Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

No. 275, April 2012

Antibiotic Prophylaxis in Gynaecologic Procedures

This clinical practice guideline has been prepared by the Infectious Diseases Committee, reviewed by the Family Physician Advisory Committee, and approved by the Executive and Council of the Society of Obstetricians and Gynaecologists of Canada.

PRINCIPAL AUTHORS

Nancy Van Eyk, MD, Halifax NS

Julie van Schalkwyk, MD, Vancouver BC

INFECTIOUS DISEASES COMMITTEE

Mark H. Yudin, MD (Chair), Toronto ON

Victoria M. Allen, MD, Halifax NS

Céline Bouchard, MD, Quebec QC

Marc Boucher, MD, Montreal QC

Sheila Caddy, MD, Edmonton AB

Eliana Castillo, MD, Calgary AB

Deborah M. Money, MD, Vancouver BC

Kellie E. Murphy, MD, Toronto ON

Gina Ogilvie, MD, Vancouver BC

Caroline Paquet, RM, Trois-Rivières QC

Julie van Schalkwyk, MD, Vancouver BC

Vyta Senikas, MD, Ottawa ON

Disclosure statements have been received from all members of the committee.

The literature searches and bibliographic support for this guideline were undertaken by Becky Skidmore, Medical Research Analyst, Society of Obstetricians and Gynaecologists of Canada.

J Obstet Gynaecol Can 2012;34(4):382–391

Key Words: Antibiotics, prophylaxis, hysterectomy, hysteroscopy, gynaecologic surgery

Abstract

Objective: To review the evidence and provide recommendations on antibiotic prophylaxis for gynaecologic procedures.

Outcomes: Outcomes evaluated include need and effectiveness of antibiotics to prevent infections in gynaecologic procedures.

Evidence: Medline and The Cochrane Library were searched for articles published between January 1978 and January 2011 on the topic of antibiotic prophylaxis in gynaecologic procedures. Results were restricted to systematic reviews, randomized control trials/controlled clinical trials, and observational studies. Searches were updated on a regular basis and incorporated in the guideline to June 2011. Grey (unpublished) literature was identified through searching the websites of health technology assessment and health technology assessment-related agencies, clinical practice guideline collections, clinical trial registries, and national and international medical specialty societies.

Values: The quality of evidence obtained was rated using the criteria described in the Report of the Canadian Task Force on Preventative Health Care (Table 1).

Benefits, harms, and costs: Guideline implementation should result in a reduction of cost and related harm of administering antibiotics when not required and a reduction of infection and related morbidities when antibiotics have demonstrated a proven benefit.

Recommendations

1. All women undergoing an abdominal or vaginal hysterectomy should receive antibiotic prophylaxis. (I-A)
2. All women undergoing laparoscopic hysterectomy or laparoscopically assisted vaginal hysterectomy should receive prophylactic antibiotics. (III-B)
3. The choice of antibiotic for hysterectomy should be a single dose of a first-generation cephalosporin. If patients are allergic to cephalosporin, then clindamycin, erythromycin, or metronidazole should be used. (I-A)
4. Prophylactic antibiotics should be administered 15 to 60 minutes prior to skin incision. No additional doses are recommended. (I-A)
5. If an open abdominal procedure is lengthy (e.g., > 3 hours), or if the estimated blood loss is > 1500 mL, an additional dose of the prophylactic antibiotic may be given 3 to 4 hours after the initial dose. (III-C)

This document reflects emerging clinical and scientific advances on the date issued and is subject to change. The information should not be construed as dictating an exclusive course of treatment or procedure to be followed. Local institutions can dictate amendments to these opinions. They should be well documented if modified at the local level. None of these contents may be reproduced in any form without prior written permission of the SOGC.

6. Antibiotic prophylaxis is not recommended for laparoscopic procedures that involve no direct access from the abdominal cavity to the uterine cavity or vagina. (I-E)
7. All women undergoing surgery for pelvic organ prolapse and/or stress urinary incontinence should receive a single dose of first-generation cephalosporin. (III-B)
8. Antibiotic prophylaxis is not recommended for hysteroscopic surgery. (II-2D)
9. All women undergoing an induced (therapeutic) surgical abortion should receive prophylactic antibiotics to reduce the risk of post-abortal infection. (I-A)
10. Prophylactic antibiotics are not suggested to reduce infectious morbidity following surgery for a missed or incomplete abortion. (I-E)
11. Antibiotic prophylaxis is not recommended for insertion of an intrauterine device. (I-E) However, health care professionals could consider screening for sexually transmitted infections in high-risk populations. (III-C)
12. There is insufficient evidence to support the use of antibiotic prophylaxis for an endometrial biopsy. (III-L)
13. The best method to prevent infection after hysterosalpingography is unknown. Women with dilated tubes found at the time of hysterosalpingography are at highest risk, and prophylactic antibiotics (e.g., doxycycline) should be given. (II-3B)
14. Antibiotic prophylaxis is not recommended for urodynamic studies in women at low risk, unless the incidence of urinary tract infection post-urodynamics is > 10%. (1-E)
15. In patients with morbid obesity (BMI > 35 kg/m^2), doubling the antibiotic dose may be considered. (III-B)
16. Administration of antibiotics solely to prevent endocarditis is not recommended for patients who undergo a genitourinary procedure. (III-E)

INTRODUCTION

Infectious complications following gynaecologic surgical procedures are a significant source of morbidity and potential mortality. They include urinary tract infection, endometritis, wound infection, vaginal cuff cellulitis, perineal infection, and sepsis, which lead to prolonged hospital stays and increased health care costs. Much work has been done to study the effect of prophylactic antibiotics in reducing infectious morbidity. A plethora of antibiotic types, dosing schedules, and routes of administration have been investigated. There is evidence to support the use of prophylactic antibiotics for a number of procedures in gynaecology. Unfortunately, few comparative trials have been conducted, leaving the clinician with uncertainty as to which regimen is superior.

ABBREVIATIONS

BV	bacterial vaginosis
HSG	hysterosalpingography
PID	pelvic inflammatory disease
STI	sexually transmitted infection
UTI	urinary tract infection

The presence of antibiotic resistant organisms is a reality in Canadian health care facilities.[1] These organisms include methicillin resistant *Staphylococcus aureus,* vancomycin resistant *Enterococcus,* and extended-spectrum beta-lactamase-producing organisms.

Both morbidity and mortality are increased in infections involving these organisms, as they may be more virulent and are more difficult to treat because therapeutic options are limited. Antibiotic resistance development results mainly from the inappropriate use of antibiotics. Incomplete courses of antibiotic therapies and the unnecessary use of broader spectrum regimens play a role.[2] Adherence to treatment and prophylaxis guidelines likely assists in reducing infection and antibiotic resistance. Physician adherence to antibiotic prophylaxis guidelines is variable and frequently at odds with published guidelines.[3,4]

In addition to antibiotic prophylaxis, all factors that affect infectious risk reduction in our specialty must be reviewed. Sterile surgical fields must be ensured, and ongoing quality assessment of sterilization technique, air ventilation, and postoperative wound care are needed. Consistent infection control surveillance and reporting of infectious complications track ability to minimize these morbidities and possibly to identify clusters of infection and the emergence of antibiotic resistant organisms. This will dictate changes to operative routines to respond to evolving microbial diversity that seems inevitable.

PRINCIPLES OF ANTIBIOTIC PROPHYLAXIS

The purpose of antibiotic prophylaxis in surgical procedures is not to sterilize tissues but to reduce the colonization pressure of microorganisms introduced at the time of operation to a level that the patient's immune system is able to overcome.[5] Prophylaxis does not prevent infection caused by postoperative contamination. Prophylactic antibiotic use differs from treatment with antibiotics in that the former is intended to prevent infection, whereas the latter is intended to resolve an established infection, typically requiring a longer course of therapy. Prophylaxis is intended for elective procedures in which the incision will be closed in the operating room.

Before an agent can be considered for use as a prophylactic, there must be evidence that it reduces postoperative infection. It must also be safe and inexpensive, and it must be effective against organisms likely to be encountered in the surgical procedure. The agent must be administered in a way that ensures that serum and tissue levels are adequate before an incision is made and that therapeutic levels of the agent can be maintained in serum and tissue

Table 1. Key to evidence statements and grading of recommendations, using the ranking of the Canadian Task Force on Preventive Health Care

Quality of evidence assessment*	Classification of recommendations†
I: Evidence obtained from at least one properly randomized controlled trial	A. There is good evidence to recommend the clinical preventive action
II-1: Evidence from well-designed controlled trials without randomization	B. There is fair evidence to recommend the clinical preventive action
II-2: Evidence from well–designed cohort (prospective or retrospective) or case–control studies, preferably from more than one centre or research group	C. The existing evidence is conflicting and does not allow to make a recommendation for or against use of the clinical preventive action; however, other factors may influence decision-making
II-3: Evidence obtained from comparisons between times or places with or without the intervention. Dramatic results in uncontrolled experiments (such as the results of treatment with penicillin in the 1940s) could also be included in this category	D. There is fair evidence to recommend against the clinical preventive action
	E. There is good evidence to recommend against the clinical preventive action
III: Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees	L. There is insufficient evidence (in quantity or quality) to make a recommendation; however, other factors may influence decision-making

*The quality of evidence reported in these guidelines has been adapted from The Evaluation of Evidence criteria described in the Canadian Task Force on Preventive Health Care.[56]

†Recommendations included in these guidelines have been adapted from the Classification of Recommendations criteria described in the Canadian Task Force on Preventive Health Care.[56]

during surgery and for a few hours (at most) after the incision is closed.[5]

Wound infections—surgical site infections—in the form of cellulitis, abscess, or dehiscence can occur following laparotomy. Pelvic infections, such as an abscess or infected hematoma, are a risk with any surgical procedure that enters the abdominal cavity. Cuff cellulitis is a specific risk for hysterectomy. Endometritis can result from Caesarean section or surgical abortion. Urinary tract infections can occur as a result of any procedure that involves catheterization of the bladder.

A 1999 guideline published by the United States Centers for Disease Control and Prevention lists the specific and stringent criteria that must be met for diagnosis of a surgical site infection.[5] Accurate surveillance for surgical site infection monitoring requires follow-up for 30 days postoperatively, and the trend towards early discharge from hospital makes surveillance a challenge. It is estimated that up to 84% of surgical site infections occur following discharge from hospital.[5]

If prophylactic antibiotics are to be given, they should be administered shortly before or at bacterial inoculation.[6,7] This should be done 15 to 60 minutes before skin incision. The majority of studies suggest that a single dose is effective but that for lengthy procedures (> 3 hours) the dose should be repeated at intervals 1 or 2 times the half-life of the drug. It has also been suggested that with large blood loss (> 1500 mL), a second dose should be given.[8]

SURGICAL PROCEDURES

Vaginal Hysterectomy

A hysterectomy is considered a "class II or clean-contaminated" wound (Table 2).[5] The method of hysterectomy may modify the inherent risk of postoperative infection. A Cochrane review suggested that vaginal hysterectomy results in fewer unspecified infections or febrile episodes (OR 0.42; 95% CI 0.21 to 0.83) than abdominal hysterectomy.[9]

There is no meta-analysis or systematic review regarding antibiotic prophylaxis for vaginal hysterectomy. A review by Duff and Park[10] included 20 studies, the majority of which were prospective randomized trials (18/20) and many of which were double-blinded (13/20). Without prophylaxis, the incidence of febrile morbidity averaged 40% to 50% but was reduced to 5% to 20% with prophylactic antibiotics.[10] The type, dose, and duration of antibiotics used were highly variable, but a first-generation cephalosporin was used in the majority of studies.

A randomized trial comparing amoxicillin-clavulanic acid with cefazolin (n = 178) showed no difference in infection rates.[11] Another trial comparing use of cefuroxime, metronidazole, or both showed an increased morbidity when metronidazole was added.[12]

Treating bacterial vaginosis with metronidazole rectally for at least 4 days prior to vaginal hysterectomy appears to reduce the incidence of vaginal cuff infection (n = 59; 0 vs. 27%) but may be impractical given the possibility of surgery

Table 2. Centers for Disease Control and Prevention surgical wound classification

Class I/Clean:	An uninfected operative wound in which no inflammation is encountered and the respiratory, alimentary, genital, or uninfected urinary tract is not entered. In addition, clean wounds are primarily closed and, if necessary, drained with closed drainage. Operative incisional wounds that follow nonpenetrating (blunt) trauma should be included in this category if they meet the criteria.
Class II/Clean-Contaminated:	An operative wound in which the respiratory, alimentary, genital, or urinary tracts are entered under controlled conditions and without unusual contamination. Specifically, operations involving the biliary tract, appendix, vagina, and oropharynx are included in this category, provided no evidence of infection or major break in technique is encountered.
Class III/Contaminated:	Open, fresh, accidental wounds. In addition, operations with major breaks in sterile technique (e.g., open cardiac massage) or gross spillage from the gastrointestinal tract, and incisions in which acute, nonpurulent inflammation is encountered are included in this category.
Class IV/Dirty-Infected:	Old traumatic wounds with retained devitalized tissue and those that involve existing clinical infection or perforated viscera. This definition suggests that the organisms causing postoperative infection were present in the operative field before the operation.

Centers for Disease Control and Prevention. Guideline for Prevention of Surgical Site Infection, 1999.[5]

cancellation.[13] It is also difficult to comment on the cost-benefit of screening all women for BV prior to surgery.

Abdominal Hysterectomy

There are 3 meta-analyses exploring the efficacy of antibiotic prophylaxis for abdominal hysterectomy. The most recent, by Tanos and Rojansky in 1994,[14] compared 17 trials (n = 2752) that used single dose or up to 24 hours of intramuscular or intravenous cephalosporins. There was a significant reduction in the incidence of infection in the treatment groups (OR = 0.35; 95% CI 0.3 to 0.4). Febrile morbidity was prevented by first-generation cephalosporins but not by some second- and third-generation choices. The authors concluded that a single dose of a first- or second-generation cephalosporin was efficacious and cost-effective. Mittendorf et al.[15] (1993) meta-analyzed 25 RCTs (n = 3604) with varying antibiotic choice, duration, and routes of administration. They found that serious infections were less common in the treatment groups (9% vs. 21.1%, $P = 0.001$). Among those who received cefazolin or metronidazole, 11.4% and 6.3% respectively had serious postoperative infections. Lastly, Wttewaall-Evelaar[16] (1990) examined 17 RCTs, the majority of which (14 of 17) used first- or second-generation cephalosporins. Infections were significantly reduced in the treatment groups ($P < 0.001$).

A randomized trial with women undergoing a gynaecologic procedure via laparotomy (which included abdominal hysterectomy) comparing amoxicillin-clavulanic acid with cefazolin (n = 511) showed no difference in infection rates.[17] A randomized trial (n = 321) comparing placebo, ampicillin, and cefazolin, demonstrated significant superiority of cefazolin to reduce postoperative infection.[18] A randomized study comparing a single dose versus 24-hour regimen of cefuroxime plus metronidazole, showed no difference.[19]

Laparoscopic Hysterectomy

A Cochrane review showed that laparoscopic hysterectomy (laparoscopically assisted vaginal hysterectomy or laparoscopic subtotal hysterectomy) results in fewer wound or abdominal wall infections (OR 0.32; 95% CI 0.12 to 0.85) and fewer unspecified infections or febrile episodes (OR 0.65; 95% CI 0.49 to 0.87) than abdominal hysterectomy. There was no difference in any infections between laparoscopic hysterectomy and vaginal hysterectomy.[9]

There are no trials assessing the use of prophylactic antibiotics for any types of laparoscopic hysterectomy. Given that this is a clean-contaminated procedure with a rate of postoperative infections similar to that of vaginal hysterectomy, it would seem reasonable to treat these patients in a similar fashion.

A single dose of cefazolin was determined to be as effective as multiple doses in a study of 310 women who underwent laparoscopically assisted vaginal hysterectomy.[20]

Laparoscopy not Entering the Uterus and/or Vagina

These procedures are considered clean (Table 2), as the genital tract is not entered. A randomized non-blinded trial of 450 women undergoing laparoscopy for various indications (not hysterectomy), found no difference in infection rates between those who received a single dose of cefazolin and those who did not.[21]

Recommendations

1. All women undergoing an abdominal or vaginal hysterectomy should receive antibiotic prophylaxis. (I-A)
2. All women undergoing laparoscopic hysterectomy or laparoscopically assisted vaginal hysterectomy should receive prophylactic antibiotics. (III-B)

3. The choice of antibiotic for hysterectomy should be a single dose of a first-generation cephalosporin. If patients are allergic to cephalosporin, then clindamycin, erythromycin, or metronidazole should be used. (I-A)
4. Prophylactic antibiotics should be administered 15 to 60 minutes prior to skin incision. No additional doses are recommended. (I-A)
5. If an open abdominal procedure is lengthy (e.g., > 3 hours), or if the estimated blood loss is > 1500 mL, an additional dose of the prophylactic antibiotic may be given 3 to 4 hours after the initial dose. (III-C)
6. Antibiotic prophylaxis is not recommended for laparoscopic procedures that involve no direct access from the abdominal cavity to the uterine cavity or vagina. (I-E)

Surgery for Pelvic Organ Prolapse and/or Stress Urinary Incontinence

A randomized double-bind, placebo-controlled trial enrolled 449 patients to receive nitrofurantoin monohydrate monocrystals or placebo preoperatively. Procedures included surgery for pelvic organ prolapse and/or stress incontinence with suprapubic catheterization. Positive urine cultures were significantly reduced (46% vs. 61%), as was symptomatic urinary tract infection (7.2% vs. 19.8%).[22] There are no studies assessing prophylactic antibiotics prior to these surgeries without use of a suprapubic catheter. There are also no studies regarding isolated sub-urethral sling procedures (e.g., transvaginal or transobturator tapes), but given the very poor outcomes associated with mesh infection, administration of a single preoperative dose of a first-generation cephalosporin is common practice.

Recommendation

7. All women undergoing surgery for pelvic organ prolapse and/or stress urinary incontinence should receive a single dose of first-generation cephalosporin. (III-B)

Hysteroscopic Surgery

A Cochrane review of prophylactic antibiotics for transcervical intrauterine procedures did not identify any randomized trials that met their criteria.[23] A pseudorandomized study that used centre-specific antibiotic prophylaxis analyzed 631 infertile women who underwent office hysteroscopy. Two hundred sixty-six women received amoxicillin-clavulanate and doxycycline 2 hours pre-procedure. There was no difference in post-procedural infection (1 in the antibiotic group).[24] A randomized trial of amoxicillin and clavulanate versus placebo for hysteroscopic ablation (n = 116) found a significant difference in the occurrence of bacteremia (16% vs. 2%); however, the authors comment that the majority of organisms were of dubious clinical significance and that contamination could not be excluded in 7 of 10 cases. No significant difference was found for women treated for presumed infection (11.4% vs. 9%), but no objective measures were used.[25] A case series of 568 women suggests that the infection risk is low (< 1%).[26] There are no studies addressing prophylactic antibiotics in the setting of hysteroscopic myomectomy.

Recommendation

8. Antibiotic prophylaxis is not recommended for hysteroscopic surgery. (II-2D)

Induced (Therapeutic) Abortion

A meta-analysis that included 12 randomized clinical trials, demonstrated that prophylactic antibiotics significantly reduced post-abortal infection (at < 16 weeks), compared with placebo.[27] The relative risk of upper genital tract infection following surgical abortion was 0.58 (95% CI 0.47 to 0.71) with antibiotics. The benefit was seen in women considered to be at high risk and in those at low risk for infection; thus, the authors conclude that universal prophylaxis should be given and that no more placebo-controlled trials should be performed. The most appropriate antibiotic regimen, however, is yet to be determined, as no comparative or superiority trials have been conducted. The largest trial to date (n = 1074), which had the most statistically significant reduction in postoperative infection rates (RR 0.12; 95% CI 0.08 to 0.38), used doxycycline 100 mg orally before the procedure followed by 200 mg after the procedure.[28] Other regimens that have been effective in a randomized trial include metronidazole 400 mg orally 1 hour before the procedure and then repeated 4 and 8 hours after the procedure (RR 0.19; 95% CI 0.10 to 0.83)[29] and doxycycline 400 mg orally 10 to 12 hours before the procedure (RR 0.33; 95% CI 0.22 to 0.73)[30] A cost-effectiveness study looking at universal screening for sexually transmitted infections versus prophylactic azithromycin (1 g) showed that prophylactic treatment provided a significant cost savings.[31] Disadvantages of not screening include the lack of case identification and the inability to complete therapy or conduct contact tracing. Some authors have questioned whether the presence of BV influences the rate of postoperative infection after induced abortion. In a double-blind placebo-controlled trial, treatment using 2% vaginal clindamycin for at least 3 days preoperatively did not decrease the risk of postoperative infection in patients with or without documented BV. The only statistically significant difference was seen when the authors combined the women who had intermediate

flora with those who had BV (RR = 4.2 in untreated group; 95% CI 1.2 to 15.9).[32] Another randomized blinded trial found that giving a single 2 g metronidazole suppository preoperatively to women who had confirmed bacterial vaginosis[33] did not make a significant difference (RR = 0.53; $P = 0.055$). Screening and treating for bacterial vaginosis prior to surgery also may be impractical, and the cost-effectiveness is not known.

Recommendation

9. All women undergoing an induced (therapeutic) surgical abortion should receive prophylactic antibiotics to reduce the risk of post-abortal infection. (I-A)

Missed or Incomplete Abortion

There are two randomized placebo-controlled trials that assess the effectiveness of prophylactic antibiotics to reduce infectious morbidity following uterine evacuation for incomplete abortion. One trial involving 240 women used a preoperative intravenous dose of doxycycline or placebo.[34] Chlamydia and gonorrhea rates were low (3% to 6%) in this population. No difference in postoperative infectious morbidity rates occurred up to 2 weeks post-procedure. A second study of 300 women investigated the use of 200 mg oral doxycycline at 30 to 60 minutes pre-procedure. Again, no significant difference between groups was found.[35] A 2007 Cochrane Review on this topic concluded there is not enough evidence to recommend routine antibiotic prophylaxis for incomplete abortion at the time of evacuation of the uterus.[36]

Recommendation

10. Prophylactic antibiotics are not suggested to reduce infectious morbidity following surgery for a missed or incomplete abortion. (I-E)

OFFICE PROCEDURES

Intrauterine Device Insertion

Various authors have demonstrated that the risk of IUD-related infection is limited to the first few weeks to months after insertion.[37,38] It is therefore likely related to contamination of the endometrial cavity at the time of insertion, rather than the IUD or strings themselves.[39] A 1999 Cochrane Review that included 4 randomized control trials found no difference in the occurrence of PID after IUD insertion in patients who were given prophylactic doxycycline or azithromycin and in those given placebo (OR 0.89; 95% CI 0.53 to 1.51). Use of these antibiotics also did not affect whether the IUD was removed within 90 days of insertion (OR 1.05; 95% CI 0.68 to 1.63).[40] However, if the patient is considered at high risk for sexually transmitted infections, it would be reasonable to consider screening before IUD placement.

Recommendation

11. Antibiotic prophylaxis is not recommended for insertion of an intrauterine device. (I-E) However, health care professionals could consider screening for sexually transmitted infections in high-risk populations. (III-C)

Endometrial Biopsy

There are no studies that assess the use of prophylactic antibiotics given before an endometrial biopsy procedure, and this is not considered standard of care.

Recommendation

12. There is insufficient evidence to support the use of antibiotic prophylaxis for an endometrial biopsy. (III-L)

Hysterosalpingography

There are many options for preventing infection that may occur as a result of HSG:

1. Universal screening for STIs could be carried out, and patients treated as necessary.
2. Only patients at high risk (determined by history) could be screened.
3. All patients could receive prophylactic antibiotics.
4. Antibiotics could be given to patients at high risk (determined by history and/or as indicated by the presence of tubal obstruction at the time of HSG).

Many of the patients may already have had screening performed as part of an infertility work-up. If infection is found, treatment should follow the Canadian Guidelines for STIs.[41] There are no prospective studies that investigate any of these options. A retrospective study found that among 278 women who did not receive antibiotics, the incidence of PID after HSG was 1.4% (4/278), and all 4 patients had dilated tubes; 31 other patients with dilated tubes did not develop infection. A second group of patients (n = 326) received a single dose of oral doxycycline before HSG; no patient (including 56 who had dilated tubes) developed PID. This study suggests that the incidence of PID with normal tubes is very low, regardless of prophylactic antibiotics (0/398) and that the highest-risk group of women with dilated tubes at the time of HSG did benefit from prophylactic doxycycline.[42]

Table 3. Cardiac conditions associated with the highest risk of adverse outcome from endocarditis

Prosthetic cardiac valve or prosthetic material used for cardiac valve repair
Previous infective endocarditis
Congenital heart disease (CHD)
Unrepaired cyanotic CHD (including palliative shunts and conduits)
Completely repaired CHD with prosthetic material < 6 months after procedure
Repaired CHD with residual defects at/near site of prosthetic material
Cardiac transplant recipient with cardiac valvulopathy

Adapted from Wilson W, Taubert KA, Gewitz M, Lockhart PB, Baddour LM, Levison M, et al. Prevention of Infective Endocarditis: Guidelines From the American Heart Association: A Guideline From the American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee, Council on Cardiovascular Disease in the Young, and the Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and the Quality of Care and Outcomes Research Interdisciplinary Working Group. Circulation 2007;116:1736–54.[54]

Used with permission of Wolters Kluwer Health.

Recommendation

13. The best method to prevent infection after hysterosalpingography is unknown, Women with dilated tubes found at the time of hysterosalpingography are at highest risk, and prophylactic antibiotics (e.g., doxycycline) should be given. (II-3B)

URODYNAMIC STUDIES

A systematic review in 2008 included 8 RCTs, with 995 patients, most of whom were women.[43] The prophylactic antibiotics differed in type, dose, and duration and were compared with either placebo or no treatment. The authors noted that most of the trials had poor methodology. They concluded that there was a 40% reduction in the risk of bacteriuria (OR 0.39; 95% CI 0.24 to 0.61), correlating to a number needed to treat of 13. This study assessed only the occurrence of bacteriuria and not that of symptomatic UTI; therefore, the clinical significance is unknown. It has been estimated that only 8% of women develop a symptomatic UTI within 1 week of a diagnosis of asymptomatic bacteriuria.[44] On the basis of the results of a decision-analysis that incorporated reasonable estimates of benefits and adverse events from the published literature, the authors concluded that prophylactic antibiotics after urodynamics in women at low risk should be administered only when the background rate of UTIs after urodynamics without prophylaxis is higher than 10%.[45]

Recommendation

14. Antibiotic prophylaxis is not recommended for urodynamic studies in women at low risk, unless the incidence of urinary tract infection post-urodynamics is > 10%. (1-E)

DOSAGE OF ANTIBIOTIC PROPHYLAXIS IN OBESE PATIENTS

Increased BMI is associated with higher rates of surgical infectious complications. Expert opinion recommends twice the normal dose of prophylaxis for morbidly obese patients (BMI > 35 km/m^2).[46] However, controlled trials assessing the required dosage for antibiotic prophylaxis based on patient BMI have not been assessed in our specialty, and future research is needed.

Recommendation

15. In patients with morbid obesity (BMI > 35 kg/m^2), doubling the antibiotic dose may be considered. (III-B)

RECOMMENDATIONS FOR PENICILLIN/ CEPHALOSPORIN ALLERGY

Penicillin allergy is self-reported by up to 10% of patients, yet only 10% of those who report themselves as allergic are allergic when skin testing is performed.[47–49] True anaphylactic response to penicillin is rare, occurring in 1 to 4 per 10 000 administrations.[50] Allergic reaction to a cephalosporin occurs at rates of 0.17% to 8.4% in those with a penicillin allergy.[51–53] Alternative prophylactic antibiotics for those deemed truly penicillin allergic include clindamycin 600 mg IV and erythromycin 500 mg IV.

PREVENTION OF INFECTIVE ENDOCARDITIS

The American Heart Assocation guideline published in 2007[54] found no evidence that genitourinary procedures cause infectious endocarditis or that administration of antibiotics prevents infectious endocarditis following such procedures. The American Heart Assocation therefore does not recommend prophylactic antibiotics for patients undergoing genitourinary procedures; this is a change from

Table 4. Prophylactic antibiotics recommendations for gynaecologic procedures

Procedure	Antibiotic	Dosage	Level
Vaginal hysterectomy	First- or second-generation cephalosporin	Single dose, IV	I-A
Abdominal hysterectomy	First- or second-generation cephalosporin	Single dose, IV	I-A
Laparoscopic hysterectomy	First- or second-generation cephalosporin	Single dose, IV	III-B
Laparoscopy (uterus and/or vagina not entered)	None recommended		I-E
Pelvic organ prolapse and/or stress urinary incontinence surgery	First-generation cephalosporin	Single dose, IV	III-B
Hysteroscopy	None recommended		II-2D
Therapeutic abortion	doxycycline	100 mg po pre-procedure and 200 mg po post-procedure	I-A
Missed/incomplete abortion	None recommended		I-E
IUD insertion	None recommended*		I-E
Endometrial biopsy	None recommended		III-L
Hysterosalpingogram	1. Consider screening for STIs†	1. Rx as per STI guidelines‡	III-B
	2. Antibiotics if dilated tubes	2. e.g., doxycycline	II-3B
Urodynamic testing	None recommended§		I-E

IV: intravenous

*Considering screening for sexually transmitted infections in high risk populations

†Evidence for/against screening unknown

‡Canadian guidelines on sexually transmitted infections—2006 edition[43]

§In patients at low risk with a background risk of UTI < 10% after urodynamics

the 1997 American Heart Assocation guideline. The 2007 guideline identifies 4 conditions that are at highest risk of adverse outcome (Table 3). For patients with the conditions listed in Table 3 who have an established gastrointestinal or genitourinary infection, or for those who receive antibiotic therapy for another reason (e.g., to prevent wound infection), it may be reasonable that the antibiotic used also be active against enterococci (ampicillin, piperacillin, or vancomycin). The guidelines also suggest that it may be reasonable for patients at high risk of infectious endocarditis who have a known enterococcal urinary tract infection or colonization to receive antibiotic treatment prior to any urinary tract manipulation. A review of this recommendation change has recently been published.[55]

Recommendation

16. Administration of antibiotics solely to prevent endocarditis is not recommended for patients who undergo a genitourinary procedure. (III-E)

SUMMARY

For a number of procedures in gynaecology, the use of prophylactic antibiotics has been shown to reduce infectious morbidity in a safe and cost-effective manner (Table 4). There remain a number of procedures for which the utility of prophylactic antibiotics is either unclear or not studied. Appropriate antibiotics used at the correct dose and time and with the appropriate frequency will reduce infectious postoperative complications and minimize the development of antibiotic resistant organisms.

REFERENCES

1. Zoutman DE, Ford BD. A comparison of infection control program resources, activities, and antibiotic resistant organism rates in Canadian acute care hospitals in 1999 and 2005: pre and post-severe acute respiratory syndrome. Am J Infect Control 2008;36:711–7.
2. Dancer SJ. How antibiotics can make us sick: the less obvious adverse effects of antimicrobial chemotherapy. Lancet Infect Dis 2004;4:611–9.
3. Huskins WC, Ba-Thike K, Festin MR, Limpongsanurak S, Lumbiganon P, Peedicayil A, et al.; Global Network for Perinatal and Reproductive Health. An international survey of practice variation in the use of antibiotic prophylaxis in cesarean section. Int J Gynaecol Obstet 2001;73:141–5.
4. Bratzler DW, Houck PM, Richards C, Steele L, Dellinger EP, Fry DE, et al. Use of antimicrobial prophylaxis for major surgery: baseline results from the National Surgical Infection Prevention Project. Arch Surg 2005;140:174–82.
5. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection, 1999. Centers for Disease Control and Prevention (CDC) Hospital Infection Control Practices Advisory Committee. Am J Infect Control 1999;27:97–134.
6. Classen DC, Evans RS, Pestotnik SL, Horn SD, Menlove RL, Burke JP. The timing of prophylactic administration of antibiotics and the risk of surgical-wound infection. N Engl J Med 1992;326:281–6.

7. Bratzler DW, Houck PM; Surgical Infection Prevention Guidelines Writers Workgroup; American Academy of Orthopaedic Surgeons; American Association of Critical Care Nurses; American Association of Nurse Anesthetists; American College of Surgeons; American College of Osteopathic Surgeons; American Geriatrics Society; American Society of Anesthesiologists; American Society of Colon and Rectal Surgeons; American Society of Health-System Pharmacists; American Society of PeriAnesthesia Nurses; Ascension Health; Association of periOperative Registered Nurses; Association for Professionals in Infection Control and Epidemiology; Infectious Diseases Society of America; Medical Letter; Premier; Society for Healthcare Epidemiology of America; Society of Thoracic Surgeons; Surgical Infection Society. Antimicrobial prophylaxis for surgery: an advisory statement from the National Surgical Infection Prevention Project. Clin Infect Dis 2004;38:1706–15.
8. Dellinger EP, Gross PA, Barrett TL, Krause PJ, Martone WJ, McGowan JE Jr, et al. Quality standard for antimicrobial prophylaxis in surgical procedures. Infectious Diseases Society of America. Clin Infect Dis 1994;18:422–7.
9. Johnson N, Barlow D, Lethaby A, Tavender E, Curr E, Garry R. Surgical approach to hysterectomy for benign gynaecological disease. Cochrane Database Syst Rev 2006;Issue 2. Art. No.: CD003677. DOI: 10.1002/14651858.CD003677.pub3.
10. Duff P, Park RC. Antibiotic prophylaxis in vaginal hysterectomy: a review. Obstet Gynecol 1980;55(Suppl 5):193–202.
11. Cormio G, Vicino M, Loizzi V, Tangari D, Selvaggi L. Antimicrobial prophylaxis in vaginal gynecologic surgery: a prospective randomized study comparing amoxicillin-clavulanic acid with cefazolin. J Chemother 2007;19:193–7.
12. Kauer FM, Wijma J, Manson WL. Vaginal hysterectomy: cefuroxime, metronidazole or both? Pharm Weekbl Sci 1990;12(6A):284–8.
13. Larsson PG, Carlsson B. Does pre and postoperative metronidazole lower vaginal cuff infection rate after abdominal hysterectomy among women with bacterial vaginosis? Infect Dis Obstet Gynecol 2002:10:133–40.
14. Tanos V, Rojansky N. Prophylactic antibiotics in abdominal hysterectomy. J Am Coll Surg 1994;179:593–600.
15. Mittendorf R, Aronson MP, Berry RE, Williams MA, Kipelnick B, Klickstein A, et al. Avoiding serious infections associated with abdominal hysterectomy: a meta-analysis of antibiotic prophylaxis. Am J Obstet Gynecol 1993;169:1119–24.
16. Wttewaall-Evelaar EW. Meta-analysis of randomized controlled trials of antibiotic prophylaxis in abdominal hysterectomy. Pharm Weekbl Sci 1990;12(6A):296–9.
17. Cormio G, Di Fazio F, Lorusso F, Di Gesù G, Cacciapuoti C, Loverro G, et al. Antimicrobial prophylaxis in laparotomic gynecologic surgery: a prospective randomized study comparing amoxicillin-clavulanic acid with cefazolin. J Chemother 2002;14:618–22.
18. Chongsomchai C, Lumbiganon P, Thinkhamrop J, Ounchai J, Vudhikamraksa N. Placebo-controlled, double-blind, randomized study of prophylactic antibiotics in elective abdominal hysterectomy. J Hosp Infect 2002;52:302–6.
19. Eckenhausen FW, Jonker PL. Antibiotic prophylaxis in abdominal hysterectomy, with special reference to the duration of the prophylaxis. Pharm Weekbl Sci 1990;12(6A):289–91.
20. Chang WC, Lee MC, Yeh LS, Hung YC, Lin CC, Lin LY. Quality-initiated prophylactic antibiotic use in laparoscopic-assisted vaginal hysterectomy. Aust N Z J Obstet Gynaecol 2008;48:592–5.
21. Kocak I, Ustun C, Emre B, Uzel A. Antibiotic prophylaxis in laparoscopy. Ceska Gynekol 2005;70:269–72.
22. Rogers RG, Kammerer-Doak D, Olsen A, Thompson PK, Walters MD, Lukacz ES, et al. A randomized, double-blind, placebo-controlled comparison of the effect of nitrofurantoin monohydrate macrocrystals on the development of urinary tract infections after surgery for pelvic organ prolapse and/or stress incontinence with suprapubic catheterization. Am J Obstet Gynecol 2004;191:182–7.
23. Thinkhamrop J, Laopaiboon M, Lumbiganon P. Prophylactic antibiotics for transcervical intrauterine procedures. Cochrane Database Syst Rev 2007;Art. No.: CD005637. DOI 10.1002/14651858.CD005637.pub2.
24. Kasius J, Broekmans F, Fauser B, Devroey P, Fatemi H. Antibiotic prophylaxis for hysteroscopy evaluation of the uterine cavity. Fertil Steril 2011;95:792–4.
25. Bhattacharya S, Parkin DE, Reid TM, Abramovich DR, Mollison J, Kitchener HC. A prospective randomized study of the effects of prophylactic antibiotics on the incidence of bacteremia following hysteroscopic surgery. Eur J Obstet Gynecol Reprod Biol 1995;63:37–40.
26. Baggish MS, Sze EH. Endometrial ablation: a series of 568 patients treated over an 11-year period. Am J Obstet Gynecol 1996;174:908–13.
27. Sawaya GF, Grady D, Kerlikowske K, Grimes DA Antibiotics at the time of induced abortion: the case for universal prophylaxis based on a meta-analysis. Obstet Gynecol 1996;87(5 Pt 2):884–90.
28. Lavellois P, Rioux JE. Prophylactic antibiotics for suction curettage abortion: results of a clinical controlled trial. Am J Obstet Gynecol 1988;158:100–5.
29. Heisterberg L, Peterson K. Metronidazole prophylaxis in elective first trimester abortion. Obstet Gynecol 1985;65:371–4.
30. Darj E, Stralin EB, Nilsson S. The prophylactic effect of doxycycline on postoperative infection rate after first-trimester abortion. Obstet Gynecol 1987;70:755–8.
31. Chen S, Li J, van den Hoek A. Universal screening or prophylactic treatment for Chlamydia trachomatis infection among women seeking induced abortions: which strategy is more cost-effective? Sex Transm Dis 2007;34:230–6.
32. Larsson PG, Platz-Christensen JJ, Dalaker K, Eriksson K, Fåhraeus L, Irminger K, et al. Treatment with 2% clindamycin vaginal cream prior to first trimester surgical abortion to reduce signs of postoperative infection: a prospective, double-blinded, placebo-controlled, multicenter study. Acta Obstet Gynecol Scand 2000;79:390–6.
33. Crowley T, Low N, Turner A, Harvey I, Bidgood K, Horner P. Antibiotic prophylaxis to prevent post-abortal upper genital tract infection in women with bacterial vaginosis: randomised controlled trial. BJOG 2001;108:396–402.
34. Prieto JA, Eriksen NL, Blanco JD. A randomized trial of prophylactic doxycycline for curettage in incomplete abortion. Obstet Gynecol 1995;85(5 Pt 1):692–6.
35. Ramin KD, Ramin SM, Hemsell PG, Nobles BJ, Heard MC, Johnson VB, et al. Prophylactic antibiotics for suction curettage in incomplete abortion. Infect Dis Obstet Gynecol 1995;2:213–7.
36. May W, Gülmezoglu AM, Ba-Thike K. Antibiotics for incomplete abortion. Cochrane Database Syst Rev 2007;Issue 4. Art. No.: CD001779. DOI: 10.1002/14651858.CD001779.pub2.
37. Lee NC, Rubin GL, Ory HW, Nurkman RT. Type of intrauterine device and the risk of pelvic inflammatory disease. Obstet Gynecol 1983:96:119–26.
38. Farley TMM, Rosenberg MJ, Rowe P, Chen J-H, Meirik O. Intraterine devices and pelvic inflammatory disease: an international perspective. Lancet 1992;339:785–8.
39. Mishell DR Jr, Bell JH, Good RG, Moyer DL. The intrauterine device: a bacteriologic study of the endometrial cavity. Am J Obstet Gynecol 1966;96:119–26.
40. Grimes DA, Lopez LM, Schulz KF. Antibiotic prophylaxis for intrauterine contraceptive device insertion. Cochrane Database Syst Rev 1999; Issue 3. Art. No.: CD001327. DOI: 10.1002/14651858.CD001327.

41. Public Health Agency of Canada. Canadian Guidelines on Sexually Transmitted Infections; 2006. Available at: http://www.publichealth.gc.ca/sti. Accessed January 30, 2012.

42. Pittaway DE, Winfield AC, Maxson W, Daniell J, Herbert C, Wentz AC. Prevention of acute inflammatory disease after hysterosalpingography: efficacy of doxycycline prophylaxis. Am J Obstet Gynecol 1983;147:623–6.

43. Latthe P, Foon R, Toozs-Hobson P. Prophylactic antibiotics in urodynamics: a systematic review of effectiveness and safety. Neurol Urodyn 2008;27:167–73.

44. Hooton TM, Scholes D, Stapleton AE, Roberts PL, Winter C, Gupta K, et al. A prospective study of asymptomatic bacteriuria in sexually active young women. N Engl J Med 2000;343:992–7.

45. Lower J, Burrows L, Howden N, Weber A. Prophylactic antibiotics after urodynamics in women: a decision analysis. Int Urogynecol J 2007;18:159–64.

46. Gordon SM. Antibiotic prophylaxis against postoperative wound infections. Cleve Clin J Med 2006;73(Suppl 1):S42–5.

47. Lee CE, Zembower TR, Fotis MA, Postelnick MJ, Greenberger PA, Peterson LR, et al. The incidence of antimicrobial allergies in hospitalized patients: implications regarding prescribing patterns and emerging bacterial resistance. Arch Intern Med 2000;160:2819–22.

48. del Real GA, Rose ME, Ramirez-Atamoros MT, Hammel J, Gordon SM, Arroliga AC, et al. Penicillin skin testing in patients with a history of beta-lactam allergy. Ann Allergy Asthma Immunol 2007;98:355–9.

49. Sogn DD, Evans R 3rd, Shepherd GM, Casale TB, Condemi J, Greenberger PA, et al. Results of the National Institute of Allergy and Infectious Diseases collaborative clinical trial to test the predictive value of skin testing with major and minor penicillin derivatives in hospitalized adults. Arch Intern Med 1992;152:1025.

50. International Rheumatic Fever Study Group. Allergic reactions to long-term benzathine penicillin prophylaxis for rheumatic fever. Lancet 1991;337(8753):1308–10.

51. Dash, CH. Penicillin allergy and the cephalosporins. J Antimicrob Chemother 1975;1:107.

52. Daulat, S, Solensky, R, Earl, HS, Casey W, Gruchalla RS. Safety of cephalosporin administration to patients with histories of penicillin allergy. J Allergy Clin Immunol 2004;113:1220.

53. Fonacier L, Hirschberg R, Gerson S. Adverse drug reactions to cephalosporins in hospitalized patients with a history of penicillin allergy. Allergy Asthma Proc 2005;26:135.

54. Wilson W, Taubert KA, Gewitz M, Lockhart PB, Baddour LM, Levison M, et al.; American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee; American Heart Association Council on Cardiovascular Disease in the Young; American Heart Association Council on Clinical Cardiology; American Heart Association Council on Cardiovascular Surgery and Anesthesia; Quality of Care and Outcomes Research Interdisciplinary Working Group. Prevention of Infective Endocarditis: Guidelines From the American Heart Association. Circulation 2007;116:1736–54

55. Castillo E, Magee LA, von Dadelszen P, Money D, Blonde-Hill E, van Schalkwyk J. Our patients do not need endocarditis prophylaxis for genitourinary tract procedures: insights fro the 2007 American Heart Association Guidelines. J Obstet Gynaecol Can 2008;30:796–9.

56. Woolf SH, Battista RN, Angerson GM, Logan AG, Eel W. Canadian Task Force on Preventive Health Care. New grades for recommendations from the Canadian Task Force on Preventive Health Care. CMAJ 2003;169:207–8.