Does Vaginal Cuff Closure Decrease the Infectious Morbidity Associated With Abdominal Hysterectomy?

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Background: Infectious morbidity after total abdominal hysterectomy includes fever (31%) and antibiotic administration (45%). Whether vaginal cuff closure reduces postoperative infectious morbidity remains unresolved.

Study Design: We reviewed the records of 172 consecutive abdominal hysterectomies for nonmalignant disease performed at an inner-city hospital. We identified potential risk factors for infectious morbidity by univariate analysis and determined adjusted odds ratios by multiple logistic regression analysis.

Results: The open vaginal cuff technique was associated with an increased risk of wound infection. Use of prophylactic antibiotics was associated with a decreased risk of febrile morbidity and a decreased risk of prolonged hospitalization. Body weight in the heaviest quartile was associated with increased risk of wound infection, increased risk of prolonged hospitalization, and decreased risk of postoperative vaginal cuff granulation tissue. Older age was associated with an increased risk of prolonged hospitalization.

Conclusions: Closure of the vaginal cuff and use of prophylactic antibiotics at total abdominal hysterectomy were associated with decreased infectious morbidity in a high-risk population. (J Am Coll Surg 1997;185: 404–407. © 1997 by the American College of Surgeons)

Total abdominal hysterectomy remains a common and morbid operation. Morbidity accompanying abdominal hysterectomy includes fever (31%), antibiotic administration (45%), and transfusion (17%) (1). Although the use of prophylactic antibiotics has been associated with decreased infection rates after hysterectomy, the method of vaginal cuff closure has not (2, 3). The American

College of Obstetricians and Gynecologists Committee Opinion advocates the use of prophylactic antibiotics for abdominal hysterectomy, but adds, "... this may not be necessary for certain subgroups of patients at low risk for pelvic or wound infection" (4). Operative gynecology textbooks disagree about the preferred treatment of the vaginal cuff. Thompson in *Te Linde's Operative Gynecology* (5) and Wheeless in *Atlas of Pelvic Surgery* (6) recommend leaving the cuff open; Hodgkinson and Drukker in Danforth's *Obstetrics and Gynecology* (7) advocate cuff closure. Because of this controversy, we examined the effect of vaginal cuff closure method on febrile and infectious morbidity after total abdominal hysterectomy in a population at high risk for infection.

Methods

We reviewed all total abdominal hysterectomies performed for nonmalignant conditions between January 1, 1991, and August 31, 1993, at San Francisco General Hospital, a municipal teaching hospital serving primarily a low socioeconomic and ethnic minority population. We abstracted demographic data including age, weight, and presence of diabetes mellitus; and details of the hysterectomy including indication, method of vaginal cuff closure, estimated blood loss, operating room time, peritoneal closure, and use of prophylactic antibiotics. All patients had preoperative povidone-iodine skin and vaginal preparation. When given, the prophylactic antibiotic was a first-generation cephalosporin (eg, cefazolin) administered preoperatively and for up to two doses afterward.

At followup outpatient examination, outcomes measured included the frequencies of postoperative febrile morbidity, wound infection, urinary tract infection, length of hospitalization, and presence of granulation tissue at the vaginal cuff. We defined febrile morbidity as oral temperature $> 38°C > 24$ hours postoperatively. Wound infections included cellulitis, abscesses, or seromas as-

Table 1. Patient Characteristics and Surgical Indication by Cuff Closure and Prophylactic Antibiotics

	Cuff closure		Prophylactic antibiotics	
Characteristic	Open (n = 100)	Closed (n = 49)	Used (n = 106)	Not used (n = 45)
Estimated blood loss (μL)	569	613	668	453
Diabetes mellitus	4%	10%	6%	7%
Peritoneum closed	35%	22%	27%	40%
Indication				
Fibroids	68%	32%*	71%	29%*
Benign neoplasm	67%	33%*	78%	22%*
Dysplasia	62%	38%*	69%	31%*
Bleeding	86%	14%*	75%	25%*
Pelvic pain	83%	17%*	50%	50%
Other†	33%	67%*	50%	50%

*Significant differences between groups at p < 0.05. For all other variables, p ≥ 0.05 between groups.
†Other includes endometriosis, infection, pregnancy related, and endometrial hyperplasia.

sociated with wound disruption. Granulation tissue was identified by the clinician examining the patient. We defined prolonged hospitalization as > 7 days.

We examined potential risk factors by univariate analysis, and those factors associated with outcomes measures at a significance level of $p < 0.05$ were entered into a stepwise logistic regression model. Significant variables included management of the vaginal cuff, use of prophylactic antibiotics, peritoneal closure, operating time by quartile, weight by quartile, and age by decade. The response variables evaluated in the model were postoperative febrile morbidity, prolonged hospital stay, wound infection, and presence of granulation tissue at the vaginal cuff. We used χ^2 or Fisher's exact tests for categoric data, where appropriate, and Student's t-tests for continuous variables using SAS software (SAS Institute, Inc., Cary, NC). Our sample size yielded sufficient statistical power to detect an increase in wound infection from 10% to 30% with $\alpha = 0.05$ and $\beta = 0.2$.

Results

One hundred seventy-two patients underwent abdominal hysterectomy during the study period. We excluded from further analysis 19 patients with malignancy and 2 additional patients with lost medical records. Missing data included the method of cuff management in 2 patients, peritoneal closure in 4 patients, and the status of vaginal cuff granulation tissue at the postoperative examination in 29 patients. Hysterectomy was performed for symptomatic leiomyomata (100 patients), benign neoplasms (18 patients), uterine bleeding (8 patients), pelvic pain (6 patients), cervical dysplasia (3 patients), and other indications (6 patients).

The method of cuff closure and the use of prophylactic antibiotics were not significantly associated with estimated blood loss, presence of diabetes mellitus, or method of peritoneal closure (Table 1). The open cuff technique and prophylactic antibiotics were used preferentially for all indications, except for a small group of six women: two with pelvic inflammatory disease, one with endometrial hyperplasia, one with placenta percreta, and two with endometriosis (Table 1).

When the anterior peritoneum was closed, wound infection occurred in 8 of 35 patients (23%) with an open cuff compared with 2 of 11 patients (18%) with a closed cuff (odds ratio [OR] = 1.3; 95% confidence interval [CI] = 0.2–11.0). When the anterior peritoneum was open, wound infection occurred in 18 of 65 patients (28%) with an open cuff compared with 3 of 34 patients (9%) with a closed cuff (OR = 4.0; 95% CI = 1.0–9.9).

The results from multiple logistic regression showed that patients who received prophylactic antibiotics were significantly less likely to have postoperative febrile morbidity (OR = 0.5; 95% CI = 0.2–0.9) or prolonged hospitalization (OR = 0.2; 95% CI = 0.1–0.5). Older patients had an increased risk of prolonged hospitalization (for each decade increase in age: OR = 2.2; 95% CI = 1.4–3.5). Patients in the heaviest quartile of weight had an increased risk of wound infection (OR = 1.5; 95% CI = 1.0–2.2) and an increased risk of prolonged hospitalization (OR = 1.6; 95% CI = 1.1–2.3). The heaviest patients also had a decreased risk of granulation tissue at postoperative examination (OR = 0.6; 95% CI = 0.4–1.0). Use of the open vaginal cuff technique was associated with an increased risk of wound infection (OR = 3.3; 95% CI = 1.2–9.2).

Discussion

Management of the vaginal cuff at hysterectomy is controversial. In 1929, Richardson (8) advocated a closed cuff technique. In a case series of >2,400 patients from 1950 to 1974, Gray (9) advocated the use of an open cuff technique to decrease vaginal cuff infections and abscesses. He also theorized, "Perhaps the open cuff technique . . . will be proved of sufficient value to make routine antibiotic prophylactic therapy unnecessary" (9).

Three recent prospective, randomized, controlled trials of vaginal cuff closure have failed to demonstrate a protective benefit from leaving the cuff open (10–12). These studies had small sample sizes and were performed in patient populations at low risk for infectious morbidity. Because of this, these studies lacked statistical power to detect clinically significant differences in infectious morbidity using the open versus closed cuff technique.

In contrast, in a patient population at high risk for infectious morbidity, we found the open vaginal cuff technique to be associated with an increased rate of wound infection. This finding could be confounded if the cuff was left open only in difficult, long, or already infected cases. Our data do not support this possibility. We found no significant differences in the duration of operation, estimated blood loss, or patient weight between the closed and open cuff groups.

It is unclear why an open vaginal cuff would lead to infection of the abdominal wound. The rate of wound infection appeared to be increased by the combination of open cuff and open abdominal wall peritoneum. Perhaps the open cuff allows greater exposure of the abdominal wound to vaginal bacteria, especially when the peritoneum is open.

Two recent metaanalyses separately confirmed that prophylactic antibiotics reduced postoperative infection and fever but not the length of hospitalization. The metaanalysis of Mittendorf and colleagues (3) of 25 trials demonstrated a significant reduction in the rate of serious postoperative morbidity after total abdominal hysterectomy from 21.1% without, to 9.0% with use of prophylactic antibiotics. Wttewaall-Evelaar (2) analyzed 17 prospective, randomized, blinded, and placebo-controlled studies of antibiotic prophylaxis for abdominal hysterectomy. This metaanalysis demonstrated significant decreases in wound infection, pelvic infection, febrile episodes, and need for antibiotic therapy in the prophylaxis group compared with the placebo group. Length

of hospital stay was unaffected (8.7 days in the placebo group and 7.7 days in the prophylaxis group, p > 0.05).

Our finding of decreased febrile morbidity with the use of prophylactic antibiotics for total abdominal hysterectomy is in accord with these two metaanalyses. In addition, we found a decrease in hospitalization associated with the use of prophylactic antibiotics. Because our average length of hospitalization was shorter than that reported by Wttewaall-Evelaar (2) (6.2 versus 8.2 days), we may have been better able to detect the effect of antibiotic prophylaxis on hospitalization.

The marginally significant association of obesity and decreased granulation tissue at the postoperative examination is most likely due to detection bias; difficulty visualizing the vaginal cuff in obese women could lead to decreased detection of vaginal cuff granulation tissue. Increased granulation tissue could occur if chromic catgut were used. In general, our surgeons used polyglactin suture to close or whipstitch the vagina.

A strength of this study is that it was performed in a setting where infectious morbidity is common. This yields sufficient statistical power to detect differences in outcomes that could be clinically important. An important limitation of the study is that the use of antibiotic prophylaxis and the cuff closure method were neither uniform nor random. The indication for operation also could have confounded our results, but if we consider just those patients who had hysterectomy for fibroids and who had prophylactic antibiotics, the odds of wound infection were 3.3 times higher with an open than with a closed vaginal cuff. Potentially important details concerning the operation such as the nature of skin, hair, and other preoperative preparation; use of an electrosurgical knife to open the skin; and presence of untreated bacterial vaginosis did not appear in our medical records. All of these have been implicated as influencing wound infection rates (13, 14). Hence, a randomized, controlled trial with adequate power studying the open versus closed cuff technique for abdominal hysterectomy should be performed in a population at high risk for infectious morbidity. All patients in such a trial should receive standardized protocols for preoperative preparation, prophylactic antibiotics, and surgical technique.

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