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Total Laparoscopic Hysterectomy: Our 5-Year Experience (1998–2002)

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ABSTRACT

Purpose: To review our experience performing total laparoscopic hysterectomy since we first introduced this procedure in 1998.

Methods: A retrospective cohort study was performed for patients undergoing total laparoscopic hysterectomy at Ochsner Clinic Foundation from February 1998 through December 2002. Rates of complications, successful completion, length of hospital stay, readmission, and reoperation were determined for this period.

Results: Among 511 patients who underwent attempted total laparoscopic hysterectomy, 487 procedures (95.3%) were completed by laparoscopy. The major intraoperative complication rate was 3.9%, and the major postoperative complication rate was 4.7%. No significant differences were seen in the intraoperative and postoperative complication rates of patients who were morbidly obese (body mass index $\geq$30 kg/m^2), patients with enlarged uteri ($\geq$300 g), or patients who underwent concomitant procedures (unilateral or bilateral salpingo-oophorectomy and lysis of adhesions). The readmission rate was 4.1%, and the reoperation rate was 2%. None of the variables studied, including age, medical problems, morbid obesity, concomitant procedures, or enlarged uterus, were found to have an association with readmission or reoperation rates.

Conclusions: Total laparoscopic hysterectomy can be performed successfully in most patients with benign indications. Morbidity is comparable to that of other types of hysterectomies, and this technique may be a more reasonable approach under some circumstances.

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INTRODUCTION

Historical Perspective

December 25, 1809, was the first time the human abdomen was deliberately opened to remove a diseased organ.[1] Dr Ephrain McDowell (1771–1830) removed a pelvic mass as the patient was lying on his kitchen table. The patient recovered from the operation and lived many years afterward. Others tried to imitate his success, but the postprocedure mortality rate remained 25% to 50% until the early 20th century.

In the early 1840s, English surgeon Charles Clay (1801–1893) introduced the term *ovariotomy*.[2] A few years previously, in 1839, he had performed the world's first hysterectomy.[1] It was not until 1853 that the first successful hysterectomy (in which the patient survived) was performed, in Lowell, MA. The surgeon, Ellis Burnham, performed 15 further hysterectomies. However, only 3 patients survived.[1]

The introduction of new instruments, anesthesia, antisepsis, anticoagulation, and antibiotic agents led to decreased morbidity and mortality and an increase in the number of hysterectomies performed.

Development of Laparoscopy

Since its introduction in the 1940s, laparoscopy has become an important tool in gynecology. Not only minor procedures such as female sterilization were being performed but also operations with precise diagnoses, allowing the surgeon to proceed with adequate treatment. Gradually, laparoscopy has become more sophisticated, and companies have developed new instrumentation for more complicated procedures.

Harvey Reich performed the world's first laparoscopic hysterectomy in 1988.[1] Other surgeons found the procedure to be time-consuming, and the laparoscopic-assisted vaginal hysterectomy became more popular soon afterward. Many surgeons started to perform more laparoscopic-assisted vaginal hysterectomies, arguing that they could visualize the pelvis for possible endometriosis or adhesions, that the pelvis could be inspected for possible bleeding, and that the ovaries could be removed easily. Many

teaching institutions encouraged this approach, mainly to improve and maintain the surgical skills required for laparoscopic and vaginal surgical procedures. It is possible that lack of training in laparoscopy could have influenced the decision by many gynecologists to avoid this surgical approach. It then became evident that none of these reasons justified the use of laparoscopic-assisted vaginal hysterectomy and that the morbidity was similar to that compared with transvaginal hysterectomies. These findings led some surgeons to develop different techniques to perfect the laparoscopic approach.

Total Laparoscopic Hysterectomy

In 1998, Koh[2] published ''A New Technique and System for Simplifying Total Laparoscopic Hysterectomy,'' arguing that this technique would accelerate the learning curve of the average gynecologist and would improve the success rate of total laparoscopic hysterectomy (TLH). The Koh colpotomizer system (Cooper Surgical, Trumbull, CT) consists of the following: (1) a colpotomy assembly using an articulated uterine manipulator; (2) a hard ring cup of polymeric resin, which is visible, palpable, and placed over the cervix to delineate the fornices, ensuring safe dissection and avoiding ureteral injury; and (3) a pneumo-occluder.

Summary of the TLH Technique

Introduced at Ochsner Clinic Foundation in 1998, TLH is practiced as described by Koh.[2] The patient is placed in a dorsal lithotomy position using adjustable stirrups. Surgical antibiotic prophylaxis is given 30 to 60 minutes before initiation of surgery. A Foley catheter is placed in the bladder, the uterus is sounded, and the cervix is dilated. The proper RUMI (Cooper Surgical) uterine manipulator tip and cervical cup are selected, and a Koh colpotomizer system is assembled. With the help of vaginal retractors, the system is introduced in the vagina, and the RUMI tip is pushed into the uterus to engage the cup around the cervix and against the fornix. The uterine balloon and the pneumo-occluder are inflated, and laparoscopy is started.

During our first 5 years performing this procedure (the study period), we used a 10-mm port (10-mm-diameter and 15-cm-long trocar, Ethicon Surgery, Cincinnati, OH) placed at the umbilicus for accommodation of a 10-mm 0-degree or 45-degree laparoscope. Two 5-mm ports (5-mm-diameter and 10-cm trocar-long, Ethicon Surgery) were placed approximately 4 to 5 cm below the umbilicus in the right and left paramedian positions for the operative instruments. Reusable unipolar electrosurgical scissors, reusable unipolar electrosurgical spatula (Encision, Boulder, CO), disposable bipolar electrosurgical desiccating and cutting forceps (Everest BiCOAG Bipolar Cutting Forceps, Vital/Med Systems, Colorado Springs, CO), and various reusable tissue forceps were used to perform the hysterectomy and, if indicated, salpingo-oophorectomy. Vaginal or power morcellation (Gynecare X-TRACT Tissue Morcellator, Ethicon, Somerville, NJ) was performed as necessary to facilitate recovery of a large uterine specimen. The specimens were removed vaginally, and the vaginal cuff was closed with a laparoscopic device (Endostitch, AutoSuture, Norwalk, CT). Typically, interrupted sutures of No. 0 braided polyglycolic acid were placed and then tied using the extracorporeal technique. Cystoscopy was performed in most cases at the discretion of the primary surgeon.

METHODS

The study was approved by the Institutional Review Board of Ochsner Clinic Foundation. The retrospective cohort study included all patients who underwent TLH for benign disease at Ochsner Clinic Foundation from February 1998 through December 2002, the first years Ochsner used this technique. The data were obtained from our departmental database of gynecologic patients, and the information was verified via a detailed review of the medical records for each patient. The TLH was performed using the same technique in all subjects by the attending gynecologist, with a senior or junior house staff member usually assisting.

Variables studied included age, parity, body mass index (BMI [calculated as weight in kilograms divided by height in meters squared]), race/ethnicity, diagnosis, date of procedure, American Society of Anesthesiologists score, and concomitant procedures (unilateral or bilateral salpingo-oophorectomy and lysis of adhesions). We also included operating room time, estimated blood loss, and uterine weight, which was subdivided into 2 categories ($<$300 and $\geq$300 g).

Intraoperative complications were categorized as none, cystotomy, large-bowel injury, hemorrhage, and others. Postoperative complications included fever, ileus, nausea and vomiting, anemia, and others. Other variables were length of hospital stay, preoperative and postoperative hemoglobin level, and hematocrit. We also looked for patients who were readmitted within 30 days of discharge and those who returned to the operating room. Statistical analyses (1-way analysis of variance and χ^2 test) were performed to evaluate unadjusted associations between independent and dependent variables of interest.

RESULTS

A total of 511 patients underwent attempted TLH (Table 1), and the procedure was successfully com-

Table 1. Patients Undergoing Attempted Total Laparoscopic Hysterectomy per Year

Year	No. (%) (n = 511)
1998	19 (3.7)
1999	71 (13.9)
2000	92 (18)
2001	138 (27)
2002	191 (37.4)

pleted by laparoscopy in 487 (95.3%). Five cases were converted to laparotomy secondary to intraoperative complications. These included hemorrhage (2 patients), cystotomy (2 patients), and large-bowel injury (1 patient). Nineteen other cases were excluded from the study because they were converted to laparotomy before any significant laparoscopic dissection. The most commonly reported reason for conversion was severe adhesive disease (8 patients), followed by inadequate visualization secondary to fibroids (5 patients) and benign pelvic masses (2 patients). Four other cases were converted to laparotomy, but no clear indication for conversion was documented in the operative report. Two other cases were converted to perform staging for endometrial cancer; they were also excluded from the study.

The most common race/ethnicity was white (54.3%), followed by African American (40.7%) and Hispanic (3.1%). The mean BMI was 28.7 (range, 18.2–65.4) (Table 2). The most common indications for the procedure were fibroids (54.5%), followed by dysfunctional uterine bleeding or abnormal uterine bleeding (31.3%) and chronic pelvic pain (11%).

Table 2. Characteristics of 511 Patients

Variable	Value, mean
Age, y	44.0
Parity	2.1
American Society of Anesthesiologists score	1.7
Body mass index[a]	28.7
Estimated blood loss, mL	175.2
Operating room time, min	123.0
Length of hospital stay, d	1.3
Uterine weight, g	225.0
Preoperative hemoglobin level, g/dL	11.5
Preoperative hematocrit, %	37.1
Postoperative hemoglobin level, g/dL	9.8
Postoperative hematocrit, %	33.3

[a] Calculated as weight in kilograms divided by height in meters squared.

Table 3. Major Intraoperative Complications

Complication	No. (%) (n = 511)
Cystotomy	5 (1)
Hemorrhage	3 (0.6)
Serosal injury of the large bowel	2 (0.4)
Inferior epigastric vessel injury	2 (0.4)
Ureteral injury	1 (0.2)
Small-bowel mesentery injury	1 (0.2)
Other major	7 (1.4)

Most patients (93.7%) had no minor or controlled medical problems; 63.6% had an American Society of Anesthesiologists score of 1. The most common concomitant procedure was unilateral or bilateral salpingo-oophorectomy, which was performed in 65.2% of the patients. Extensive lysis of adhesions was performed in 24.6% of the patients. The mean uterine weight was 225 g (Table 2); most patients (80.3%) had a uterine weight of less than 300 g, and 19.7% had a uterine weight of at least 300 g.

Twenty patients (3.9%) experienced major intraoperative complications (Table 3). These included 5 cystotomies, 3 hemorrhages, 2 serosal injuries of the large bowel, 2 inferior epigastric vessel injuries, 1 ureteral injury, 1 injury of the small-bowel mesentery, and 7 other major complications.

We found no significant difference in the intraoperative complication rate among patients stratified according to uterine weight ($P = 0.589$) or BMI ($P = 0.472$). Having a unilateral or bilateral salpingo-oophorectomy or significant lysis of adhesions was not associated with increased intraoperative complications.

Thirty-five patients (6.8%) experienced postoperative complications; 24 (4.7%) were considered major (Table 4). These included 7 vaginal cuff cellulites, 5 vaginal cuff dehiscences, 4 wound infections, 2 pelvic

Table 4. Major and Minor Postoperative Complications

Complication	No. (%) (n = 511)
Vaginal cuff cellulitis	7 (1.4)
Vaginal cuff dehiscence	5 (1)
Wound infection	4 (0.8)
Pelvic abscess	2 (0.4)
Vesicovaginal fistula	1 (0.2)
Thromboembolic event	1 (0.2)
Other major	4 (0.8)
All minor (urinary tract infection, fever, nausea, vomiting, etc)	11 (2.2)

Table 5. Complication Rates per Year

Year	Major Intraoperative Complications, %	Major and Minor Postoperative Complications, %	Readmission, %
1998	10.5	21.0	15.8
1999	7.0	9.8	4.2
2000	3.2	6.5	2.2
2001	3.6	6.5	5.0
2002	2.6	4.7	3.1

abscesses, 1 each of vesicovaginal fistula and thromboembolic event, and 4 other major complications. Eleven (2.2%) were classified as minor complications.

None of the variables studied had a significant association with increased postoperative complications. These included age ($P = 0.372$), race/ethnicity ($P = 3.8$), BMI of at least 30 kg/m^2 ($P = 0.89$), unilateral or bilateral salpingo-oophorectomy ($P = 0.998$), lysis of adhesions ($P = 0.411$), and uterine weight of at least 300 g ($P = 0.186$).

The mean preoperative hematocrit for patients with postoperative complications was 35.3%, a slightly statistically significant difference compared with patients without complications (mean, 37.3%) ($P = 0.06$). However, no difference was observed for preoperative hemoglobin level (11.4 vs 11 g/dL, $P = 0.121$).

Only 21 patients (4.1%) were readmitted for postoperative complications, and 10 patients (2%) required reoperation. Neither the risk of readmission nor the risk of reoperation was significantly different in patients who were morbidly obese (BMI ≥30 kg/m^2) or patients who had an enlarged uterus (≥300 g).

DISCUSSION

Hysterectomy is the second most common operation performed in the United States, second only to cesarean section. Annually, approximately 600 000 women undergo hysterectomy; by age 60 years, 1 of every 3 women in the United States will have had this procedure.[3] These numbers are expected to increase, creating a major economic effect and the need to look for other conservative and less invasive options compared with the traditional method. Unfortunately, conservative therapy is not effective in most cases, leaving surgery as the only reasonable option.

Laparotomy remains the standard method for hysterectomy in the United States, performed in almost 75% of all hysterectomies.[4,5] This has led to increasing interest on the part of some surgeons to develop and improve laparoscopic techniques. Since Reich[6] described the first laparoscopic hysterectomy, other authors have reported different techniques for performing this procedure.[7–10]

Many advantages of TLH have been described, including improved cosmetic result, reduced postoperative discomfort, shorter hospital stay, quicker return to the activities of daily life, and decreased costs.[11] By reducing the amount of time spent as an inpatient, patients are exposed to fewer nosocomial infections, in theory decreasing the risk of iatrogenic infections.[8] TLH could be performed successfully in most obese patients,[12,13] and operating room times are comparable to those of abdominal hysterectomies.[14] Some authors agree that TLH is safe and feasible in the presence of enlarged uteri[15,16] and in women with certain types of gynecologic cancer.[16–19]

Another potential benefit of TLH was described by Koh[2] in his initial study and is related to the preservation of pelvic tissue. According to Koh, vaginal length is maximized with the Koh colpotomizer system, and preservation of the uterosacral ligament may maintain vaginal innervation. Laparoscopic closure of vaginal vault without inversion minimizes granulation formation, and incorporation of pubocervical fascia gives excellent vault support.

Limitations in performing TLH mainly relate to the learning curve associated with this procedure.[7,14] Few skilled surgeons have the experience and desire to perform and learn this new technique. The requirement for more complex equipment and the increased anxiety associated with medical and legal concerns during the learning phase are among other disadvantages reported.

In our study, the learning curve was clearly seen when we stratified the major intraoperative complication rates, postoperative complication rates, and readmission rates per year since we began performing the procedure in 1998 (Table 5). It would be noteworthy to compare these results with those of 5 years that followed our study (2003–2007), after the development of new technology and the improvement of surgeons' skills. It would also be worthwhile to see how surgeons' experience affects operating room time and morbidity in general. With the development of robotic surgery and newer technology, we expect that surgeons would be more motivated to learn new procedures for the benefit of patient care.

Among studies addressing TLH as described by Koh,[2] our study comprises the largest cohort to date, to our knowledge. This gives enormous validity to our results and might encourage other surgeons to look for alternatives to laparotomy and vaginal hysterectomy. Study results in the literature continue to be encouraging, and we strongly believe that this procedure should be part of the gynecologist's

training, offering patients alternatives that are associated with low morbidity and rapid recovery.

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