

Surgical site infection after hysterectomy

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OBJECTIVE: Our objective was to estimate the occurrence of surgical site infections (SSI) after hysterectomy and the associated risk factors.

STUDY DESIGN: We conducted a cross-sectional analysis of the 2005-2009 American College of Surgeons National Surgical Quality Improvement Program participant use data files to analyze hysterectomies. Different routes of hysterectomy were compared. The primary outcome was to identify the occurrence of 30-day superficial SSI (cellulitis) after hysterectomy. Secondary outcomes were the occurrence of deep and organ-space SSI after hysterectomy. Logistic regression models were conducted to further explore the associations of risks factors with SSI after hysterectomy.

RESULTS: A total of 13,822 women were included in our final analysis. The occurrence of postoperative cellulitis after hysterectomy was 1.6%

(n = 221 women). Risk factors that were associated with cellulitis were route of hysterectomy with an adjusted odds ratio (AOR) of 3.74 (95% confidence interval [CI], 2.26–6.22) for laparotomy compared with the vaginal approach, operative time >75th percentile (AOR, 1.84; 95% CI, 1.40–2.44), American Society of Anesthesia class ≥ 3 (AOR, 1.79; 95% CI, 1.31–2.43), body mass index ≥ 40 kg/m² (AOR, 2.65; 95% CI, 1.85–3.80), and diabetes mellitus (AOR, 1.54; 95% CI, 1.06–2.24). The occurrence of deep and organ-space SSI was 1.1% (n = 154 women) after hysterectomy.

CONCLUSION: Our finding of the decreased occurrence of superficial SSI after the vaginal approach for hysterectomy reaffirms the role for vaginal hysterectomy as the route of choice for hysterectomy.

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BACKGROUND AND OBJECTIVE

Healthcare initiatives sponsored by the Centers for Medicare and Medicaid Services (CMS) and The Joint Commission have targeted preventable hospital-acquired infections, such as postoperative surgical site infections (SSI), as a priority in improving patient safety. Effective January 2012, CMS required all Medicare-certified hospitals to publicly report clinical data and outcome measures in a Systematic Clinical Database Registry for General Surgery in the Hospital Inpatient Quality Reporting Program. The consequence for an institution or hospital not reporting will be a payment penalty as of October 2013. The 2 surgical

procedures that were identified by CMS in this recent mandate for public reporting of postoperative SSI are colon surgery and hysterectomy.

Our objective was to estimate the occurrence of 30-day postoperative SSI after all routes of hysterectomy and to identify associated risk factors.

MATERIALS AND METHODS

We conducted a secondary database analysis of the 2005-2009 American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) participant use data files to analyze data for women who undergo hysterectomy performed by gynecologic services. The ACS NSQIP is a

national program for surgical quality improvement that collects uniform data on patients who undergo surgical procedures. Hospital participation in the ACS NSQIP program is voluntary and confidential. This information is collected by a formal chart review process in addition to 30-day postoperative follow-up evaluation of patients. Variables that are collected include preoperative characteristics, surgical information, and 30-day postoperative complications.

Hysterectomy route was assigned based on *Current Procedural Terminology Coding System*, 4th edition, coding of the primary procedure: total abdominal hysterectomy (TAH), abdominal supracervical hysterectomy (SCH), total vaginal hysterectomy (TVH), laparoscopically assisted vaginal hysterectomy (LAVH), total laparoscopic hysterectomy (TLH), and laparoscopically assisted supracervical hysterectomy (LASCH). We further examined SSI based on abdominal incisions: laparotomy (TAH, SCH), laparoscopy (LAVH, TLH, LASCH), or total vaginal hysterectomy. Finally, we examined SSI based on vaginal cuff incisions: no vaginal cuff incisions (SCH, LASCH) vs vaginal cuff incisions (TAH, TVH, LAVH, TLH).

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The authors report no conflict of interest.

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Risk factors for SSI were explored and grouped into the following categories: demographic features, preoperative medical comorbidities, and intraoperative factors. SSI categories were defined by the criteria found in the Participant Use Data File of the ACS NSQIP.

Urinary tract infection (UTI) was defined by Centers for Disease Control and Prevention criteria for symptomatic UTI and asymptomatic bacteriuria, which take into account recent use of indwelling catheters and patient age.

RESULTS

A total of 23,569 participants were classified as undergoing a gynecologic procedure in the 2005-2009 ACS NSQIP participant-use dataset. The overall occurrence of cellulitis (superficial SSI) after hysterectomy was 1.6% (n/N = 221/13,822).

Variables that were associated with 30-day postoperative cellulitis on multivariate logistic regression were route of hysterectomy with an adjusted odds ratio (AOR) of 3.74 (95% confidence interval [CI], 2.26–6.22) for laparotomy incisions compared with the vaginal approach, operative time >75th percentile, American Society of Anesthesia (ASA) class ≥ 3 , morbid obesity (body mass index [BMI], ≥ 40 kg/m²; AOR, 2.65; 95% CI, 1.85–3.80), and diabetes mellitus (Table).

The occurrence of deep and organ-space SSI was 1.1% (n/N = 154/13,822) after hysterectomy. Variables that were associated with deep and organ-space SSI on multivariate logistic regression included ASA class ≥ 3 , current smoking, history of cerebrovascular accident (CVA) with neurologic deficit, preoperative anemia, and morbid obesity (AOR, 2.23; 95% CI, 1.43–3.49).

Postoperative UTI occurred in 2.7% of women (n/N = 370/13,822) after hysterectomy. Variables that were associated with postoperative UTI on multivariate logistic regression were a history of CVA with neurologic deficit, current corticosteroid use, and operative time >75th percentile.

When we examined 6 different routes of hysterectomy (TAH, SCH, TLH, LASCH, LAVH, and TVH), we noticed

TABLE

Logistic regression model for association of cellulitis after hysterectomy

Variable	Adjusted odds ratio	95% CI	P value
Route of hysterectomy			
Total vaginal hysterectomy (referent)	1	—	—
Laparotomy ^a	3.74	2.26–6.22	< .001
Laparoscopic incisions ^b	1.45	0.83–2.56	.20
Operative time >75th percentile duration			
American Society of Anesthesiologists class ≥ 3	1.84	1.40–2.44	< .001
Body mass index, kg/m ²	1.79	1.31–2.43	< .001
<30 (referent)	1	—	—
≥ 30 and <40	1.31	0.94–1.81	.11
≥ 40	2.65	1.85–3.80	< .001
Diabetes mellitus	1.54	1.06–2.24	.02

^a Laparotomy included total abdominal hysterectomy and supracervical hysterectomy; ^b Laparoscopic incisions included laparoscopic-assisted vaginal hysterectomy, total laparoscopic hysterectomy, and laparoscopic supracervical hysterectomy.

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similarities in the occurrence of SSI by abdominal incision type. We examined routes of hysterectomy based solely on abdominal incision (laparotomy, laparoscopic incisions, and no abdominal incision) and noted that the route of hysterectomy was associated with superficial SSI but not with deep/organ-space SSI or postoperative UTI. Finally, we examined the association of post-hysterectomy SSI by the presence or absence of vaginal cuff incision (supracervical hysterectomy vs vaginal colpotomy) and found no association with any postoperative SSI.

COMMENT

The following risk factors were associated with the occurrence of postoperative cellulitis: hysterectomy route, operative time >75th percentile (149 minutes), ASA class ≥ 3 , diabetes mellitus, and obesity category (BMI, ≥ 40 kg/m²). We did not find smoking status or hysterectomy for gynecologic cancer to be independent risk factors for postoperative cellulitis.

Our finding of the decreased occurrence of superficial SSI after the vaginal approach for hysterectomy reaffirms the long-appreciated role for vaginal hysterectomy as the route of choice

for hysterectomy. Laparotomy independently increased the risk for superficial SSI after hysterectomy. A trend was seen for increased SSI with trocar incisions (minimally invasive hysterectomies), but this was not statistically significant.

We found that considering BMI >30 kg/m² identified BMI as a risk factor for superficial SSI (cellulitis). We identified risk factors that were associated with deep and organ-space SSI after hysterectomy that included preoperative anemia and a history of CVA, which may reflect chronic preoperative systemic disease.

Our study has limitations. First, our analysis was limited to the variables in the database. For example, we were limited by the ACS NSQIP definition of deep and organ-space SSI and therefore unable to distinguish between pelvic abscesses, vaginal cuff cellulitis, and fasciitis.

Second, specific variables were not collected in the general ACS-NSQIP dataset that would have enhanced our study findings. For example, the type and timing of preoperative prophylactic antibiotic administration, a factor well linked to postoperative infection, were unavailable.

Our study suggests that numerous factors, which include hysterectomy

route, operative time, diabetes mellitus, ASA class ≥ 3 , BMI, smoking status, preoperative anemia, CVA with neurologic deficit, and corticosteroid use are associated with SSI after hysterectomy. A predictive model for SSI after all types of hysterectomy must be developed. Unfortunately, we cannot develop a predictive model with this current work because of lack of a validation cohort.

Reducing preventable hospital-acquired infections is important for high-quality patient care. In light of the recent national CMS mandate that requires all Medicare-certified hospitals

to report data and outcome measures publicly, the prevention of SSI will soon become important for hospitals' financial stability as well. Because CMS enforces mandatory public reporting of postoperative SSI after hysterectomy without risk adjustment specific to hysterectomy, careful monitoring will be essential to identify unintended consequences.

CLINICAL IMPLICATIONS

- The decrease in superficial surgical site infections (SSI) after the vaginal

approach for hysterectomy reaffirms the long-appreciated role of vaginal hysterectomy as the route of choice for hysterectomy.

- Body mass index of >40 kg/m² was identified as a risk factor for superficial SSI (cellulitis).
- A predictive model for SSI after all types of hysterectomy must be developed.
- Without risk-adjusted reporting, many tertiary care and referral centers may be at risk of incurring unfair penalties. ■

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