of Medicine, Bronx, New York, USA (Dr Huang).

Duke University School of Medicine, Durham, North Carolina, USA (Ms Garnier).

University of California at San Francisco, San Francisco, California, USA (Ms Dibble).

Ruprecht-Karls-Universitaet, Heidelberg, Germany (Dr Reuland).

Stanford University School of Medicine, Palo Alto, California, USA (Ms Lopez).

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Address reprint requests to: Kate O'Hanlan, MD, Gynecologic Oncology Associates, 4370 Alpine Rd, Stes 103–104, Portola Valley, CA 94028, USA. Telephone: 650 851 6669, Fax: 650 851 9747, E-mail: ohanlan@AOL.com

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INTRODUCTION

Traditional therapy for uterine hyperplasia, carcinoma, or sarcoma includes total abdominal hysterectomy (TAH) with salpingo-oophorectomy, and when pathologic stage is higher than IB or tumor grade is 3, lymph node sampling is performed.[1] In 1993, laparoscopic-assisted vaginal hysterectomy (LAVH) with indicated node dissection was described as an alternative to TAH for clinical stage I endometrial cancer patients.[2] LAVH has also been shown to be appropriate for women over the age of 75 with endometrial cancer, conferring a similar blood loss, equal or higher node counts, longer operating times, shorter hospital stays, and less pain than TAH.[3,4] In randomized trials comparing TAH versus 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 LAVH.[5–9]

However, LAVH is predicated upon the ability to dissect the cervix and lower uterine segment through the vagina. Obesity, nulliparity, and senior age, the 3 most common risk factors for endometrial cancer, may all contribute to making the vagina longer, narrower, and thus it is more difficult to complete the vaginal portion of the LAVH. Many obese, senior, and nulligravid women will not qualify for the LAVH because they lack sufficient uterine prolapse or vaginal capacity.

The total laparoscopic hysterectomy (TLH) has been described over the last 10 years as potentially quicker, more

efficient, and associated with less blood loss than LAVH.[10,11] In 2003, we reported our TLH data from a series of patients and observed it to be safe in the care of obese patients with pelvic masses and early ovarian carcinoma.[12] It is also more available to nulliparous women[13] and senior women.[14] Although a randomized clinical trial would be the standard for confirming the indications, safety, efficacy, and complication rates of TLH in women with endometrial neoplasia, as yet, no large cohort reviews of TLH procedures have been conducted for this indication to serve as pilot data.

This retrospective, nonrandomized cohort review delineates the surgical and pathological findings of a clinical series of all patients with early endometrial cancer, hyperplasia, or sarcoma in a private practice in which over 611 TLHs have been performed. The standard in this practice is to assign patients to TLH or TAH based on evaluation of the medical history, physical examination, and clinical testing, with specific documentation of severe adhesions from prior surgeries, a large uterus (>250 g) confirmed by ultrasound, or significant chronic obstructive pulmonary disease (COPD). The objective of this retrospective cohort analysis was to generate pilot data that confirm the safety of this selective approach to assigning the appropriate surgical method.

METHODS

Study Design

Chart abstraction with Investigational Review Board approval was undertaken for all cases of hysterectomy performed by 1 attending surgeon from September 5, 1996 to November 15, 2004, at 4 San Francisco Bay area hospitals for patients with clinically localized, pathologically confirmed, endometrial carcinoma, hyperplasia, or sarcoma. The names were obtained by searching the computer billing data for Current Procedural Terminology (CPT) code diagnoses 621.3, 179.0, and 182.0. Women with metastatic disease by clinical or radiographic assessment were not included in this retrospective study. At the time of their initial presentation, patients were assigned to an abdominal approach if they had any of the following: documentation of severe adhesions from a prior operative report, a large uterus that would not fit through the vagina without morcellation, or significant COPD that precluded a 45-degree Trendelenburg position. Patient's weight, height, (body mass index) BMI, and age were not considerations in selection of the approach, because both BMI and age have previously been shown to not impact outcomes of TLH.[12,14] COPD was defined as any history of severe asthma or moderate to severe pulmonary obstructive disease considered poorly controlled. All other women were assigned to undergo a laparoscopic approach.

Surgical Approaches

All patients received general anesthesia and standard prophylactic cephalosporin antibiotic, a subcutaneous injection of an antithrombin agent, and wore sequential compression devices on their upper and lower legs.

TAH is defined as an abdominal hysterectomy with a 10-cm to 15-cm vertical incision in the abdominal wall, through which the standard operation is carried out.[15] Patients usually require a 3-day to 5-day hospitalization, followed by a 6-week recovery time.

For both approaches, all uteri with grade 1 and 2 carcinomas were given to the pathologist for frozen section examination for indicators of lymph node sampling: cervical invasion, deep myometrial invasion, or lymphatic space invasion. Pelvic and aortic nodes were also dissected whenever patients had grade 3 carcinoma. The pelvic lymph node dissection consists of resecting the fibro-fatty lymph-bearing tissue from the genitofemoral nerve medially, over the external iliac artery and vein down to the crossing of the deep circumflex iliac vein over the external iliac artery, including the tissue around the internal iliac artery, anterior and medial to the obturator nerve, and lateral to the superior vesical artery and ureter. Aortic node dissections included the fibro-fatty node-bearing tissue anterior to the vena cava, the aorta, and to the left of the aorta from the ureters up to the inferior mesenteric artery.

The term "TLH" means all surgery was performed entirely through the laparoscopic ports.[16] Because this is a relatively new application of surgical technique in gynecologic oncology, the specific steps will be delineated: the patient is positioned in a modified lithotomy position with the hips at about a 180-degree extension and the knees flexed at nearly 90 degrees, with the table tilted nearly 45-degrees Trendelenburg. The arms are tucked along the patient's side and secured in a sled, and large gel or foam bolsters are taped to the table above the shoulders to prevent sliding on the table. After injecting the umbilical apex with Marcaine, towel clips are used to elevate the abdominal wall, and a bladed 5-mm EndoEthicon trocar is inserted vertically without preinsufflation.[17] After insufflation with CO_2 to 12 mm Hg, 3 additional 5-mm ports are inserted under direct visualization, 1 suprapubic and 2

positioned 2 cm medial and superior to the anterior superior iliac crests.

The abdominal inspection and cytologic washing are performed before inserting the Humi Uterine Manipulator (CooperSurgical, Inc. Trumbull, CT) through the cervix. All adhesions are lysed, and any peritoneal lesions are biopsied or excised before the hysterectomy. Once the ureters are identified through the peritoneum at the pelvic brim, the infundibulopelvic ligaments are cauterized with bipolar cautery and incised with the 5-mm LCS Harmonic scalpel (Ethicon Endo-Surgery, Cincinnati, OH).[18] Then, the broad and round ligaments are incised with the Harmonic scalpel. To replicate the effects of "traction-counter-traction," to facilitate parametrial dissection, the uterus is placed under tense axial elevation by pushing the uterine manipulator directly cephalad. The bladder flap is opened and incised with the Harmonic scalpel exposing the anterior cervical fascia. From this point to the incising into the vagina, the cervico-vaginal margin is repeatedly, carefully confirmed by using instrument "palpation" of the firmer cervix stroma, which moves together as a solid mass, compared with the more pliant upper lateral vagina that dimples easily. Also, the surface of the cervix anteriorly and posteriorly are frequently visualized and palpated with the instruments to replace the usual open palpation of the cervico-vaginal margin by the fingers. If it is difficult to identify the precise cervico-vaginal margin, a right angle retractor or ribbon can be passed into the vagina anterior to the uterine manipulator to identify the junction anteriorly so that the Harmonic scalpel can by used to puncture into the vagina at 12 o'clock. The uterine arteries are then skeletonized and extensively cauterized at the junction of the lower and middle third of the cervical body by using the bipolar cautery, and incised with the Harmonic scalpel directly through to the glistening white, smooth cervical fascia beneath. The arterial pedicle is pushed inferiorly exposing the cardinal ligament fibers. These are incised in 3 bundles, anteriorly, then posteriorly to include the uterosacral ligament, and lastly medially and inferiorly. This last incision usually identifies the exact edge of the cervico-vaginal margin and allows for the next medial bite to pierce into the vagina at either 9 o'clock or 3 o'clock. Entry into the vagina is confirmed by rapid loss of pneumoperitoneum. The uterine manipulator is then removed and a folded glove containing 2 dry, fluffed 4x4-inch gauze is placed in the vagina to maintain the pneumoperitoneum. With direct exposure of the cervical os by using toothed biopsy forceps as graspers on the vagina and the cervical edge, it is possible to expose and incise along the precise margin between the cervix and vagina. Once the entire cervix is cut away from the vagina, a tenaculum is inserted through the vagina, beside the glove, to grasp the cervix and deliver the tissue out of the vagina. The uterus is submitted for frozen section.

If node dissection is not indicated, the vaginal apex is closed by using toothed biopsy forceps as graspers and #1 Vicryl laparoscopic suture (JK-10 Endo Ethicon) with an ST-3 needle in 3 or more figure-eight (technically spiral) sutures made with a Wolfe or Ethicon needle driver, fixing the vaginal angle to the proximal-most uterosacral ligaments for suspension.

Patients are given printed information about their bowel preparation, and their inpatient postoperative and home recovery. Discharge instructions recommend resumption of all activities as soon as tolerable, and early ambulation and resumption of floor exercise is encouraged. Patients are instructed not to engage in any vaginal penetration until after their 6-week vaginal checkup. All patients are seen postoperatively for an abdominal incision check at 10 days and again at 6 weeks. Patients are referred for radiation if they have a grade 3 cancer with any invasion, lymphatic channel invasion, or Stage Ic or higher.[19]

Data Management and Analysis

Office and hospital charts were then 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 like depth of invasion, grade, presence or absence of lymph-vascular invasion, cervical invasion, pelvic cytologic washings, number of nodes dissected, and complications. The data were analyzed with SPSS statistical analysis software, with ANOVA and the *t* test used 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

Of the 105 patients with endometrial pathology, 76 qualified for TLH, and 29 underwent TAH. Patients had a significantly higher mean age in the TAH group, (68 vs. 61 years, $P=0.021$) **(Table 1)**. No significant differences existed in height, weight, body mass index (BMI), or parity. Therefore, the surgico-pathological analyses that would be affected by age were done controlling for age.

Most women had a diagnosis of endometrial carcinoma

Table 1.
Patient Demographics (ANOVA)

	Open n=29, mean (SD)	Laparoscopic n=76, mean (SD)	*P* Value
Age (y)	67.6 (13.0)	60.9 (13.1)	0.021
Parity	1.8 (1.4)	1.6 (1.4)	0.426
Height (inches)	63.8 (2.8)	64.0 (2.7)	0.738
Weight (lbs)	184.8 (74.3)	176.5 (48.5)	0.580
Body Mass Index	31.9 (12.7)	30.5 (8.9)	0.583

preoperatively (83.8%) as well as a final diagnosis postoperatively (81%). The TAH group had more cases of endometrial carcinoma than did the TLH group both by preoperative biopsy assessment (97% vs. 79%, P=0.036), and by postoperative final pathology (97% vs. 78%, P=0.021). One patient in each group had complete staging for a pelvic mass and was later confirmed to have 2 primaries: Stage Ia endometrial carcinoma and Stage Ia ovarian carcinoma. Two patients were found to have a sarcoma, a Stage Ic low-grade sarcoma, and a stage Ia high-grade stromal sarcoma **(Table 2)**.

In **Table 3**, the surgical data are stratified by approach, adjusting the means for age. The mean durations of surgery for abdominal and laparoscopic approaches were similar (154 min). Blood loss was higher in the TAH group (504 mL vs. 138 mL, P<0.001), and transfusions were more common (0.69 units/patient vs. 0.04, P=0.001). Length of hospital stay was longer for TAH than for TLH (5.4 days vs. 1.8 days, P<0.0001).

In **Table 4**, the pathological data are stratified by approach. Uterine sizes were larger in the abdominal approach groups by width (P=0.018), depth (P=0.041), and weight (P=0.008), but not length. TAH cases were more likely to have outer third myometrial invasion (48% vs. 17%, P=0.001), but TLH cases had more superficial or noninvasive tumors (28% vs 68%, P=0.001). Tumor grade and incidence of cervical invasion or peritoneal fluid spread were similar in both approaches, but a higher incidence of lymph vascular space invasion (LVSI) (38% vs. 17%, P=0.036) occurred in the TAH group. More patients with 1998 FIGO stage II or higher were assigned to the TAH group (35% vs. 17, P=0.038). TAH group patients were more likely to have a node dissection indicated by virulence factors (79% vs. 28%, P=0.001); however, the lymph node yields were similar (P=0.810): 16.3 nodes by laparotomy (range, 2 to 45) and 18.0 nodes by laparoscopy (range, 4 to 56).

Table 2.
Patient Diagnoses (Fisher's Exact Test)

	Open n=29, N(%)	Laparoscopic n=76, N(%)	*P* Value
Preoperative Diagnosis			0.036
Atypical endometrial hyperplasia	1 (3)	16 (21)	
Endometrial carcinoma	28 (97)	60 (79)	
Postoperative Diagnosis			0.021
Noninvasive sarcoma, or hyperplasia	1 (3)	17 (22)	
Invasive carcinoma, or sarcoma	28 (97)	59 (78)	

Table 3.
Surgical Data by Approach (ANOVA)

	Open n=29, M*(SD)	Laparoscopic n=76, M*(SD)	*P* Value
Duration of surgery (min.)	143 (52.6)	158 (48.9)	0.783
Blood loss (mL)	504 (333.3)	138 (157.3)	0.001
Transfusions (units/pt)	0.60 (1.3)	0.04 (0.6)	0.001
Length of hospital stay (days)	5.4 (3.2)	1.8 (1.1)	0.0001

*Mean adjusted for age.

No significant difference existed in total complication rates for the abdominal or laparoscopic groups (14% vs. 5%, P=0.111) or in reoperative complication rates (10 vs. 3%, P=0.128) **(Table 5)**. Four complications occurred in the TAH group: 2 cases of wound dehiscence and 1 case of postoperative hemorrhage requiring reoperation, and 1 case of postoperative wound infection treated with packing. Among the TLH cases, 1 case each of trocar site herniation and small-bowel adhesions to the vaginal cuff causing small-bowel obstruction required reoperation. One patient had prolonged diverticulitis after her TLH, and one had vaginal cuff dehiscence, both resolving with expectant management. One TLH patient was converted to open laparotomy when bulky metastatic lesions were identified in the nodes, and on the peritoneal surfaces.

DISCUSSION

This study documents a series of patients with clinically early uterine neoplasia assigned by clinical safety param-

Table 4.
Pathologic Data by Approach

	Open n=29, M*(SD)	Laparoscopic n=76, M*(SD)	*P* Value
Size of Uterus			
Length (cm)	9.2 (2.1)	8.7 (2.2)	0.338
Width (cm)	6.9 (1.8)	5.9 (1.9)	0.008
Depth (cm)	4.8 (2.1)	4.2 (1.3)	0.041
Weight (g)	197 (138.5)	135 (80.3)	0.008
Depth of Myoinvasion			0.001
Noninvasive or superficial	8 (28)	52 (68)	
Inner 50%	7 (24)	11 (15)	
Outer 50%	14 (48)	13 (17)	
Grade of Lesion*			0.066
Atypical hyperplasia	1 (3)	15 (20)	
Well differentiated	11 (38)	34 (45)	
Moderately differentiated	8 (28)	17 (22)	
Poorly differentiated	9 (31)	8 (11)	
Sarcoma	0	2 (3)	
Cervical Involvement			0.750
Present	4 (14)	9 (12)	
Absent	25 (86)	67 (88)	
Lymph Vascular Space Invasion			0.036
Absent	18 (62)	63 (83)	
Present	11 (38)	13 (17)	
Cytologic Washing			0.550
Negative	21 (78)	61 (85)	
Positive	6 (22)	11 (15)	
FIGO Stage 1998			0.038
O (Hyperplasia)	1 (3)	15 (20)	
IA	7	28	
IB	10 18 (62)	14 48 (63)	
IC	1	6	
II or higher	10 (35)	13 (17)	
No. of Patients Having Node Dissection	23 (79%)	21 (28%)	<0.001
No. of Nodes Obtained	16.3 (10.6)	18.0 (13.4)	0.810

*Mean adjusted for age.

Table 5.
Complications by Approach (Fisher's Exact Test)

Complication	Open n=29, N(%)	Laparoscopic n=76, N(%)	*P* Value
None	25 (86)	72 (95)	
Diverticulitis	0	1 (1.3)	
Abdominal wound dehiscence	2 (7)	1 (1.3)	
Peritoneal vaginal dehiscence	0	1 (1.3)	
Postoperative bowel obstruction	0	1 (1.3)	
Postoperative wound infection	1 (3.5)	0	
Postoperative hemorrhage	1 (3.5)	0	
No. Reoperative complications	3 (10.3)	2 (2.6)	0.128
Total complications	4 (14.3)	4 (5.2)	0.111

eters to TLH as default, or to TAH when necessary. Based on the results of this series, TLH can be recommended for randomized clinical trials as a potentially safe alternative to TAH for many women, with no increased morbidity.

Obese, elderly, and nulliparous women have a higher[20–22] incidence of uterine carcinoma in comparison with others. Although we did not use BMI, age, or parity in the assignment of surgical approach, historically, obesity and senior age have been seen by some as a relative contraindications to a laparoscopic approach.[23] Obese patients sustain more blood loss and more incisional and infectious complications from laparotomy and may incur significant potential benefit from a laparoscopic approach.[24–26] Although obese women can tolerate increased intraperitoneal pressure well if they have normal cardiac function,[27] respiratory mechanics can be adversely affected for the duration of the pneumoperitoneum.[28] In particular, obese women often need higher than usual inspiratory pressures in the Trendelenburg position, because the weight of the abdominal wall, bowel, and omentum on the diaphragm reduces ventilatory compliance during surgery.[29] Peritoneal insufflation has also been shown to cause a significant reduction in cardiac output, increases in mean arterial pressure and pulmonary vascular resistance, demonstrating that senior patients with COPD are not candidates for a laparoscopic approach.[30] In one series, a higher risk of conversion to open laparotomy was observed with increasing BMI over 30. In our entire series of laparoscopic hysterectomies reported elsewhere,[13] which now totals over 611, we have not observed higher complications, blood loss, surgical durations, hospital

stay, or conversions to laparotomy due to obesity, senior age, or cardiorespiratory problems. In this uterine neoplasia series, 56/105 (53%) of our TLH patients had BMI over 30 with no increase in complications. Our heaviest patient weighed 331lbs, with a BMI of 60, and sustained a 50cc operative blood loss, taking 90 minutes to complete, and was discharged the day after surgery.

Senior women have been observed to benefit from a laparoscopic approach in multiple gynecologic cancer sites.[24,31] Age has not been seen as a contraindication for laparoscopic lymphadenectomies for endometrial cancers.[32] We have previously reported our series of total laparoscopic hysterectomies for women with oncologic problems stratifying our outcomes by age,[14] showing no increase in rate of complications, surgical durations, volume of blood loss, or hospital stays. Twenty of 76 (26%) women in this laparoscopic series were over age 70, with the eldest being 90. All but 4 of these 20 patients were discharged within 2 days of surgery. None required conversion to laparotomy, but one had trocar-site herniation.

In both treatment groups in this study, 39% of the patients were nulliparous. Although LAVH has been reported for treatment of women with endometrial carcinoma,[33] many nulliparous women, lacking descensus, will still require open laparotomy or risk conversion to laparotomy when the vaginal dissection becomes impossible.[34] Because all of the dissections in the TLH are performed abdominally via a laparoscopic approach, this procedure is available for women with no descensus or who have long, narrow vaginas. We believe that if surgeons learn to perform hysterectomy entirely via laparoscopes, morbidity from hysterectomy would be reduced. In addition, avoiding any vaginal approach, even among women with adequate descensus or vaginal capacity, may also reduce the risk of subsequent urinary incontinence and vault prolapse, both of which are seen more often after vaginal hysterectomies than after laparotomy hysterectomies.[35–37]

Many are concerned that significantly longer operating times are necessary with any laparoscopic approach, especially with LAVH;[38] however, shorter endoscopic operating times have been reported with greater laparoscopic surgical experience[39,40] and with a total laparoscopic approach when compared with LAVH.[11,41] Our data support this, showing no difference in operating times between our TLH and TAH groups, which persists even when all patients having node dissection are excluded (154 min vs. 138 minutes, $P=0.535$).

As expected, we observed a lower mean blood loss and fewer transfusions with TLH; however, this information should be tempered with the observation that women undergoing abdominal approaches had significantly larger uteri than women having laparoscopic approaches. Our TLH blood losses have decreased over time. From the 20 most recent laparoscopic cases, 13 patients lost under 100 mL, with 9 of these patients undergoing node dissections.

The shorter median and mean hospital stay for the TLH patients (mean, 5.4 days vs. 1.8 days, $P<0.001$) is similar to observations by others.[38,42–44] Currently, we discharge patients in the afternoon of postoperative day 1 even if they require a node dissection. From the 20 most recent TLH cases, with 9 of these patients undergoing node dissections, 19 went home the first day after surgery.

The TAH group also had significantly larger uteri, deeper myoinvasion, more lymphatic channel invasion and a trend to higher grade; thus, significantly more lymph node dissections. This may also relate to the fact that the TAH patients were older, as senior women with endometrial cancers have been shown to have more aggressive disease.[21] Women with larger uteri may have had more progression of their disease before diagnosis and thus be assigned to open approach more often.

Laparoscopic lymph node dissections were equally productive in both approaches. Prior reports from this cohort have confirmed that node dissections were not more complicated in senior or obese women compared with node dissections in younger or more ideal-weight patients.[13,14] Laparoscopic node dissections are generally easier and incur less blood loss because the vasa vasorum are much more clearly seen and clipped. In fact, we analyzed blood loss in TLH cases with and without node dissection and found no difference (148 vs. 124 mL, $P=0.841$).

Peritoneal cytology was positive in similar proportions of both groups (22% vs. 15%), and roughly similar to other reports of 11% in clinically early stage series.[45] Some of our patients had undergone hysteroscopy before referral to our oncology service, which may have contributed to risk of peritoneal cytology positivity[46–49] and obscured finding natural differences in tumor virulence. Unfortunately, we did not collect data on the use of preoperative hysteroscopy to analyze the effects of this procedure. Recent reports have associated LAVH with a higher risk of positive cytology, possibly because of excessive uterine manipulation during the procedure extruding malignant cells out through the fallopian tubes.[50] In our practice, we minimize risks of iatrogenic peritoneal positivity by strongly discouraging the use of diagnostic hysteroscopy among our referral base unless uterine cancer has been

ruled out. We also do not insert the uterine manipulator until after coagulating the tubes, and we use only gentle and minimal manipulation of the uterus.

The rate of urologic complications seen so often in patients undergoing LAVH or TLH was surprisingly not seen in this series, although other patients in the surgical practice of the authors have sustained urologic injuries, which are reported elsewhere.[12] Currently, after completing 611 TLHs for all gynecologic indications, 15 patients (2.5%) sustained a urologic injury, with 7 (1.2%) undergoing recognition and immediate repair (4 cystotomy repairs and 2 ureteroureterostomies), and 8 (1.3%) requiring reoperation (4 ureteral stents, and 4 ureteroneocystotomies). All but 2 of the urologic injuries occurred during the first two thirds of cases. We attribute the decreasing rate of urologic injuries in this series to the learning curve and to our method of dissection of the cardinal ligament precisely on the cervical fascia, with rigorous use of traction-counter-traction, and frequent palpatory and visual reappraisal of the cervico-vaginal anatomy.

No port-site recurrences were noted, but 1 patient had a vaginal cuff recurrence and is disease free after radiation. Although 2 patients developed wound dehiscence in the TAH group, 1 TLH patient herniated her small bowel through a 5-mm trocar site, and all required reoperation.[51] Vaginal dehiscence developed in another patient after sexual penetration at 6 weeks, which healed without reoperation.[52]

Limitations of the Study

Many serious challenges exist to the utility and validity of comparing these 2 groups of patients in a single practice, most having to do with the initial nonrandom, clinically based assignment of approach. Such selection bias does significantly mimic clinical practice standards, offering implications for surgeons in practice, but this selection bias also hinders the broader utility of these data except as a pilot series. In the absence of the randomized clinical trials confirming any guidelines for assignment of approach, our conservative pattern of assignment was entirely clinically based: pulmonary disease, metastatic disease, documented severe adhesions, or a measurably large uterus,[30,53,54] but randomized clinical trials are now needed and indicated.

The nonrandom assignment to approach is also the most probable cause of the age disparity observed between the patients undergoing the 2 approaches. Older women are more likely to have had more surgeries, developed pulmonary disease, and to be at risk for postoperative medical complications.[24,55] No difference existed, however, in their height, weight, or BMI. Age is not normally a limiting factor for laparoscopic approaches,[14] but pulmonary function must be grossly normal or evaluated and cleared preoperatively.[24]

The nonrandom assignment criteria for surgical approach are likely also responsible for the observation of TAH group patients having larger uteri, deeper myoinvasion, higher stage, and trend of higher grade, and thus more node dissections. Elderly women have been shown to have more aggressive carcinomas.[1] However, the lymph node yields were similar in both approaches, and similar to yields previously reported for either laparotomy or laparoscopy.[31,39,40,42,44,56]

Another of the initial assignment criteria, that the uterus not be overly enlarged precluding its removal per vagina without morcellation, also contributes to the observation of larger uterine size in the laparotomy group and may predispose to larger, more invasive lesions. This criterion was initially important because of the concern about spillage of cancer cells into the peritoneum with morcellation of a large, cancerous uterus. Recently, we have obviated that concern in multiparous women to some degree by using a Lapsac (Cook Surgical, Chicago, IL) ripstop nylon 5x8-inch sack with a purse string. The sack is passed through the 10-mm umbilical trocar, encasing the uterus with the cervix pointing toward the open end, and passed out of the vagina, draw string first, allowing morcellation of the uterus from within the sack, with no peritoneal spillage. This technique is not possible when the vagina is narrow and long.

The laparoscopic techniques used and described above roughly parallel that of the traditional open technique (except the morcellation), making the procedure more easily learned by abdominal gynecologic surgeons. One can safely obtain experience and practice the technique 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 procedures. Other safety procedures, similar in both the open and laparoscopic, and familiar to every gynecologic surgeon, include frequent identification of the ureters, constant traction-counter-traction to separate the uterine arteries from the ureters with constant upward axial pressure on the uterine manipulator, and frequent palpatory identification of the cervical and parametrial anatomy. The last limitation is the great variability of surgeons' experience at laparoscopic surgery and ability to convert

their open skills to laparoscopic skills. We recommend that surgeons learning these techniques should work with other attending surgeons in their early series, because residents are not typically able to prevent complications when they are also learning these techniques.

We are hopeful that these data will serve to justify prospective, randomized clinical trials. The series exposes difficulties, highlights risks that need to be minimized, and confirms the safety of the procedure, which will be important in designing randomized trials. Taking into account concerns about the assignment to approach and the disparities in age, comparison of data from the 2 different approaches is still very useful and mimics actual clinical practice standards.

Gynecologic oncologists do not randomly assign a surgical approach. Rather, they evaluate each patient's surgical and medical history, physical examination, and radiological testing data to determine the safest and most feasible approach. They also perform additional procedures to address pelvic floor dysfunction and anomalous findings as needed. This series reflects just that standard, documents the surgical difficulties and clinical utility of each approach, and illuminates the need for study in prospective randomized trials.

CONCLUSION

We report this retrospective, observational series of total laparoscopic hysterectomies and total abdominal hysterectomies to document the safety and reasonable surgical parameters so that more surgeons will undertake a total laparoscopic approach for their patients with endometrial pathology when safely indicated. Given that a laparoscopic approach can never be recommended for all women with clinically early endometrial cancer due to the previously mentioned contraindications, selective assignment of approach will always be needed. The data generated from this series, which demonstrate the feasibility, benefits, and utility for select patients in real clinical practice, should serve as a basis for conducting future randomized clinical trials.

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