detection of platelet antibody in patients with idiopathic thrombocytopenic purpura and systemic lupus erythematosus. *Blood* 33: 795, 1969
31. KARPATKIN S, STRICK N, KARPATKIN MB, et al: Cumulative experience in the detection of antiplatelet antibody in 234 patients with idiopathic thrombocytopenic purpura, systemic lupus erythematosus and other clinical diseases. *Am J Med* 52: 776, 1972
32. DIXON RH, ROSSE WF: Platelet antibody in autoimmune thrombocytopenia. *Br J Haematol* 31: 129, 1975
33. BUDMAN DR, STEINBERG AD: Hematologic aspects of systemic lupus erythematosus. Current concepts. *Ann Intern Med* 86: 220, 1977

Use of a topical antibiotic spray in vaginal surgery

V. CECIL WRIGHT, MD, FRCS[C]; NORA M. LANNING, RN, DPHN; RENATO NATALE, MD, FRCS[C]

During vaginal hysterectomy with or without colporrhaphy a topical aerosol spray containing neomycin sulfate, polymyxin B sulfate and zinc bacitracin was used in 50 patients to decrease the chance of postoperative pelvic infection; a placebo spray was used in another 50 patients. All patients were treated preoperatively with povidone iodine and postoperatively with nitrofurantoin and an antibacterial irrigating solution for the bladder if catheter drainage was necessary. The frequency of postoperative pelvic infection was 16% in the group sprayed with the antibiotic combination and 34% in the group sprayed with the placebo, a significant difference ($P < 0.05$).

Un vaporisateur topique en aérosol contenant du sulfate de néomycine, du sulfate de polymyxine B et de la bacitracine zinc a été utilisé chez 50 patientes durant une hystérectomie par voie vaginale, avec ou sans colporraphie, afin de diminuer les risques d'infection pelvienne post-opératoires; un vaporisateur "placebo" a été utilisé chez 50 autres patientes. Toutes les patientes ont été traitées en préopératoire à la povidone iodée et, en postopératoire, avec de la nitrofurantoïne et une solution antibactérienne pour irrigation de la vessie lorsqu'un cathétérisme était nécessaire. La fréquence des infections pelviennes postopératoires a été de 16% dans le groupe ayant reçu l'association d'antibiotiques en vaporisateur et de 34% dans le groupe placebo. Cette différence est significative ($P < 0.05$).

Vaginal hysterectomy with or without colporrhaphy has been associated with a higher frequency of postoperative infection than abdominal hysterectomy. The former has usually varied between 35% and 55%,[1-6] but when specific measures such as systemic antibiotic therapy have been used the rate has ranged between 4% and 13%.[5-17] Infection following vaginal hysterectomy has been attributed to: the fact that the operation is performed through the vagina, a potentially infected operative field;[7] failure to control the main blood supply until the operation is almost completed;[18] collection of exudate between the peritoneum and the vaginal vault;[10] the need for continuous catheter drainage;[19,20] age, patients less than 35 years old being prone to such infection;[18,21] and the surgical technique.[6,9]

To help decrease the number of bacteria in the vagina surgeons have used a variety of chemotherapeutic agents preoperatively and postoperatively, with good results.[7,8] Various drainage techniques designed to decrease the collection of serosanguineous fluid behind the vaginal cuff have been reported to decrease the rate of postoperative infection.[9,10] With acceptance of the use of suprapubic cystotomy in preference to the indwelling urethral Foley catheter postoperatively, the rate of urinary tract infection has greatly decreased.[19,20]

In this paper we describe a study undertaken to compare the frequency of postoperative infection in patients undergoing vaginal hysterectomy with or without colporrhaphy, during which an aerosol spray containing neomycin sulfate, polymyxin B sulfate and zinc bacitracin was used topically.

Methods

Preoperative

The study group comprised 100 patients who underwent vaginal hysterectomy with or without colporrhaphy, none of whom had received systemic antibiotic therapy in the 2 weeks before the operation. Of the 100 patients 56 underwent vaginal hysterectomy alone, 40 vaginal hysterectomy with anterior colporrhaphy, 2 vaginal hysterectomy with anterior and posterior colporrhaphy and 2 vaginal hysterectomy with posterior colporrhaphy. Indications for the operation included prolapse with associated stress incontinence of urine in 32, cervical dysplasia or carcinoma in situ in 11, functional uterine bleeding in 42 and a combination of these factors in 15.

Preoperative preparation of all patients included administration of a soapsuds enema and a cleansing povidone iodine vaginal douch, followed by insertion of one applicator of povidone iodine gel high into the vagina the night before the operation. A blood sample was obtained for determination of the hemoglobin concentration, urinalysis was done and a midstream specimen of urine was obtained for culture and sensitivity testing. In the operating room the vagina and perineum were prepared with povidine iodine surgical solution and sterile draping of the patient was done.

Using a code that only he knew, the chief pharmacist issued for 50 patients a canister of topical aerosol spray (Sterispray, Fisons) containing 500 mg of neomycin sulfate, 165 000 IU of polymyxin B sulfate and 10 000 IU of zinc bacitracin, and for the other 50 a canister identical in appearance containing the same aerosol agent but no antibiotic; testing in the bacteriology laboratory demonstrated that the placebo spray had no antibacterial activity. Before each canister was issued its weight was recorded.

Operative

Basically the Heaney hysterectomy

From the department of obstetrics and gynecology, St. Joseph's Hospital and the University of Western Ontario, London

Reprint requests to: Dr. V. Cecil Wright, 554 Waterloo St., London, Ont. N6B 2P9

was done in each case and the vaginal vault was closed transversely. Immediately after the uterus was removed a sample of pelvic peritoneal fluid was placed in Robertson's meat broth and submitted to the bacteriology laboratory for incubation and subculture.

The circulating nurse sprayed the raw surgical field with the topical aerosol at specific times during the operation, particularly after the sample of peritoneal fluid was taken, before the pelvic peritoneum was closed, after the anterior and posterior vaginal walls were dissected in instances of colporrhaphy and before the vaginal vault was closed. The total spraying time in each case was approximately 30 seconds.

At the end of the procedure a vaginal pack soaked in povidone iodine solution was inserted into the vagina; it was removed after 24 hours. If continuous catheter drainage was necessary a suprapubic three-way Foley catheter was usually used. The canister was returned to the pharmacy for reweighing.

Postoperative

Each patient received nitrofurantoin, 50 mg four times a day. If catheter drainage was necessary the bladder was continuously irrigated with a solution containing 57 mg of neomycin sulfate and 200 000 IU of polymyxin B sulfate in 1000 mL of normal saline. The catheter was removed when the patient was voiding well and had a residuum of less than 100 mL of urine in the bladder. In the event of a postoperative infection or other complication the surgeon in charge treated the patient with systemic antibiotic therapy or other therapy, as appropriate.

Postoperative infection was considered to be present when the patient had a temperature of 38.0°C on two different occasions 6 hours apart, excluding the first 24 hours postoperatively, or other signs of obvious infection. Urinary tract infection was diagnosed if the bacterial count was greater than 100 000/mL in a culture of urine obtained from the catheter before it was removed or, in patients not requiring catheter drainage postoperatively, in a midstream specimen of urine.

The canister code was not broken until the patients had been declared infected or uninfected; no patient was reclassified after the code was broken.

Results

The types of postoperative complications in the two groups are listed in Table I.

The proportion of patients with postoperative vaginal vault infection was significantly greater ($P < 0.05$) in the group in which the placebo spray was used — 34% v. 16%. The surgical procedures used in these patients are shown in Table II, and the organisms recovered from the vault drainage of those with an abscess are listed in Table III. All the patients with postoperative vaginal vault infection required hospitalization for more than 7 days (Table IV), and those with vault abscesses required the longest hospitalization in both groups. In those without an abscess the hospital stay was not prolonged when colporrhaphy accompanied the hysterectomy. The infection responded to systemic antibiotic treatment before the patient began voiding well. The topical use of an antibiotic spray did not appear to predispose the patients to a more serious or refractory infection, and no difference between the two groups in the timing of the infection was evident.

The two patients with postoperative atelectasis, in whom the antibiotic spray had been used, did not require systemic antibiotic therapy but responded to chest physiotherapy.

The overall proportion of patients with bacteriuria was 7%. There was no particular difference between the groups in the type of organism isolated or in the proportion with positive cultures from the postoperative urine specimen. No clinical urinary tract infection developed in either group.

The patient with pulmonary embolism and pelvic thrombophlebitis had a normal postoperative course but was readmitted 10 days after discharge with chest pain and fever. Systemic antibiotic and anticoagulant therapy brought about rapid improvement.

Organisms were cultured from the pelvic peritoneum after removal of the uterus in 90% of the patients. The organisms are listed in Table V; the most common were coagulase-negative staphylococci.

Other differences between the two groups in, for example, operating time, length of time before catheter removal and frequency of need for blood transfusion were not significant. There were no drug reactions in the two groups.

Discussion

Postoperative infection can result

Table I — Complications in 100 patients after vaginal hysterectomy with or without colporrhaphy

Complication	Spray used during operation; no. of patients: Antibiotic (n = 50)	Placebo (n = 50)
Infection	10	17
Of vaginal vault		
Without abscess	7	13
With abscess	1	4
Atelectasis	2	0
Bacteriuria without clinical signs of infection	2	5
Pulmonary embolism with pelvic thrombophlebitis	1	0

Table II—Surgical procedures used in all patients and in those with postoperative vaginal vault infection

Procedure	Spray; no. of patients (and no. with infections): Antibiotic	Placebo
Vaginal hysterectomy alone	30 (4)	26 (8)
Vaginal hysterectomy and anterior colporrhaphy	19 (4)	21 (9)
Vaginal hysterectomy and anterior and posterior colporrhaphy	1 (0)	1 (0)
Vaginal hysterectomy and posterior colporrhaphy	0 (0)	2 (0)

Table III—Organisms recovered from vault drainage of patients with postoperative vaginal vault abscesses

Organism	Spray; no. of patients: Antibiotic	Placebo
Anaerobic streptococci	0	4
Bacteroides species	0	3
Coliforms	1	2
Lactobacilli	0	1
Diphtheroides	0	1
Beta-hemolytic streptococci, group B	1	0

in delayed healing of the vaginal vault, late hemorrhage, pelvic cellulitis, parametritis, pelvic thrombophlebitis, pelvic abscess and, on occasion, bacteremic shock and death. Associated with sepsis is pain suffered by the patient, possible further surgery, prolonged hospital stay, excessive cost and loss of the patient's income.

The topical use of antibiotics has a place in gynecologic operations because it decreases the chance of postoperative pelvic infection; an aerosol antibiotic preparation can be used to spray the raw surgical field in both vaginal and abdominal hysterectomy as well as the abdominal surgical wound. Since it is impossible to sterilize the vagina, bacteria are introduced to the dissection planes and pedicles. With topical application of antibiotics to these tissues by an aerosol spray the introduced bacteria are destroyed and their entry into the tissues is prevented.

Prophylactic systemic administration of antibiotics, although reducing the likelihood of postoperative infection, destroys the normal bacterial

Table IV—Number of days of hospitalization for patients with and without postoperative vaginal vault infection*

Procedure; no. of days of hospitalization	Spray; no. of patients			
	Antibiotic		Placebo	
	Infected	Uninfected	Infected	Uninfected
Vaginal hysterectomy alone				
⩽ 7	0	13	0	6
8–10	0	9	5 (1)	12
11–14	2	2	2 (2)	0
> 14	2 (1)	2	1	0
Vaginal hysterectomy and anterior colporrhaphy				
⩽ 7	0	2	0	0
8–10	1	6	6	5
11–14	1	3	2	6
> 14	2	4	1 (1)	1
Vaginal hysterectomy and anterior–posterior colporrhaphy				
⩽ 7	0	1	0	0
8–10	0	0	0	0
11–14	0	0	0	0
> 14	0	0	0	1
Vaginal hysterectomy and posterior colporrhaphy				
⩽ 7	0	0	0	0
8–10	0	0	0	2
11–14	0	0	0	0
> 14	0	0	0	0

*Numbers with abscess formation are in parenthesis.

Table V—Organisms cultured from peritoneal fluid after removal of uterus

Organism	Spray; no. of patients			
	Infected		Uninfected	
	Antibiotic	Placebo	Antibiotic	Placebo
Coagulase-negative staphylococci	5	9	28	13
Enterococci	3	3	13	0
Coliforms	2	2	6	4
Staphylococcus aureus	0	0	2	4
Anaerobic streptococci	0	1	3	2
Diphtheroids	0	2	2	2
Beta-hemolytic streptococci				
Group B	1	3	0	3
Group C	0	0	1	0
Proteus species	1	0	2	1
Bacteroides species	0	1	2	0
Streptococcus viridans	1	0	0	2
Lactobacilli	0	0	2	0

flora in other body sites and may result in superinfection and the development of resistant strains.[21]

Our use of an antibiotic spray resulted in a frequency of postoperative pelvic infection of only 16%, a rate comparable to that found in studies of prophylactic systemic administration of antibiotics. Our patients did not appear to be predisposed to more serious or refractory infections.

Previous studies have shown that *Escherichia coli, Proteus mirabilis* and *Klebsiella aerogenes* are the gram-negative bacilli most commonly isolated from the urine, and that these organisms are sensitive to nitrofurantoin.[22-24] Using an irrigating solution of neomycin and polymyxin also appears well warranted. Studies by Martin and Bookrajian[25] have demonstrated that bacterial counts in patients with indwelling catheters can be reduced greatly by continuous bladder irrigation.

Conclusion

The routine use of a topical antibiotic aerosol spray containing 500 mg of neomycin sulfate, 165 000 IU of polymyxin B sulfate and 10 000 IU of zinc bacitracin can significantly reduce the frequency of postoperative pelvic infection in patients undergoing vaginal hysterectomy with or without associated colporrhaphy.

We thank the departmental members for their support in supplying clinical material for this study.

The study was supported by a grant from Fisons (Canada) Limited.

References

1. COPENHAVER EH: Hysterectomy: vaginal versus abdominal. *Surg Clin North Am* 45: 751, 1965
2. FLEMING SP, KEARNS PR, LOCK FR: Factors influencing morbidity following vaginal hysterectomy. *Obstet Gynecol* 4: 295, 1954
3. JOHNSON CG: Vaginal hysterectomy and vaginectomy in personal retrospect. *Am J Obstet Gynecol* 105: 14, 1969
4. WHITE SC, WARTEL LJ, WADE ME: Comparison of abdominal and vaginal hysterectomies. A review of 600 operations. *Obstet Gynecol* 37: 530, 1971
5. GOOSENBERG J, EMICH JP JR, SCHWARZ RH: Prophylactic antibiotics in vaginal hysterectomy. *Am J Obstet Gynecol* 105: 503, 1969
6. ALLEN JL, RAMPONE JF, WHEELESS CR: Use of a prophylactic antibiotic in elective major gynecologic operations. *Obstet Gynecol* 39: 218, 1972
7. GRIMES HG, GEIGER CJ: Furacin (nitrofurazone) vaginal suppositories in operative gynecology. *Am J Obstet Gynecol* 79: 441, 1960
8. PRATT JH, SCHERMAN Q: Morbidity in vaginal hysterectomy. *Am J Obstet Gynecol* 67: 1323, 1954
9. CHEHAB HE: Decreasing the morbidity of vaginal hysterectomy. *Obstet Gynecol* 31: 198, 1968
10. NEELY MR: Reducing the morbidity of vaginal hysterectomy. *J Obstet Gynaecol Br Commonw* 76: 176, 1969
11. GLOVER MW, VAN NAGELL JR JR: The effect of prophylactic ampicillin on pelvic infection following vaginal hysterectomy. *Am J Obstet Gynecol* 126: 385, 1976
12. LEDGER WJ: Infections in obstetrics and gynecology: new developments in treatment. *Surg Clin North Am* 52: 1447, 1972
13. LEDGER WJ, SWEET RL, HEADINGTON JT: Prophylactic cephaloridine in the prevention of postoperative pelvic infections in premenopausal women undergoing vaginal hysterectomy. *Am J Obstet Gynecol* 115: 766, 1973
14. BOLLING DR JR, PLUNKETT GD: Prophylactic antibiotics for vaginal hysterectomies. *Obstet Gynecol* 41: 689, 1973
15. BREEDEN JT, MAYO JE: Low dose prophylactic antibiotics in vaginal hysterectomy. *Obstet Gynecol* 43: 379, 1974
16. HARRALSON JD, VAN NAGELL JR JR, RODDICK JW JR, et al: The effect of prophylactic antibiotics on pelvic infection following vaginal hysterectomy. *Am J Obstet Gynecol* 120: 1046, 1974
17. MORO M, ANDREWS M: Prophylactic antibiotics in cesarean section. *Obstet Gynecol* 44: 688, 1973
18. TAYLOR ES, HANSEN RR: Morbidity following vaginal hysterectomy and colpoplasty. *Obstet Gynecol* 17: 346, 1961
19. JACKSON GW: Suprapubic postoperative bladder drainage. A report of 50 cases. *Am J Obstet Gynecol* 105: 59, 1969
20. FRYMIRE LJ: Comparison of suprapubic versus Foley drains. *Obstet Gynecol* 38: 239, 1971
21. PRATT JH, GALLOWAY JR: Vaginal hysterectomy in patients less than 36 or more than 60 years of age. *Am J Obstet Gynecol* 93: 812, 1965
22. GROSSMAN JH, ADAMS RL, HIERHOLZER WJ: Epidemiologic surveillance during a clinical trial of antibiotic prophylaxis in pelvic surgery. *Am J Obstet Gynecol* 128: 690, 1977
23. BLACK WA, HATCH LA: Increasing sensitivity rates of urinary gram-negative bacilli to antimicrobials. *J Urol* 110: 336, 1973
24. MCALLISTER TA, ALEXANDER JG, DULAKE C, et al: Multicentric study of sensitivities of urinary pathogens. *Postgrad Med J* 47 (suppl): 7, Sept 1971
25. MARTIN CM, BOOKRAJIAN EN: Bacteriuria prevention after indwelling urinary catheterization. *Arch Intern Med* 110: 703, 1962