Wound Infection in Gynecologic Surgery

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ABSTRACT

Objective: We sought to determine the wound infection rate among patients undergoing elective gynecologic surgery at a single tertiary care center and to determine the predictive value of various factors that contribute to infection. We further investigated the adequacy of hospital records in documenting infection rates as well as the timing of presentation of wound infections.

Methods: The records of 115 patients undergoing elective gynecologic surgery at our institution were reviewed. Patients were further subdivided based on route of surgery. We analyzed the importance of antibiotic prophylaxis, route of surgery, smoking, diabetes, and body mass index (BMI).

Results: The overall wound infection rate was 12.17% with no significant difference in the subgroups by route of surgery. Overall, antibiotic prophylaxis significantly decreased infection rates \( P = 0.0118 \), but the route of surgery, BMI, smoking, and diabetes were not significant predictors of infection. Only one case of infection was detected during the initial hospital stay (6.1%). Fifty percent of the patients with infection required readmission, and of these 35.7% required an additional surgical procedure. The average length of hospital stay was 2.4 days longer in patients with infection.

Conclusions: Antibiotic prophylaxis has a role in the management of patients undergoing abdominal gynecologic surgery. In today’s environment of cost containment, an increased hospital stay and the added likelihood of additional surgical intervention associated with wound infection are important targets for prevention. Most patients with wound infection were diagnosed after discharge from the hospital. In our population, among whom transportation problems and remote residence are prevalent, strategies for infection surveillance should be integral to discharge planning. Infect. Dis. Obstet. Gynecol. 8:230–234, 2000. © 2000 Wiley-Liss, Inc.

KEY WORDS
antibiotics; prophylaxis; hysterectomy

Wound infection is one of the most common complications associated with surgical treatment of patients and accounts for significant morbidity in 8–10% of gynecologic surgical hospitalizations. Elective gynecologic surgeries are classified under the “clean-contaminated” type as defined by the National Research Council Wound Classification Criteria. The incidence of wound infection varies with the type of procedure, the premorbid condition of the patient, and the presence of various other risk factors. In old, malnourished, or immunocompromised patients, the rates of wound infection are higher. Finally, surgeon-controlled factors such as sterile technique, blood loss and the operative time, and use of prophylactic antibiotics are important determinants of wound infection rates. The rate of wound infection serves as a useful measure of the adequacy of sterile precautions and adherence to surgical techniques and principles.

OBJECTIVES

We sought to determine the wound infection rate among patients undergoing elective gynecologic
surgery for nonmalignant pathology at West Virginia University for a predefined time period. First, because a trend toward shorter hospital stays for surgical patients may limit ascertainment of wound complications that develop over several days, we wished to determine the adequacy of hospital records in documenting wound infection rates. Second, although several studies have demonstrated the value of antibiotic prophylaxis for vaginal surgery, we wished to evaluate the potential benefit of antibiotic prophylaxis in prevention of operative site and wound infection among women undergoing the above-mentioned procedures, with special emphasis on abdominal hysterectomy.

**MATERIALS AND METHODS**

We performed an internal review board-approved retrospective chart review using both inpatient and outpatient records for all patients undergoing abdominal and vaginal surgery for benign gynecologic indications between September 1, 1996, and July 31, 1997. Criteria for inclusion were those patients undergoing abdominal and vaginal procedures who were older than 18 years of age and who had elective gynecologic surgery for nonmalignant pathology. Laparoscopic procedures were excluded unless combined with open surgery. Residents, under supervision of the attending staff physician, performed the surgeries. Information regarding the postoperative course following discharge was obtained from the outpatient records and from records documenting postoperative follow-up by referring gynecologists or primary care physicians.

Data were analyzed to document and classify all infectious morbidity and wound infection rates, and operative site infections were specifically documented for this analysis. The factors used for subsequent analysis in each patient were the use of preoperative antibiotics, body mass index (BMI), presence of known diabetes mellitus, route of surgery, and history of smoking. We analyzed the association of these factors with infectious morbidity using Fischer’s exact test; the relative risk associating these factors with infectious morbidity was calculated by the Mantel Haenszel weighted method.

A working definition of *wound infection* was developed to include either wound cellulitis, abscess, wound dehiscence, or seroma requiring drainage and packing, any of which occurred within 30 days of the surgical procedure. We included seromas in our definition, because cultures were not obtained and early wound infections can often present as wound seromas. In our system, prophylactic antibiotic administration consisted of a second- or third-generation cephalosporin administered in a single preoperative dose.

**RESULTS**

The results of our study are summarized in Tables 1 and 2. Based on our inclusion criteria, in total 147 patients were eligible for analysis. Among the 147 patients were 115 for whom there were sufficiently detailed follow-up records to allow inclusion in this study (i.e., we were unable to obtain adequate postoperative records for the remainder). Among these, 72 had abdominal surgery, 27 had vaginal surgery, and 16 had undergone combined vaginal and abdominal procedures. The average age of the patients was 41 years (range 24–68 years). The average height was 64 inches, and the average weight was 157.5 pounds, with an average BMI of 27.31.

There were 14 patients with wound infection among the 115 total patients, an overall infection rate of 12.17%. The difference in wound infection rates between the three subgroups by route of surgery was not statistically significant, being 12.5% (9/72) for the abdominal group, 11.1% (3/27) for the vaginal group, and 12.5% (2/16) for the combined group. This is in agreement with published data.

Only 1 of these 14 cases was detected in the initial hospital stay; the remaining 13 were identified only through examination of records of subsequent care after hospitalization. Among all subjects, 89 patients received preoperative antibiotic prophylaxis. Of those who received antibiotic prophylaxis, 7.9% developed wound infection (7/89), whereas, among those who did not receive any antibiotic prophylaxis, 26.9% developed a wound infection (7/26). This difference was statistically significant ($P = 0.0123$, RR = 0.26, with a CI of 0.10–0.72). Fifty percent of the patients with infection required repeat hospitalization compared to only 1.98% patients without infection. Five of the fourteen patients with infection required a repeat surgical procedure directly related to the wound infection. We analyzed the data by logistic regression and found that after stepwise adjustment only antibiotic prophylaxis was a significant variable ($P = 0.012$, RR = 0.28, with CI 0.11–0.72), whereas a
TABLE 1. Morbidity associated with wound infection

|                      | Wound infection | No wound infection | P value (Fischer’s exact) |
|----------------------|-----------------|--------------------|--------------------------|
| Abdominal surgery    |                 |                    |                          |
| Number of cases      | 9               | 63                 |                          |
| Antibiotic prophylaxis (%) | 5 (55.6)       | 52 (82.5)         | 0.079                    |
| Length of stay (avg) in days | 5            | 3.2                |                          |
| Rehospitalization    | 4               | 1                  |                          |
| Repeat surgery       | 4               | 2                  |                          |
| Vaginal surgery      |                 |                    |                          |
| Number of cases      | 3               | 24                 |                          |
| Antibiotic prophylaxis (%) | 2 (66.7)     | 20 (83.3)          | 0.49                     |
| Length of stay (avg) in days | 6            | 2.4                |                          |
| Rehospitalization    | 2               | 0                  |                          |
| Repeat surgery       | 1               | 0                  |                          |
| Combined Surgery     |                 |                    |                          |
| Number of cases      | 2               | 14                 |                          |
| Antibiotic prophylaxis (%) | 0 (0.0)       | 10 (71.4)          | 0.083                    |
| Length of stay (avg) in days | 4.5          | 2.3                |                          |
| Rehospitalization    | 2               | 1                  |                          |
| Repeat surgery       | 0               | 0                  |                          |
| Combined Data        |                 |                    |                          |
| Number of cases      | 14              | 101                |                          |
| Antibiotic prophylaxis (%) | 7 (50.0)     | 82 (81.2)          | 0.0123                   |
| Length of stay (avg) in days | 5.1          | 2.7                |                          |
| Rehospitalization    | 7               | 2                  |                          |
| Repeat surgery       | 5               | 3                  |                          |

TABLE 2. Risk of wound infection related to antibiotic prophylaxis

|                      | Antibiotic prophylaxis given | No antibiotic prophylaxis | P value (Fischer’s exact) |
|----------------------|------------------------------|----------------------------|--------------------------|
| Abdominal surgery    | Wound infection             | 5                          | 4                        | 0.079                    |
| No wound infection   | 52                           | 11                         |                          |
| Total                | 57                           | 15                         |                          |
| Vaginal surgery      | Wound infection             | 2                          | 1                        | 0.49                     |
| No wound infection   | 20                           | 4                          |                          |
| Total                | 22                           | 5                          |                          |
| Combined surgery     | Wound infection             | 0                          | 2                        | 0.083                    |
| No wound infection   | 10                           | 4                          |                          |
| Total                | 10                           | 6                          |                          |
| Combined data        | Wound infection             | 7                          | 7                        | 0.0123                   |
| No wound infection   | 82                           | 19                         |                          |
| Total                | 89                           | 26                         |                          |

TABLE 3. Analysis of variables of wound infection by logistic regression

| Variable             | P value |
|----------------------|---------|
| Antibiotic prophylaxis | 0.012   |
| Route of surgery     | 0.980   |
| Body mass index      | 0.370   |
| Smoking              | 0.330   |
| Diabetes mellitus    | 0.293   |

history of diabetes mellitus, smoking, route of surgery, and BMI were not significant predictors of wound infection. These data are shown in Table 3.

Abdominal Surgery

There were nine wound or operative site infections among the 72 patients with an exclusively abdomi-

nal route for surgery (12.5%). Four patients with infections were readmitted, received intravenous antibiotics, and underwent wound incision and drainage of vaginal cuff abscess. One patient without operative site infection was readmitted for treatment of pneumonia, and two other patients in this group underwent repeat surgery for small bowel obstruction (unassociated with the surgical wound). Among the 72 patients, 57 received antibiotic prophylaxis, and 15 did not receive antibiotic prophylaxis. Among those receiving preoperative antibiotics, 8.8% developed an infection compared to 26.7% among those who did not. The difference in infection rates among women managed with or without antibiotic prophylaxis approached statistical significance ($P = 0.079$, RR = 0.32, with CI of 0.10–1.06). The average length of stay (LOS) was increased from 3.2 days to 5 days among those
women who experienced wound or operative site infections.

**Vaginal Surgery**
The observed rate of operative site infection was 11.1% (3/27). Two patients in the infection group were rehospitalized and treated with intravenous antibiotics, and one of the two underwent transvaginal drainage of a cuff abscess in the ward. Of the 27 patients undergoing an exclusively vaginal procedure, 22 received preoperative antibiotics, and 5 did not. Among those who received preoperative antibiotics, the wound infection rate was 9.09% compared to 20% among those who did not receive prophylaxis ($P = 0.49$, RR = 0.48, with CI of 0.05–4.27). Infection increased the average LOS by 3.6 days in this group.

**Combined Surgery**
The average rate of infection was 12.5% (2/16). One patient in each group was readmitted. In both groups, the reason for admission was unrelated to the surgical wound. Of note, none of the patients with infection received prophylaxis compared to 71.4% (10/14) of the patients without infection. There were no infections among those treated with antibiotic prophylaxis compared to 33.33% among those who did not receive antibiotics ($P = 0.083$). Again, an increase in average LOS from 2.3 to 4.5 days was seen with infection.

**DISCUSSION**
Wound infection is one of the most common complications in gynecologic surgery. Its occurrence is associated with the highest incidence of reoperation, the longest duration of hospitalization, and the greatest increase in cost of any postoperative gynecologic complication. Opening the lower genital tract exposes the pelvic operative site and the abdominal wound to vaginal flora in spite of preoperative vaginal preparation. The most common infections include cuff cellulitis and wound cellulitis. These complications most often present after the first few postoperative days, by which time most patients are discharged home. This was reflected by the most important finding of this study: Operative site and wound infections cannot be monitored from hospital records. Adequate assessment of postsurgical infectious morbidity requires scrupulous follow-up of outpatient records and tracking for readmission, which may not occur at the institution where the primary procedure was performed.

Antibiotic prophylaxis has been proved to decrease the infectious morbidity for vaginal procedures. In a prospective, randomized, double-blind study, Hemsell et al. showed that only 8% of women undergoing vaginal hysterectomy who were given cefoxitin had major postoperative infection compared to 57% of women given placebo ($P < 0.001$). Although our data suggest a similar result, the number of women receiving prophylaxis in this retrospective study did not afford adequate power for ascertainment of important differences in infectious morbidity related to use of antibiotic prophylaxis.

There is still debate whether routine antibiotic prophylaxis is useful in elective abdominal procedures. There have been recent reports on the utility of prophylactic antibiotics in successfully decreasing the incidence of wound infections in women undergoing abdominal hysterectomy. A metaanalysis of 25 randomized controlled trials of antibiotic prophylaxis that used rigorous protocols revealed that antibiotic prophylaxis can reduce wound infection rates in abdominal procedures from 21.2% to 5.0% ($P < 0.001$). Our data reveal a comparable decrease in wound infection rates associated with antibiotic prophylaxis, from 26.67% to 8.77%, that is in close accordance with that metaanalysis. Although the reduction in infection rates attributable to antibiotic prophylaxis approached statistical significance, this study had marginal power to detect even a threefold reduction in infection rates. The difference is even more striking in combined surgical cases, among whom wound infection rates were decreased from 33.33% to 0% with antibiotic prophylaxis.

**CONCLUSIONS**
Our overall experience with wound and operative site infection (12.17% of all patients) is similar to that reported in similar series from several other institutions. Our study suggests that antibiotic prophylaxis has a role in the management of patients undergoing abdominal gynecologic surgery. Although our statistical power is limited due to our sample size, we believe that the reduction in infection rates from 26.8% to 8.8% is clinically important and confirms a recent, relevant metaanaly-
sis. In today’s environment of cost containment and risk avoidance, an increased hospital stay of 2.4 days and the added likelihood of additional surgical intervention associated with wound infection seen in our analysis are important targets for prevention. We believe that it may well be ethically questionable to subject this issue to a randomized prospective trial unless such a trial is limited to patients in the lowest risk category for infection or is evaluating nonantibiotic regimens for infection prevention.

We also found that most cases of wound infection were diagnosed after discharge from the hospital. Studies of this question cannot rely on hospital databases alone. Careful and stringent follow-up of patients with specific instructions on wound checks is needed if adverse infectious outcomes are to be addressed in a timely fashion and if outcome data are to be considered complete. In our population, among whom transportation problems and remote residence are prevalent, strategies for infection surveillance should be integral to discharge planning.

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