

Minimally Invasive Hysterectomy at a University Teaching Hospital

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ABSTRACT

Background and Objectives: To evaluate the feasibility of a minimally invasive approach for hysterectomy for benign disease at a university teaching hospital.

Methods: Five hundred thirty-seven consecutive patients underwent hysterectomy for benign disease at Penn State Milton S. Hershey Medical Center in 2010. No cases were excluded. Minimally invasive approaches included total vaginal hysterectomy, laparoscopy-assisted vaginal hysterectomy, total laparoscopic hysterectomy, and laparoscopic supracervical hysterectomy. All surgeries were completed with the resident as the primary surgeon or first assistant.

Results: The median age was 45 years, the median body mass index was 30 kg/m², the median estimated uterine size was 11 cm, and 22% of patients had a prior cesarean section. Of the 537 hysterectomies, 526 (98%) were started with a minimally invasive approach and 517 (96%) were completed in that fashion; thus only 9 conversions (2%) were required. Of the cases in which a minimally invasive approach was used, 16% were vaginal and 84% were laparoscopic. The median operative time was 86 minutes, the median blood loss was 95 mL, the median hospital stay was 1 day, and the median uterine weight was 199 g. For the minimally invasive hysterectomies, there was a 5% major complication rate.

Conclusion: Our residency training institution completed 96% of 537 hysterectomies using a minimally invasive approach while maintaining an acceptable operative time, amount of blood loss, hospital stay, and complication rate. Thus our study supports that a minimally invasive ap-

proach for hysterectomy for benign disease at an academic resident teaching facility is feasible.

Key Words: Minimally invasive hysterectomy, Resident program.

INTRODUCTION

Advanced laparoscopic procedures are increasingly being used as an alternative to laparotomy in gynecologic surgery.¹⁻⁷ A recent meta-analysis of 34 prospective randomized trials proves the benefits of minimally invasive surgery (MIS) compared with abdominal gynecologic surgery, including decreased pain, decreased surgical-site infections, decreased hospital stay, quicker return to activity, and fewer postoperative adhesions.⁸ Despite the improved outcomes with MIS, most hysterectomies are still performed by a laparotomy. Per the Centers for Disease Control and Prevention's national discharge survey in 2009, 60% of the 497,000 hysterectomies performed in the United States in that year used an abdominal approach.⁹ The predominance of a laparotomy approach to hysterectomy is mirrored by data from the Residency Review Committee that showed that a 2010 obstetrics and gynecology residency graduate in the 50th percentile for operative experience will complete 64 abdominal hysterectomies (61%), 18 vaginal hysterectomies (17%), and 23 laparoscopic hysterectomies (22%) during his or her residency.¹⁰

In 2009 a division of MIS was established in our obstetrics and gynecology residency program with 2 experienced full-time faculty members (G.H. and M.D.), with the emphasis placed on a minimally invasive approach to gynecologic surgery. The purpose of this study is to evaluate the safety and surgical outcomes of minimally invasive hysterectomy in a residency training program.

MATERIALS AND METHODS

The Penn State College of Medicine Institutional Review Board approved the study design and methods for the protection of the study participants. From January 1 through December 31, 2010, 537 patients underwent hys-

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terectomy for benign indications at Penn State Milton S. Hershey Medical Center with or without concomitant surgery. These patients were identified by use of *International Classification of Diseases, Ninth Revision* codes for hysterectomy types (total abdominal, abdominal supracervical, total vaginal, laparoscopy-assisted vaginal, laparoscopic supracervical, and total laparoscopic). No patients were excluded. In a retrospective fashion, demographic characteristics, surgical outcomes, and follow-up data were collected from the electronic medical record by the primary author and entered into a confidential database. Complications were also checked by review of monthly morbidity and mortality data.

The obstetrics and gynecology resident physician was the primary surgeon with an attending as the first assistant, or vice versa. Residents performed port placement, half of the hysterectomy, laparoscopic and/or vaginal colpotomy, morcellation, or closure of the vaginal cuff as needed. The attending physician for most hysterectomies (81%) was 1 of the 2 minimally invasive surgeons. The decision to proceed with a specific type of MIS hysterectomy (vaginal, laparoscopy-assisted, total laparoscopic, or laparoscopic supracervical) was dependent on vaginal access and the presence of an adnexal mass, as well as surgeon and patient preference. Using an abdominal approach was only intended from the outset in a paucity of situations (11 of 537), as discussed later.

Patients underwent a preoperative bowel preparation with either 1 bottle of magnesium citrate, Saline Laxative enema, or Bisacodyl suppository. Patients were admitted on the day of surgery, received a single dose of prophylactic antibiotics and pneumatic compression stockings, and underwent early ambulation postoperatively. Unless contraindicated, the postoperative pain management protocol consisted of ketorolac, 30 mg intravenously, at the completion of surgery; morphine, 2 to 4 mg intravenously every 2 hours as needed; and oxycodone, 5 to 10 mg orally every 4 hours. The patients were started on a regular diet on postoperative day 0.

All procedures were performed with patients under general endotracheal anesthesia. An orogastric tube was inserted at the start of the case and then removed at the end of surgery. Patients were positioned in the dorsolithotomy position by use of Ultrafin stirrups (Alten Medical, Acton, MA, USA) in the maximal Trendelenburg position (approximately 30°) for any laparoscopic portion of the surgery. For laparoscopic hysterectomy, a 3-port (5- to 10-mm) transperitoneal approach was used: intraumbilical, right lower quadrant, and left lower quadrant. Harmonic

Ace Curved Shears (Ethicon Endo-Surgery, Cincinnati, Ohio)—or, rarely, PlasmaKinetic cutting forceps (Gyrus ACMI, Southborough, Massachusetts) per surgeon preference—were used to ligate the triple pedicle (fallopian tube, round ligament, and utero-ovarian ligament), skeletonize the uterine artery, ligate the uterine artery, ligate the cardinal and uterosacral ligaments, and incise the vaginal colpotomy if necessary. If morcellation was necessary (eg, during laparoscopic supracervical hysterectomy), the Gynecare Morceller tissue morcellator (Ethicon, Cincinnati, Ohio) or Storz Rotocut G1 tissue morcellator (Karl Storz, Tuttlingen, Germany) was used per surgeon preference. For total hysterectomy, the vaginal cuff was closed laparoscopically, including vaginal cuff fixation to the uterosacral ligaments, with V-Loc 180 No. 2–0 glycolide/lactide copolymer (Covidien, Dublin, Ireland) or No. 2–0 polyglactin 910 with Lapra Ty II (Ethicon). For vaginal cuff closure during laparoscopy-assisted vaginal hysterectomy, No. 0 polyglactin 910 was used in 3 layers for vaginal cuff fixation to the uterosacral ligaments, reperitonealization, and reapproximation of the anterior cuff edge to its posterior counterpart.

Patients were followed up in the office at 1 and 6 weeks after surgery. Complications were noted from the electronic medical record at hospital discharge, at office follow-up, on readmission, at emergency department visits, at unscheduled postoperative visits, and based on morbidity and mortality data.

RESULTS

The demographic characteristics are presented in **Table 1**. The median age was 45 years (range, 22–90 years), the median body mass index was 30 kg/m² (range, 16–60 kg/m²), the median estimated uterine size was 11 cm (range, 6–30 cm), and 22% of patients had prior cesarean delivery.

Of the 537 hysterectomies, 526 (98%) were initiated with a minimally invasive approach and 517 (96%) were completed in that fashion; thus only 9 conversions (2%) were required. Of the cases in which a minimally invasive approach was used, 16% were vaginal and 84% were laparoscopic. Vaginal hysterectomies were primarily performed for pelvic organ prolapse or incontinence diagnoses, whereas laparoscopic hysterectomies were performed for more varied preoperative diagnoses including abnormal uterine bleeding, fibroids, endometriosis, and pelvic pain. The abdominal approach was used in only 11 patients. The indications for laparotomy included concomitant bowel malignancy surgery (n = 4), uterine size

Table 1.
Patient Demographic Characteristics

	MIS	Laparoscopic Hysterectomy	Vaginal Hysterectomy
No. of patients	526	448	78
Diagnosis			
Abnormal bleeding	141	137	4
Pelvic pain	113	104	9
Fibroids	116	116	
Endometriosis	76	76	
Prolapse/incontinence	65		65
Other	15	15	
Age [median (range)] (y)	45 (22–90)	43 (22–68)	56 (28–90)
Parity [median (range)]	2 (0–6)	2 (0–6)	3 (0–5)
Body mass index [median (range)] (kg/m ²)	30 (16–60)	30 (16–58)	29 (18–60)
History of cesarean section	114 (21%)	113 (25%)	1 (1%)
Preoperative uterine size [median (range)] (cm)	11 (6–30)	12 (6–30)	9 (6–14)

Table 2.
Operative Findings

	MIS	Laparoscopic Hysterectomy	Vaginal Hysterectomy
No. of patients	526	448	78
Blood loss [median (range)] (mL)	95 (20–1250)	80 (20–1250)	184 (25–1150)
Operative time [median (range)] (min) ^a	86 (31–396)	83 (31–396)	106 (56–189)
Hospital stay [median (range)] (d)	1 (0–22)	1 (0–22)	1 (1–2)
Uterine weight [median (range)] (g)	199 (25–2900)	216 (26–2900)	99 (25–339)

^aA concomitant procedure was performed in 11% of laparoscopic hysterectomy cases and 82% of vaginal hysterectomy cases.

>16 cm (n = 3), nulliparous patients with minimal pelvic descent cared for by a surgeon not trained in total laparoscopic hysterectomy (n = 3), significant prior abdominal surgeries (n = 2), and vaginal agenesis and VATER association (presence of [me]3 of the following congenital malformations: vertebral defects, anal atresia, cardiac defects, tracheoesophageal fistula, renal anomalies, and limb abnormalities) (n = 1). Nine cases required conversion because of lack of visualization, adhesive disease, repair of bowel/urinary tract injury, or control of bleeding.

The operative characteristics are presented in **Table 2**. The median operative time was 86 minutes (range, 31–396 minutes), the median blood loss was 95 mL (range, 20–1250 mL), the median hospital stay was 1 day (range, 0–22 days), and the median uterine weight was 199 g (range, 25–2900 g).

The overall complication rate was 11%, comprising major complications in 5% of patients and minor complications in 6% (**Table 3**). There were 3 bowel injuries, 3 urinary tract injuries, and 12 reoperations for either cuff abscess⁵ or cuff dehiscence.⁷

DISCUSSION

Proven benefits of minimally invasive hysterectomy include decreased pain, decreased surgical-site infections, decreased intestinal complications, fewer postoperative adhesions, decreased hospital stay, and quicker return to activity.⁸ Despite these clear benefits, a minimally invasive approach is used in only 40% of hysterectomies performed in the United States⁹ and in only 39% of hysterectomies performed by obstetrics and gynecology resi-

Table 3.
Complications

	MIS (n = 526)	LAVH ^a (n = 33)	TVH ^a (n = 78)	LSH ^a (n = 190)	TLH ^a (n = 225)
Major (No. of patients)	27 (5%)	4 (12%)	8 (10%)	2 (1%)	13 (6%)
Bowel injury	3 (1%)	0 (0%)	0 (0%)	0 (0%)	3 (1%)
Urinary tract injury	3 (1%)	2 (6%)	1 (1%)	0 (0%)	0 (0%)
Reoperation	12 (2%)	2 (6%)	4 (5%)	1 (1%)	5 (2%)
Pelvic abscess	5 (1%)	0 (0%)	4 (5%)	1 (1%)	0 (0%)
Cuff dehiscence	7 (1%)	2 (6%)	1 (1%)	0 (0%)	4 (2%)
Cuff cellulitis	8 (2%)	0 (0%)	2 (3%)	0 (0%)	6 (3%)
Minor (No. of patients)	30 (6%)	3 (9%)	3 (4%)	8 (4%)	16 (7%)
Transfusion	4 (1%)	2 (6%)	1 (1%)	0 (0%)	1 (0%)
Readmission	11 (2%)	1 (3%)	4 (5%)	2 (1%)	4 (2%)
Conversion	9 (2%)	1 (3%)	0 (0%)	5 (3%)	3 (1%)
Ileus	8 (2%)	2 (6%)	0 (0%)	2 (1%)	4 (2%)
Urinary retention	2 (0%)	0 (0%)	1 (1%)	1 (1%)	0 (0%)
Urinary tract infection	12 (2%)	1 (3%)	2 (3%)	1 (1%)	8 (4%)
Fever	2 (0%)	0 (0%)	0 (0%)	1 (1%)	1 (0%)
No. of patients with complications ^b	57 (11%)	7 (21%)	11 (14%)	10 (5%)	29 (13%)
Mortality	0	0	0	0	0

^aLAVH = laparoscopy-assisted vaginal hysterectomy; LSH = laparoscopic supracervical hysterectomy; TLH = total laparoscopic hysterectomy; TVH = total vaginal hysterectomy.

^bPatients may have had >1 complication.

dents.¹⁰ In our study 96% of hysterectomies were completed with a minimally invasive approach, which represents a 2.4-fold increase over the national average. In a PubMed review, we located very few studies on minimally invasive hysterectomies for benign disease at a residency teaching institution. Abdelmonem et al¹¹ reported on 177 hysterectomies at a residency teaching institution where 72% were completed with a minimally invasive approach. However, the number of patients excluded was not reported. Kovac et al¹² reported on vaginal hysterectomies from a residency clinic. However, their review spanned a 5-year period, the number of patients excluded was not reported, and data retrieval was biased. To our knowledge, our 96% minimally invasive approach is the highest rate reported from an obstetrics and gynecology residency program. In the nonresidency setting, 99% and 100% minimally invasive approaches have been reported.^{13,14} The abdominal approach was used in 5 of 11 patients in our study for a uterine size >16 cm and significant prior abdominal surgeries, neither of which is a contraindication to a laparoscopic approach.^{3,15}

In a residency training program, complication rates for hysterectomy would be expected to be increased compared with those of practicing gynecologic surgeons. A review in the Cochrane Database of Systematic Reviews (CDSR) of 34 randomized controlled trials with 4,495 women reported on minimally invasive hysterectomies for benign disease performed by practicing gynecologic surgeons.⁸ Our operative time of 86 minutes compares favorably with the CDSR time of 121 minutes. Our reported blood loss was 95 mL versus 311 mL in the CDSR, and our hospital stay was 1 day versus 3 days in the CDSR. Thus our operative time, blood loss, and hospital stay appear similar to those of practicing gynecologic surgeons.

In our study the major complication rate was 5%. Abdelmonem et al¹¹ reported a 9% major complication rate in a residency teaching institution. Although the CDSR did not report the overall major complication rate, it did report on specific complications.⁸ Our urinary tract injury rate was 1% versus 3% in the CDSR, our vaginal cuff infection rate was 2% versus 4% in the CDSR, and our urinary tract

infection rate was 2% versus 6% in the CDSR. Thus our complication rate appears similar to or better than that reported for a wide variety of practicing gynecologic surgeons. Because of our limited follow-up, postoperative cuff prolapse was not evaluated.

CONCLUSION

Our residency training institution completed 96% of 537 hysterectomies using a minimally invasive approach while maintaining an acceptable operative time, amount of blood loss, hospital stay, and complication rate. These findings support a minimally invasive approach for hysterectomy for benign disease at an academic resident teaching facility. Because of the proven benefits of a minimally invasive approach, it is our opinion that residency training institutions should emphasize a minimally invasive approach for hysterectomy. Our Division of Minimally Invasive Surgery has now begun robotic training in the residency training program, and this will be reviewed in the future.

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