

GYNECOLOGY

Resident participation in laparoscopic hysterectomy: impact of trainee involvement on operative times and surgical outcomes

Elena Igwe, MD; Enrique Hernandez, MD; Stephen Rose, MD; Shitanshu Uppal, MD

OBJECTIVE: The purpose of this study was to determine the impact of resident involvement on morbidity after total laparoscopic hysterectomy for benign disease.

STUDY DESIGN: We performed a retrospective review of a National Surgical Quality Improvement Program database of total laparoscopic hysterectomy for benign disease that was performed with resident involvement vs attending alone between Jan. 1, 2008, and Dec. 31, 2011. Surgical operative times and morbidity and mortality rates were compared. Binary logistic regression was used to control for covariates that were significant on univariate analysis ($P < .05$).

RESULTS: A total of 3441 patients were identified as having undergone a total laparoscopic hysterectomy for benign disease. The mean age of patients was 47.4 ± 11.1 years; the mean body mass index was 30.6 ± 7.9 kg/m². A resident participated in 1591 of cases (46.2%); 1850 of the procedures (53.8%) were done by an attending physician alone. Cases with resident involvement had higher mean age, Charlson morbidity scoring, and American Society of Anesthesiologists classification and were more likely to be inpatient cases. With resident involvement, the mean operative time was increased (179.29 vs 135.46 minutes; $P < .0001$). There were no differences in the rates of experiencing at least 1 complication (6.8% for resident involvement vs

5.4% for attending alone; $P = .5$), composite severe morbidity (1.3% resident vs 1.0% attending alone), or 30-day mortality rate (0% resident vs 0.1% attending alone). Additionally, there were no differences between groups in the infectious, wound, neurorenal, thromboembolic, septic, and cardiopulmonary complications. Cases with resident involvement had significantly increased rates of postoperative transfusion of packed red blood cells (2% vs 0.4%; $P < .0001$), reoperation (2.2% vs 1.3%; $P = .048$), and a 30-day readmission (5.5% vs 2.9%; $P = .015$). In models that were adjusted for factors that differed between the 2 groups, cases with resident involvement had increased odds of receiving postoperative blood transfusion (odds ratio [OR], 4.98; 95% confidence interval [CI], 2.18–11.33), reoperation (OR, 1.7, 95% CI, 1.01–2.89) and readmission (OR, 1.93, 95% CI, 1.09–3.42).

CONCLUSION: Resident involvement in total laparoscopic hysterectomy for benign disease was associated with clinically appreciable longer surgical time and small differences in the rates of postoperative transfusions, reoperation, and readmission. However, the rates of overall complications, severe complications, and 30-day mortality rate remain comparable.

Key words: laparoscopic hysterectomy, NSQIP, resident involvement, surgical outcome

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The Halstedian theory of residency and fellow training, based on a continuing learning process with gradual increases in responsibility, is currently the basis of all US training programs.¹ In an era of enhanced emphasis on patient safety, it is of paramount importance to understand how trainee involvement affects surgical outcomes. This concern has been well studied in the vascular, orthopedic, and general surgery fields. Most researchers have come to a similar conclusion that trainee involvement leads to increased surgical times along with clinically

From the Department of Obstetrics and Gynecology, Temple University Hospital, Philadelphia, PA (Drs Igwe and Hernandez), and Division of Gynecologic Oncology, Department of Obstetrics and Gynecology, University of Wisconsin School of Medicine and Public Health, Madison, WI (Drs Rose and Uppal). Received April 1, 2014; revised May 30, 2014; accepted June 11, 2014.

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The American College of Surgeons (ACS) intermittently audits the data to ensure its integrity. The ACS National Surgical Quality Improvement Program and the hospitals participating in the ACS National Surgical Quality Improvement Program are the source of the data used herein; they have not verified and are not responsible for the statistical validity of the data analysis or the conclusions derived by the authors.

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Corresponding author: Shitanshu Uppal, MD. emailuppal@gmail.com

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insignificant increases in minor morbidities. However, no appreciable effect on mortality rate has been reported.²⁻⁸

Among reproductive-aged women, hysterectomy is the second most frequent surgical procedure. With the growth of minimally invasive procedures, of the approximately 600,000 hysterectomies performed each year in the United States, 12% are being performed laparoscopically.^{9,10} The laparoscopic hysterectomy has been shown consistently to decrease postoperative pain, reduce postoperative morbidity, and decrease hospital stay.¹¹⁻¹³ The obvious advantages of this desirable approach make it imperative that obstetrics and gynecology residents receive adequate exposure and experience to this technique.

To find a balance between patient safety and resident education, the direct effects of resident participation in the operating room must be scrutinized by evaluation of postoperative outcomes. This current study aimed to investigate the effect of resident involvement in benign laparoscopic hysterectomies on the postoperative surgical outcomes.

MATERIALS AND METHODS

Data sources and patient population

The National Surgical Quality Improvement Program (NSQIP) database was analyzed for this study. NSQIP is an American College of Surgeons (ACS) initiative that allows for the collection of risk-adjusted data to facilitate the assessment of outcome measures after surgery. A trained surgical clinical reviewer prospectively collects the NSQIP data. Validated data from patients' medical charts allows quantification of 30-day, risk-adjusted surgical outcomes, which includes after discharge at which time approximately 50% of complications occur.

The NSQIP dataset includes data for patients who underwent a total laparoscopic hysterectomy for a benign disease from Jan. 1, 2008 to Dec. 31, 2011. Patients who underwent supracervical or laparoscopic-assisted vaginal hysterectomy were excluded from the analysis. The human subjects committee at the University of Wisconsin policy on publicly available datasets with deidentified

patient information makes this study exempt from institutional review board review.

Data collection and analysis

From the NSQIP database, we abstracted the details of patients' preoperative laboratory values, comorbidities, details of the procedure, postoperative complications, and death. The Charlson Index, a measure of comorbidity, was derived from recorded medical history in our cohort. Medical comorbidities were assigned a score (Charlson score) according to the method described by Charlson et al^{14,15} and the Deyo et al¹⁶ modification for use with administrative databases.¹⁶ The Charlson Index has been previously studied in a gynecologic population.^{17,18}

Postoperative complications were then classified into the following categories; vascular (bleeding that requires reoperation, deep vein thrombosis), cardiopulmonary (pneumonia, pulmonary embolism, reintubation, prolonged intubation, myocardial infarction, and cardiac arrest), wound (superficial or deep surgical site infections or wound dehiscence), infectious (superficial, deep and organ space surgical site infections, urinary tract infection, pneumonia, systemic sepsis, and septic shock), neurorenal (acute renal failure, progressive renal insufficiency, urinary tract infections, cardiovascular accident/stroke, coma >24 hours, peripheral nerve injury), thromboembolic (pulmonary embolism and deep vein thrombosis), and transfusion (any units of blood transfused). The complexity of surgery was determined by the total relative value units assigned to the procedure. Additionally, the database was queried for Current Procedural Terminology codes 44180 and 58660, which are used in circumstances of extensive lysis of adhesions. Cases with these additional procedural codes were labeled as requiring "extensive lysis of adhesions." Readmission data were available only for the year 2011.

Three separate variables were created to quantify the number of postoperative complications that were experienced by the patients. These 3 variables were ≥ 1 complications (patients who experienced at least 1 complication in any domain),

≥ 3 complications (patients who experienced ≥ 3 complications in any domain), and severe morbidity (patients who experienced ≥ 1 of the following complications: organ space surgical site infection, wound dehiscence, cerebrovascular accident with coma lasting >24 hours, pulmonary embolism, ventilator support for >48 hours, progressive renal insufficiency that required dialysis, or septic shock).

Analysis of the level of training

NSQIP variable "Level of Residency Supervision" was used to determine the role of the residents in the surgery. The dataset provides information on the highest level of supervision provided by the attending staff surgeon for the case. For the cases with resident involvement, NSQIP variable "Highest Level of Resident Surgeon" was used to determine the postgraduate year of training. Trainees in the first 2 years of training were categorized as "junior residents" and all other postgraduate-year trainees were categorized as "senior residents."

Statistical analysis

Mean and median values were used to describe continuous data, with discrete variables displayed as totals and frequencies. For univariate analyses, 2-tailed *t* tests and Mann-Whitney *U* tests were used to compare continuous data; the Fisher exact and χ^2 tests were used for categorical variables, as appropriate. Binary logistic regression was used to control for covariates that were noted to be significant on univariate analysis ($P < .05$). Point estimates are expressed as odds ratios (ORs) and 95% confidence intervals (95% CI) are provided.

RESULTS

A total of 5478 patients were identified as having undergone laparoscopic hysterectomy with/without bilateral salpingo-oophorectomy. After the exclusion of 1910 cases in which the data for the resident/attending involvement was not available and 127 cases with discrepant information, a total of 3441 patients were considered for analysis. From these, 480 cases did not have details of the postgraduate year level and were not

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