Cochrane Library

Cochrane Database of Systematic Reviews

Antibiotic prophylaxis for elective hysterectomy (Review)

Ayeleke RO, Mourad S, Marjoribanks J, Calis KA, Jordan V

Ayeleke RO, Mourad S, Marjoribanks J, Calis KA, Jordan V.
Antibiotic prophylaxis for elective hysterectomy.
Cochrane Database of Systematic Reviews 2017, Issue 6. Art. No.: CD004637.
DOI: 10.1002/14651858.CD004637.pub2.

www.cochranelibrary.com

WILEY

TABLE OF CONTENTS

[Intervention Review]

Antibiotic prophylaxis for elective hysterectomy

Reuben Olugbenga Ayeleke[1], Selma Mourad[2], Jane Marjoribanks[1], Karim A Calis[3], Vanessa Jordan[1]

[1]Department of Obstetrics and Gynaecology, University of Auckland, Auckland, New Zealand. [2]Radboud University Medical Centre, Nijmegen, Netherlands. [3]National Institute of Child Health and Human Development, National Institutes of Health, Bethesda, Maryland, USA

Contact address: Vanessa Jordan, Department of Obstetrics and Gynaecology, University of Auckland, Private Bag 92019, Auckland, New Zealand. v.jordan@auckland.ac.nz.

Editorial group: Cochrane Gynaecology and Fertility Group.
Publication status and date: New, published in Issue 6, 2017.

Citation: Ayeleke RO, Mourad S, Marjoribanks J, Calis KA, Jordan V. Antibiotic prophylaxis for elective hysterectomy. *Cochrane Database of Systematic Reviews* 2017, Issue 6. Art. No.: CD004637. DOI: 10.1002/14651858.CD004637.pub2.

ABSTRACT

Background

Elective hysterectomy is commonly performed for benign gynaecological conditions. Hysterectomy can be performed abdominally, laparoscopically, or vaginally, with or without laparoscopic assistance. Antibiotic prophylaxis consists of administration of antibiotics to reduce the rate of postoperative infection, which otherwise affects 40%-50% of women after vaginal hysterectomy, and more than 20% after abdominal hysterectomy. No Cochrane review has systematically assessed evidence on this topic.

Objectives

To determine the effectiveness and safety of antibiotic prophylaxis in women undergoing elective hysterectomy.

Search methods

We searched electronic databases to November 2016 (including the Cochrane Gynaecology and Fertility Group Specialised Register, the Cochrane Central Register of Studies (CRSO), MEDLINE, Embase, PsycINFO, and the Cumulative Index to Nursing and Allied Health Literature (CINAHL), as well as clinical trials registers, conference abstracts, and reference lists of relevant articles.

Selection criteria

All randomised controlled trials (RCTs) comparing use of antibiotics versus placebo or other antibiotics as prophylaxis in women undergoing elective hysterectomy.

Data collection and analysis

We used Cochrane standard methodological procedures.

Main results

We included in this review 37 RCTs, which performed 20 comparisons of various antibiotics versus placebo and versus one another (6079 women). The quality of the evidence ranged from very low to moderate. The main limitations of study findings were risk of bias due to poor reporting of methods, imprecision due to small samples and low event rates, and inadequate reporting of adverse effects.

Any antibiotic versus placebo

Vaginal hysterectomy

Moderate-quality evidence shows that women who received antibiotic prophylaxis had fewer total postoperative infections (risk ratio (RR) 0.28, 95% confidence interval (CI) 0.19 to 0.40; five RCTs, N = 610; I^2 = 85%), less urinary tract infection (UTI) (RR 0.58, 95% CI 0.43 to 0.77; eight RCTs, N = 1790; I^2 = 44%), fewer pelvic infections (RR 0.28, 95% CI 0.20 to 0.39; 11 RCTs, N = 2010; I^2 = 57%), and fewer postoperative fevers (RR 0.43, 95% CI 0.34 to 0.54; nine RCTs, N = 1879; I^2 = 48%) than women who did not receive such prophylaxis. This suggests that antibiotic prophylaxis reduces the average risk of postoperative infection from about 34% to 7% to 14%. Whether this treatment has led to differences in rates of other serious infection remains unclear (RR 0.20, 95% CI 0.01 to 4.10; one RCT, N = 146; very low-quality evidence).

Data were insufficient for comparison of adverse effects.

Abdominal hysterectomy

Women who received antibiotic prophylaxis of any class had fewer total postoperative infections (RR 0.16, 95% CI 0.06 to 0.38; one RCT, N = 345; low-quality evidence), abdominal wound infections (RR 0.64, 95% CI 0.45 to 0.92; 11 RCTs, N = 2434; I^2 = 0%; moderate-quality evidence), UTIs (RR 0.39, 95% CI 0.29 to 0.51; 11 RCTs, N = 2547; I^2 = 26%; moderate-quality evidence), pelvic infections (RR 0.50, 95% CI 0.35 to 0.71; 11 RCTs, N = 1883; I^2 = 11%; moderate-quality evidence), and postoperative fevers (RR 0.60, 95% CI 0.51 to 0.70; 11 RCTs, N = 2581; I^2 = 51%; moderate-quality evidence) than women who did not receive prophylaxis, suggesting that antibiotic prophylaxis reduces the average risk of postoperative infection from about 16% to 1% to 6%. Whether this treatment has led to differences in rates of other serious infection remains unclear (RR 0.44, 95% CI 0.12 to 1.69; two RCTs, N = 476; I^2 = 29%; very low-quality evidence).

It is unclear whether rates of adverse effects differed between groups (RR 1.80, 95% CI 0.62 to 5.18; two RCTs, N = 430; I^2 = 0%; very low-quality evidence).

Head-to-head comparisons between antibiotics

Vaginal hysterectomy

We identified four comparisons: cephalosporin versus penicillin (two RCTs, N = 470), cephalosporin versus tetracycline (one RCT, N = 51), antiprotozoal versus lincosamide (one RCT, N = 80), and cephalosporin versus antiprotozoal (one RCT, N = 78). Data show no evidence of differences between groups for any of the primary outcomes, except that fewer cases of total postoperative infection and postoperative fever were reported in women who received cephalosporin than in those who received antiprotozoal.

Only one comparison (cephalosporin vs penicillin; two RCTs, N = 451) yielded data on adverse effects and showed no differences between groups.

Abdominal hysterectomy

We identified only one comparison: cephalosporin versus penicillin (N = 220). Data show no evidence of differences between groups for any of the primary outcomes. Adverse effects were not reported.

Combined antibiotics versus single antibiotics

Vaginal hysterectomy

We identified three comparisons: cephalosporin plus antiprotozoal versus cephalosporin (one RCT, N = 78), cephalosporin plus antiprotozoal versus antiprotozoal (one RCT, N = 78), and penicillin plus antiprotozoal versus penicillin (one RCT, N = 230). Data were unavailable for most outcomes, including adverse effects. We found no evidence of differences between groups, except that fewer women receiving cephalosporin with antiprotozoal received a diagnosis of total postoperative infection, UTI, or postoperative fever compared with women receiving antiprotozoal.

Abdominal hysterectomy

We identified one comparison (penicillin plus antiprotozoal vs penicillin only; one RCT, N = 230). Whether differences between groups occurred was unclear. Adverse effects were not reported.

Comparison of cephalosporins in different regimens

Single small trials addressed dose comparisons and provided no data for most outcomes, including adverse effects. Whether differences between groups occurred was unclear. No trials compared route of administration.

The quality of evidence for all head-to-head and dose comparisons was very low owing to very serious imprecision and serious risk of bias related to poor reporting of methods.

Authors' conclusions

Antibiotic prophylaxis appears to be effective in preventing postoperative infection in women undergoing elective vaginal or abdominal hysterectomy, regardless of the dose regimen. However, evidence is insufficient to show whether use of prophylactic antibiotics influences rates of adverse effects. Similarly, evidence is insufficient to show which (if any) individual antibiotic, dose regimen, or route of administration is safest and most effective. The most recent studies included in this review were 14 years old at the time of our search. Thus findings from included studies may not reflect current practice in perioperative and postoperative care and may not show locoregional antimicrobial resistance patterns.

PLAIN LANGUAGE SUMMARY

Antibiotic prophylaxis for elective hysterectomy

Review question

Are antibiotics effective and safe for preventing postoperative infection in women undergoing elective (non-urgent) hysterectomy?

Background

Surgical operation carried out to remove the uterus (hysterectomy) is commonly performed. Most cases are performed as non-urgent (elective) procedures for non-cancerous (benign) conditions affecting the uterus, such as menstrual pain or abnormal bleeding patterns. Antibiotics are usually given before the operation is performed (prophylactic antibiotics, or antibiotic prophylaxis) to prevent or reduce the occurrence of infection after the procedure. Researchers in the Cochrane Collaboration reviewed the evidence on effectiveness and safety of antibiotics used to prevent infection after non-urgent surgical operation to remove the uterus. Evidence is current to November 2016.

Study characteristics

We identified 37 randomised controlled trials (RCTs), which included a total of 6079 women and compared 20 different types of antibiotics versus placebo (an inactive pill) or versus one another.

Key results

This review found moderate-quality evidence showing that antibiotics appear to be effective in preventing infection in women undergoing non-urgent surgical removal of the uterus through the vagina or abdomen. This suggests that antibiotic prophylaxis reduces the average risk of postoperative infection after vaginal hysterectomy from about 34% to 7% to 14%, and after abdominal hysterectomy from about 16% to 1% to 6%.

However, evidence is insufficient to show whether use of prophylactic antibiotics influences rates of adverse effects (side effects), or whether any one antibiotic is more effective or safer than the others.

When antibiotics are compared head-to-head or in combination versus single antibiotics, it is unclear which individual antibiotic was more effective and safer, or whether combined antibiotics were more effective and safer than single antibiotics. The quality of the evidence for these comparisons is very low.

It is also unclear which dose regimen or route of administration of antibiotics is safest or most effective in women undergoing elective hysterectomy.

The most recent of the studies included in this review was published 14 years ago, at the time of our search. Thus findings from the included studies may not reflect current practice in perioperative and postoperative care and may not show locoregional antimicrobial resistance patterns.

Quality of the evidence

The quality of evidence for our main comparisons ranged from very low to moderate. The main limitations of this evidence are risk of bias due to poor reporting of randomisation methods, imprecision due to small sample sizes and low event rates, and inadequate reporting of adverse effects.

SUMMARY OF FINDINGS FOR THE MAIN COMPARISON [Explanation]

Antibiotics compared with placebo for prophylaxis in elective vaginal hysterectomy

Population: women having elective vaginal hysterectomy
Settings: hospital
Intervention: antibiotics
Comparison: placebo

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	Number of participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Placebo	Antibiotics				
Total postoperative infections - early and late	Moderate[a]		RR 0.28 (0.19 to 0.4)	610 (4 studies)	⊕⊕⊕◯ moderate[b,c]	
	343 per 1000	96 per 1000 (65 to 137)				
Urinary tract infection	Moderate[a]		RR 0.58 (0.43 to 0.77)	1790 (8 studies)	⊕⊕⊕◯ moderate[b]	
	110 per 1000	64 per 1000 (47 to 85)				
Pelvic infection	Moderate[a]		RR 0.28 (0.20 to 0.39)	2010 (11 studies)	⊕⊕⊕◯ moderate[b,d]	
	119 per 1000	33 per 1000 (24 to 46)				
Other serious infections	Moderate[a]		RR 0.20 (0.01 to 4.10)	146 (1 study)	⊕◯◯◯ very low[b,e]	
	27 per 1000	5 per 1000 (0 to 111)				
Postoperative fever	Moderate[a]		RR 0.43 (0.34 to 0.54)	1879 (9 studies)	⊕⊕⊕◯ moderate[b]	

	193 per 1000	**83 per 1000** (66 to 104)	
Total adverse effects - not reported	This outcome was not reported		

*The basis for the **assumed risk** (e.g. median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on assumed risk in the comparison group and **relative effect** of the intervention (and its 95% CI)
CI: confidence interval; RR: risk ratio

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate
Very low quality: We are very uncertain about the estimate

[a] Median baseline risk of control group
[b] Downgraded one level for serious risk of bias: sequence generation and allocation concealment assessed as "unclear" in some studies owing to poor reporting
[c] Substantial heterogeneity for this comparison (I^2 = 85%). The quality of the evidence was not downgraded for inconsistency, as the direction of effect was consistent and all inconsistency was attributable to a study that measured only early postoperative infection rates (to hospital discharge), whereas the other three studies measured both early and late infection
[d] Substantial heterogeneity for this comparison (I^2 = 57%), but the quality of the evidence was not downgraded for inconsistency, as the direction of effect was consistent
[e] Downgraded two levels for very serious imprecision: small sample size and effect estimate with wide confidence interval

BACKGROUND

Description of the condition

Hysterectomy is one of the most commonly performed operations, particularly in the United States, where the lifetime risk of a hysterectomy is 45% (Merrill 2013). Most hysterectomies are elective (non-urgent) procedures for benign gynaecological conditions; the most common of these in the United States is leiomyoma (fibroids). Other common indications include endometriosis, heavy menstrual bleeding, and uterovaginal prolapse. This surgery can be performed abdominally, laparoscopically, or vaginally, with or without laparoscopic assistance (Farquhar 2002). The incidence of postoperative infection after hysterectomy was found to be 2% in a recent large cohort from the United States, in which women had surgery between 2012 and 2015 (Upall 2016). In older cohorts, this percentage is likely to be higher owing to factors such as longer hospital stay and prolonged postoperative urinary catheterisation. Some types of hysterectomy may be more susceptible to infectious complications than others, depending on the extent of the breach in body tissues and in the genital tract.

Even with the best surgical and postoperative care, hysterectomy is unavoidably associated with high risk of infection because the procedure breaches the genital tract - an area commonly colonised by a wide variety and large numbers of micro-organisms. In addition, most women undergoing hysterectomy require an indwelling urinary catheter for the first 24 hours, which increases the risk of urinary tract infection. Common sites of infection after hysterectomy include bladder, pelvic floor, the cuff of tissue at the top of the vagina (vaginal vault), and the abdominal wound; related complications include pelvic abscess, infected haematoma (accumulation of blood from the wound), septicaemia (infection of the blood), and pneumonia (Duff 1980; Faro 2001). Such infections are usually caused by a mixture of bacteria from the woman's own vaginal or urethral tissues - both Gram-positive and Gram-negative, and both aerobic and anaerobic (these terms refer to the staining techniques used in identification, and whether the bacteria are oxygen dependent). The individual woman's susceptibility to infection depends upon the effectiveness of her immune system, the virulence of the bacteria present, and the extent of tissue trauma and fluid collection resulting from surgery (Duff 1980).

Description of the intervention

"Antibiotic prophylaxis" refers to administration of antibiotics to prevent infection: It has been used in surgery since antibiotics were introduced in the 1950s, in an attempt to reduce the rate of postoperative infection. Such infection not only causes patient morbidity but may result in additional costs, extended hospital stay, and increased antibiotic use, which promotes the emergence of antimicrobial resistant organisms (Dellinger 1994). Antibiotic prophylaxis for hysterectomy has been extensively studied, and it has been estimated that such prophylaxis has reduced the rate of postoperative infection by more than half; otherwise, about 40% to 50% of women would develop infection after vaginal hysterectomy, and more than 20% after abdominal hysterectomy (Duff 1980; Mittendorf 1993). National guidelines now recommend this practice for all types of hysterectomy (ACOG 2009; Bratzler 2013; Dellinger 1994; Nelson 2016; RCOG 1999; SIGN 2008; Van Eyk N, van Schalkwyk J 2012), although in reality, application of such guidelines is variable (Gorecki 1999).

Although various antibiotic regimens and routes of delivery have been used, the most frequent current practice consists of a single dose of antibiotic given intravenously within two hours of the surgical incision, to facilitate optimum serum antibiotic levels during the operation (Classen 1992; DiPiro 1984; Nelson 2016). A single dose has been reported to be as effective as multiple doses, although some researchers have suggested repeat dosing if surgery is long or blood loss is high (DiPiro 1986; Tanos 1994). If prophylaxis is continued postoperatively, it is recommended that the duration of therapy should not exceed 24 hours (Dellinger 1994).

The type of antibiotic most commonly used is active against a wide range of bacteria (broad spectrum); this type includes amoxicillin/clavulanic acid (Augmentin) or a cephalosporin. Cephalosporins are grouped into generations according to their antimicrobial properties, with the oldest type referred to as "first generation". Subsequent generations of these drugs have progressively widened their antibacterial coverage against Gram-negative organisms while showing a concurrent reduction in effectiveness against Gram-positive organisms; moreover, wide use of very broad-spectrum antibiotics greatly increases the risk of emergence of drug-resistant bacteria (BNF 2002). It is generally recommended that first- or second-generation cephalosporins should be used for prophylaxis, as they appear to be equally effective for this purpose, less expensive than other treatments, and less likely to favour drug resistance (Fukatsu 1997; Tanos 1994; Weed 2003).

How the intervention might work

Prophylaxis works by briefly bolstering tissue defence mechanisms to promote rapid restoration of normal immune responses after the trauma of surgery.

Why it is important to do this review

A very large body of evidence on prophylactic antibiotics for hysterectomy involves hundreds of clinical trials. However, review authors have not systematically assessed this evidence in recent times. Existing meta-analyses conducted some years back focused mainly on abdominal hysterectomy. No meta-analysis has focused on trials involving other routes of hysterectomy.

Several Cochrane reviews of prophylactic antibiotics for elective surgery have reported mixed findings. Two of these examined the topic of caesarean section (Gyte 2014; Nabhan 2016). Gyte 2014 evaluated different classes of prophylactic antibiotics for women undergoing caesarean section and found that cephalosporins and penicillins had similar efficacy for preventing immediate postoperative infection. Investigators provided no data on late infection, nor on outcomes for the baby. Nabhan 2016 compared routes of administration of prophylactic antibiotics and concluded that data show no clear difference between irrigation and intravenous routes in rates of post-caesarean endometritis. A review on elective endoscopic retrograde cholangiopancreatography (Brand 2010) reported that antibiotic prophylaxis appeared to reduce rates of bacteraemia, cholangitis, and septicaemia. A review of different regimens of antibiotic prophylaxis for people undergoing orthognathic surgery (Brignardello-Petersen 2015) found that long-term antibiotic prophylaxis decreased the risk of skin and skin structure infection compared with short-term prophylaxis, but comparisons between short-term prophylaxis and a single preoperative dose were inconclusive. Reviews of antibiotic prophylaxis for elective open inguinal hernia repair (Sanchez-Manuel 2012) or for elective laparoscopic cholecystectomy (Sanabria 2010) provided no clear evidence of benefit for the intervention group.

OBJECTIVES

To determine the effectiveness and safety of antibiotic prophylaxis in women undergoing elective hysterectomy.

METHODS

Criteria for considering studies for this review

Types of studies

Randomised, controlled trials (RCTs) of women having an elective total or subtotal hysterectomy by any route and comparing prophylactic antibiotics versus placebo or versus a different type, route, or timing of antibiotic. Trials were at least double-blinded (i.e. with participants and clinicians blinded). We did not include quasi-randomised trials (e.g. trials that allocated treatment by date of birth, day of the week, medical record number, month of the year, or the order in which participants were enrolled in the study). We excluded from the review studies that did not analyse at least 80% of women randomised for at least one outcome. When trials analysed at least 80% of participants for some outcomes but analysed less than 80% of participants for other outcomes, we included only those outcomes analysed for at least 80% of participants. The rationale for excluding trials with high numbers of withdrawals is that attrition was unlikely to be equally distributed between trial arms: Women who did not develop infection were more likely to be lost to follow-up than those who did develop infection.

Types of participants

Women of any age without serious comorbidity (such as cancer) undergoing an elective total or subtotal abdominal, vaginal, laparoscopic, or laparoscopically assisted hysterectomy, with or without oophorectomy, for a benign gynaecological condition such as fibroids, endometriosis, uterovaginal prolapse, or heavy menstrual bleeding.

Types of interventions

Prophylactic antibiotics versus placebo or a different type or regimen of antibiotics.

The term "prophylactic" was defined as follows. Prophylactic: antibiotic(s) given when an individual had no signs or symptoms of infection, when no antibiotics had been taken within the previous 48 hours, and when the first dose was given up to 12 hours preoperatively and the last dose was given not more than 24 hours postoperatively.

Types of antibiotics

Antibiotics were classified into the following types.

1. Cephalosporins.
   i) First-generation (e.g. cefazolin, cephradine, cephazolin, cephalexin, cefadroxil).
   ii) Second-generation (e.g. cefoxitin, cefuroxime, cephamandole, cefaclor, cefprozil, loracarbef).
   iii) Third-generation (e.g. cefotaxime, cefotetan, ceftazidime, ceftriaxone, cefixime, cefpodoxime proxetil, ceftibuten, cefdinir, cephoperazone, ceftizoxime).
   iv) Fourth-generation (e.g. cefepime).
2. Penicillins (e.g. penicillin, amoxicillin).
3. Macrolides (e.g. erythromycin, clarithromycin, azithromycin).
4. Fluoroquinolones (e.g. ciprofloxacin, levofloxacin, oxfloxacin).
5. Sulfonamides (e.g. co-trimoxazole, trimethoprim).
6. Tetracyclines (e.g. tetracycline, doxycycline).
7. Aminoglycosides (e.g. gentamycin, tobramycin).
8. Glycopeptides (e.g. vancomycin).
9. Antiprotozoals (e.g. metronidazole, anitroimidazole).
10. Combination drugs.
    i) Augmentin (amoxicillin and clavulanic acid).
    ii) Other combinations of drugs (will be considered individually).

Antibiotic regimens include the following.

1. Route: Any systemic regimen was included, irrespective of the route of administration (e.g. intravenous, intramuscular, oral, rectal).
2. Number of doses (e.g. single vs repeated doses).

Types of outcome measures

We considered trials if they reported any of the following clinical outcomes.

Primary outcomes

1. Infection: measured as the proportion of women who within eight weeks of surgery developed one of the following as defined by the study.
   i) Total postoperative infection.
   ii) Abdominal wound infection (e.g. wound cellulitis, abscess, dehiscence).
   iii) Pelvic infection (including vaginal cuff (vault) infection, pelvic inflammatory disease, pelvic abscess, infected haematoma).
   iv) Urinary tract infection.
   v) Other serious infection or infectious complication, such as septicaemia, septic shock, distant infection (e.g. pneumonia).
2. Postoperative fever of > 38° on at least two occasions more than four hours apart, excluding the day of surgery.
3. Total adverse effects: morbidity (e.g. allergic reaction, diarrhoea, bacterial resistance, or as defined by the study) and mortality (infection-related and all-cause).

We classified primary outcomes as early (before discharge from hospital or within seven days of surgery), late (at follow-up: within eight weeks of surgery), or total (early + late).

Secondary outcomes

1. Need for therapeutic antibiotics - early (before discharge from hospital or within seven days of surgery), late (at follow-up: within eight weeks of surgery), or total (early + late).
2. Length of hospital stay.
3. Quality of life.

Search methods for identification of studies

In consultation with the Gynaecology and Fertility Group Information Specialist, we searched the following databases for all published and unpublished RCTs.

Electronic searches

We searched the following electronic databases, trial registers, and websites up to 29 November 2016.

1. Gynaecology and Fertility Group (CGF) Specialised Register of Controlled Trials.
2. Cochrane Central Register of Studies Online (CRSO).
3. MEDLINE.
4. Embase.
5. PsycINFO.
6. Cumulative Index to Nursing Allied Health and Literature (CINAHL).

   i) We combined the MEDLINE search with the Cochrane highly sensitive search strategy for identifying randomised trials, which appears in the *Cochrane Handbook for Systematic Reviews of Interventions* (Version 5.0.2, Chapter 6, 6.4.11). We combined Embase, PsycINFO, and CINAHL searches using trial filters developed by the Scottish Intercollegiate Guidelines Network (SIGN) (http://www.sign.ac.uk/methodology/filters.html#random).
7. Other electronic sources of trials included:
   i) trial registers for ongoing and registered trials;
   ii) http://www.clinicaltrials.gov (a service of the US National Institutes of Health);
   iii) http://www.who.int/trialsearch/Default.aspx (World Health Organization International Clinical Trials Registry Platform search portal) (Note: it is now mandatory for Cochrane reviews to include searches of trial registers);
   iv) DARE (Database of Abstracts of Reviews of Effects) in the Cochrane Library (http://onlinelibrary.wiley.com/o/cochrane/cochrane_cldare_articles_fs.html) (for reference lists from relevant non-Cochrane reviews);
   v) Web of Knowledge (http://wokinfo.com/ - another source of trials and conference abstracts);
   vi) OpenGrey (http://www.opengrey.eu/ - for unpublished literature from Europe);
   vii) Latin American Caribbean Health Sciences Literature (LILACS database) (http://regional.bvsalud.org/php/index.php?lang=en - for trials from the Portuguese- and Spanish-speaking world); and
   viii) PubMed and Google Scholar (for recent trials not yet indexed in MEDLINE).

For details of search strategies, see Appendix 1, Appendix 2, Appendix 3, Appendix 4, Appendix 5, and Appendix 6.

Searching other resources

We handsearched the reference lists of articles retrieved by the search and contacted experts in the field to request additional data. We also handsearched relevant journals and conference abstracts not included in the CGF register, in liaison with the Information Specialist from the CGF Group.

Data collection and analysis

Selection of studies

After an initial screen of titles and abstracts retrieved by the search, we retrieved the full texts of all potentially eligible studies. At least two review authors (of VJ, JM, and RA) independently examined these full-text articles for compliance with the inclusion criteria and selected studies that were eligible for inclusion in the review. We contacted study investigators as required to clarify study eligibility. We resolved disagreements regarding study eligibility by discussion or by consultation with a third review author. We documented the selection process using a PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow chart.

Data extraction and management

Two review authors independently extracted data from eligible studies using a data extraction form that they had designed and pilot-tested. We resolved disagreements by discussion or by consultation with a third review author. Data extracted included study characteristics and outcome data. When studies had multiple publications, review authors collated multiple reports of the same study, so that each study rather than each report was the unit of interest in the review, and assigned such studies a single study ID with multiple references.

We contacted study investigators to request additional data on methods and/or results, as required.

Assessment of risk of bias in included studies

Two review authors independently examined included studies for risk of bias using the Cochrane "Risk of bias" assessment tool (Higgins 2011) to assess selection (random sequence generation and allocation concealment); performance (blinding of participants and personnel); detection (blinding of outcome assessors); attrition (incomplete outcome data); reporting (selective reporting); and other bias such as differences in demographic characteristics of participants. We took care to search for within-trial selective reporting, as seen in trials failing to report obvious outcomes, or reporting them in insufficient detail to allow inclusion. We sought published protocols and compared outcomes between the protocol and the final published study.

We resolved disagreements by discussion or by consultation with a third review author. We described all judgements fully and presented conclusions in the "Risk of bias" table; we incorporated these into the interpretation of review findings by performing sensitivity analyses (see below).

Measures of treatment effect

For dichotomous data (e.g. infection rates), we used numbers of events in control and intervention groups of each study to calculate risk ratios (RRs). For continuous data (e.g. length of hospital stay), when studies reported exactly the same outcomes, we calculated mean differences (MDs) between treatment groups. We reversed the direction of effect of individual studies, if required, to ensure consistency across trials. We intended to treat ordinal data (e.g. quality of life scores) as continuous data if any included studies reported ordinal data. We presented 95% confidence intervals (CIs) for all outcomes. We compared the magnitude and direction of effects reported by studies versus how they were presented in the review, while taking account of legitimate differences.

Unit of analysis issues

The primary analysis was per woman randomised.

Dealing with missing data

We analysed the data on an intention-to-treat basis as far as possible and attempted to obtain missing data from the original trialists. When these were unobtainable, we analysed only available data.

When studies reported sufficient detail for calculation of mean differences but no information on associated standard deviation (SD), we assumed the outcome to have a standard deviation equal to the highest SD from other studies within the same analysis.

Assessment of heterogeneity

We considered whether clinical and methodological characteristics of included studies were sufficiently similar for meta-analysis to provide a clinically meaningful summary. We assessed statistical heterogeneity by using the I^2 measurement. We took an I^2 measurement greater than 50% to indicate substantial heterogeneity (Higgins 2003; Higgins 2011).

Assessment of reporting biases

In view of the difficulty of detecting and correcting for publication bias and other reporting biases, review authors aimed to minimise their potential impact by ensuring a comprehensive search for eligible studies and by staying alert for duplication of data. When we included 10 or more studies in an analysis, we used a funnel plot to explore the possibility of small-study effects (the tendency for estimates of the intervention effect to be more beneficial in smaller studies).

Data synthesis

When studies were sufficiently similar, we combined the data using a fixed-effect model.

We graphically displayed an increase in risk of a particular outcome within meta-analyses to the right of the centre-line, and a decrease in risk of a particular outcome to the left of the centre-line.

We made the following comparisons.

1. Any antibiotic versus placebo.
2. Specific antibiotics versus placebo.
3. Head-to-head comparisons of antibiotics.
4. Comparisons of antibiotic regimens.

We subgrouped all analyses by surgical route: vaginal or abdominal. We did not pool these subgroups.

Subgroup analysis and investigation of heterogeneity

We subgrouped our main analysis according to the surgical route used (vaginal or abdominal). We did not undertake other prespecified subgroup analyses.

When we detected substantial heterogeneity (I^2 > 50%), we explored possible explanations by performing sensitivity analyses. We took any statistical heterogeneity into account when interpreting results, especially if we noted any variation in the direction of effect estimates.

Sensitivity analysis

When heterogeneity was substantial (I^2 > 50%), we conducted sensitivity analysis by choosing a statistical model (fixed-effect vs random-effects) and an effect estimate (risk ratio vs odds ratio), regardless of the number of trials included in an analysis. We planned to explore other clinical or methodological differences between studies only if data showed variation in the direction of effect.

Overall quality of the body of evidence: "Summary of findings" table

We prepared two separate "Summary of findings" tables for vaginal hysterectomy and abdominal hysterectomy based on the review's main comparison, that is, any antibiotics versus placebo. We used GRADEPRO (GRADEPro GDT 2014) and Cochrane methods (Higgins 2011) and used these tables to evaluate the overall quality of the body of evidence for main review outcomes (total postoperative infections, abdominal wound infection, urinary tract infection, pelvic infection, other serious infection, postoperative fever, and total adverse effects) by applying GRADE criteria (study limitations (i.e. risk of bias), consistency of effect, imprecision, indirectness, and publication bias). Two review authors working independently made judgements about evidence quality (high, moderate, low, or very low) and resolved disagreements by discussion. We justified, documented, and incorporated our judgements into reporting of results for each outcome.

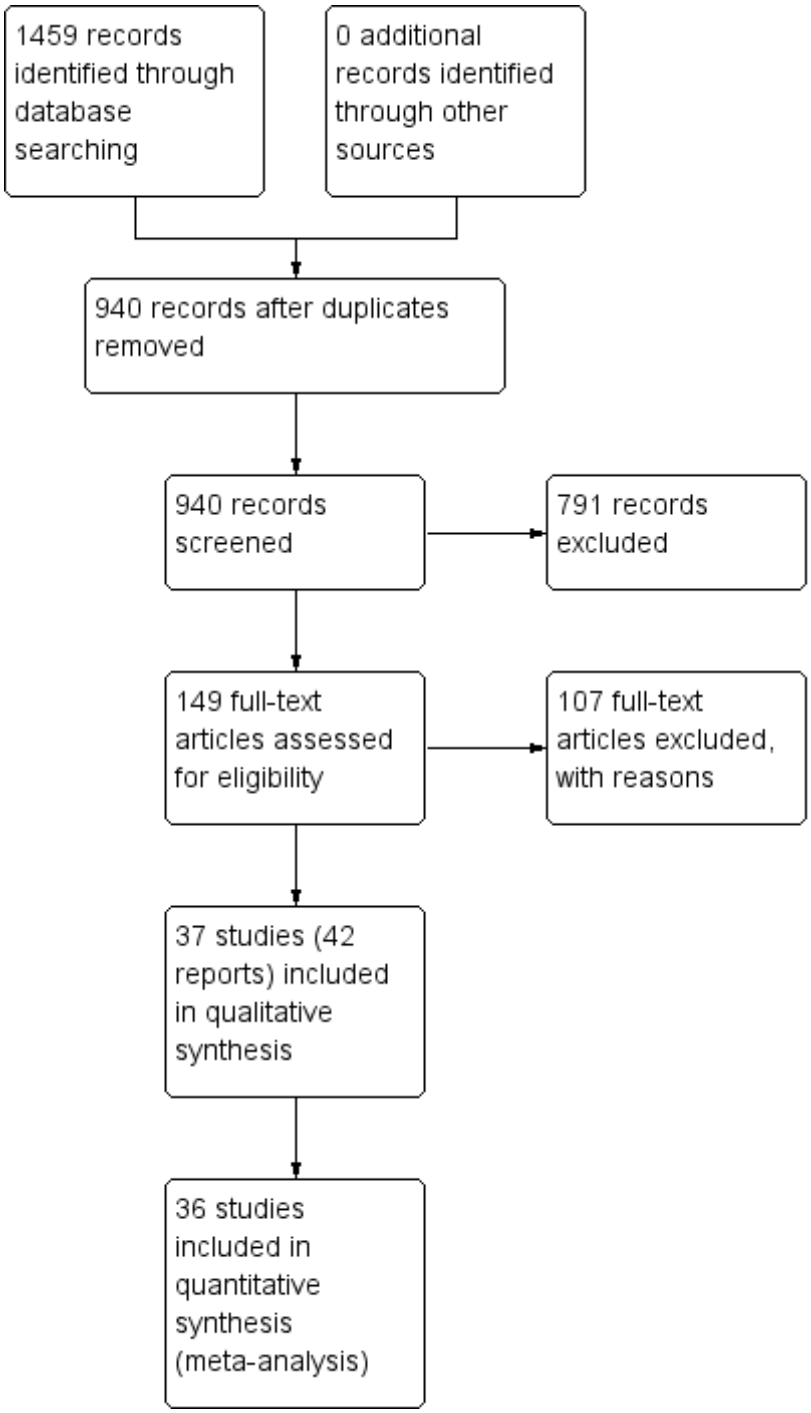
RESULTS

Description of studies

Results of the search

The search produced a total of 940 titles and abstracts after duplicates were removed; we considered 149 full-text articles for further assessment. Thirty-seven trials in 42 reports met the eligibility criteria for inclusion, and we excluded 107 full-text articles. See Characteristics of included studies and Characteristics of excluded studies tables. The PRISMA flow chart in Figure 1 illustrates the flow of literature throughout the search and assessment process.

Figure 1. PRISMA flow chart.



Included studies

Study design and setting

We included 37 studies in this review (Benigno 1986; Boodt 1990; Chongsomchai 2002; Crosthwaite 1985; Davi 1985; Dhar 1993; Dhar 1993a; Duff 1982; Egarter 1988; Eron 1989; Faro 1988; Gall 1983; Hager 1989; Hedican 1976; Hemsell 1980; Hemsell 1983; Hemsell 1984; Hemsell 1985; Hemsell 1985a; Hemsell 1987; Hemsell 1989; Henriksson 1998; Holman 1978; Houang 1984; Houang 1984a; Jaffe 1985; Janssens 1982; Kauer 1990; Ledger 1973; Mathews 1977; Mathews 1979; Mendelson 1979; Polk 1980; Schepers 1981; Smith 1984; Stage 1982; Vincelette 1983).

The most recent study was Chongsomchai 2002, which was already 14 years old at the time of our search.

All included studies were parallel, double-blinded, randomised controlled trials (RCTs). Twenty-nine studies were two-arm RCTs (Boodt 1990; Crosthwaite 1985; Davi 1985; Dhar 1993; Dhar 1993a; Duff 1982; Faro 1988; Gall 1983; Hager 1989; Hedican 1976; Hemsell 1980; Hemsell 1983; Hemsell 1984; Hemsell 1985a; Hemsell 1989; Henriksson 1998; Holman 1978; Houang 1984a; Jaffe 1985; Janssens 1982; Ledger 1973; Mathews 1977; Mathews 1979; Mendelson 1979; Polk 1980; Schepers 1981; Smith 1984; Stage 1982; Vincelette 1983). Eight studies were three-arm RCTs (Benigno 1986; Chongsomchai 2002; Egarter 1988; Eron 1989; Hemsell 1985; Hemsell 1987; Houang 1984; Kauer 1990).

Seventeen studies were conducted in the United States (Benigno 1986; Duff 1982; Eron 1989; Gall 1983; Hager 1989; Hedican 1976; Hemsell 1980; Hemsell 1983; Hemsell 1984; Hemsell 1985; Hemsell 1985a; Hemsell 1987; Hemsell 1989; Holman 1978; Ledger 1973; Polk 1980; Stage 1982); five studies were conducted in the United Kingdom (Houang 1984; Houang 1984a; Mathews 1977; Mathews 1979; Smith 1984); two were conducted in Canada (Mendelson 1979; Vincelette 1983); and three in the Netherlands (Boodt 1990; Kauer 1990; Schepers 1981). Two studies each were conducted in Australia (Crosthwaite 1985; Egarter 1988) and India (Chandigarth) (Dhar 1993; Dhar 1993a); one study each was conducted in Belgium (Janssens 1982), Israel (Jaffe 1985), Sweden (Henriksson 1998), and Thailand (Chongsomchai 2002). The remaining two studies did not provide information on the countries in which they were conducted (Davi 1985; Faro 1988).

Six of the included studies were conducted at more than one centre: 14 centres (Stage 1982), four centres (Benigno 1986), three centres (Hager 1989; Henriksson 1998), and two centres (Chongsomchai 2002; Eron 1989); five studies did not report the number of centres (Davi 1985; Egarter 1988; Faro 1988; Hemsell 1985; Schepers 1981); and each of the remaining 26 studies was conducted at a single centre (Boodt 1990; Crosthwaite 1985; Dhar 1993; Dhar 1993a; Duff 1982; Gall 1983; Hedican 1976; Hemsell 1980; Hemsell 1983; Hemsell 1984; Hemsell 1985a; Hemsell 1987; Hemsell 1989; Holman 1978; Houang 1984; Houang 1984a; Jaffe 1985; Janssens 1982; Kauer 1990; Ledger 1973; Mathews 1977; Mathews 1979; Mendelson 1979; Polk 1980; Smith 1984; Vincelette 1983).

Participants

The 37 included studies enrolled a total of 6079 women. Seventeen studies randomised or analysed a total of 100 or fewer women (Crosthwaite 1985; Dhar 1993; Dhar 1993a; Duff 1982; Gall 1983; Hager 1989; Hedican 1976; Hemsell 1980; Hemsell 1985a; Houang 1984a; Jaffe 1985; Kauer 1990; Ledger 1973; Mathews 1977; Mathews 1979; Mendelson 1979; Smith 1984); eight studies randomised or analysed a total of 101 to 200 women (Egarter 1988; Faro 1988; Hemsell 1983; Hemsell 1984; Hemsell 1985; Janssens 1982; Schepers 1981; Vincelette 1983); five studies randomised or analysed a total of 201 to 300 women (Eron 1989; Hemsell 1987; Hemsell 1989; Holman 1978; Stage 1982); five studies randomised or analysed a total of 301 to 400 women (Benigno 1986; Chongsomchai 2002; Davi 1985; Henriksson 1998; Houang 1984); one study randomised a total of 403 women (Boodt 1990); and another randomised a total of 557 women (Polk 1980).

A common inclusion criterion was that women had to be scheduled for elective abdominal hysterectomy, vaginal hysterectomy, or both types of hysterectomy for a benign condition. Thirteeen studies included women scheduled for abdominal hysterectomy (Boodt 1990; Chongsomchai 2002; Davi 1985; Dhar 1993a; Duff 1982; Gall 1983; Hemsell 1983; Hemsell 1985; Houang 1984a; Jaffe 1985; Mathews 1977; Schepers 1981; Smith 1984); 14 studies included women scheduled for elective vaginal hysterectomy (Benigno 1986; Dhar 1993; Egarter 1988; Faro 1988; Hager 1989; Hedican 1976; Hemsell 1980; Hemsell 1984; Hemsell 1985a; Hemsell 1987; Kauer 1990; Ledger 1973; Mathews 1979; Mendelson 1979); nine studies included women scheduled for either abdominal or vaginal hysterectomy (Crosthwaite 1985; Eron 1989; Hemsell 1989; Holman 1978; Houang 1984; Janssens 1982; Polk 1980; Stage 1982; Vincelette 1983); and one study did not report the type of hysterectomy for which women were scheduled (Henriksson 1998).

No included studies focused on antibiotic prophylaxis in participants undergoing laparoscopically performed hysterectomy.

Common exclusion criteria were emergency hysterectomy; pregnancy-related hysterectomy; hypersensitivity to antibiotics such as

cephalosporin, penicillin, amoxicillin, etc.; and use of antibiotics within two to seven days before surgery.

Interventions

Included studies compared different classes of antibiotics with placebo or with each other. Included studies identified the following treatment groups.

1. Any antibiotic versus placebo (Boodt 1990; Chongsomchai 2002; Crosthwaite 1985; Davi 1985; Dhar 1993; Dhar 1993a; Duff 1982; Egarter 1988; Gall 1983; Hedican 1976; Hemsell 1980; Hemsell 1983; Henriksson 1998; Holman 1978; Houang 1984; Jaffe 1985; Janssens 1982; Ledger 1973; Mathews 1977; Mathews 1979; Mendelson 1979; Polk 1980; Smith 1984; Vincelette 1983).
2. Cephalosporin versus placebo (Chongsomchai 2002; Davi 1985; Duff 1982; Gall 1983; Hedican 1976; Hemsell 1980; Hemsell 1983; Holman 1978; Ledger 1973; Mendelson 1979; Polk 1980; Stage 1982).
3. Penicillin versus placebo (Chongsomchai 2002; Houang 1984).
4. Antiprotozoal versus placebo (Crosthwaite 1985; Dhar 1993; Dhar 1993a; Egarter 1988; Hemsell 1983; Henriksson 1998; Janssens 1982; Vincelette 1983).
5. Sulphonamides versus placebo (Jaffe 1985; Mathews 1977; Mathews 1979; Smith 1984).
6. Cephalosporin plus antiprotozoal versus placebo (Boodt 1990).
7. Penicillin plus antiprotozoal versus placebo (Houang 1984).
8. Lincosamide versus placebo (Egarter 1988).
9. Cephalosporin versus penicillin (Benigno 1986; Chongsomchai 2002; Faro 1988; Hager 1989).
10. Cephalosporin versus tetracycline (Hemsell 1985a).
11. Cephalosporin versus antiprotozoal (Kauer 1990).
12. Antiprotozoal versus lincosamide (Egarter 1988).
13. Cephalosporin plus antiprotozoal versus cephalosporin only (Kauer 1990).
14. Cephalosporin plus antiprotozoal versus antiprotozoal only (Kauer 1990).
15. Penicillin plus antiprotozoal versus penicillin only (Houang 1984; Houang 1984a).
16. Cephalosporin early administration versus usual timing (both single dose) (Eron 1989).
17. Cephalosporin one dose versus two doses (Hemsell 1985).
18. Cephalosporin one dose versus three doses (Hemsell 1984; Hemsell 1985).
19. Cephalosporin one dose versus multiple doses (Mendelson 1979).
20. Cephalosporin one gram versus two grams (Hemsell 1987).

Included studies administered antibiotics through the following routes.

1. Intravenous (IV) (Benigno 1986; Boodt 1990; Chongsomchai 2002; Duff 1982; Egarter 1988; Faro 1988; Gall 1983; Hager 1989; Hemsell 1985; Hemsell 1985a; Hemsell 1989; Henriksson 1998; Jaffe 1985; Kauer 1990; Mathews 1979; Mendelson 1979; Polk 1980; Schepers 1981; Stage 1982; Vincelette 1983).
2. Intramuscular (IM) (Davi 1985; Hemsell 1980; Hemsell 1983; Hemsell 1987; Smith 1984).
3. IV and IM (Eron 1989; Hedican 1976; Hemsell 1984; Holman 1978).
4. Oral (Crosthwaite 1985; Dhar 1993; Dhar 1993a; Janssens 1982).
5. IV and rectal (Houang 1984; Houang 1984a).

One of the included studies did not state the route used for administration of antibiotics (Ledger 1973).

Investigators administered antibiotics as a single dose, as multiple doses, or as single versus multiple doses in the following studies.

1. Single dose (Boodt 1990; Chongsomchai 2002; Crosthwaite 1985; Dhar 1993; Dhar 1993a; Duff 1982; Hager 1989; Hemsell 1987; Janssens 1982; Ledger 1973; Mathews 1977; Mathews 1979).
2. Multiple doses (Boodt 1990; Davi 1985; Egarter 1988; Faro 1988; Gall 1983; Hedican 1976; Hemsell 1980; Hemsell 1983; Hemsell 1984; Henriksson 1998; Holman 1978; Houang 1984; Houang 1984a; Ledger 1973; Polk 1980; Schepers 1981; Stage 1982; Vincelette 1983).
3. Single dose versus multiple doses (Eron 1989; Hemsell 1985; Hemsell 1985a; Hemsell 1989; Janssens 1982; Mendelson 1979).

Timing and duration of administration varied in the included studies. However, none of the included studies administered the first dose of antibiotics more than 12 hours before surgery and the last dose more than 24 hours after surgery.

Outcomes

Primary outcome measures of this review were presence of postoperative infection (total postoperative infections, abdominal wound infection, pelvic infection, urinary tract infection (UTI), other serious infection (such as pneumonia, septicaemia, septic shock), and postoperative fever), total adverse effects such as morbidity (e.g. diarrhoea, allergic reactions), and mortality. Thirty-six included studies reported data on at least one of the review's primary outcome measures (Benigno 1986; Boodt 1990; Chongsomchai 2002; Crosthwaite 1985; Davi 1985; Dhar 1993; Dhar 1993a; Duff 1982; Egarter 1988; Eron 1989; Faro 1988; Gall 1983; Hager 1989; Hedican 1976; Hemsell 1980; Hemsell 1983; Hemsell 1984; Hemsell 1985; Hemsell 1985a; Hemsell 1987; Hemsell 1989; Henriksson 1998; Holman 1978; Houang 1984; Houang 1984a; Jaffe 1985; Janssens 1982; Kauer 1990; Ledger 1973; Mathews 1977; Mathews 1979; Polk 1980; Schepers 1981; Smith 1984; Stage 1982; Vincelette 1983); and one of the

included studies did not report data on any of the review's primary outcomes (Mendelson 1979). Twenty-five included studies reported data on adverse effects, most in narrative form (Benigno 1986; Chongsomchai 2002; Crosthwaite 1985; Davi 1985; Dhar 1993; Dhar 1993a; Duff 1982; Eron 1989; Gall 1983; Hager 1989; Hemsell 1980; Hemsell 1984; Hemsell 1985a; Hemsell 1987; Hemsell 1989; Henriksson 1998; Jaffe 1985; Kauer 1990; Mathews 1977; Mathews 1979; Polk 1980; Schepers 1981; Smith 1984; Stage 1982; Vincelette 1983). Common adverse effects included allergy reactions and diarrhoea. None of the included studies reported any incident of mortality.

Secondary outcome measures included any requirement for therapeutic antibiotics, length of hospital stay, and quality of life following surgery. Twenty-seven included studies reported on at least one of the secondary outcome measures (Benigno 1986; Boodt 1990; Chongsomchai 2002; Dhar 1993; Dhar 1993a; Duff 1982; Egarter 1988; Eron 1989; Faro 1988; Gall 1983; Hager 1989; Hemsell 1980; Hemsell 1983; Hemsell 1984; Hemsell 1985; Hemsell 1985a; Hemsell 1987; Hemsell 1989; Holman 1978; Jaffe 1985; Kauer 1990; Ledger 1973; Mathews 1977; Mathews 1979; Polk 1980; Stage 1982; Vincelette 1983). Secondary outcome measures commonly reported were need for therapeutic antibiotics and length of hospital stay; no studies provided data on quality of life. The remaining 10 studies did not report on any of the secondary outcome measures (Crosthwaite 1985; Davi 1985; Hedican 1976; Henriksson 1998; Houang 1984; Houang 1984a; Janssens 1982; Mendelson 1979; Schepers 1981; Smith 1984).

Excluded studies

Review authors determined that 107 studies were not eligible for inclusion in this review. Common reasons for exclusion were administration of antibiotics more than 12 hours before surgery or for more than 24 hours after surgery and non-blinding of participants and personnel. For further details on reasons for exclusion of studies, see Characteristics of excluded studies table.

Risk of bias in included studies

See Figure 2 and Figure 3.

Figure 2. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.

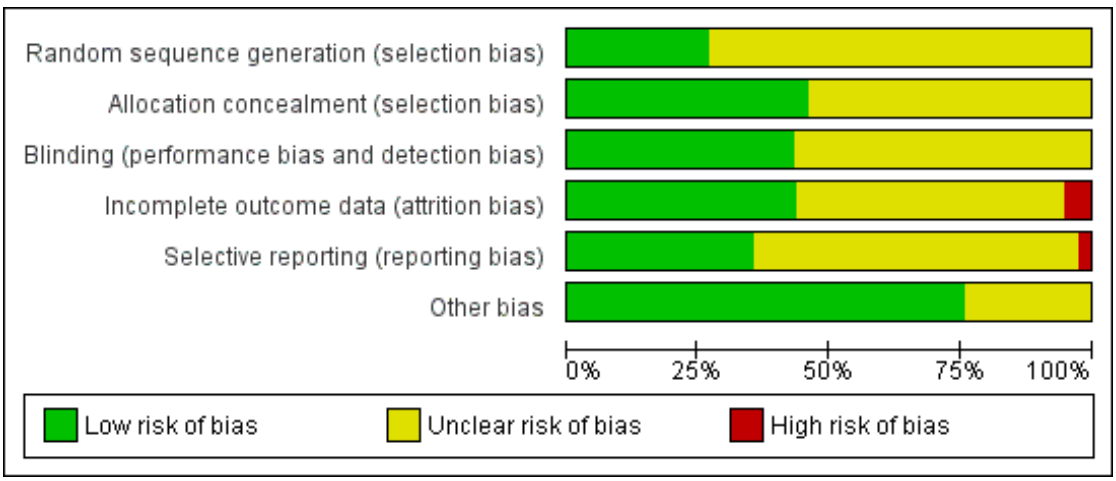
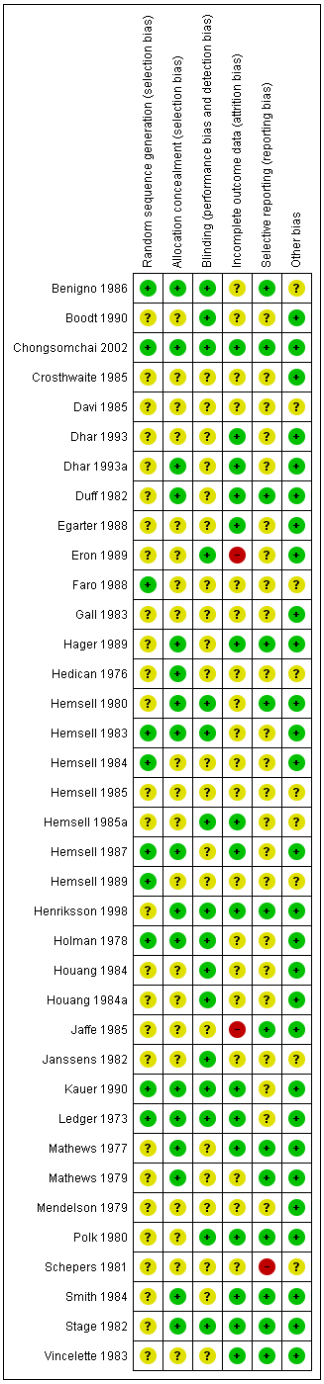


Figure 3. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.



Allocation

Random sequence generation

We considered processes used in sequence generation to be adequate in 10 of the included studies because they involved the use of computers (Benigno 1986; Chongsomchai 2002; Faro 1988; Hemsell 1984; Hemsell 1987; Hemsell 1989) or random number tables (Hemsell 1983; Holman 1978; Kauer 1990; Ledger 1973). We therefore rated these studies as having low risk of bias with respect to random sequence generation. The remaining 27 studies provided insufficient information to permit conclusive judgements on the process involved in sequence generation; thus we rated them as having unclear risk of bias.

Allocation concealment

We rated 17 studies as having low risk of bias with respect to allocation concealment (Benigno 1986; Chongsomchai 2002; Dhar 1993a; Duff 1982; Hager 1989; Hedican 1976; Hemsell 1980; Hemsell 1983; Hemsell 1987; Henriksson 1998; Holman 1978; Kauer 1990; Ledger 1973; Mathews 1977; Mathews 1979; Smith 1984; Stage 1982). We considered the processes involved in concealing allocations in these studies to be adequate; these included remote or central allocation through the hospital pharmacy and use of sealed opaque envelopes. We assessed the remaining 20 studies as having unclear risk because information was insufficient to allow conclusive judgements with respect to allocation concealment.

Blinding

We considered that blinding was likely to influence findings for both primary and secondary review outcomes. Although we considered all included studies to be adequate with regard to blinding of both participants and physicians, most did not provide adequate information on how participants were evaluated postoperatively. Only 16 studies reported sufficient information on outcome assessment and/or participant follow-up; we thus rated these studies as having low risk with respect to performance and detection bias (Benigno 1986; Boodt 1990; Chongsomchai 2002; Eron 1989; Hemsell 1980; Hemsell 1983; Hemsell 1985a; Henriksson 1998; Holman 1978; Houang 1984; Houang 1984a; Janssens 1982; Kauer 1990; Ledger 1973; Polk 1980; Stage 1982). The remaining 21 studies did not provide sufficient information on whether outcome assessors were blinded; we therefore rated these studies as having unclear risk with respect to performance and detection bias (Crosthwaite 1985; Davi 1985; Dhar 1993; Dhar 1993a; Duff 1982; Egarter 1988; Faro 1988; Gall 1983; Hager 1989; Hedican 1976; Hemsell 1984; Hemsell 1985; Hemsell 1987; Hemsell 1989; Jaffe 1985; Mathews 1977; Mathews 1979; Mendelson 1979; Schepers 1981; Smith 1984; Vincelette 1983).

Incomplete outcome data

We judged 16 studies as having low risk with respect to incomplete outcome data or attrition bias (Chongsomchai 2002; Dhar 1993; Dhar 1993a; Duff 1982; Egarter 1988; Hager 1989; Hemsell 1985a; Hemsell 1987; Henriksson 1998; Kauer 1990; Ledger 1973; Mathews 1977; Polk 1980; Smith 1984; Stage 1982; Vincelette 1983). Proportions of withdrawals/losses to follow-up and reasons for withdrawal in these studies were fairly well balanced or similar across treatment groups, or outcome data were analysed on an intention-to-treat (ITT) basis by including all randomised women in data analyses. Nineteen studies provided insufficient information on the number of withdrawals/losses to follow-up and/or on reasons for withdrawal, and data were not analysed on the basis of ITT (Benigno 1986; Boodt 1990; Crosthwaite 1985; Davi 1985; Faro 1988; Gall 1983; Hedican 1976; Hemsell 1980; Hemsell 1983; Hemsell 1984; Hemsell 1985; Hemsell 1989; Houang 1984a; Janssens 1982; Mathews 1979; Mendelson 1979; Schepers 1981). We thus rated these studies as having unclear risk with respect to attrition bias. We rated the remaining two studies as having high risk of bias: In one of these studies, proportions of withdrawals were not balanced between groups and data were not analysed on the basis of ITT (Eron 1989); in the other study, proportions of withdrawals and reasons for withdrawal were not balanced across treatment groups (Jaffe 1985).

Selective reporting

Protocols were not available for any of the included studies, and review authors could not determine whether outcomes were selectively reported. Therefore, the process of detecting selective reporting bias in included studies involved careful assessment of methods sections to determine which outcomes were prespecified and whether data were reported on all prespecified outcomes. Thirteen studies provided data on all outcomes prespecified in the methods sections; we rated these as having low risk with respect to selective reporting (within-trial selective reporting) (Benigno 1986; Chongsomchai 2002; Duff 1982; Hager 1989; Hemsell 1980; Henriksson 1998; Jaffe 1985; Mathews 1977; Mathews 1979; Polk 1980; Smith 1984; Stage 1982; Vincelette 1983). Twenty-three studies provided insufficient information to allow conclusive judgements with respect to selective reporting; therefore, we rated these studies as having unclear risk of selective reporting bias (Boodt 1990; Crosthwaite 1985; Davi 1985; Dhar 1993; Dhar 1993a; Egarter 1988; Eron 1989; Faro 1988; Gall 1983; Hedican 1976; Hemsell 1983; Hemsell 1984; Hemsell 1985; Hemsell

1985a; Hemsell 1987; Hemsell 1989; Holman 1978; Houang 1984; Houang 1984a; Janssens 1982; Kauer 1990; Ledger 1973; Mendelson 1979). We rated the only remaining study as having high risk of selective reporting because evidence showed selective reporting, with no data reported on some of the outcomes prespecified in the methods section (Schepers 1981).

Other potential sources of bias

We assessed other potential sources of bias with respect to whether data showed significant differences between treatment groups in terms of baseline demographic characteristics of participants, such as age and body mass index (BMI). In 28 studies, baseline demographic characteristics were similar between treatment groups; thus we rated these studies as having low risk with respect to other potential sources of bias (Boodt 1990; Chongsomchai 2002; Crosthwaite 1985; Dhar 1993; Dhar 1993a; Duff 1982; Egarter 1988; Eron 1989; Gall 1983; Hager 1989; Hemsell 1980; Hemsell 1983; Hemsell 1984; Hemsell 1987; Henriksson 1998; Holman 1978; Houang 1984; Houang 1984a; Jaffe 1985; Kauer 1990; Ledger 1973; Mathews 1977; Mathews 1979; Mendelson 1979; Polk 1980; Smith 1984; Stage 1982; Vincelette 1983). The remaining nine studies provided insufficient information to allow conclusive judgements with respect to whether significant differences in baseline demographic characteristics were evident between treatment groups; we thus rated these studies as having unclear risk with respect to other sources of bias (Benigno 1986; Davi 1985; Faro 1988; Hedican 1976; Hemsell 1985; Hemsell 1985a; Hemsell 1989; Janssens 1982; Schepers 1981).

Effects of interventions

See: **Summary of findings for the main comparison** Antibiotics compared with placebo for prophylaxis in elective vaginal hysterectomy; **Summary of findings 2** Antibiotics compared with placebo for prophylaxis in elective abdominal hysterectomy; **Summary of findings 3** Head-to-head comparisons of antibiotics for prophylaxis in elective vaginal hysterectomy; **Summary of findings 4** Head-to-head comparisons of antibiotics for prophylaxis in elective abdominal hysterectomy

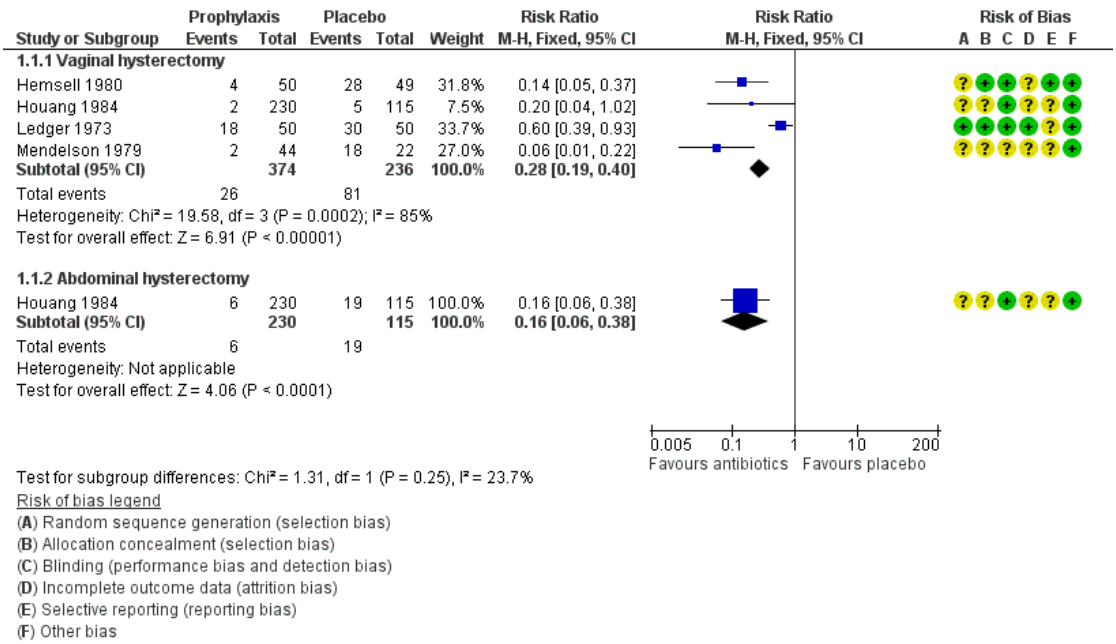
1. Any antibiotics versus placebo

Primary outcomes

1.1 Total postoperative infections - early and late

See Analysis 1.1; Figure 4

Figure 4. Forest plot of comparison: 1 Any antibiotic versus placebo, outcome: 1.1 Total postoperative infections - early and late.



1.1.1 Vaginal hysterectomy

The rate of postoperative infection (early or late) was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.28, 95% CI 0.19 to 0.40; four RCTs, N = 610; I^2 = 85%; moderate-quality evidence; Analysis 1.1). Evidence suggests that if the average risk of infection with placebo is assumed to be 34%, the risk following antibiotic prophylaxis would be between 7% and 14%. Although heterogeneity for this comparison was substantial (I^2 = 85%), we did not downgrade the quality of evidence for inconsistency because the direction of effect was consistent and all inconsistency was attributable to Ledger 1973, which measured only early postoperative infection rates (to hospital discharge). The other three studies in this comparison measured both early and late infections.

On sensitivity analysis, observed evidence of a difference in the incidence of total postoperative infections between the two groups remained whether odds ratio (OR) (OR 0.14, 95% CI 0.08 to 0.24) or a random-effects (RE) model (RR 0.19, 95% CI 0.05 to 0.67) was used.

1.1.2 Abdominal hysterectomy

The rate of postoperative infection was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.16, 95% CI 0.06 to 0.38; one RCT, N = 345; low-quality evidence; Analysis 1.1). Evidence suggests that if the average risk of infection with placebo is assumed to be 17%, risk following antibiotic prophylaxis would be between 1% and 6%.

1.2 Abdominal wound infection

1.2.1 Abdominal hysterectomy

The rate of abdominal wound infection in women who received prophylactic antibiotics was lower than in those given placebo (RR 0.64, 95% CI 0.45 to 0.92; 11 RCTs, N = 2434; I^2 = 0%; moderate-quality evidence; Analysis 1.2). Evidence suggests that if the average risk of infection with placebo is assumed to be 6%, risk following antibiotic prophylaxis would be between 3% and 5%.

1.3 Urinary tract infection

1.3.1 Vaginal hysterectomy

The rate of urinary tract infection (UTI) in women who received prophylactic antibiotics was lower than in those given placebo (RR 0.58, 95% CI 0.43 to 0.77; eight RCTs, N = 1790; I^2 = 44%; moderate-quality evidence; Analysis 1.3). Evidence suggests that if the average risk of infection with placebo is assumed to be 11%, risk following antibiotic prophylaxis would be between 5% and 9%.

1.3.2 Abdominal hysterectomy

The rate of UTI was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.39, 95% CI 0.29 to 0.51; 11 RCTs, N = 2547; I^2 = 26%; moderate-quality evidence; Analysis 1.3). Evidence suggests that if the average risk of infection with placebo is assumed to be 13%, risk following antibiotic prophylaxis would be between 4% and 7%.

1.4 Pelvic infection

1.4.1 Vaginal hysterectomy

The rate of pelvic infection in women who received prophylactic antibiotics was lower than in those given placebo (RR 0.28, 95% CI 0.20 to 0.39; 11 RCTs, N = 2010; I^2 = 57%; moderate-quality evidence; Analysis 1.4). Evidence suggests that if the average risk of infection with placebo is assumed to be 12%, risk following antibiotic prophylaxis would be between 2% and 5%. Heterogeneity for this comparison was substantial (I^2 = 57%), but we did not downgrade the quality of the evidence for inconsistency, as the direction of effect was consistent. Evidence of a difference in reported cases of pelvic infection persisted whether sensitivity analysis was based on OR (OR 0.17, 95% CI 0.11 to 0.27) or on an RE model (RR 0.22, 95% CI 0.11 to 0.46).

1.4.2 Abdominal hysterectomy

The rate of pelvic infection in women who received prophylactic antibiotics was lower than in those given placebo (RR 0.50, 95% CI 0.35 to 0.71; 11 RCTs, N = 1883; I^2 = 11%; moderate-quality evidence; Analysis 1.4). Evidence suggests that if the average risk of infection with placebo is assumed to be 8%, risk following antibiotic prophylaxis would be between 3% and 6%.

1.5 Other serious infection

1.5.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups in the rate of other serious infection (RR 0.20, 95% CI 0.01 to 4.10; one RCT, N = 146; very low-quality evidence; Analysis 1.5). Evidence suggests that if the average risk of infection with placebo is assumed to be 3%, risk following antibiotic prophylaxis would be between 0% and 11%.

1.5.2 Abdominal hysterectomy

It is unclear whether data showed a difference between groups in the rate of other serious infection (RR 0.44, 95% CI 0.12 to 1.69; two RCTs, N = 476; I^2 = 29%; very low-quality evidence; Analysis 1.5). Evidence suggests that if the risk of other serious infection with placebo is assumed to be 3%, risk following antibiotic prophylaxis would be between 0% and 5%.

1.6. Postoperative fever

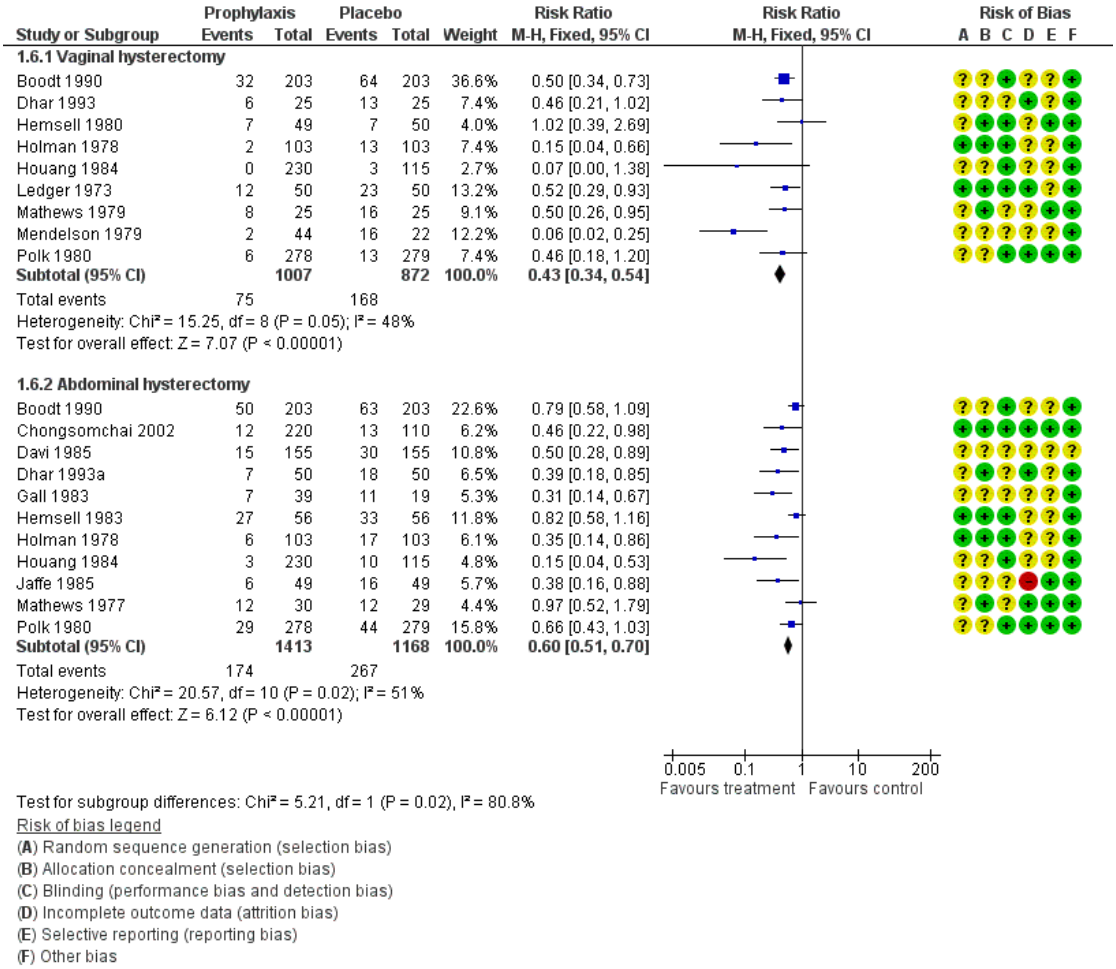
1.6.1 Vaginal hysterectomy

The rate of postoperative fever in women who received prophylactic antibiotics was lower than in those given placebo (RR 0.43, 95% CI 0.34 to 0.54; nine RCTs, N = 1879; I^2 = 48%; moderate-quality evidence; Analysis 1.6). Evidence suggests that if the average risk of postoperative fever with placebo is assumed to be 19%, risk following antibiotic prophylaxis would be between 7% and 10%.

1.6.2 Abdominal hysterectomy

The rate of postoperative fever in women who received prophylactic antibiotics was lower than in those given placebo (RR 0.60, 95% CI 0.51 to 0.70; 11 RCTs, N = 2581; I^2 = 51%; moderate-quality evidence; Analysis 1.6; Figure 5). Evidence suggests that if the average risk of postoperative fever with placebo is assumed to be 23%, risk following antibiotic prophylaxis would be between 12% and 16%. Heterogeneity for this comparison was substantial (I^2 = 51%), but we did not downgrade the quality of the evidence for inconsistency, as the direction of effect was consistent. Evidence of a difference in reported cases of postoperative fever persisted whether sensitivity analysis as based on OR (OR 0.50, 95% CI 0.40 to 0.63) or on an RE model (RR 0.55, 95% CI 0.43 to 0.72).

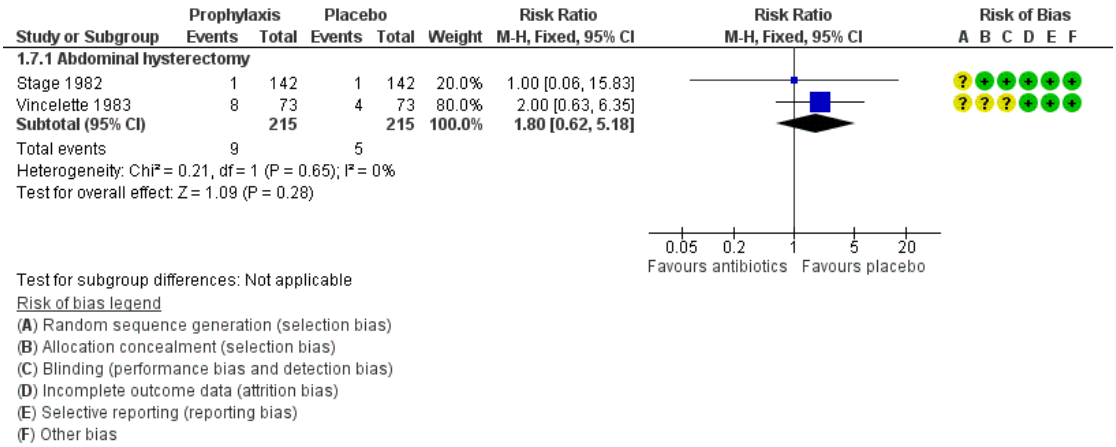
Figure 5. Forest plot of comparison: 1 Any antibiotic versus placebo, outcome: 1.6 Postoperative fever.



1.7 Total adverse effects

See Analysis 1.7; Figure 6

Figure 6. Forest plot of comparison: 1 Any antibiotic versus placebo, outcome: 1.7 Total adverse effects.



1.7.1 Vaginal hysterectomy

Investigators provided no data for this outcome.

1.7.2 Abdominal hysterectomy

It is unclear whether results showed a difference between groups in the rate of total adverse effects (RR 1.80, 95% CI 0.62 to 5.18; two RCTs, N = 430; I^2 = 0%; very low-quality evidence; Analysis 1.7). Evidence suggests that if the average risk of total adverse effects with placebo is assumed to be 2%, risk following antibiotic prophylaxis would be between 1% and 12%.

Secondary outcomes

1.8 Need for therapeutic antibiotics

1.8.1 Vaginal hysterectomy

The rate of need for therapeutic antibiotics was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.51, 95% CI 0.37 to 0.68; six RCTs, N = 1309; I^2 = 30%; Analysis 1.8).

1.8.2 Abdominal hysterectomy

The rate of need for therapeutic antibiotics was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.74, 95% CI 0.59 to 0.93; six RCTs, N = 1359; I^2 = 34%; Analysis 1.8).

1.9 Length of hospital stay

1.9.1 Vaginal hysterectomy

Mean length of hospital stay was shorter in women who received prophylactic antibiotics than in those given placebo (MD -1.35 days, 95% CI -1.78 to -0.92; four RCTs, N = 853; I^2 = 0%; Analysis 1.9).

1.9.2 Abdominal hysterectomy

Mean length of hospital stay was shorter in women who received prophylactic antibiotics than in those given placebo (MD -0.59 days, 95% CI -0.76 to -0.43; seven RCTs, N = 1510; I^2 = 87%; Analysis 1.9). We explored the presence of significant heterogeneity.

2. Cephalosporin versus placebo

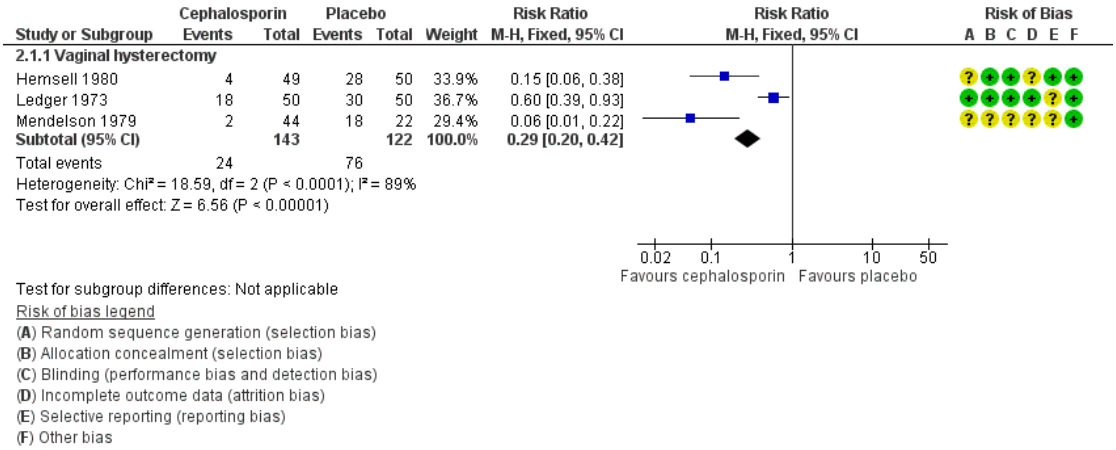
Primary outcomes

2.1 Total postoperative infections - early and late

2.1.1 Vaginal hysterectomy

The total postoperative infection rate was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.29, 95% CI 0.20 to 0.42; three RCTs, N = 265; I^2 = 89%; Analysis 2.1; Figure 7). Although heterogeneity among studies was substantial, the directions of effect estimates for individual studies were consistent. In addition, we examined the presence of heterogeneity using sensitivity analysis. The observed difference in outcomes between the two groups remained whether sensitivity analysis was based on OR (OR 0.14, 95% CI 0.08 to 0.24) or on an RE model (RR 0.19, 95% CI 0.04 to 0.88), and more cases of total postoperative infection were reported in women in the placebo group in both analyses.

Figure 7. Forest plot of comparison: 2 Cephalosporin versus placebo, outcome: 2.1 Total postoperative infections - early and late.



2.2 Abdominal wound infection

2.2.1 Abdominal hysterectomy

The rate of abdominal wound infection was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.41, 95% CI 0.25 to 0.66; seven RCTs, N = 1528; I^2 = 0%; Analysis 2.2).

2.3 Urinary tract infection

2.3.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups in the rate of UTI (RR 0.71, 95% CI 0.46 to 1.08; five RCTs, N = 499; I^2 = 31%; Analysis 2.3).

2.3.2 Abdominal hysterectomy

The rate of UTI was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.42, 95% CI 0.31 to 0.58; six RCTs, N = 1668; I^2 = 25%; Analysis 2.3).

2.4 Pelvic infection

2.4.1 Vaginal hysterectomy

The rate of pelvic infection was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.15, 95% CI 0.09 to 0.28; six RCTs, N = 1281; I^2 = 8%; Analysis 2.4).

2.4.2 Abdominal hysterectomy

The rate of pelvic infection was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.60, 95% CI 0.39 to 0.93; seven RCTs, N = 1528; I^2 = 3%; Analysis 2.4).

2.5 Other serious infection

2.5.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups in the rate of other serious infection (RR 0.20, 95% CI 0.01 to 4.12; one RCT, N = 206; Analysis 2.5).

2.5.2 Abdominal hysterectomy

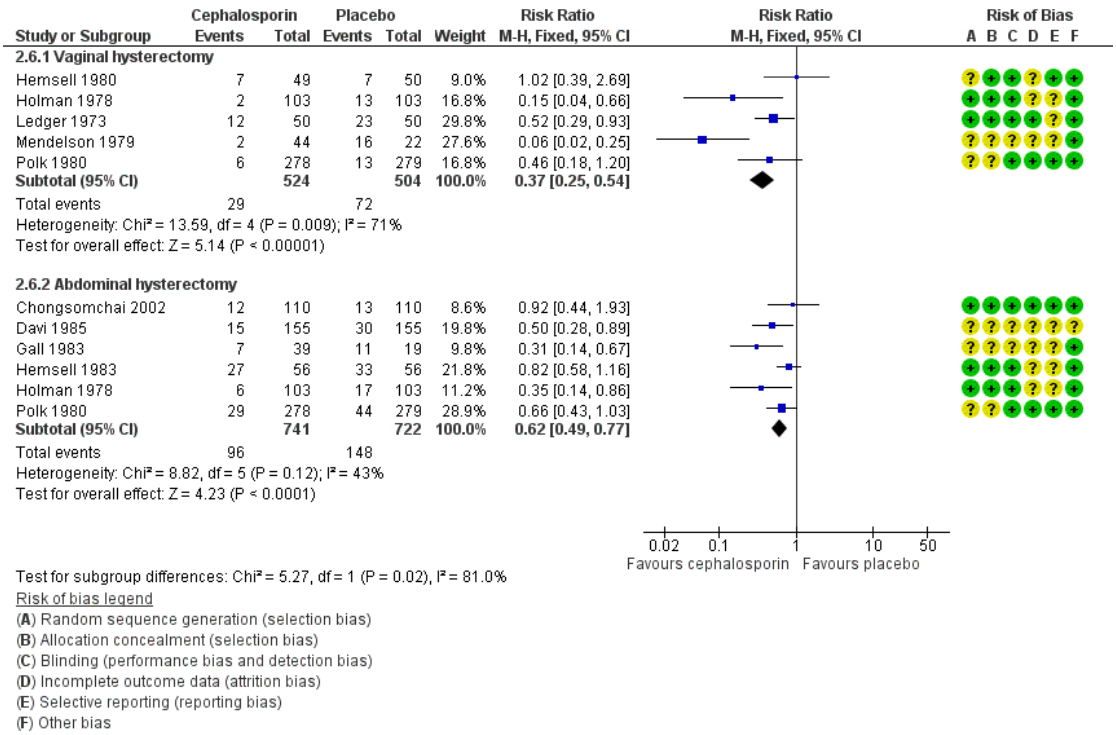
It is unclear whether data showed a difference between groups in the rate of other serious infection (RR 0.33, 95% CI 0.04 to 3.16; one RCT, N = 220; Analysis 2.5).

2.6 Postoperative fever

2.6.1 Vaginal hysterectomy

The rate of postoperative fever was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.37, 95% CI 0.25 to 0.54; five RCTs, N = 1028; I^2 = 71%; Analysis 2.6; Figure 8). Direction of effect estimates in all five studies were consistent. We investigated the presence of significant heterogeneity using sensitivity analysis. The observed difference in outcomes between the two groups persisted whether sensitivity analysis was based on OR (OR 0.29, 95% CI 0.18 to 0.47) or on an RE model (RR 0.34, 95% CI 0.15 to 0.78), and more women in the placebo group were given the diagnosis of postoperative fever.

Figure 8. Forest plot of comparison: 2 Cephalosporin versus placebo, outcome: 2.6 Postoperative fever.



2.6.2 Abdominal hysterectomy

The rate of postoperative fever was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.62, 95% CI 0.49 to 0.77; six RCTs, N = 1463; I^2 = 43%; Analysis 2.6).

2.7 Total adverse effects

2.7.1 Abdominal hysterectomy

It is unclear whether results showed a difference between groups in the rate of adverse effects (RR 1.00, 95% CI 0.06 to 15.83; one RCT, N = 284; Analysis 2.7).

Secondary outcomes

2.8 Need for therapeutic antibiotics

2.8.1 Vaginal hysterectomy

The rate of need for therapeutic antibiotics in women who received prophylactic antibiotics was lower than in those given placebo (RR 0.55, 95% CI 0.37 to 0.81; three RCTs, N = 863; I^2 = 36%; Analysis 2.8).

2.8.2 Abdominal hysterectomy

We found no conclusive evidence of a difference between groups in the number of women requiring therapeutic antibiotics, although data suggest benefit for the antibiotic prophylaxis group (RR 0.79, 95% CI 0.61 to 1.01; four RCTs, N = 1138; I^2 = 0%; Analysis 2.8).

2.9 Length of hospital stay

2.9.1 Vaginal hysterectomy

Mean length of hospital stay was shorter in women who received prophylactic antibiotics than in those given placebo (MD -1.30 days, 95% CI -1.88 to -0.72; two RCTs, N = 657; I^2 = 0%; Analysis 2.9).

2.9.2 Abdominal hysterectomy

Mean length of hospital stay was shorter in women who received prophylactic antibiotics than in those given placebo (MD -0.43 days, 95% CI -0.67 to -0.19; four RCTs, N = 818; I^2 = 63%; Analysis 2.9). Four studies showed consistency in direction of effect estimates. In addition, we found evidence that a difference in length of hospital stay between the two groups persisted when we subjected the evidence to sensitivity analysis based on an RE model (MD -0.54, 95% CI -1.04 to -0.05), and that women in the placebo group stayed longer in hospital than those in the cephalosporin group.

3. Penicillin versus placebo

Primary outcomes

3.1 Total postoperative infections - early and late

3.1.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups in the incidence of total postoperative infections (early and late) (RR 0.20, 95% CI 0.02 to 1.69; one RCT, N = 230; Analysis 3.1).

3.1.2 Abdominal hysterectomy

The total infection rate was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.32, 95% CI 0.13 to 0.76; one RCT, N = 230; Analysis 3.1).

3.2 Abdominal wound infection

3.2.1 Abdominal hysterectomy

The rate of abdominal wound infection was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.17, 95% CI 0.05 to 0.56; two RCTs, N = 450; I^2 = 0%; Analysis 3.2).

3.3 Urinary tract infection

3.3.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups in the rate of UTI (RR 0.50, 95% CI 0.05 to 5.44; one RCT, N = 230; Analysis 3.3).

3.3.2 Abdominal hysterectomy

It is unclear whether results showed a difference between groups in the rate of UTI (RR 0.63, 95% CI 0.21 to 1.87; two RCTs, N = 450; I^2 = 0%; Analysis 3.3).

3.4 Pelvic infection

3.4.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups in the rate of pelvic infection (RR 0.14, 95% CI 0.01 to 2.73; one RCT, N = 230; Analysis 3.4).

3.4.2 Abdominal hysterectomy

The rate of pelvic infection was lower in women who received prophylactic antibiotics than in those given placebo (RR 1.33, 95% CI 0.31 to 5.82; one RCT, N = 220; Analysis 3.4).

3.5 Other serious infection

3.5.1 Abdominal hysterectomy

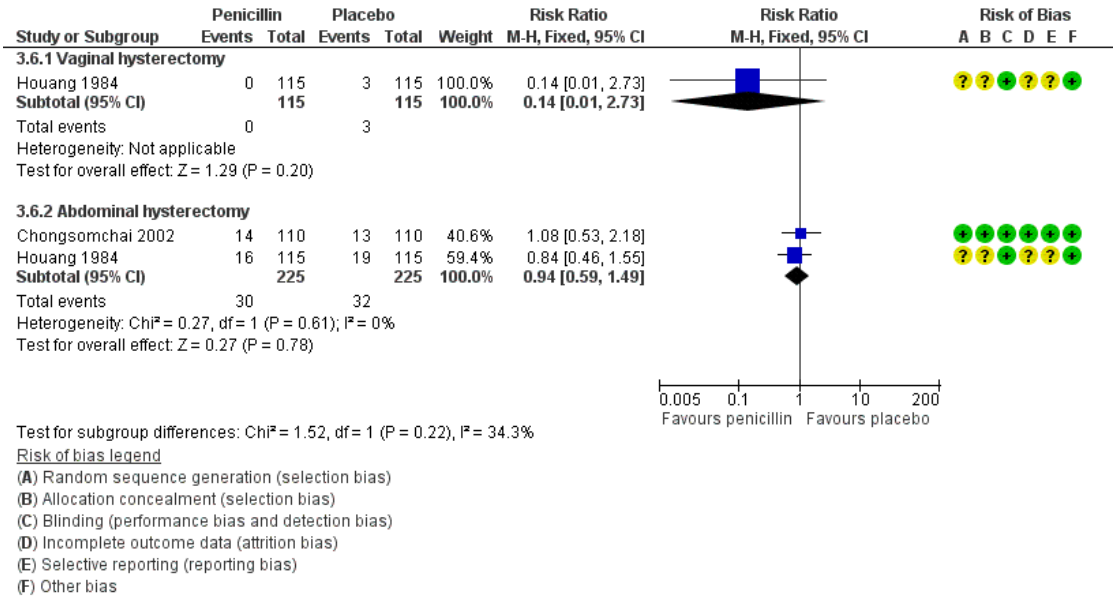
It is unclear whether data showed a difference between groups in the rate of other serious infection (RR 0.14, 95% CI 0.01 to 2.73; one RCT, N = 220; Analysis 3.5).

3.6 Postoperative fever

3.6.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups in the rate of postoperative fever (RR 0.14, 95% CI 0.01 to 2.73; one RCT, N = 230; Analysis 3.6; Figure 9).

Figure 9. Forest plot of comparison: 3 Penicillin versus placebo, outcome: 3.6 Postoperative fever.



3.6.2 Abdominal hysterectomy

It is unclear whether data showed a difference between groups in the rate of postoperative fever (RR 0.94, 95% CI 0.59 to 1.49; two RCTs, N = 450; I^2 = 0%; Analysis 3.6).

3.7 Total adverse effects

Investigators provided no data for this outcome.

3.8 Need for therapeutic antibiotics

Investigators provided no data for this outcome.

3.9 Length of hospital stay

Investigators provided no data for this outcome.

4. Antiprotozoal versus placebo

Primary outcomes

Secondary outcomes

4.1 Total postoperative infections - early and late

Investigators provided no data for this outcome.

4.2 Abdominal wound infection

4.2.1 Abdominal hysterectomy

It is unclear whether results showed a difference between groups in rates of abdominal wound infection (RR 0.71, 95% CI 0.32 to 1.57; two RCTs, N = 462; I^2 = 0%; Analysis 4.1).

4.3 Urinary tract infection

4.3.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups in rates of UTI (RR 1.25, 95% CI 0.51 to 3.04; one RCT, N = 226; I^2 = 75%; Analysis 4.2).

4.3.2 Abdominal hysterectomy

It is unclear whether results showed a difference between groups in rates of UTI (RR 1.00, 95% CI 0.34 to 2.96; one RCT, N = 146; Analysis 4.2).

4.4 Pelvic infection

4.4.1 Vaginal hysterectomy

The rate of pelvic infection was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.36, 95% CI 0.17 to 0.75; four RCTs, N = 375; I^2 = 0%; Analysis 4.3).

4.4.2 Abdominal hysterectomy

The rate of pelvic infection was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.42, 95% CI 0.22 to 0.83; four RCTs, N = 662; I^2 = 0%; Analysis 4.3).

4.5 Other serious infection

4.5.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups in rates of other serious infection (RR 0.25, 95% CI 0.03 to 2.21; two RCTs, N = 246; I^2 = 0%; Analysis 4.4).

4.5.2 Abdominal hysterectomy

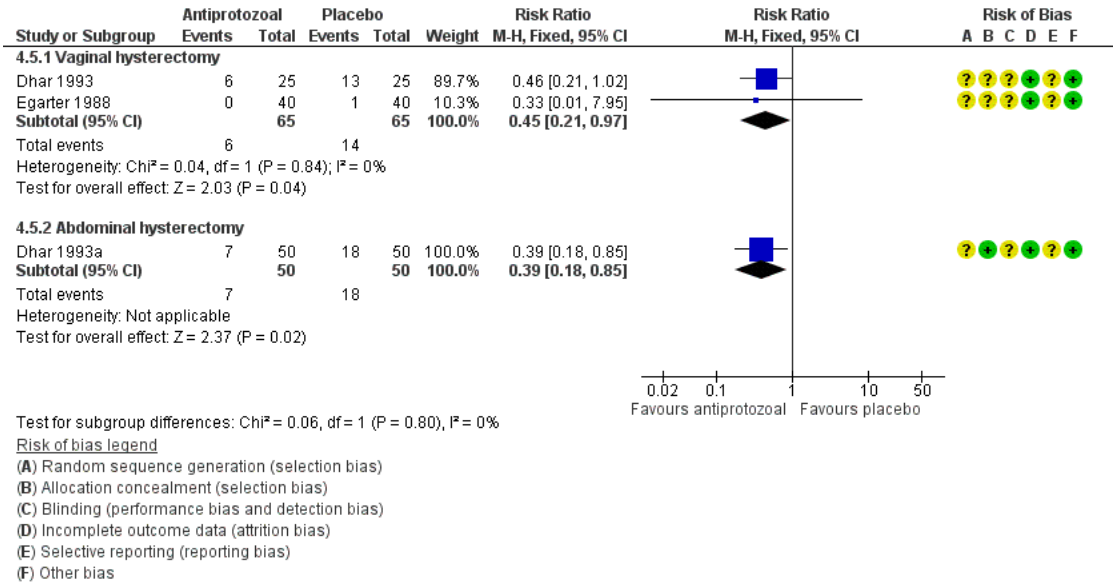
It is unclear whether results showed a difference between groups in rates of other serious infection (RR 1.00, 95% CI 0.14 to 6.91; one RCT, N = 146; Analysis 4.4).

4.6 Postoperative fever

4.6.1 Vaginal hysterectomy

The rate of postoperative fever was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.45, 95% CI 0.21 to 0.97; two RCTs, N = 130; I^2 = 0%; Analysis 4.5; Figure 10).

Figure 10. Forest plot of comparison: 4 Antiprotozoal versus placebo, outcome: 4.5 Postoperative fever.



4.6.2 Abdominal hysterectomy

The rate of postoperative fever was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.39, 95% CI 0.18 to 0.85; one RCT, N = 100; Analysis 4.5).

4.7 Total adverse effects

4.7.1 Abdominal hysterectomy

It is unclear whether results showed differences between groups in rates of adverse effects (RR 2.00, 95% CI 0.63 to 6.35; one RCT, N = 146; Analysis 4.6).

Secondary outcomes

4.8 Need for therapeutic antibiotics

4.8.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups in the need for therapeutic antibiotics (RR 0.58, 95% CI 0.29 to 1.15; two RCTs, N = 196; I^2 = 67%; Analysis 4.7). Findings did not change whether sensitivity analysis was based on OR (OR 0.52, 95% CI 0.24 to 1.17) or on an RE model (RR 0.55, 95% CI 0.15 to 1.95).

4.8.2 Abdominal hysterectomy

It is unclear whether results showed a difference between groups in the need for therapeutic antibiotics (RR 0.62, 95% CI 0.36 to 1.06; two RCTs, N = 246; I^2 = 78%; Analysis 4.7). Findings did not change whether sensitivity analysis was based on OR (OR 0.56, 95% CI 0.30 to 1.07) or on an RE model (RR 0.55, 95% CI 0.15 to 2.02).

4.9 Length of hospital stay

4.9.1 Vaginal hysterectomy

Mean length of hospital stay was shorter in women who received prophylactic antibiotics than in those given placebo (MD -0.86 days, 95% CI -1.22 to -0.49; three RCTs, N = 276; I^2 = 63%; Analysis 4.8). Direction of effect estimates were consistent in the three studies. Evidence of a difference in outcome between the two groups persisted when subjected to sensitivity analysis based on an RE model (MD -0.97, 95% CI -1.72 to -0.23), with women in the placebo group staying longer in hospital than those in the antiprotozoal group.

4.9.2 Abdominal hysterectomy

Mean length of hospital stay was shorter in women who received prophylactic antibiotics than in those given placebo (MD -1.33 days, 95% CI -1.68 to -0.97; three RCTs; N = 358; I^2 = 89%; Analysis 4.8). Direction of effect estimates of individual studies were not consistent. We investigated the presence of significant heterogeneity and found no evidence of a difference in outcome between the two groups when an RE model (MD -0.93, 95% CI -2.12 to 0.26) was used.

5. Sulphonamides versus placebo

Primary outcomes

5.1 Total postoperative infections - early and late

Investigators provided no data for this outcome.

5.2 Abdominal wound infection

5.2.1 Abdominal hysterectomy

It is unclear whether results showed a difference between groups in rates of abdominal wound infection (RR 1.23, 95% CI 0.35 to 4.35; two RCTs, N = 119; I^2 = 0%; Analysis 5.1).

5.3 Urinary tract infection

5.3.1 Vaginal hysterectomy

The rate of UTI was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.36, 95% CI 0.15 to 0.84; one RCT, N = 50; Analysis 5.2).

5.3.2 Abdominal hysterectomy

The rate of UTI was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.18, 95% CI 0.06 to 0.50; two RCTs, N = 157; I^2 = 0%; Analysis 5.2).

5.4 Pelvic infection

5.4.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups in rates of pelvic infection (RR 0.14, 95% CI 0.01 to 2.63; one RCT, N = 50; Analysis 5.3).

5.4.2 Abdominal hysterectomy

The rate of pelvic infection was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.11, 95% CI 0.01 to 0.84; two RCTs, N = 119; I^2 = 0%; Analysis 5.3).

5.5 Other serious infection

Investigators provided no data for this outcome.

5.6 Postoperative fever

5.6.1 Vaginal hysterectomy

The rate of postoperative fever was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.50, 95% CI 0.26 to 0.95; one RCT, N = 50; Analysis 5.4).

5.6.2 Abdominal hysterectomy

It is unclear whether data showed a difference between groups in the numbers of women with a diagnosis of postoperative fever (RR 0.63, 95% CI 0.38 to 1.04; two RCTs, N = 157; I^2 = 69%; Analysis 5.4). Direction of effect estimates were consistent across studies. We examined the presence of significant heterogeneity using sensitivity analysis; whether sensitivity analysis was based on OR (OR 0.51, 95% CI 0.25 to 1.05) or an RE model (RR 0.63, 95% CI 0.24 to 1.62) did not substantially influence the findings.

5.7 Total adverse effects

Investigators provided no data for this outcome.

Secondary outcomes

5.8 Need for therapeutic antibiotics

5.8.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups in the need for therapeutic antibiotics as the study that reported on this outcome did not find any evidence of a difference Mathews 1977 (RR 0.33, 95% CI 0.10 to 1.09; one RCT, N = 50).

5.8.2 Abdominal hysterectomy

It is unclear whether data showed a difference between groups in the need for therapeutic antibiotics as the study that reported on this outcome did not find any evidence of a difference Mathews 1977 (RR 0.97, 95% CI 0.15 to 6.41; one RCT, N = 59).

5.9 Length of hospital stay

Investigators provided no data for this outcome.

6. Cephalosporin plus antiprotozoal versus placebo

Primary outcomes

6.1 Total postoperative infections - early and late

Investigators provided no data for this outcome.

6.2 Abdominal wound infection

6.2.1 Abdominal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 1.00, 95% CI 0.14 to 7.03; two RCTs, N = 406; I^2 = 0%; Analysis 6.1).

6.3 Urinary tract infection

6.3.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 0.50, 95% CI 0.24 to 1.04; one RCT, N = 406; Analysis 6.2).

6.3.2 Abdominal hysterectomy

The rate of urinary tract infection was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.27, 95% CI 0.08 to 0.96; one RCT, N = 406; Analysis 6.2).

6.4 Pelvic infection

6.4.1 Vaginal hysterectomy

The rate of pelvic infection was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.05, 95% CI 0.01 to 0.37; one RCT, N = 406; Analysis 6.3).

6.5 Other serious infection

Investigators provided no data for this outcome.

6.6 Postoperative fever

6.6.1 Vaginal hysterectomy

The rate of postoperative fever was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.50, 95% CI 0.34 to 0.73; one RCT, N = 406; Analysis 6.4).

6.6.2 Abdominal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 0.79, 95% CI 0.58 to 1.09; one RCT, N = 406; Analysis 6.4).

6.7 Total adverse effects

Investigators provided no data for this outcome.

Secondary outcomes

6.8 Need for therapeutic antibiotics

6.8.1 Vaginal hysterectomy

The rate of need for therapeutic antibiotics was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.36, 95% CI 0.19 to 0.68; one RCT, N = 406; Analysis 6.5).

6.8.2 Abdominal hysterectomy

The rate of need for therapeutic antibiotics was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.38, 95% CI 0.15 to 0.94; one RCT, N = 406; Analysis 6.5).

6.9 Length of hospital stay

6.9.1 Abdominal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (MD -0.30 days, 95% CI -0.60 to -0.00; one RCT, N = 406; Analysis 6.6).

7. Penicillin plus antiprotozoal versus placebo

Primary outcomes

7.1 Total postoperative infections - early and late

7.1.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 0.20, 95% CI 0.02 to 1.69; one RCT, n 230; Analysis 7.1).

7.1.2 Abdominal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 0.53, 95% CI 0.26 to 1.08; one RCT, N = 230; Analysis 7.1).

7.2 Abdominal wound infection

7.2.1 Abdominal hysterectomy

The rate of abdominal wound infection was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.17, 95% CI 0.04 to 0.73; one RCT, N = 230; Analysis 7.2).

7.3 Urinary tract infection

7.3.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 0.50, 95% CI 0.05 to 5.44; one RCT, n = 230; Analysis 7.3).

7.3.2 Abdominal hysterectomy

The rate of UTI was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.17, 95% CI 0.04 to 0.73; one RCT, N = 230; Analysis 7.3).

7.4 Pelvic infection

7.4.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 0.14, 95% CI 0.01 to 2.73; one RCT, N = 230; Analysis 7.4).

7.5 Other serious infection

Investigators provided no data for this outcome.

7.6 Postoperative fever

7.6.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 0.14, 95% CI 0.01 to 2.73; one RCT, N = 230; Analysis 7.5).

7.6.2 Abdominal hysterectomy

The rate of postoperative fever was lower in women who received prophylactic antibiotics than in those given placebo (RR 0.10, 95% CI 0.01 to 0.77; one RCT, N = 230; Analysis 7.5).

7.7 Total adverse effects

Researchers provided no data for this outcome.

Secondary outcomes

7.8 Need for therapeutic antibiotics

Researchers provided no data for this outcome.

7.9 Length of hospital stay

Researchers provided no data for this outcome.

8. Lincosamide versus placebo

Primary outcomes

8.1 Total postoperative infections - early and late

Researchers provided no data for this outcome.

8.2 Abdominal wound infection

Researchers provided no data for this outcome.

8.3 Urinary tract infection

8.3.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups (RR 0.71, 95% CI 0.25 to 2.06; one RCT, N = 80; Analysis 8.1).

8.4 Pelvic infection

Researchers provided no data for this outcome.

8.5 Other serious infection

Researchers provided no data for this outcome.

8.6 Postoperative fever

8.6.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 1.00, 95% CI 0.06 to 15.44; one RCT, N = 80; Analysis 8.2).

8.7 Total adverse effects

Researchers provided no data for this outcome.

Secondary outcomes

8.8 Need for therapeutic antibiotics

Researchers provided no data for this outcome.

8.9 Length of hospital stay

8.9.1 Vaginal hysterectomy

Evidence showed a difference in length of hospital stay between the two treatment groups, with women in the placebo group staying longer in hospital than those in the lincosamide group (MD -0.40, 95% CI -0.77 to -0.03; one RCT, N = 80; Analysis 8.3).

9. Cephalosporin versus penicillin

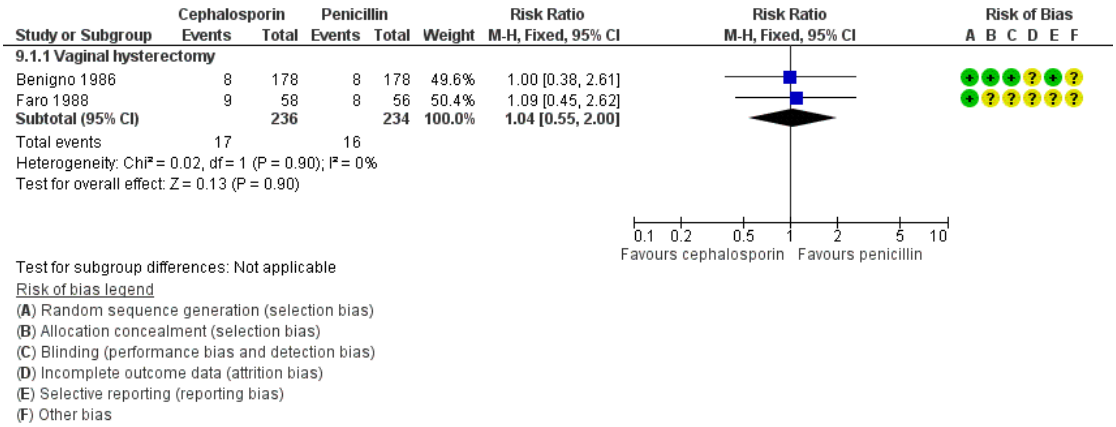
Primary outcomes

9.1 Total postoperative infections - early and late

9.1.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 1.04, 95% CI 0.55 to 2.00; two RCTs, N = 470; I^2 = 0%; Analysis 9.1; Figure 11).

Figure 11. Forest plot of comparison: 9 Cephalosporin versus penicillin, outcome: 9.1 Total postoperative infections - early and late.



9.2 Abdominal wound infection

9.2.1 Abdominal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 0.33, 95% CI 0.01 to 8.09; one RCT, N = 220; Analysis 9.2).

9.3 Urinary tract infection

9.3.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 0.20, 95% CI 0.01 to 3.98; one RCT, N = 95; Analysis 9.3).

9.3.2 Abdominal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 1.00, 95% CI 0.06 to 15.79; one RCT, N = 220; Analysis 9.3).

9.4 Pelvic infection

9.4.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 0.88, 95% CI 0.47 to 1.64; three RCTs, N = 565; I^2 = 0%; Analysis 9.4).

9.4.2 Abdominal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 0.50, 95% CI 0.09 to 2.67; one RCT, N = 220; Analysis 9.4).

9.5 Other serious infection

9.5.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 2.90, 95% CI 0.12 to 69.68; one RCT, N = 114; Analysis 9.5).

9.5.2 Abdominal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 3.00, 95% CI 0.12 to 72.85; one RCT, N = 220; Analysis 9.5).

9.6 Postoperative fever

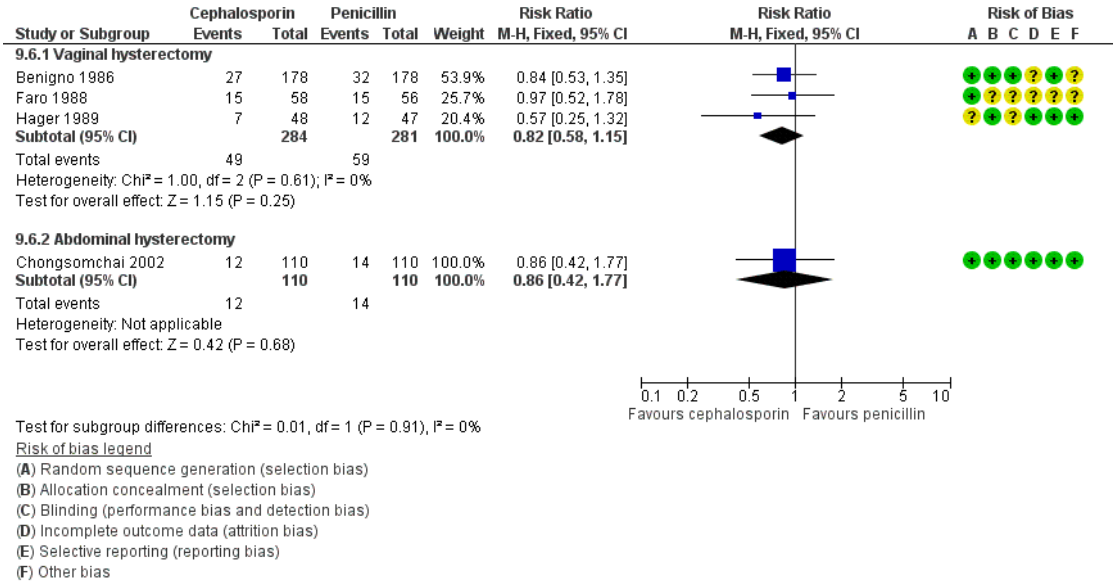
9.6.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 0.82, 95% CI 0.58 to 1.15; three RCTs, N = 565; I^2 = 0%; Analysis 9.6).

9.6.2 Abdominal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 0.86, 95% CI 0.42 to 1.77; one RCT, N = 220; Analysis 9.6; Figure 12).

Figure 12. Forest plot of comparison: 9 Cephalosporin versus penicillin, outcome: 9.6 Postoperative fever.

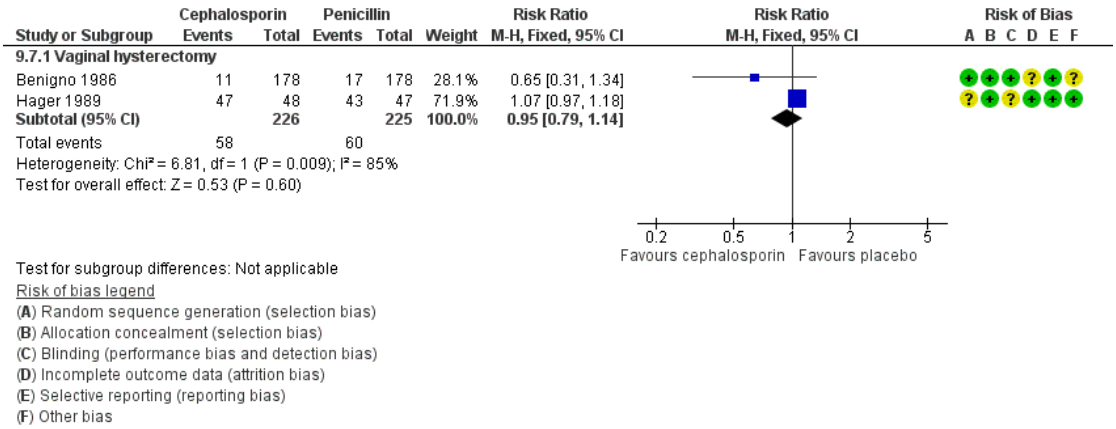


9.7 Total adverse effects

9.7.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 0.95, 95% CI 0.79 to 1.14; two RCTs, N = 451; I^2 = 85%; Analysis 9.7; Figure 13).

Figure 13. Forest plot of comparison: 9 Cephalosporin versus penicillin, outcome: 9.7 Total adverse effects.



Secondary outcomes

9.8 Need for therapeutic antibiotics

9.8.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 1.32, 95% CI 0.88 to 1.97; two RCTs, N = 470; I^2 = 0%; Analysis 9.8).

9.9 Length of hospital stay

9.9.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (MD -0.47, 95% CI -0.97 to 0.04; two RCTs, N = 209; I^2 = 0%; Analysis 9.9).

10 Cephalosporin versus tetracycline

Primary outcomes

10.1 Total postoperative infections - early and late

10.1.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 0.59, 95% CI 0.20 to 1.78; one RCT, N = 51; Analysis 10.1).

10.2 Abdominal wound infection

Researchers provided no data for this outcome.

10.3 Urinary tract infection

Researchers provided no data for this outcome.

10.4 Pelvic infection

10.4.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 0.83, 95% CI 0.25 to 2.75; one RCT, N = 51; Analysis 10.2).

10.5 Other serious infection

Researchers provided no data for this outcome.

10.6 Postoperative fever

10.6.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 0.69, 95% CI 0.13 to 3.81; one RCT, N = 51; Analysis 10.3).

10.7 Total adverse effects

Researchers provided no data for this outcome.

Secondary outcomes

10.8 Need for therapeutic antibiotics

Researchers provided no data for this outcome.

10.9 Length of hospital stay

10.9.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (MD -0.20 days, 95% CI -1.11 to 0.71; one RCT, N = 51; Analysis 10.4).

11. Cephalosporin versus antiprotozoal

Primary outcomes

11.1 Total postoperative infections - early and late

11.1.1 Vaginal hysterectomy

The rate of postoperative infection was lower in the cephalosporin group (RR 0.04, 95% CI 0.00 to 0.67; one RCT, N = 78; Analysis 11.1).

11.2 Abdominal wound infection

Researchers provided no data for this outcome.

11.3 Urinary tract infection

11.3.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 0.05, 95% CI 0.00 to 0.81; one RCT, N = 78; Analysis 11.2).

11.4 Pelvic infection

11.4.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 0.17, 95% CI 0.01 to 4.03; one RCT, N = 78; Analysis 11.3).

11.5 Other serious infection

Investigators provided no data for this outcome.

11.6 Postoperative fever

11.6.1 Vaginal hysterectomy

The rate of postoperative fever was lower in women who received cephalosporin than in those given antiprotozoal (RR 0.06, 95% CI 0.01 to 0.42; one RCT, N = 78; Analysis 11.4).

11.7 Total adverse effects

Investigators provided no data for this outcome.

Secondary outcomes

11.8 Need for therapeutic antibiotics

11.8.1 Vaginal hysterectomy

The rate of need for therapeutic antibiotics was lower in women who received cephalosporin than in those given antiprotozoal (RR 0.03, 95% CI 0.00 to 0.44; one RCT, N = 78; Analysis 11.5).

11.9 Length of hospital stay

11.9.1 Vaginal hysterectomy

Mean length of hospital stay was shorter in women who received cephalosporin than in those given antiprotozoal (MD -1.90 days, 95% CI -3.32 to -0.48; one RCT, N = 78; Analysis 11.6).

12. Antiprotozoal versus lincosamide

Primary outcomes

12.1 Total postoperative infections - early and late

Researchers provided no data for this outcome.

12.2 Abdominal wound infection

Researchers provided no data for this outcome.

12.3 Urinary tract infection

12.3.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 4.00, 95% CI 0.47 to 34.24; one RCT, N = 80; Analysis 12.1).

12.4 Pelvic infection

Researchers provided no data for this outcome.

12.5 Other serious infection

Researchers provided no data for this outcome.

12.6 Postoperative fever

12.6.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 0.33, 95% CI 0.01 to 7.95; one RCT, N = 80; Analysis 12.2).

12.7 Total adverse effects

Researchers provided no data for this outcome.

Secondary outcomes

12.8 Need for therapeutic antibiotics

Researchers provided no data for this outcome.

12.9 Length of hospital stay

12.9.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (MD -0.20 days, 95% CI -0.60 to 0.20; one RCT, N = 80; Analysis 12.3).

13. Cephalosporin plus antiprotozoal versus cephalosporin

Primary outcomes

13.1 Total postoperative infections - early and late

Researchers provided no data for this outcome.

13.2 Abdominal wound infection

Researchers provided no data for this outcome.

13.3 Urinary tract infection

Researchers provided no data for this outcome.

13.4 Pelvic infection

Researchers provided no data for this outcome.

13.5 Other serious infections

Researchers provided no data for this outcome.

13.6 Postoperative fever

13.6.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 0.50, 95% CI 0.03 to 7.68; one RCT, N = 78; Analysis 13.1).

13.7 Total adverse effects

Researchers provided no data for this outcome.

Secondary outcomes

13.8 Need for therapeutic antibiotics

Researchers provided no data for this outcome.

13.9 Length of hospital stay

13.9.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (MD 0.30 days, 95% CI -0.43 to 1.03; one RCT, N = 78; Analysis 13.2).

14. Cephalosporin plus antiprotozoal versus antiprotozoal only

Primary outcomes

14.1 Total postoperative infections - early and late

14.1.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups (RR 0.04, 95% CI 0.00 to 0.67; one RCT, N = 78; Analysis 14.1).

14.2 Abdominal wound infection

Researchers provided no data for this outcome.

14.3 Urinary tract infection

14.3.1 Vaginal hysterectomy

The rate of UTI was lower in women who received cephalosporin plus antiprotozoal than in those given antiprotozoal only (RR 0.05, 95% CI 0.00 to 0.81; one RCT, N = 78; Analysis 14.2).

14.4 Pelvic infection

14.4.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 0.17, 95% CI 0.01 to 4.03; one RCT, N = 78; Analysis 14.3).

14.5 Other serious infection

Researchers provided no data for this outcome.

14.6 Postoperative fever

14.6.1 Vaginal hysterectomy

The rate of postoperative fever was lower in women who received cephalosporin plus antiprotozoal than in those given antiprotozoal only (RR 0.06, 95% CI 0.01 to 0.42; one RCT, N = 78; Analysis 14.4).

14.7 Total adverse effects

Investigators provided no data for this outcome.

Secondary outcomes

14.8 Need for therapeutic antibiotics

14.8.1 Vaginal hysterectomy

The rate of need for therapeutic antibiotics was lower in women who received cephalosporin plus antiprotozoal than in those given antiprotozoal only (RR 0.03, 95% CI 0.00 to 0.44; one RCT, N = 78; Analysis 14.5).

14.9 Length of hospital stay

14.9.1 Vaginal hysterectomy

Length of hospital stay was shorter in women who received cephalosporin plus antiprotozoal than in those given antiprotozoal only (MD -1.60 days, 95% CI -3.11 to -0.09; one RCT, N = 78; Analysis 14.6).

15. Penicillin plus antiprotozoal versus penicillin only

Primary outcomes

15.1 Total postoperative infections - early and late

15.1.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 1.00, 95% CI 0.06 to 15.80; one RCT, N = 230; Analysis 15.1).

15.1.2 Abdominal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 1.67, 95% CI 0.63 to 4.43; one RCT, N = 230; Analysis 15.1).

15.2 Abdominal wound infection

15.2.1 Abdominal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 1.00, 95% CI 0.26 to 3.85; one RCT, N = 276; I^2 = 0%; Analysis 15.2).

15.3 Urinary tract infection

15.3.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 1.00, 95% CI 0.06 to 15.80; one RCT, N = 230; Analysis 15.3).

15.3.2 Abdominal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 1.50, 95% CI 0.45 to 5.01; two RCTs, N = 276; I^2 = 19%; Analysis 15.3).

15.4 Pelvic infection

Investigators provided no data for this outcome.

15.5 Other serious infection

Investigators provided no data for this outcome.

15.6 Postoperative fever

15.6.1 Abdominal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 1.50, 95% CI 0.63 to 3.56; two RCTs, N = 276; I^2 = 0%; Analysis 15.4).

15.7 Total adverse effects

Investigators provided no data for this outcome.

Secondary outcomes

15.8 Need for therapeutic antibiotics

Investigators provided no data for this outcome.

15.9 Length of hospital stay

Investigators provided no data for this outcome.

16. Cephalosporin early administration versus usual timing (both single dose)

Primary outcomes

16.1 Total postoperative infections - early and late

Researchers provided no data for this outcome.

16.2 Abdominal wound infection

16.2.1 Abdominal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 0.50, 95% CI 0.03 to 7.90; one RCT, n = 252; Analysis 16.1).

16.3 Urinary tract infection

Investigators provided no data for this outcome.

16.4 Pelvic infection

16.4.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 1.50, 95% CI 0.16 to 14.20; one RCT, N = 252; Analysis 16.2).

16.4.2 Abdominal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 1.50, 95% CI 0.16 to 14.20; one RCT, N = 252; Analysis 16.2).

16.5 Other serious infection

Researchers provided no data for this outcome.

16.6 Postoperative fever

Researchers provided no data for this outcome.

16.7 Total adverse effects

Researchers provided no data for this outcome.

Secondary outcomes

16.8 Need for therapeutic antibiotics

Researchers provided no data for this outcome.

16.9 Length of hospital stay

Researchers provided no data for this outcome.

17. Cephalosporin one dose versus two doses

Primary outcomes

17.1 Total postoperative infections - early and late

17.1.1 Abdominal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 0.67, 95% CI 0.14 to 3.18; one RCT, N = 150; Analysis 17.1).

17.2 Abdominal wound infection

Researchers provided no data for this outcome.

17.3 Urinary tract infection

Researchers provided no data for this outcome.

17.4 Pelvic infection

Researchers provided no data for this outcome.

17.5 Other serious infection

Researchers provided no data for this outcome.

17.6 Postoperative fever

17.6.1 Abdominal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 2.00, 95% CI 0.97 to 4.13; one RCT, N = 150; Analysis 17.2).

17.7 Total adverse effects

Researchers provided no data for this outcome.

Secondary outcomes

17.8 Need for therapeutic antibiotics

17.8.1 Abdominal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 9.90, 95% CI 0.48 to 202.43; one RCT, N = 150; Analysis 17.3).

17.9 Length of hospital stay

Researchers provided no data for this outcome.

18. Cephalosporin one dose versus three doses

Primary outcomes

18.1 Total postoperative infections - early and late

18.1.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 0.50, 95% CI 0.05 to 5.36; one RCT, N = 116; Analysis 18.1).

18.2 Abdominal wound infection

Investigators provided no data for this outcome.

18.3 Urinary tract infection

Investigators provided no data for this outcome.

18.4 Pelvic infection

18.4.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 0.50, 95% CI 0.05 to 5.36; one RCT, N = 116; Analysis 18.2).

18.5 Other serious infection

Investigators provided no data for this outcome.

18.6 Postoperative fever

18.6.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 0.91, 95% CI 0.42 to 1.97; one RCT, N = 116; Analysis 18.3).

18.7 Total adverse effects

Investigators provided no data for this outcome.

Secondary outcomes

18.8 Need for therapeutic antibiotics

Investigators provided no data for this outcome.

18.9 Length of hospital stay

It is unclear whether data showed a difference between groups for this outcome (MD -0.30 days, 95% CI -0.72 to 0.12; one RCT, N = 116; Analysis 18.4).

19. Cephalosporin one dose versus multiple doses

Primary outcomes

19.1 Total postoperative infections - early and late

19.1.1 Vaginal hysterectomy

We found no clear evidence of a difference between groups (RR 5.00, 95% CI 0.25 to 98.52; one RCT, N = 44; Analysis 19.1).

19.2 Abdominal wound infection

Researchers provided no data for this outcome.

19.3 Urinary tract infection

19.3.1 Vaginal hysterectomy

We found no clear evidence of a difference between groups (RR 3.00, 95% CI 0.13 to 69.87; one RCT, N = 44; Analysis 19.2).

19.4 Pelvic infection

19.4.1 Vaginal hysterectomy

We found no clear evidence of a difference between groups (RR 3.00, 95% CI 0.13 to 69.87; one RCT, N = 44; Analysis 19.3).

19.5 Other serious infection

Researchers provided no data for this outcome.

19.6 Postoperative fever

19.6.1 Vaginal hysterectomy

We found no clear evidence of a difference between groups for this outcome (RR 5.00, 95% CI 0.25 to 98.52; one RCT, N = 44; Analysis 19.4).

19.7 Total adverse effects

Researchers provided no data for this outcome.

Secondary outcomes

19.8 Need for therapeutic antibiotics

Researchers provided no data for this outcome.

19.9 Length of hospital stay

Researchers provided no data for this outcome.

20 Cephalosporin one gram versus two grams

Primary outcomes

20.1 Total postoperative infections - early and late

20.1.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 1.49, 95% CI 0.25 to 8.74; one RCT, N = 237; Analysis 20.1).

20.2 Abdominal wound infection

Investigators reported no data for this outcome.

20.3 Urinary tract infection

Investigators reported no data for this outcome.

20.4 Pelvic infection

20.4.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 1.49, 95% CI 0.25 to 8.74; one RCT, N = 237; Analysis 20.2).

20.5 Other serious infection

Investigators provided no data for this outcome.

20.6 Postoperative fever

20.6.1 Vaginal hysterectomy

It is unclear whether results showed a difference between groups for this outcome (RR 1.49, 95% CI 0.43 to 5.14; one RCT, N = 237; Analysis 20.3).

20.7 Total adverse effects

Investigators provided no data for this outcome.

Secondary outcomes

20.8 Need for therapeutic antibiotics

20.8.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (RR 1.49, 95% CI 0.25 to 8.74; one RCT, N = 237; Analysis 20.4).

20.9 Length of hospital stay

20.9.1 Vaginal hysterectomy

It is unclear whether data showed a difference between groups for this outcome (MD -0.10 days, 95% CI -0.60 to 0.40; one RCT, N = 237; Analysis 20.5).

Funnel plots

We examined the presence of publication or reporting bias by analysing funnel plots in five subgroups: 1.2.1 (Figure 14); 1.3.2 (Figure 15); 1.4.1 and 1.4.2 (Figure 16); and 1.6.2 (Figure 17). We found evidence suggesting a tendency towards publication bias; smaller studies were likely to report beneficial effects with the use of antibiotic prophylaxis.

Figure 14. Funnel plot of comparison: 1 Any antibiotic versus placebo, outcome: 1.2 Abdominal wound infection.

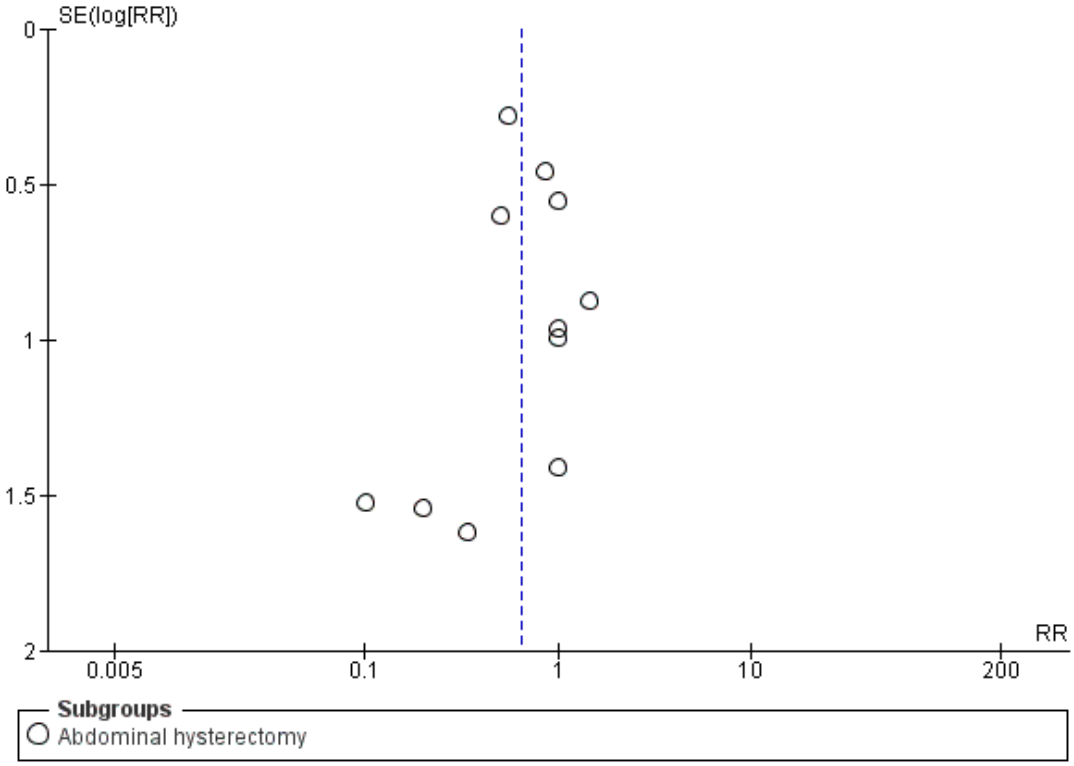


Figure 15. Funnel plot of comparison: 1 Any antibiotic versus placebo, outcome: 1.3 Urinary tract infection.

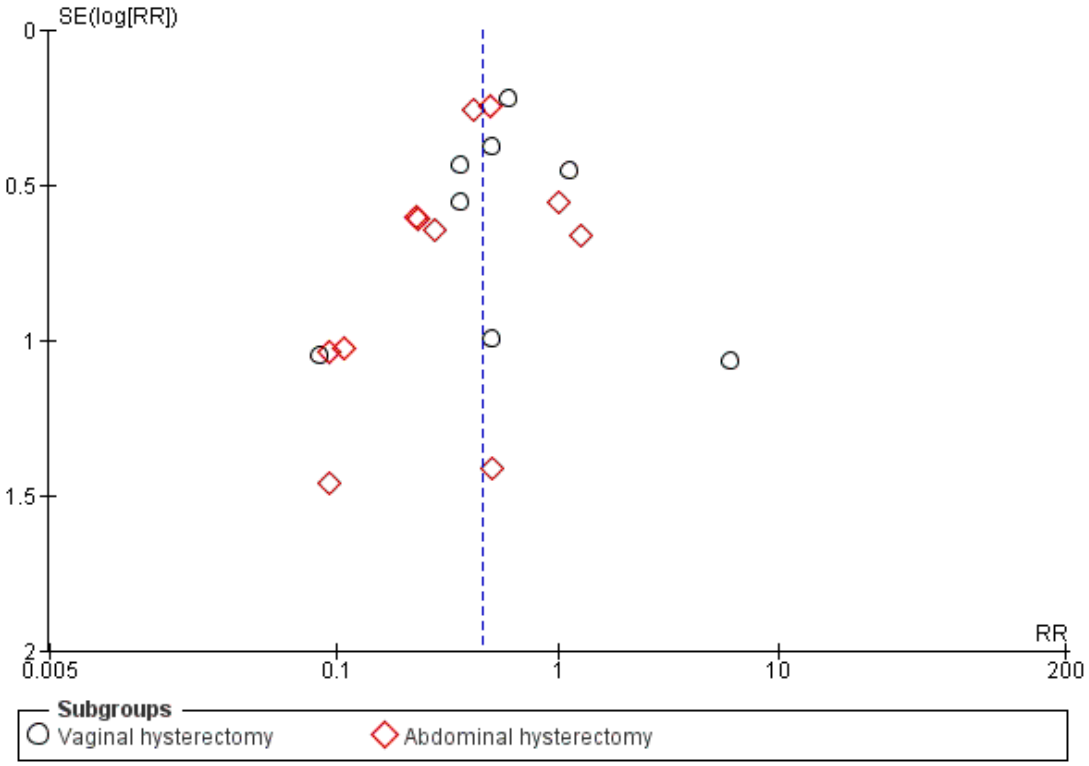


Figure 16. Funnel plot of comparison: 1 Any antibiotic versus placebo, outcome: 1.4 Pelvic infection.

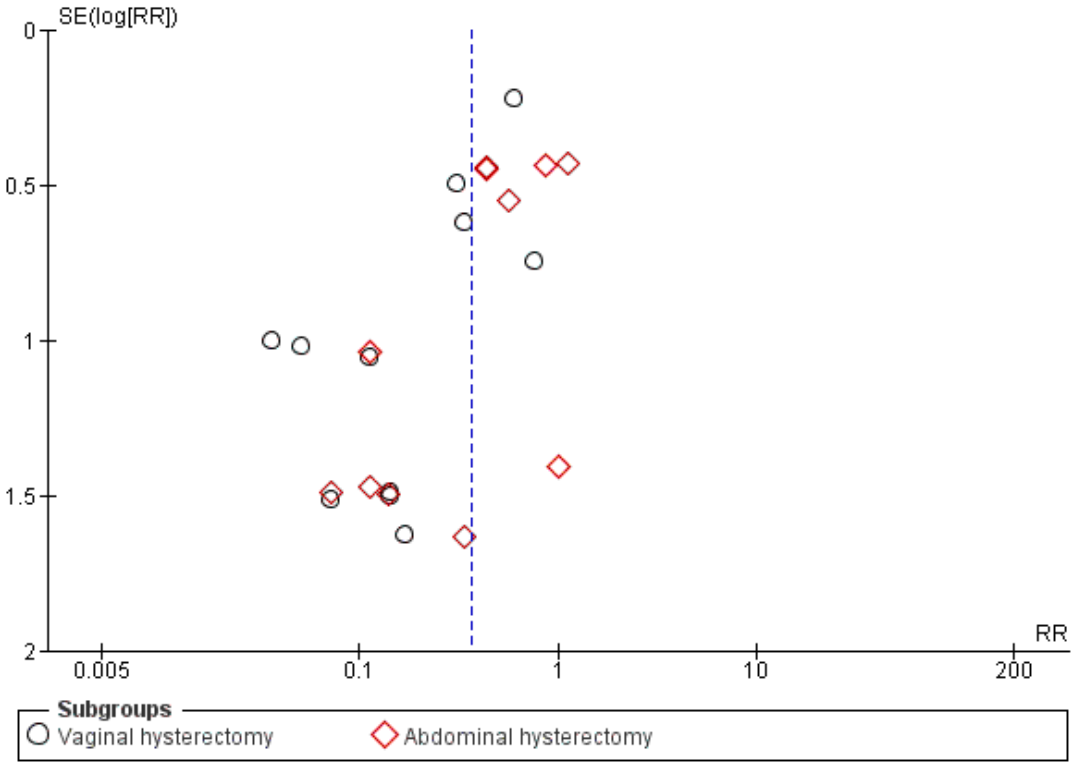
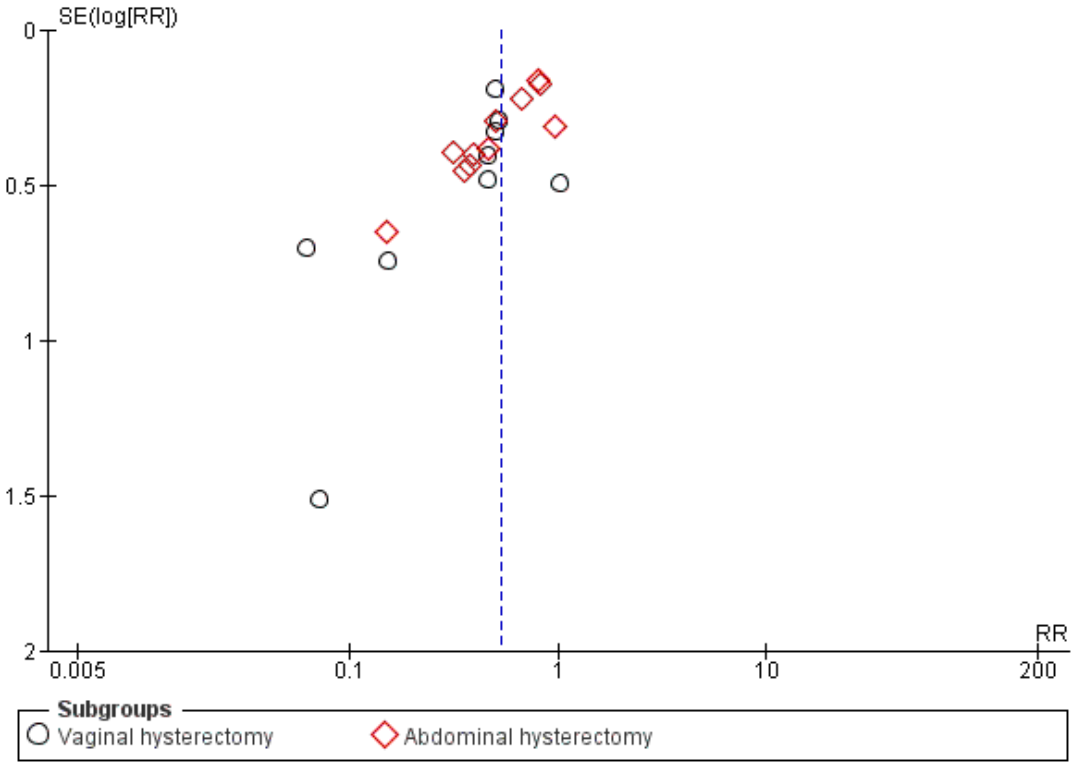


Figure 17. Funnel plot of comparison: 1 Any antibiotic versus placebo, outcome: 1.6 Postoperative fever.



ADDITIONAL SUMMARY OF FINDINGS [Explanation]

Antibiotics compared with placebo for prophylaxis in elective abdominal hysterectomy

Population: women having elective abdominal hysterectomy
Settings: hospital
Intervention: antibiotics
Comparison: placebo

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	Number of participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Placebo	Antibiotics				
Total postoperative infections - early and late	Moderate[a]		RR 0.16 (0.06 to 0.38)	345 (1 study)	⊕⊕◯◯ low[b,c]	
	165 per 1000	26 per 1000 (10 to 63)				
Abdominal wound infection	Moderate[a]		RR 0.64 (0.45 to 0.92)	2434 (11 studies)	⊕⊕⊕◯ moderate[b]	
	57 per 1000	36 per 1000 (26 to 52)				
Urinary tract infection	Moderate[a]		RR 0.39 (0.29 to 0.51)	2547 (11 studies)	⊕⊕⊕◯ moderate[b]	
	131 per 1000	51 per 1000 (38 to 67)				
Pelvic infection	Moderate[a]		RR 0.50 (0.35 to 0.71)	1883 (11 studies)	⊕⊕⊕◯ moderate[b]	
	83 per 1000	42 per 1000 (29 to 59)				
Other serious infections	Moderate[a]		RR 0.44 (0.12 to 1.69)	476 (2 studies)	⊕◯◯◯ very low[b,d,e]	

	27 per 1000	**12 per 1000** (3 to 46)			
Postoperative fever	**Moderate**[a]		**RR 0.60** (0.51 to 0.70)	2581 (11 studies)	⊕⊕⊕◯ **moderate**[b]
	229 per 1000	**137 per 1000** (117 to 160)			
Total adverse effects	**Moderate**[a]		**RR 1.80** (0.62 to 5.18)	430 (2 studies)	⊕◯◯◯ **very low**[b,e]
	23 per 1000	**41 per 1000** (14 to 119)			

*The basis for **assumed risk** (e.g. median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on assumed risk in the comparison group and **relative effect** of the intervention (and its 95% CI)
CI: confidence interval; RR: risk ratio

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate
Very low quality: We are very uncertain about the estimate

[a]Median baseline risk of control group
[b]Downgraded one level for serious risk of bias: sequence generation and/or allocation concealment assessed as "unclear" in some studies owing to poor reporting
[c]Downgraded one level for serious imprecision: small sample size
[d]Substantial heterogeneity for this comparison ($I^2 = 51\%$), but the quality of the evidence was not downgraded for inconsistency, as the direction of effect was consistent
[e]Downgraded two levels for very serious imprecision: small sample size and effect estimate with wide confidence interval

Antibiotics compared with alternative antibiotics for prophylaxis in elective vaginal hysterectomy

Population: women having elective vaginal hysterectomy
Settings: hospital
Intervention: antibiotics
Comparison: alternative antibiotics

Outcomes	Illustrative comparative risks Antibiotics vs alternative antibiotics	Relative effect (95% CI)	Number of participants (studies)	Quality of the evidence (GRADE)	Comments
• **Total postoperative infections - early and late** • **Urinary tract infection** • **Pelvic infection** • **Other serious infections** • **Postoperative fever**	When data were available, no evidence showed a difference between any groups compared for any of our primary outcomes, except: • fewer cases of total postoperative infection and postoperative fever in women who received cephalosporin than in those who received antiprotozoal • fewer cases of total postoperative infection, UTI, or postoperative fever in women receiving cephalosporin with antiprotozoal than in those receiving antiprotozoal only		• cephalosporin vs penicillin (2 RCTs, 470 women) • cephalosporin vs tetracycline (1 RCT, 51 women) • cephalosporin vs antiprotozoal (1 RCT, 78 women) • antiprotozoal vs lincosamide (1 RCT, 80 women) • cephalosporin plus antiprotozoal vs cephalosporin only (1 RCT, 78 women) • cephalosporin plus antiprotozoal vs antiprotozoal only (1 RCT, 78 women) • penicillin plus antiprotozoal vs penicillin only (1 RCT, 230 women)	⊕○○○ **very low**[a,b]	

Total adverse effects	• No evidence of a difference between cephalosporin and penicillin. • No data available for other comparisons	• cephalosporin vs penicillin (2 RCTs, 451 women)	⊕◯◯◯ **very low**[a,b]

CI: confidence interval; RCT: randomised controlled trial
GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate
Very low quality: We are very uncertain about the estimate

[a]Downgraded two levels for very serious imprecision with very few events and wide confidence intervals
[b]Downgraded one level for serious risk of bias: methods were poorly reported in most studies

Head-to-head comparisons of antibiotics for prophylaxis in elective abdominal hysterectomy

Population: women having elective abdominal hysterectomy
Settings: hospital
Intervention: antibiotics
Comparison: alternative antibiotics

Outcomes	Illustrative comparative risks (95% CI)	Relative effect	Number of participants (studies)	Quality of the evidence (GRADE)	Comments
	Antibiotics vs alternative antibiotics				
• **Total postoperative infections - early and late** • **Abdominal wound infection** • **Urinary tract infection** • **Pelvic infection** • **Other serious infections** • **Postoperative fever**	• No clear evidence of differences between groups		• cephalosporin vs penicillin (1 RCT, 220 women) • penicillin plus antiprotozoal vs penicillin only (1 RCT, 230 women)	⊕◯◯◯ **very low**[1,2]	
• **Total adverse effects**	• No data reported on adverse effects				

CI: confidence interval; RCT: randomised controlled trial
GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate
Very low quality: We are very uncertain about the estimate

[a] Downgraded two levels for very serious imprecision with very few events and wide confidence intervals
[b] Downgraded one level for serious risk of bias: methods were poorly reported in most studies

DISCUSSION

Summary of main results

This is the first Cochrane review to assess the effectiveness and safety of antibiotic prophylaxis for elective hysterectomy for benign disease, and to determine which, if any, prophylactic regimen is most suitable. Thirty-seven studies met the eligibility criteria for inclusion; they compared various antibiotics with placebo and with one another in 20 comparisons involving a total of 6079 participants. Primary outcomes reported were infection (total postoperative infections - early and late, abdominal wound infection, urinary tract infection, pelvic infection, other serious infection, and postoperative fever) and total adverse effects. Secondary outcomes reported were need for therapeutic antibiotics and length of hospital stay.

We subsumed the various comparisons under four broad groups as follows.

1. Any antibiotics versus placebo

Antibiotics in this case included cephalosporin, penicillin, antiprotozoal, sulphonamide, and lincosamide. Researchers compared these individually or in combination with placebo in two subgroups.

Vaginal hysterectomy

We found evidence of a difference in the incidence of postoperative infection between women who received prophylactic antibiotics and those given placebo. Researchers reported fewer cases of total postoperative infection, urinary tract infection (UTI), pelvic infection, and postoperative fever in women who were given prophylactic antibiotics of any class compared with those who received placebo. However, we found no evidence of a difference between groups in the proportions of women who developed other serious infection.

On safety, we found no available data that would allow us to properly evaluate the adverse effects associated with each group.

With regard to need for therapeutic antibiotics, fewer women in the antibiotic groups required therapeutic antibiotics postoperatively compared with those in the placebo group. Similarly, women who received prophylactic antibiotics spent fewer days in hospital than those given placebo.

Abdominal hysterectomy

As in the vaginal hysterectomy subgroup, we found evidence of a difference between groups in the proportions of women given a diagnosis of postoperative infection. Lower proportions of women who received prophylactic antibiotics received a diagnosis of total postoperative infection, abdominal wound infection, UTI, pelvic infection, and postoperative fever compared with those given placebo. However, we found no evidence of a difference between groups in reported cases of other serious infection.

With regard to safety, we found evidence of a difference between groups in the incidence of total adverse effects, with fewer cases of adverse effects reported in women who received antibiotics compared with those given placebo.

On the need for therapeutic antibiotics, fewer women in the antibiotic group required therapeutic antibiotics compared with those in the placebo group. Similarly, women who received prophylactic antibiotics spent shorter days in hospital than those given placebo.

2. Head-to-head comparisons between antibiotics

We identified four different head-to-head comparisons: cephalosporin versus penicillin, cephalosporin versus tetracycline, cephalosporin versus antiprotozoal, and antiprotozoal versus lincosamide. Investigators compared participants in two subgroups as follows.

Vaginal hysterectomy

Investigators performed all four comparisons in this subgroup. We found no evidence of a difference between groups in reported cases of total postoperative infection, abdominal wound infection, UTI, pelvic infection, other serious infection, and postoperative fever with cephalosporin versus penicillin, cephalosporin versus tetracycline, and antiprotozoal versus lincosamide, when data were available. However, researchers reported fewer cases of total postoperative infection and postoperative fever in women who received cephalosporin compared with those given antiprotozoal.

Only one comparison (cephalosporin vs penicillin) yielded data on adverse effects, and no evidence showed differences in total adverse effects between the two groups.

With regard to the need for therapeutic antibiotics and length of hospital stay, we found no evidence of a difference between groups in the proportions of women requiring therapeutic antibiotics or in the numbers of days spent in hospital with cephalosporin versus penicillin, cephalosporin versus tetracycline, and antiprotozoal versus lincosamide. However, we found evidence of a difference in the two outcomes between cephalosporin and antiprotozoal groups: Fewer women in the cephalosporin group required therapeutic antibiotics, and women in this group spent fewer days in hospital, compared with those in the antiprotozoal group.

Abdominal hysterectomy

Researchers performed only one of the comparisons (cephalosporin vs penicillin) in this subgroup. We found no evidence of a difference in reported cases of infection (total postoperative infection, abdominal wound infection, UTI, pelvic infection, other serious infection, and postoperative fever) between the two groups. Investigators provided no data on adverse effects, need for therapeutic antibiotics, and length of hospital stay.

3. Combined antibiotics versus single antibiotic

We identified three different comparisons: cephalosporin plus antiprotozoal versus cephalosporin, cephalosporin plus antiprotozoal versus antiprotozoal, and penicillin plus antiprotozoal versus penicillin. Researchers performed these comparisons in two subgroups as follows.

Vaginal hysterectomy

Investigators performed all three comparisons in this subgroup but did not provide data for most outcomes, including adverse effects. When data were available, we found no evidence of a difference in outcomes between the two groups for two of the comparisons (cephalosporin plus antiprotozoal vs cephalosporin only and penicillin plus antiprotozoal vs penicillin only). However, fewer women who received cephalosporin combined with antiprotozoal received a diagnosis of total postoperative infection, UTI, or postoperative fever compared with those who received antiprotozoal only.

Abdominal hysterectomy

Researchers performed only one comparison (penicillin plus antiprotozoal vs penicillin only) in this subgroup. They provided no data on some outcomes, including adverse effects. When data were available, we found no evidence of a difference in outcomes between the two groups.

4. Cephalosporins in different dose regimens

Investigators addressed comparisons subsumed under this broad heading most often in single small trials and did not provide data on most of the outcome measures, including total adverse effects. When outcome data were reported, we found no evidence of a difference between groups in the incidence of postoperative infection, the need for therapeutic antibiotics, and length of hospital stay for each of these comparisons.

Overall completeness and applicability of evidence

Overall, the data demonstrate that prophylactic antibiotics are more effective than placebo in preventing postoperative infection, reducing the requirement for therapeutic antibiotics, and shortening length of hospital stay in women undergoing elective vaginal or abdominal hysterectomy. However, few studies reported data on adverse effects associated with the use of antibiotic prophylaxis; therefore, we were unable to determine whether prophylactic antibiotics are associated with significant adverse effects. However, as prophylaxis is usually given as a single shot, the adverse effect rate might truly be low.

Similarly, few studies compared antibiotics head-to-head; thus we were unable to determine which specific antibiotic is most effective, or whether individual antibiotics are similar with respect to effectiveness and safety.

We identified few studies evaluating antibiotics in different combinations, dose regimens, and routes of administration. Thus we could not determine whether it is possible to sustain the effectiveness of antibiotics while reducing adverse effects by combining lower doses of two different antibiotics, or by using certain dose regimens or routes of administration.

None of the included studies investigated laparoscopic hysterectomy (total or subtotal laparoscopic hysterectomy or laparoscopically assisted vaginal hysterectomy). Thus the findings of this review are not applicable to this type of hysterectomy, which has been performed increasingly over the past decade.

One should interpret the results on "length of hospital stay" and "urinary tract infections" with caution, as some studies reporting these outcomes were conducted decades ago. Meanwhile, hospital stay has decreased tremendously over the past few decades owing to improved knowledge of postoperative care and doctors' adaptation of the principles of "early recovery after surgery" (ERAS®). These include striving postoperatively for early mobilisation, normalisation of oral intake, and early removal of urinary catheters, thus decreasing length of hospital stay, risk of nosocomial infection, and risk of UTI. For example, it is very rare nowadays for healthy patients who undergo uncomplicated vaginal hysterectomy to be admitted to a hospital for longer than three days, whereas the studies in Analysis 1.9 show mean hospitalisation duration of 8.3 to 11.9 days.

Quality of the evidence

Most studies considered for this review were of poor quality in relation to risk of bias. We excluded many studies owing to unclear design, lack of double-blinding, or non-blinding. Among the included studies, very few clearly described their methods of sequence generation and allocation concealment. For most comparisons, effect estimates were associated with imprecision due to small sample sizes and wide confidence intervals.

We assessed the quality of evidence for the review's main comparison (any antibiotics vs placebo for vaginal and abdominal hysterectomy). The quality of evidence for our primary outcome ranged from very low to moderate. The main limitations in the body of evidence were risk of bias (due to poor reporting of sequence generation and allocation concealment), serious imprecision (associated with small sample size and low event rates, leading to wide confidence intervals), and inadequate reporting of adverse effects. We rated the quality of evidence for head-to head comparisons of antibiotics and for dose comparisons as very low owing to imprecision related to wide confidence intervals and low event rates, and to risk of bias associated with poor reporting of study methods.

We examined the presence of publication or reporting bias in a

funnel plot for five subgroups in one of the comparisons (any antibiotics vs placebo) and found evidence suggesting a tendency towards publication or reporting bias, with smaller studies likely to report beneficial effects with antibiotic prophylaxis. However, we did not consider that evidence of publication bias was strong enough to necessitate downgrading the quality of evidence.

Potential biases in the review process

Although we undertook a comprehensive search to ensure that we identified potentially eligible studies, it is possible that some eligible studies might have been left out in the course of the search and selection process.

Agreements and disagreements with other studies or reviews

Clinical guidelines (ACOG 2009; Deffieux 2015; SIGN 2008) and narrative reviews (Clifford 2012; Hodges 2014; Steiner 2017) recommend antibiotic prophylaxis for women undergoing hysterectomy, and pragmatically opt to advise cephalosporins as a first choice. However, the evidence base for first-line cephalosporins is limited by the lack of recent trials. Moreover, no randomised controlled trials (RCTs) at all examined the topic of antibiotic prophylaxis for laparoscopic hysterectomy.

Much of the evidence is very old: For example, Clifford 2012 is a narrative review that refers to old studies such as Duff 1982 and Tanos 1994 to recommend prophylactic antibiotics for hysterectomy, and Larsson 2002 to recommend preoperative treatment of bacterial vaginosis. We excluded both Larsson 2002 and Tanos 1994 from the current review because investigators utilised extended seven-day prophylaxis as well as an historical comparison group (respectively).

A more recent review (Morrill 2013) investigated antibiotic prophylaxis in selected gynaecological surgeries, including hysteroscopic and cervical surgery, while *excluding* hysterectomy (Morrill 2013). Review authors concluded that evidence provides a strong case for prophylactic antibiotics for abdominal gynaecological surgery but acknowledged lack of evidence for their use in vaginal surgery. For laparoscopic surgery, we found no advantage of prophylactic antibiotics, but high-quality evidence was lacking and results were hampered by heterogeneity of the population; women underwent widely varying surgeries, from diagnostic laparoscopy to ovarian cystectomy or extended endometriosis surgery.

A large retrospective cohort of 21,358 hysterectomies performed in the United States (Upall 2016) investigated associations between a composite outcome of "any surgical site infection" and classes of antibiotics administered preoperatively. Investigators found that women receiving beta-lactam antibiotic regimens (i.e. first- or second-generation cephalosporins, ampicillin plus sulbactam, or ertapenem) had lower risk of surgical site infection than women given a beta-lactam alternative (i.e. clindamycin combination, gentamycin combination, metronidazole combination) or a non-standard regimen (i.e. clindamycin, gentamycin, or aztreonam, or another antibiotic alone). We found comparable benefit for cephalosporins but only for vaginal hysterectomy when compared with antiprotozoal alone.

Several published systematic reviews and meta-analyses of the use of antibiotics in hysterectomy have reported mainly on the same set of included RCTs.

Wttewaall-Evelaar 1990 meta-analysed 17 randomised blinded placebo-controlled trials of prophylaxis for elective abdominal hysterectomy, all published between 1986 and 1988. In most cases, the antibiotics used were cephalosporins. Review authors concluded that prophylaxis significantly reduced levels of infection ($p < 0.001$; no odds ratio reported), and that additional placebo-controlled trials were not warranted. Mittendorf 1993 meta-analysed 31 English-language RCTs published from 1972 to 1986, and concluded that antibiotic prophylaxis reduced the rate of serious infection after abdominal hysterectomy from 21.1% to 9% ($P = 0.00001$; no odds ratio reported in text). Trials that used different routes of administration and differing prophylaxis regimens, varying from a single dose to five days' duration, were pooled. Tanos 1994 meta-analysed 17 "controlled or comparative" trials conducted between 1978 and 1990 to investigate single or one-day prophylactic regimens of intravenous or intramuscular cephalosporins for abdominal hysterectomy. It is unclear whether all of the included trials were randomised, and some trials included oncology patients among their participants. Again, results clearly favoured the use of prophylaxis (odds ratio (OR) 0.35, 95% confidence interval (CI) 0.3 to 0.4).

Two of these meta-analyses combined results from studies that included very different participants or interventions. The other (Wttewaall-Evelaar 1990) was more rigorous but did not include any of the numerous studies carried out since 1986.

More recently, a systematic review by Costa and Krauss-Silva meta-analysed double-blinded, placebo-controlled trials on the use of antibiotic prophylaxis for elective, non-radical abdominal hysterectomy (Costa 2004). Review authors meta-analysed a total of 16 studies published between 1977 and 2003, but it is important to note that the most recent study was published in 1998, and the 15 remaining RCTs were published in 1988 or earlier. Review authors concluded that use of antibiotic prophylaxis is effective for prevention of postoperative infection (risk ratio (RR) 0.49, 95% CI 0.41 to 0.59). They concluded that no evidence showed benefit for multiple- versus single-dose prophylaxis.

We identified no RCTs on the use of antibiotics in laparoscopic hysterectomy for inclusion in this review. A recent review by Lachiewicz on laparoscopic hysterectomy recommends use of antibiotics, with dose adjusted to body weight (increased dosage when patients weigh more than 120 kilograms), and use of antiprotozoals. The latter recommendation consists of using antiprotozoals routinely or after screening for bacterial vaginosis before surgery in which the vaginal-abdominal barrier was breached (Lachiewicz 2015). However, arguments for these recommenda-

tions in laparoscopy derive from authority-based guidelines or non-randomised trials (Bratzler 2013; Soper 1993).

Findings from the studies above are consistent with the findings of this review, which found evidence that antibiotic prophylaxis is effective in preventing postoperative infection in women undergoing elective vaginal or abdominal hysterectomy.

AUTHORS' CONCLUSIONS

Implications for practice

Antibiotic prophylaxis appears to be effective in preventing postoperative infection in women undergoing elective vaginal or abdominal hysterectomy, regardless of the dose regimen. However, evidence was insufficient to show whether their use influences rates of adverse effects. Similarly, evidence was insufficient to show which (if any) individual antibiotic, dose regimen, or route of administration is safest and most effective. In interpreting results, it is important to realise that the most recent of the included studies was published 14 years ago, at the time of our search. Thus findings from included studies might not reflect current practice in perioperative and postoperative care or might not show locoregional antimicrobial resistance patterns.

Implications for research

More studies including large numbers of women and based on sound methods are needed to detect meaningful differences in efficacy between various antibiotics and to properly evaluate adverse effects associated with their use as prophylaxis for women undergoing elective hysterectomy. Also needed are more studies investigating various antibiotics in different combinations, dose regimens, and routes of administration to determine which combinations, dose regimens, and routes of administration are associated with better efficacy and fewer adverse effects. Laparoscopic hysterectomy is now commonly performed; thus future research should focus on the use of prophylaxis in laparoscopic hysterectomy (total or subtotal laparoscopic hysterectomy or laparoscopically assisted vaginal hysterectomy).

In addition, trial publications should adequately report trial methods in accordance with the CONSORT statement.

ACKNOWLEDGEMENTS

The review authors would like to thank all members of the Cochrane Gynaecology and Fertility Group for valuable support during preparation of this review. The review authors also wish to thank Dr Karim Calis for contributions to the protocol, and Dr Irena Zakarija-Grkovic for assistance in translating Vecek 1993 from Croatian and extracting data.

REFERENCES

References to studies included in this review

Benigno 1986 *{published data only}*
Benigno BB, Evrard J, Faro S, Ford LC, LaCroix G, Lawrence WD, et al. A comparison of piperacillin, cephalothin and cefoxitin in the prevention of postoperative infections in patients undergoing vaginal hysterectomy. *Surgery Gynecology & Obstetrics* 1986;**163**(5):421–7.

Boodt 1990 *{published data only}*
Boodt PJ, Snijders WP, Janknegt R. Single-dose prophylaxis in hysterectomies. An interim analysis. *Pharmaceutisch Weekblad Scientific Edition* 1990;**12**(6A):280–3.

Chongsomchai 2002 *{published data only}*
Chongsomchai C, Lumbiganon P, Anansuwanchai J, Ounchai J. Prophylactic antibiotics in abdominal hysterectomy. XVI FIGO World Congress of O & G, 2000 Sept, Washington DC. Washington DC, 2000.
Chongsomchai C, Lumbiganon P, Thinkhamrop J, Ounchai J, Vudhikamraksa N. Placebo-controlled, double-blind, randomized study of prophylactic antibiotics in elective abdominal hysterectomy. *Journal of Hospital Infection* 2002; **52**(4):302–6.

Crosthwaite 1985 *{published data only}*
Crosthwaite AH, Hurse AB, McDonald IA, Miles HM, Pavillard ER. Single dose tinidazole prophylaxis in hysterectomy. *Australian & New Zealand Journal of Obstetrics & Gynaecology* 1985;**25**(1):55–8.

Davi 1985 *{published data only}*
Davi E, Ausin J, Escofet C, et al. Cefoxitin versus placebo in the prophylaxis of postoperative infection in abdominal hysterectomy [abstract]. *Archives of Gynecology* 1985;**237** (Suppl).

Dhar 1993 *{published data only}*
Dhar KK, Dhall GI, Ayyagari A. Single dose tinidazole prophylaxis in vaginal hysterectomy. *International Journal of Gynaecology & Obstetrics* 1993;**42**(2):117–20.

Dhar 1993a *{published data only}*
Dhar KK, Dhall GI, Ayyagari A. Tinidazole prophylaxis in elective abdominal hysterectomy. *International Journal of Gynaecology & Obstetrics* 1993;**42**(2):121–5.

Duff 1982 *{published data only}*
Duff P. Antibiotic prophylaxis for abdominal hysterectomy. *Obstetrics & Gynecology* 1982;**60**(1):25–9.

Egarter 1988 *{published data only}*
Egarter C, Fitz R, Brehm R, Husslein P. Prophylactic perioperative use of clindamycin and metronidazole in vaginal hysterectomy without pelvic floor repair. *Archives of Gynecology & Obstetrics* 1988;**244**(1):53–7.

Eron 1989 *{published data only}*
Eron LJ, Gordon SF, Harvey LI, Sites JG. A trial using early preoperative administration of cefonicid for antimicrobial prophylaxis with hysterectomies. *Annals of Pharmacotherapy* 1989;**23**(9):655–8.

Faro 1988 *{published data only}*
Faro S, Pastorek JG, Aldridge KE, Nicaud S, Cunningham G. Randomized double-blind comparison of mezlocillin versus cefoxitin prophylaxis for vaginal hysterectomy. *Surgery Gynecology & Obstetrics* 1988;**166**(5):431–5.

Gall 1983 *{published data only}*
Gall SA, Hill G. Cefoperazone as a prophylactic agent in abdominal hysterectomy. *Reviews of Infectious Diseases* 1983; **5**(Suppl 1):s200–1.

Hager 1989 *{published data only}*
Hager WD, Sweet RL, Charles D, Larsen B. Comparative study of mezlocillin versus cefotaxime single-dose prophylaxis in patients undergoing vaginal hysterectomy. *Current Therapeutic Research, Clinical & Experimental* 1989; **45**(1):63–9.

Hedican 1976 *{published data only}*
Hedican RE Jr, Sarto GE. Use of prophylactic antibiotic and vaginal cuff inflammation. *Journal of the Iowa Medical Society* 1976;**66**(9):373-4, 378.

Hemsell 1980 *{published data only}*
Hemsell DL, Cunningham FG, Kappus S, Nobles B. Cefoxitin for prophylaxis in premenopausal women undergoing vaginal hysterectomy. *Obstetrics & Gynecology* 1980;**56**(5):629–34.

Hemsell 1983 *{published data only}*
Hemsell DL, Reisch J, Nobles B, Hemsell PG. Prevention of major infection after elective abdominal hysterectomy: individual determination required. *American Journal of Obstetrics & Gynecology* 1983;**147**(5):520–8.

Hemsell 1984 *{published data only}*
Hemsell DL, Heard ML, Nobles BJ, Hemsell PG. Single-dose cefoxitin prophylaxis for premenopausal women undergoing vaginal hysterectomy. *Obstetrics & Gynecology* 1984;**63**(3):285–90.

Hemsell 1985 *{published data only}*
Hemsell DL, Hemsell PG, Heard ML, Nobles BJ. Preoperative cefoxitin prophylaxis for elective abdominal hysterectomy. *American Journal of Obstetrics & Gynecology* 1985;**153**(2):225–6.

Hemsell 1985a *{published data only}*
Hemsell DL, Hemsell PG, Nobles BJ. Doxycycline and cefamandole prophylaxis for premenopausal women undergoing vaginal hysterectomy. *Surgery Gynecology & Obstetrics* 1985;**161**(5):462–4.

Hemsell 1987 *{published data only}*
Hemsell DL, Bawdon RE, Hemsell PG, Nobles BJ, Johnson ER, Heard MC. Single-dose cephalosporin for prevention of major pelvic infection after vaginal hysterectomy: cefazolin versus cefoxitin versus cefotaxime. *American Journal of Obstetrics & Gynecology* 1987;**156**(5):1201–5.

Hemsell 1989 *{published data only}*
Hemsell DL, Johnson ER, Heard MC, Hemsell PG, Nobles BJ, Bawdon RE. Single-dose piperacillin versus triple-dose cefoxitin prophylaxis at vaginal and abdominal hysterectomy. *Southern Medical Journal* 1989;**82**(4): 438–42.

Henriksson 1998 *{published data only}*
Henriksson L, Colling-Saltin AS, Frick G, Kullander S, Sandholm LE, Ursing J, et al. Metronidazole prophylaxis to prevent infections after total abdominal hysterectomy. *Acta Obstetricia et Gynecologica Scandinavica* 1998;**77**(1):116–9.

Holman 1978 *{published data only}*
Holman JF, McGowan JE, Thompson JD. Perioperative antibiotics in major elective gynecologic surgery. *Southern Medical Journal* 1978;**71**(4):417–20.

Houang 1984 *{published data only}*
Houang ET. The trials of antibiotic prophylaxis at Chelsea Hospital for Women. *Journal of Obstetrics & Gynaecology* 1984;**5**(Suppl 1):S20–2.
Houang ETW, Howell CR, Chapman M. Ampicillin combined with sulbactam or metronidazole for single-dose chemoprophylaxis in major gynaecological surgery. *Journal of Antimicrobial Chemotherapy* 1984;**14**(5):529–35.
MEDLINE: PBS Workform: MDG form for journal articles

Houang 1984a *{published data only}*
Houang ET. The trials of antibiotic prophylaxis at Chelsea Hospital for women. *Journal of Obstetrics & Gynaecology* 1984;**5**(Suppl 1):S20–2.

Jaffe 1985 *{published data only}*
Jaffe R, Altaras M, Fejgin M, Ben-Aderet N. Prophylactic single-dose co-trimoxazole for prevention of urinary tract infection after abdominal hysterectomy. *Chemotherapy* 1985;**31**(6):476–9.

Janssens 1982 *{published data only}*
Janssens D, Peeters N, Sauwaert E, Cattersel B. Tinidazole in the prevention of post-operative wound infection after hysterectomy. *Journal of Antimicrobial Chemotherapy* 1982; **10**(Suppl. A):87–94.

Kauer 1990 *{published data only}*
Kauer FM, Wijma J, Manson WL. Vaginal hysterectomy: cefuroxime, metronidazole or both?. *Pharmaceutisch Weekblad Scientific Edition* 1990;**12**(6A):284–8.

Ledger 1973 *{published data only}*
Ledger WJ, Sweet RL, Headington JT. Prophylactic cephaloridine in the prevention of postoperative pelvic infections in premenopausal women undergoing vaginal hysterectomy. *American Journal of Obstetrics & Gynecology* 1973;**115**(6):766–74.

Mathews 1977 *{published data only}*

Mathews DDR, Cooper J. A double-blind trial of single-dose chemoprophylaxis with co-trimoxazole during total abdominal hysterectomy. *British Journal of Obstetrics & Gynaecology* 1977;**84**(12):894–7. MEDLINE: PBS Workform: MDG form for journal articles

Mathews 1979 *{published data only}*

Mathews DDA, Argawal V, Gordon AM, Cooper J. A double-blind trial of single-dose chemoprophylaxis with co-trimoxazole during vaginal hysterectomy and repair. *British Journal of Obstetrics & Gynaecology* 1979;**86**(9):737–40. MEDLINE: PBS Workform: MDG form for journal articles

Mendelson 1979 *{published data only}*

Mendelson J, Portnoy J, De Saint Victor JR, Gelfand MM. Effect of single and multidose cephradine prophylaxis on infectious morbidity of vaginal hysterectomy. *Obstetrics & Gynecology* 1979;**53**(1):31–5.

Polk 1980 *{published data only}*

Polk BF, Tager IB, Shapiro M, Goren-White B, Goldstein P, Schoenbaum SC. Randomised clinical trial of perioperative cefazolin in preventing infection after hysterectomy. *Lancet* 1980;**1**(8166):437–40.

Schepers 1981 *{published data only}*

Schepers JP, Merkus F. Cefoxitin sodium: double-blind, placebo-controlled prophylactic study in premenopausal patients undergoing abdominal hysterectomy. *Clinical Pharmacology & Therapeutics* 1981;**29**(2):230–90.

Smith 1984 *{published data only}*

Smith ARB, Stanbridge TN, Morewood GA, Cooper J. Double blind trial with a single intramuscular dose of co-trimoxazole before total abdominal hysterectomy. *Journal of Obstetrics & Gynaecology* 1984;**5**(1):49–52.

Stage 1982 *{published data only}*

Stage AH, Glover DD, Vaughan JE. Low-dose cephradine prophylaxis in obstetric and gynecologic surgery. *Journal of Reproductive Medicine* 1982;**27**(3):113–9.

Vincelette 1983 *{published data only}*

Ti TY, Vincelette J, Aoki F, et al. Randomized clinical trial of prophylactic metronidazole in vaginal hysterectomy. *Clinical & Investigative Medicine (Medecine Clinique et Experimentale)* 1981;**4**(2).

Vincelette J, Finkelstein F, Aoki FY, Ogilvie RI, Richards GK, Seymour RJ. Double-blind trial of perioperative intravenous metronidazole prophylaxis for abdominal hysterectomy. *Canadian Medical Association Journal* 1982; **127**(2):119–23.

Vincelette J, Finkelstein F, Aoki FY, Ogilvie RI, Richards GK, Seymour RJ. Double-blind trial of perioperative intravenous metronidazole prophylaxis for abdominal hysterectomy. *Clinical & Investigative Medicine* 1981;**4**(2): 119–23.

* Vincelette J, Finkelstein F, Aoki FY, Ti TY, Ogilvie RI, Richard GK, et al. Double-blind trial of perioperative intravenous metronidazole prophylaxis for abdominal and vaginal hysterectomy. *Surgery* 1983;**93**(1II):185–9.

References to studies excluded from this review

Adno 1979 *{published data only}*

Adno J, Cassel R. The effect of prophylactic tinidazole on the anaerobic vaginal flora in patients undergoing gynaecological surgery. *South African Medical Journal* 1979; **56**(14):565–8.

Allen 1972 *{published data only}*

Allen JL, Rampone JF, Wheeless CR. Use of a prophylactic antibiotic in elective major gynecologic operations. *Obstetrics & Gynecology* 1972;**39**(2):218–24.

Appelbaum 1978 *{published data only}*

Appelbaum PC, Moodley J, Chatterton SA, Cowan DB, Africa CW. Metronidazole in the prophylaxis and treatment of anaerobic infection. *South African Medical Journal* 1978; **54**(17):703–6.

Appelbaum 1980 *{published data only}*

Appelbaum PC, Moodley J, Chatterton SA, Cowan DB, Africa CW. Tinidazole in the prophylaxis and treatment of anaerobic infection. *Chemotherapy* 1980;**26**(2):145–51.

Batres 1980 *{published data only}*

Batres F, Barclay DL. Minocycline (Minocin(TM)) prophylaxis in vaginal hysterectomy. *Current Therapeutic Research, Clinical & Experimental* 1980;**28**(3 I):387–93.

Bian 1987 *{published data only}*

Bian DH. Use of prophylactic antibiotics in total abdominal hysterectomy. *Chung-Hua Fu Chan Ko Tsa Chih [Chinese Journal of Obstetrics & Gynecology]* 1987;**22**(3):138-40, 189.

Bivens 1975 *{published data only}*

Bivens MD, Neufeld J, McCarty WD. The prophylactic use of Keflex and Keflin in vaginal hysterectomy. *American Journal of Obstetrics & Gynecology* 1975;**122**(2):169–75.

Britt 1978 *{published data only}*

Britt MR, Burke JP, Weidner M, Johnson GH, Hebertson R. The use of cefamandole prophylaxis in vaginal hysterectomy patients. Clinical Research. 1978; Vol. 26:390A.

Brouwer WK, Hoo2 *{published data only}*

Brouwer WK, Hoogkamp-Korstanje JAA, Kuiper KM. Single shot ciprofloxacin, cefuroxime + metronidazole and placebo as prophylaxis in vaginal hysterectomy. *International Journal of Experimental and Clinical Chemotherapy* 1990;**3** (3):172–7.

Brown 1986 *{published data only}*

Brown E, Depares J, Robertson A. Antimicrobial prophylaxis for hysterectomy - a prospective randomised trial [abstract]. 24th British Congress of Obstetrics and Gynaecology. 1986.

Brown 1988 *{published data only}*

Brown EM, Depares J, Robertson AA, Jones S, Hughes AB, Coles EC, et al. Amoxicillin-clavulanic acid (Augmentin) versus metronidazole as prophylaxis in hysterectomy: a prospective, randomized clinical trial. *British Journal of Obstetrics & Gynaecology* 1988;**95**(3):286–93.

Cartana J, Yarn2 *{published data only}*

Cartana J, Yarnoz MC, Ruiz de Gopegui RM, Mascaro M, Cortes J. Antibiotic prophylaxis with piperacillin in vaginal

hysterectomy. Study of 1 dose versus 3 doses. *Enfermedades Infecciosas y Microbiologia Clinica* 1990;**8**(4):218–21.

Chimura 1987 ***{published data only}***
Chimura T, Sato S, Suzuki T, Ito K, Sumiyoshi Y, Kanasugi H, et al. Prophylactic effects of a combined use of a cephem antibiotic, latamoxef, and tobramycin on postoperative infection in obstetrics and gynecology. *Japanese Journal of Antibiotics* 1987;**40**(7):1253–8.

Ciraru-Vigneron 1988 ***{published data only}***
Ciraru-Vigneron N, Engelman P, Bercau G, Sauvanet E, Bitton C. The value of antibiotic prophylaxis using cefotetan in high-risk abdominal hysterectomy. Apropos of a prospective randomized study of 71 patients. *Revue Francaise de Gynecologie et d'Obstetrique* 1988;**83**(11): 737–40.

de Lalla1993 ***{published data only}***
de Lalla F, Scalambrino S, Tassi PG, Alegente G, Conturso R, Doregatti L, et al. Piperacillin versus cefotetan as single-dose prophylaxis in abdominal hysterectomy: a prospective, randomized, multicenter study. *Journal of Chemotherapy* 1993;**5**(2):113–8.

Ferrari 1980 ***{published data only}***
Ferrari A, Ferrari N, Molteni P, Sartor V, Baccolo M, Marzi MM, et al. Short-term antibiotic prophylaxis in 665 cases of vaginal and abdominal hysterectomy: controlled clinical study. *Annali di Ostetricia, Ginecologia, Medicina Perinatale* 1980;**101**(3):149–58.

Fischbach 1988 ***{published data only}***
Fischbach F, Voss A, Loos W, Thurmayr R, Graeff H. Peri-operative preventive use of antibiotics in abdominal hysterectomy. *Geburtshilfe und Frauenheilkunde* 1988;**48** (12):889–92.

Forney 1976 ***{published data only}***
Forney JP, Morrow CP, Townsend DE, Disaia PJ. Impact of cephalosporin prophylaxis on conization-vaginal hysterectomy morbidity. *American Journal of Obstetrics & Gynecology* 1976;**125**(1):100–3.

Friese 1988 ***{published data only}***
Friese S, Pricker GJ, Willems FT, Loriaux SM. Single-dose prophylaxis in gynaecological surgery: amoxicillin/ clavulanic acid versus the combination of cefuroxim and metronidazole in a randomized prospective comparison. *European Journal of Obstetrics, Gynecology, & Reproductive Biology* 1988;**27**(4):313–17. MEDLINE: PBS Workform: MDG form for journal articles

Friese 1989 ***{published data only}***
Friese S, Willems FTC, Loriaux SM, Meewis J. Prophylaxis in gynaecological surgery: a prospective randomized comparison between single dose prophylaxis with amoxicillin/clavulanate and the combination of cefuroxime and metronidazole. *Journal of Antimicrobial Chemotherapy* 1989;**24**(Suppl B):213–6.

Fujiwara 1994 ***{published data only}***
Fujiwara M, Koike H, Kohno I. Evaluation of prophylactic administration of antibiotics following total abdominal hysterectomy. *Chemotherapy* 1994;**42**(6):735–9.

Goodlin 1974 ***{published data only}***
Goodlin RC. Letter. Prophylactic antibiotics. *Obstetrics & Gynecology* 1974;**44**(2):310–1.

Gordon 1982 ***{published data only}***
Gordon SF, Russell J. A randomized controlled study comparing ceftizoxime, cefamandole, and cefoxitin in obstetric and gynecological surgery: a preliminary report. *Journal of Antimicrobial Chemotherapy* 1982;**10**(Suppl C): 289–92.

Harms 1987 ***{published data only}***
Harms E, Schumacher C. Effectiveness of perioperative prophylaxis with ceftriaxone and cefotaxime in vaginal hysterectomy with and without anterior and/or posterior colporrhaphy. *Chemioterapia* 1987;**6**(2 Suppl):622–3.

Haverkorn 1987 ***{published data only}***
Haverkorn MJ. A comparison of single-dose and multi-dose metronidazole prophylaxis for hysterectomy. *Journal of Hospital Infection* 1987;**9**(3):249–54.

Hayashi 2000 ***{published data only}***
Hayashi H, Yaginuma Y, Yamashita T, Morizaki A, Ishiya T, Katou Y, et al. Prospective randomized study of antibiotic prophylaxis for nonlaparotomy surgery in benign conditions. *Chemotherapy* 2000;**46**(3):213–8.

Hemsell 1990a ***{published data only}***
Hemsell DL, Johnson ER, Hemsell PG, Nobles BJ, Heard MC. Cefazolin for hysterectomy prophylaxis. *Obstetrics & Gynecology* 1990;**76**(4):603–6.

Huang 1987 ***{published data only}***
Huang RL. Prophylactic use of antibiotics in gynecologic abdominal surgery: a prospective study of 234 cases. *Chung-Hua Fu Chan Ko Tsa Chih [Chinese Journal of Obstetrics & Gynecology].* 1987;**22**(3):134-7, 189.

Ireland 1982 ***{published data only}***
Ireland D, Tacchi D, Bint AJ. Effect of single-dose prophylactic co-trimoxazole on the incidence of gynaecological postoperative urinary tract infection. *British Journal of Obstetrics & Gynaecology* 1982;**89**(7):578–80.

Jacobson 1982 ***{published data only}***
Jacobson JA, Hebertson R, Kasworm E. Comparison of ceforanide and cephalothin prophylaxis for vaginal hysterectomies. *Antimicrobial Agents & Chemotherapy* 1982; **22**(4):643–7.

Jennings 1978 ***{published data only}***
Jennings RH. Prophylactic antibiotics in vaginal and abdominal hysterectomy. *Southern Medical Journal* 1978;**71** (3):251–4.

Jones RN, Wojes2 ***{published data only}***
Jones RN, Wojeski W, Bakke J, Porter C, Searles M. Antibiotic prophylaxis of 1,036 patients undergoing elective surgical procedures. A prospective, randomized comparative trial of cefazolin, cefoxitin, and cefotaxime in a prepaid medical practice. *American Journal of Surgery* 1987;**153**(4): 341–6.

Jyothi 2010 *{published data only}*
Jyothi S, Neetha V, Pratap K, Asha K. Antibiotic prophylaxis for hysterectomy and cesarean section: amoxicillin-clavulanic acid versus cefazolin. *Journal of Obstetrics and Gynecology of India* 2010;**60**(5):419–23.

Kauppila 1983 *{published data only}*
Kauppila A, Rautiainen H, Tuimala R. Prevention of posthysterectomy infection with a combination of preoperative vaginal and perioperative intravenous administration of metronidazole. *Annales Chirurgiae et Gynaecologiae* 1983;**72**(4):214–7. MEDLINE: PBS Workform: MDG form for journal articles

Khan 1981 *{published data only}*
Khan MS, Begg HB, Frampton J, Hughes TB. A comparative study of the prophylactic effect of one dose and two dose intravenous metronidazole therapy in gynaecological surgery. *Scandinavian Journal of Infectious Diseases Supplementum* 1981;**26**:115–7.

Knippenberger 1984 *{published data only}*
Knippenberger H, Heinrich D, Wilbrand K. Antibiotic prophylaxis in hysterectomy by means of substances with selective effects. *Der Klinikarzt* 1984;**13**:375–84.

Kunz 1982 *{published data only}*
Kunz J, Genswein A. Advantages and disadvantages of peri-surgical antibiotic prophylaxis in routine gynecologic operations: long-term versus short-term prophylaxis. *Schweizerische Rundsdchau fur Medizinische Praxis* 1982;**71** (1):36–46.

Larsson 2002 *{published data only}*
Larsson PG, Carlsson B. Does pre- and postoperative metronidazole treatment lower vaginal cuff infection rate after abdominal hysterectomy among women with bacterial vaginosis?. *Infectious Diseases in Obstetrics & Gynecology* 2002;**10**(3):133–40.

Littlejohn 1985 *{published data only}*
Littlejohn Jr TW, Evrard HM, Moonsammy G. Comparison of cefonicid and cefoxitin for prevention of infection following vaginal hysterectomy. *Advances in Therapy* 1985; **2**(5):240–9.

Luke 1999 *{published data only}*
Luke DR. Oral trovafloxacin versus intravenous cefoxitin in elective hysterectomy. *Drugs* 1999;**58**(Suppl 2):284–5. MEDLINE: PBS Workform: MDG form for journal articles

Maki 1984 *{published data only}*
Maki DG, Lammers JL, Aughey DR. Comparative studies of multiple-dose cefoxitin vs. single-dose cefonicid for surgical prophylaxis in patients undergoing biliary tract operations or hysterectomy. *Reviews of Infectious Diseases* 1984;**6**(4):s887–95.

Mamsen 1992 *{published data only}*
Mamsen A, Hansen V, Moller BR. A prospective randomized double-blind trial of ceftriaxone versus no treatment for abdominal hysterectomy. *European Journal of Obstetrics, Gynecology, & Reproductive Biology* 1992;**47**(3): 235–8.

Mangioni 1991 *{published data only}*
Mangioni C, Bianchi L, Bolis PF, Lomeo AM, Mazzeo F, Ventriglia L, Scalambrino S. Multicenter trial of prophylaxis with clindamycin plus aztreonam or cefotaxime in gynecologic surgery. *Reviews of Infectious Diseases* 1991; **13**(7):s621–5.

Mansani 1984 *{published data only}*
Mansani FE, Caltabiano M, Condemi V, Scarpignato C. Short- or long-term antibiotic prophylaxis in obstetric and gynecologic laparotomy?. *Acta Bio-Medica de l'Ateneo Parmense* 1984;**55**(3-4):147–51.

Manthorpe 1982 *{published data only}*
Manthorpe T, Justesen T. Metronidazole prophylaxis in abdominal hysterectomy. A double-blind controlled trial. *Acta Obstetricia et Gynecologica Scandinavica* 1982;**61**(3): 243–6.

Marsden 1985 *{published data only}*
Marsden DE, Cavanagh D, Wisniewski BJ, Roberts WS, Lyman GH. Factors affecting the incidence of infectious morbidity after radical hysterectomy. *American Journal of Obstetrics & Gynecology* 1985;**152**(7 Pt 1):817–21.

Matkaris 1991 *{published data only}*
Matkaris M, Markantes K, Stayannis K, Iatrakis G, Kourounis G, Tzingounis V. Reduction of hospital cost and administration of prophylactic antibiotherapy in gynecological surgery. [comment]. *Israel Journal of Medical Sciences* 1991;**27**(3):134–6.

Mattheussens 1985 *{published data only}*
Mattheussens OJA, Goormans E, Branolte JH. Effects of two different prophylactic antibiotic regimens on infection morbidity following vaginal hysterectomy. *Archives of Gynecology* 1985;**237**(Suppl):91.

McDonald 1984 *{published data only}*
McDonald PJ, Sanders T, Higgins G, Finlay-Jones L, Hakendorf M, Turnidge J, et al. Antibiotic prophylaxis in hysterectomy - cefotaxime compared to ampicillin-tinidazole. *Journal of Antimicrobial Chemotherapy* 1984;**14** (Suppl B):223–30.

McDonald 1988 *{published data only}*
McDonald PJ, Sanders R, Turnidge J, Hakendorf P, Jolley P, McDonald H, et al. Optimal duration of cefotaxime prophylaxis in abdominal and vaginal hysterectomy. *Drugs* 1988;**35**(2):216–20.

McGregor 1994 *{published data only}*
McGregor JA, Phillips LE, Roy S, Dunne JT, Warwaruk AS, Johnston DW, et al. Results of a double-blind, placebo-controlled clinical trial program of single-dose ceftizoxime versus multiple-dose cefoxitin as prophylaxis for patients undergoing vaginal and abdominal hysterectomy. *Journal of the American College of Surgeons* 1994;**178**(2):123–31.

Mele 1985 *{published data only}*
Mele G, Greco P, Gadaleta G, et al. Clinical evaluation of short-term prophylaxis with 2 antibiotics in gynecologic surgery. *Giornale Italiano di Ostetricia e Ginecologia* 1985;**7** (3):241–4.

Mele 1988 *{published data only}*
Mele G, Gargano G, Greco P, Tartagni M. Antimicrobial prophylaxis for vaginal hysterectomy: comparison of two regimens. *Clinical & Experimental Obstetrics & Gynecology* 1988;**15**(4):174–7.

Mercer 1988 *{published data only}*
Mercer LJ, Murphy HJ, Ismail MA, Hajj SN. A comparison of cefonicid and cefoxitin for preventing infections after vaginal hysterectomy. *Journal of Reproductive Medicine* 1988;**33**(2):223–6.

Mickal 1980 *{published data only}*
Mickal A, Curole D, Lewis C. Cefoxitin sodium: double-blind vaginal hysterectomy prophylaxis in premenopausal patients. *Obstetrics & Gynecology* 1980;**56**(2):222–5.

Moroni 1979 *{published data only}*
Moroni M, Baccolo M, Cavalli G, Belloni C, Ferrari N, Sartor V. Short-term antibiotic prophylaxis of mixed infections during hysterectomy. *Progress in Clinical & Biological Research* 1979;**35**:43–52.

Moroni 1984 *{published data only}*
Moroni M, Mangioni C, Ortisi G, Marca G. Thiamphenicol in the prophylaxis and treatment of mixed infections of the female genital tract. *Sexually Transmitted Diseases* 1984;**11** (4 Suppl):444–8.

Mozzillo 1989 *{published data only}*
Mozzillo N, Dionigi lR, Ventriglia L. Multicenter study of aztreonam in the prophylaxis of colorectal, gynecologic and urologic surgery. *Chemotherapy* 1989;**35**(1):58–71.

Multicenter 1989 *{published data only}*
The Multicenter Study Group. Single-dose prophylaxis in patients undergoing vaginal hysterectomy: cefamandole versus cefotaxime. *American Journal of Obstetrics & Gynecology.* 1989;**160**(5 Pt 1):1198–201.

Munck 1989 *{published data only}*
Munck AM, Jensen HK. Preoperative clindamycin treatment and vaginal drainage in hysterectomy. *Acta Obstetricia et Gynecologica Scandinavica* 1989;**68**(3):241–5.

Ohm 1975 *{published data only}*
Ohm MJ, Galask RP. The effect of antibiotic prophylaxis on patients undergoing vaginal operations. I. The effect on morbidity. *American Journal of Obstetrics & Gynecology* 1975;**123**(6):590–6.

Ohm 1976 *{published data only}*
Ohm MJ, Galask RP. The effect of antibiotic prophylaxis on patients undergoing total abdominal hysterectomy. II. Alterations of microbial flora. *American Journal of Obstetrics & Gynecology* 1976;**125**(4):448–54.

Ohm MJ, Galask 2 *{published data only}*
Ohm MJ, Galask RP. The effect of antibiotic prophylaxis on patients undergoing total abdominal hysterectomy. I. Effect on morbidity. *American Journal of Obstetrics & Gynecology* 1976;**125**(4):442–7.

Ohm MJ, Galask 3 *{published data only}*
Ohm MJ, Galask RP. The effect of antibiotic prophylaxis on patients undergoing vaginal operations. II. Alterations of microbial flora. *American Journal of Obstetrics & Gynecology* 1975;**123**(6):597–604.

Olgiati 1980 *{published data only}*
Olgiati ML, Brignoli DM, Nencioni T. Ampicillin as antibiotic prophylaxis in gynecological surgery. *Annali di Ostetricia, Ginecologia, Medicina Perinatale* 1980;**101**(3): 159–67.

Oliva 1990 *{published data only}*
Oliva GC, Fratoni A, Papadia L, Pieroni A, Paparella PL, Mancuso S. Antibiotic prophylaxis in gynecological surgery. *Journal of Chemotherapy* 1990;**2**(5):306–9.

Orr 1988 *{published data only}*
Orr JWJ, Sisson PF, Barrett JM, Ellington JR, Jennings RH, Taylor DL. Single-center study results of cefotetan and cefoxitin prophylaxis for abdominal or vaginal hysterectomy. *American Journal of Obstetrics & Gynecology* 1988;**158**(3 Pt 2):714–6.

Periti 1988 *{published data only}*
Periti P, Mazzei T, Orlandini F, Mini E. Comparison of the antimicrobial prophylactic efficacy of cefotaxime and cephazolin in obstetric and gynaecological surgery. A randomised multicentre study. *Drugs* 1988;**35**(2):133–8.

Periti P, Mazze2 *{published data only}*
Periti P, Mazzei T, Periti E. Prophylaxis in gynaecological and obstetric surgery: a comparative randomised multicentre study of single-dose cefotetan versus two doses of cefazolin. *Chemioterapia* 1988;**7**(4):245–52.

Perri 1986 *{published data only}*
Perri G, D'Aloya P, Mari A, et al. Comparative prospective study on antibiotic prophylaxis in hysterectomy. *Giornale Italiano di Ostetricia e Ginecologia* 1986;**8**(1):31–5.

Phoolcharoen 2012 *{published data only}*
Phoolcharoen N, Nilgate S, Rattanapuntamanee O, Limpongsanurak S, Chaithongwongwatthana S. A randomized controlled trial comparing ceftriaxone with cefazolin for antibiotic prophylaxis in abdominal hysterectomy. *International Journal of Gynecology and Obstetrics* 2012;**119**:11–3. [DOI: 1016/j.ijgo.2012.04.023]

Popkin 1983 *{published data only}*
Popkin DR, Martinez LA, Carswell GA. Metronidazole in the prophylaxis of anaerobic infections in gynecologic surgery. *Surgery* 1983;**93**(1 Pt 2):180–4.

Poulsen 1984 *{published data only}*
Poulsen HK, Borel J, Olsen H. Prophylactic metronidazole or suction drainage in abdominal hysterectomy. *Obstetrics & Gynecology* 1984;**63**(3):291–4.

Poulsen HK, Bor2 *{published data only}*
Poulsen HK, Borel J. T-tube suction drainage and/ or prophylactic two-dose metronidazole in abdominal hysterectomy. *Acta Obstetricia et Gynecologica Scandinavica* 1984;**63**(8):711–4.

Queck 1991 *{published data only}*
Queck M, Weiss E, Berle P. Local administration of metronidazole before hysterectomy - effect on infectious

morbidity. A prospective study. *Geburtshilfe und Frauenheilkunde* 1991;**51**(10):839–42.

Rapp 1982 ***{published data only}***
Rapp RP, Van Nagell JRJ, May JR. A double-blind randomized study of prophylactic antibiotics in vaginal hysterectomy. *Hospital Formulary* 1982;**17**:524.

Rapp 1986 ***{published data only}***
Rapp RP, Connors JE, Hager WD, Donaldson ES, van Nagell JR Jr. Comparison of single-dose moxalactam and a three-dose regimen of cefoxitin for prophylaxis in vaginal hysterectomy. *Clinical Pharmacy* 1986;**5**(12):988–93.

Regallo 1987 ***{published data only}***
Regallo M, Scalambrino S, Landoni F, Consonni R, Mangioni C. Antibiotic prophylaxis of infection after gynecologic surgery: a prospective randomized trial between cefotetan and piperacillin. *Chemioterapia* 1987;**6**(2 Suppl): 624–6.

Reggiori 1996 ***{published data only}***
Reggiori A, Ravera M, Cocozza E, Andreata M, Mukasa F. Prophylaxis with ampicillin before surgery was more effective than penicillin after surgery in rural Africa. *Therapeutics* 1996;**Sep/Oct**:172. MEDLINE: PBS Workform: MDG form for journal articles

Reggiori A, Rav2 ***{published data only}***
Reggiori A, Ravera M, Cocozza E, Andreata M, Mukasa F. Randomized study of antibiotic prophylaxis for general and gynaecological surgery from a single centre in rural Africa. *British Journal of Surgery* 1996;**83**(3):356–9.

Regidor 2000 ***{published data only}***
Regidor PA, Bier UW, Preuss MJ, Eickhoff C, Hillger H, Kienle E, et al. Efficacy and safety of two cephalosporins in the perioperative prophylaxis in patients undergoing abdominal or vaginal hysterectomies or gynaecological laparotomies: a prospective randomized study. *Gynakologisch Geburtshilfliche Rundschau* 2000;**40**(3-4):153–8.

Roberts 1978 ***{published data only}***
Roberts JM, Homesley HD. Low-dose carbenicillin prophylaxis for vaginal and abdominal hysterectomy. *Obstetrics & Gynecology* 1978;**52**(1):83–7.

Roy 1982 ***{published data only}***
Roy S, Wilkins J. Comparison of cefotaxime with cefazolin for prophylaxis of vaginal or abdominal hysterectomy. *Clinical Therapeutics* 1982;**5**:74–82.

Roy 1984 ***{published data only}***
Roy S, Wilkins J. Single-dose cefotaxime versus 3 to 5 dose cefoxitin for prophylaxis of vaginal or abdominal hysterectomy. *Journal of Antimicrobial Chemotherapy* 1984; **14**:217–21.

Roy 1988 ***{published data only}***
Roy S, Wilkins J, Hemsell DL, March CM, Spirtos NM. Efficacy and safety of single-dose ceftizoxime vs. multiple-dose cefoxitin in preventing infection after vaginal hysterectomy. *Journal of Reproductive Medicine* 1988;**33**(1 Suppl):149–53.

Roy 1989 ***{published data only}***
Roy S, Wilkins J, Galaif E, Azen C. Comparative efficacy and safety of cefmetazole or cefoxitin in the prevention of postoperative infection following vaginal and abdominal hysterectomy. *Journal of Antimicrobial Chemotherapy* 1989; **23**:109–17.

Roy 1990 ***{published data only}***
Roy S, Wilkins J, March CM, Solera NC, Galvan NI, Ressler RL, et al. Cefmetazole and cefonicid. Comparative efficacy and safety in preventing postoperative infections after vaginal and abdominal hysterectomy. *Journal of Reproductive Medicine* 1990;**35**(11 Suppl):1082–90.

Roy 1998 ***{published data only}***
Roy S, Hemsell D, Gordon S, Godwin D, Pearlman M, Luke D, et al. Oral trovafloxacin compared with intravenous cefoxitin in the prevention of bacterial infection after elective vaginal or abdominal hysterectomy for nonmalignant disease. *American Journal of Surgery* 1998; **176**(6A):62s–66s.

Santarelli 1988 ***{published data only}***
Santarelli J, Scavizzi M, Buisson P, Jupeau-Vessieres A. Post-operative infections in vaginal hysterectomies and antibiotic prophylaxis. *Medecine et Maladies Infectieuses* 1988;**18**(6/7): 313–6.

Savage 1984 ***{published data only}***
Savage EW, Thadepalli H, Rambhatla K, Roy I, Davidson EC Jr. Minocycline prophylaxis in elective hysterectomy. *Journal of Reproductive Medicine* 1984;**29**(2):81–7.

Scarpignato 1980 ***{published data only}***
Scarpignato C, Labruna C, Condemi V, Mansani FE. Comparative efficacy of two different regimens of antibiotic prophylaxis in total abdominal hysterectomy. *Pharmatherapeutica* 1980;**2**(7):450–5.

Siekmann 1983 ***{published data only}***
Siekmann U, Heilmann L, Daschner F, Bornemann H. Single-dose mezlocillin prophylaxis and postoperative morbidity after vaginal hysterectomy: pharmacokinetic and clinical results. *Geburtshilfe und Frauenheilkunde* 1983;**43** (1):20–6.

Simoes 2008 ***{published data only}***
Simoes JA, Discacciati MG, Poletti GB, Pereira GF. Tinidazole versus cefazolin in antibiotic prophylaxis of vaginal and abdominal hysterectomy. *Revista Brasileira de Ginecologia e Obstetrícia* 2008;**30**(11):544–9.

Stocklund 1980 ***{published data only}***
Stocklund KE, Kessel M, Jensen RH. Ornidazole in the prevention of infections after abdominal hysterectomy. *Chemotherapy* 1980;**26**(5):397–401.

Sutthijumroon 1990 ***{published data only}***
Sutthijumroon S, Chandeying V, Tungphaisal S. Efficacy of cefoxitin for the prevention of postoperative infection in abdominal hysterectomy. *Asia Oceania Journal of Obstetrics & Gynaecology* 1990;**16**(4):347–51.

Suvonnakote 1988 *{published data only}*
Suvonnakote T. A comparative study of two prophylactic antibiotic regimens in abdominal hysterectomy. *Journal of the Medical Association of Thailand* 1988;**71**(8):431–5.

Szalay 1996 *{published data only}*
Szalay J. Ciprofloxacin prophylaxis in vaginal and abdominal hysterectomy. *Magyar Noorvosok Lapja* 1996;**59**(3):221–5.

Tarczali 1997 *{published data only}*
Tarczali D, Smid I. Prophylactic antibiotic treatment in case of abdominal and vaginal hysterectomies. *Magyar Noorvosok Lapja* 1997;**60**(1):33–7.

Tchabo 1985 *{published data only}*
Tchabo JG, Cutting ME, Butler C. Prophylactic antibiotics in patients undergoing total vaginal or abdominal hysterectomy. *International Surgery* 1985;**70**(4):349–52.

Turano 1992 *{published data only}*
Turano A. New clinical data on the prophylaxis of infections in abdominal, gynecologic, and urologic surgery. Multicenter Study Group. *American Journal of Surgery* 1992;**164**(4A Suppl):16s–20s.

van der Linden1993 *{published data only}*
van der Linden MC, van Erp EJ, Ruijs GJ, Holm JP. A prospective randomized study comparing amoxicillin/clavulanate with cefuroxime plus metronidazole for perioperative prophylaxis in gynaecological surgery. *European Journal of Obstetrics, Gynecology, & Reproductive Biology* 1993;**50**(2):141–5.

Vecek 1993 *{published data only}*
Vecek N, Dzanic N, Pazur D, Kalenic S, Marinovic T, Ljubojevic N. A comparison of the prophylactic use of one and three cefuroxime doses in vaginal hysterectomy with correction of the bladder bolting mechanism. *Gynaecologia et Perinatologia* 1993;**2**(3):121–2.

Voss 1989 *{published data only}*
Voss A, Fischbach F, Loss W, Graeff H. Antibiotic prophylaxis in abdominal hysterectomy: a single dosis of cefotetan. *Archives of Gynecology & Obstetrics* 1989;**245**(1-4):449–50.

Walker 1982 *{published data only}*
Walker EM, Gordon AJ, Hare MJ, Warren RE. Prophylactic single-dose metronidazole before abdominal hysterectomy. *British Journal of Obstetrics & Gynaecology* 1982;**89**(11):957–61.

Wideman 1982 *{published data only}*
Wideman GL, Matthijssen C. Comparative efficacy of cefotaxime and cefazolin as prophylaxis against infections following elective hysterectomy. *Clinical Therapeutics* 1982;**5**(Suppl A):67–73.

Zivny 1997 *{published data only}*
Zivny J, Mara M, Jedlickova A, Fucikova Z, Krejci V, Dohnalova J. Antibiotic prophylaxis of infectious complications in gynecologic surgery. *Ceska Gynekologie* 1997;**62**(4):204–12.

Additional references

ACOG 2009
ACOG (American College of Obstetricians and Gynecologists). Antibiotic prophylaxis for gynecologic procedures. *Obstetrics & Gynecology* 2009;**reaffirmed 2016**(113):1180–9.

BNF 2002
British Medical Association and Royal Pharmaceutical Society of Great Britain. *British National Formulary, 2002*. 4th Edition. http://www.bnf.org/ [accessed May 2003].

Brand 2010
Brand M, Bizos D, O'Farrell PJR. Antibiotic prophylaxis for patients undergoing elective endoscopic retrograde cholangiopancreatography. *Cochrane Database of Systematic Reviews* 2010, Issue 10. [DOI: 10.1002/14651858.CD007345.pub2]

Bratzler 2013
Bratzler DW, Dellinger EP, Olsen KM, Perl TM, Auwaerter PG, Bolon MK, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. *American Journal of Health-System Pharmacy* 2013;**70**(3):195-283.

Brignardello-Petersen 2015
Brignardello-Petersen R, Carrasco-Labra A, Araya I, Yanine N, Cordova Jara L, Villanueva J. Antibiotic prophylaxis for preventing infectious complications in orthognathic surgery. *Cochrane Database of Systematic Reviews* 2015, Issue 1. [DOI: 10.1002/14651858.CD010266.pub2]

Classen 1992
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. *New England Journal of Medicine* 1992;**326**(5):281–6.

Clifford 2012
Clifford V, Daley A. Antibiotic prophylaxis in obstetric and gynaecological procedures: a review. *Australian and New Zealand Journal of Obstetrics and Gynaecology* 2012;**52**(5):412–9.

Costa 2004
Costa RJ, Krauss-Silva L. Systematic review and meta-analysis of antibiotic prophylaxis in abdominal hysterectomy [Revisão sistemática e meta–análiseda antibioticoprofilaxiana histerectomia abdominal]. *Cadernos de Saúde Pública* 2004;**20**(Suppl 2):S175–89.

Deffieux 2015
Deffieux X, de Rochambeau B, Chêne G, Gauthier T, Huet S4, Lamblin G, et al: French College of Obstetrics and Gynaecology (CNGOF). Hysterectomy for benign pathology: guidelines for clinical practice [Hystérectomie pour pathologie bénigne: recommandations pour la pratique clinique]. *Journal de Gynécologie Obstétrique et Biologie de la Reproduction* 2015;**44**(10):1219–27.

Dellinger 1994
Dellinger EP, Gross PA, Barrett TL, Krause PJ, Martone WJ, McGowan JE, et al. Quality standard for antimicrobial prophylaxis in surgical procedures. *Clinical Infectious Diseases* 1994;**18**:422–7.

DiPiro 1984
DiPiro JT, Vallner JJ, Bowden TA, Clark B, Sisley JF. Intraoperative serum concentrations of cefazolin and cefoxitin administered preoperatively at different times. *Clinical Pharmacy* 1984;**3**(1):64–7.

DiPiro 1986
DiPiro JT, Cheung RP, Bowden TA, Mansberger JA. Single dose systemic antibiotic prophylaxis of surgical wound infections. *American Journal of Surgery* 1986;**152**(5):552–9.

Duff 1980
Duff P, Park RC. Antibiotic prophylaxis in vaginal hysterectomy: a review. *Obstetrics & Gynecology* 1980;**55**(5 Suppl):193S–202S.

Faro 2001
Faro 2001. Postoperative infections. In: Gershensen CM, DeCheney AH, Curry SL, Brubaker L editor(s). *Operative Gynecology*. 2nd Edition. Philadelphia: WB Saunders, 2001:123–31.

Farquhar 2002
Farquhar C, Steiner A. Hysterectomy rates in the United States 1990-1997. *Obstetrics & Gynecology* 2002;**99**(2): 229–34.

Fukatsu 1997
Fukatsu K, Saito H, Matsuda T, Ikeda S, Furukawa S, Muto T. Influences of type and duration of antimicrobial prophylaxis on an outbreak of methicillin-resistant *Staphylococcus aureus* and on the incidence of wound infection. *Archives of Surgery* 1997;**132**(12):1320–5.

Gorecki 1999
Gorecki P, Schein M, Rucinski JC, Wise L. Antibiotic administration in patients undergoing common surgical procedures in a community teaching hospital: the chaos continues. *World Journal of Surgery* 1999;**23**:429–33.

GRADEPro GDT 2014 [Computer program]
GRADE Working Group, McMaster University. GRADEpro GDT. Version accessed prior to November 2016. Hamilton, Ontario: GRADE Working Group, McMaster University, 2014.

Gyte 2014
Gyte GML, Dou L, Vazquez JC. Different classes of antibiotics given to women routinely for preventing infection at caesarean section. *Cochrane Database of Systematic Reviews* 2014, Issue 11. [DOI: 10.1002/14651858.CD008726.pub2]

Higgins 2003
Higgins JPT, Thompson SG, Deeks JJ, Altman DG. Measuring inconsistency in meta-analyses. *BMJ* 2003;**327**: 557–60.

Higgins 2011
Higgins JPT, Green S (editors). *Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011]*. The Cochrane Collaboration, 2011. www.cochrane–handbook.org.

Hodges 2014
Hodges KR, Davis BR, Swaim LS. Prevention and management of hysterectomy complications. *Clinical Obstetrics and Gynecology* 2014;**57**(1):43–57.

Lachiewicz 2015
Lachiewicz MP, Moulton LJ, Jaiyeoba O. Infection prevention and evaluation of fever after laparoscopic hysterectomy. *Journal of the Society of Laparoendscopic Surgeons* 2015;**19**(3):pii: e2015.00065. doi: 10.4293/JSLS.2015.00065..

Merrill 2013
Merrill RM. Hysterectomy surveillance in the United States - 1997 through 2005. *Medical Science Monitor* 2008;**14**: CR24–CR31.

Mittendorf 1993
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. *American Journal of Obstetrics and Gynecology* 1993;**169**:1119–24.

Morrill 2013
Morrill MY, Schimpf MO, Abed H, Carberry C, Margulies RU, White AB, et al. Society of Gynecologic Surgeons Systematic Review Group. Antibiotic prophylaxis for selected gynecologic surgeries. *International Journal of Gynaecology and Obstetrics* 2013;**120**(1):10–5.

Nabhan 2016
Nabhan AF, Allam NE, Hamed Abdel-Aziz Salama M. Routes of administration of antibiotic prophylaxis for preventing infection after caesarean section. *Cochrane Database of Systematic Reviews* 2016, Issue 6. [DOI: 10.1002/14651858.CD011876.pub2]

Nelson 2016
Nelson G, Altman AD, Nick A, Meyer LA, Ramirez PT, Achtari C, et al. Guidelines for pre- and intra-operative care in gynecologic/oncology surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations - PART I. *Gynecologic Oncology* 2016;**140**(2):313–22.

RCOG 1999
Royal College of Obstetricians and Gynaecologists. Effective procedures in gynaecology suitable for audit, 1999. www.rcog.org.uk (accessed 27 May 2003).

Sanabria 2010
Sanabria A, Dominguez LC, Valdivieso E, Gomez G. Antibiotic prophylaxis for patients undergoing elective laparoscopic cholecystectomy. *Cochrane Database of Systematic Reviews* 2010, Issue 12. [DOI: 10.1002/14651858.CD005265.pub2]

Sanchez-Manuel 2012
Sanchez-Manuel FJ, Lozano-García J, Seco-Gil JL. Antibiotic prophylaxis for hernia repair. *Cochrane Database of Systematic Reviews* 2012, Issue 2. [DOI: 10.1002/14651858.CD003769.pub4]

SIGN 2008
Scottish Intercollegiate Guidelines Network. Antibiotic prophylaxis in surgery. http://www.sign.ac.uk/pdf/sign104.pdf 2008, updated April 2014.

Soper 1993
Soper DE. Bacterial vaginosis and postoperative infections. *American Journal of Obstetrics and Gynecology* 1993;**169**(2 Pt 2):467–9.

Steiner 2017
Steiner HL, Strand EA. Surgical-site infection in gynecologic surgery: pathophysiology and prevention. *American Journal of Obstetrics and Gynecology* 2017;**S0002-9378**(17):30254-5. doi: 10.1016/j.ajog.2017.02.014. [Epub ahead of print].

Tanos 1994
Tanos V, Rojansky N. Prophylactic antibiotics in abdominal hysterectomy. *Journal of the American College of Surgeons* 1994;**179**:593–600.

Upall 2016
Uppal S, Harris J, Al-Niaimi A, Swenson CW, Pearlman MD, Reynolds RK, et al. Prophylactic antibiotic choice and risk of surgical site infection after hysterectomy. *Obstetrics and Gynecology* 2016;**127**(2):321–9.

Van Eyk N, van Schalkwyk J 2012
Van Eyk N, Van Schalkwyk J, Infectious Disease Committee. Anitbiotic prophylaxis in gynaecologic procedures. *Journal of Obstetrics and Gynaecology Canada* 2012;**34**(4):382–91.

Weed 2003
Weed HG. Antimicrobial prophylaxis in the surgical patient. *The Medical Clinics of North America* 2003;**87**:59–75.

Wttewaall-Evelaar 1990
Wttewaall-Evelaar EW. Meta-analysis of randomized controlled trials of antibiotic prophylaxis in abdominal hysterectomy. *Pharmaceutisch Weekblad Scientific* 1990;**12**(6A):296–9.

* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Benigno 1986

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: 356 No. analysed:298 Drop-outs/withdrawals: 58 (27 piperacillin, 23 cephalothin, and 8 cefoxitin groups) were excluded for the following reasons: pre-study administration of antibiotics (3), pre-operative infection (15), dosage violation (11), total abdominal hysterectomy performed (8), failure to attend clinical follow-up examination (21) Years of recruitment: not stated Setting: 7 study centres, United States
Participants	Inclusion criteria: scheduled to undergo vaginal hysterectomy Exclusion criteria: receipt of antimicrobial therapy within 7 days before entrance into study, history of hypersensitivity to cephalosporin or penicillin, renal or hepatic or both, test results significantly outside normal limits, infection at time of screening for enrolment of study Age: 19 to 80 years Type of hysterectomy: vaginal, some with associated procedures
Interventions	Two protocols: piperacillin vs cephalothin, piperacillin vs cefoxitin Treatment 1: piperacillin (penicillin) Treatment 2: cephalothin (first-generation cephalosporin) Treatment 3: cefoxitin (second-generation cephalosporin) Dose: 3 doses of 2 grams, same regimen for all treatment groups Route: IV Single/multiple doses: multiple Duration of course of antibiotics: approx. 13 hours Timing of doses: 2 grams in first hour, then 2 grams 6-hourly
Outcomes	Total postoperative infections Pelvic infection Postoperative fever Adverse effects Need for therapeutic antibiotics Length of hospital stay Follow up: 3 to 10 weeks
Funding	Not stated
Notes	No SDs for LOS

Risk of bias

Bias	Authors' judgement	Support for judgement

Benigno 1986 (*Continued*)

Random sequence generation (selection bias)	Low risk	"Computer-generated randomization schedule"
Allocation concealment (selection bias)	Low risk	"Schedule maintained by hospital pharmacy"
Blinding (performance bias and detection bias) All outcomes	Low risk	"The investigator and staff were unaware of the antibiotic assignment"
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Insufficient information on proportions of withdrawals and reasons for withdrawals per treatment group
Selective reporting (reporting bias)	Low risk	Outcome data available on all prespecified outcomes
Other bias	Unclear risk	"The data were identical with regard to patient selection and criteria used for evaluation..."

Boodt 1990

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: 406 No. analysed: 406 (reported in table of results) Drop-outs/withdrawals: states 7 participants not evaluable (5 underwent vaginal hysterectomy with repair, 2 underwent surgery for urinary incontinence) Years of recruitment: not stated Setting: single centre, Dutch teaching hospital
Participants	Inclusion criteria: patients hospitalised for an abdominal or vaginal hysterectomy or a vaginal hysterectomy with vaginal repair, who were informed about the objective of trial in writing before the operation and gave permission to be included Exclusion criteria: emergency operation, known sensitivity to cephalosporins, preexisting infection or antibiotic therapy in the 48 hours preceding surgery Age: 41 to 59 years Type of hysterectomy: abdominal or vaginal (some vaginal with associated procedures)
Interventions	Treatment: 1500 mg cefuroxime (second-generation cephalosporin) plus 500 mg metronidazole (antiprotozoal) Control: placebo Route: IV Single/multiple doses: single Timing of doses: 10-minute infusion during induction of anaesthesia

Boodt 1990 (*Continued*)

Outcomes	Urinary tract infection Pelvic infection Postoperative fever Need for therapeutic antibiotics Length of hospital stay Follow up: 6 weeks
Funding	Not stated
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Stated as randomised but method not described
Allocation concealment (selection bias)	Unclear risk	Not described
Blinding (performance bias and detection bias) All outcomes	Low risk	"In view of the double blind...both the active and the placebo infusions were coloured yellow..."
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Insufficient information on withdrawals and reasons for withdrawals
Selective reporting (reporting bias)	Unclear risk	Adverse effects not systematically reported
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Chongsomchai 2002

Methods	Design: randomised double-blinded No. eligible: 330 No. randomised: 330 No. analysed: 321 Drop-outs/withdrawals: 9 did not undergo hysterectomy as planned (3 in cefazolin group, 4 in ampicillin group, 2 in placebo group) Years of recruitment: 1997 to 1999 Setting: 2 regional hospitals in Thailand
Participants	Inclusion criteria: scheduled for elective total abdominal hysterectomy Exclusion criteria: preoperative fever or infection, allergic to ampicillin or cefazolin, had received antibiotics within 48 hours of surgery, emergency cases, pregnancy-related cases Age: mean 43 years

Chongsomchai 2002 (*Continued*)

	Type of hysterectomy: abdominal
Interventions	Treatment 1: 1 gram ampicillin (penicillin) Treatment 2: 1 gram cefazolin (first-generation cephalosporin) Control: placebo Route: IV Single/multiple doses: single Timing of doses: 30 minutes before surgery
Outcomes	Postoperative infection, early and late Abdominal wound infection Urinary tract infection Pelvic infection Adverse effects (narrative data only) Other serious infection Postoperative fever Asymptomatic infection Follow-up: 4 weeks
Funding	National Research Council, Thailand
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Computer-generated randomization"
Allocation concealment (selection bias)	Low risk	"Opaque sealed envelopes" - probably done
Blinding (performance bias and detection bias) All outcomes	Low risk	"Patients, their gynaecologists, all investigators and evaluators were blinded to the random allocation throughout the study"
Incomplete outcome data (attrition bias) All outcomes	Low risk	Proportions of withdrawals/losses to follow-up similar in treatment groups and < 10% in each group
Selective reporting (reporting bias)	Low risk	All reported outcomes were prespecified in the methods section
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Crosthwaite 1985

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: unclear, states "100 women participated" No. analysed: 100 Drop-outs/withdrawals: none described Years of recruitment: not stated Setting: Gynaecology Unit, Royal Melbourne Hospital
Participants	Inclusion criteria: all patients undergoing hysterectomy in hospital unit Exclusion criteria: not stated Age: mean 53 years (intervention group) vs 55 years (control group) Type of hysterectomy: abdominal or vaginal
Interventions	Treatment: 2 grams tinidazole (antiprotozoal): Control: placebo Route: oral Single/multiple doses: single Timing of doses: 12 hours preop
Outcomes	Postoperative infection, early Abdominal wound infection Urinary tract infection Pelvic infection Other serious infection Adverse effects (narrative data only)
Funding	Pfizer
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Described as randomised; method not described
Allocation concealment (selection bias)	Unclear risk	Not described
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Described as "double-blind"; method not described
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not categorically stated how many women were randomised
Selective reporting (reporting bias)	Unclear risk	Insufficient information in the methods section to detect presence of selective reporting

Crosthwaite 1985 (*Continued*)

Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Davi 1985

Methods	Design: randomised double-blinded No. randomised: not explicitly stated No. analysed:310 Drop-outs/withdrawals: not stated Years of recruitment: not stated Setting: not stated
Participants	Inclusion criteria: not stated Exclusion criteria: not stated Age: not stated Type of hysterectomy: abdominal
Interventions	Treatment: 2 grams cefoxitin (second-generation cephalosporin) Control: placebo Route: IM Single/multiple doses: multiple Timing of doses: 20 minutes preoperatively, then 6 and 12 hours later
Outcomes	Postoperative infection, early Urinary tract infection Postoperative fever Adverse effects (narrative data only)
Funding	Not stated
Notes	Abstract only

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Insuficient information on random sequence generation
Allocation concealment (selection bias)	Unclear risk	Not described
Blinding (performance bias and detection bias) All outcomes	Unclear risk	States "double-blind"; no additional details given
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Insufficient information on withdrawals and reasons for withdrawals

Davi 1985 (*Continued*)

Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Unclear risk	Insufficient information to make a conclusive judgement

Dhar 1993

Methods	Design: randomised double-blinded No. randomised: 50 No. analysed: 49 Drop-outs/withdrawals: 1 (vomited tablets) Years of recruitment: 1986 to 1988 Setting: tertiary hospital, Chandigarh
Participants	Inclusion criteria: women undergoing vaginal hysterectomy with pelvic floor repair for genital prolapse, aged 35 to 60 years Exclusion criteria: haemoglobin low, current infection, systemic disease, antimicrobial infection in past week, using corticosteroids Age: mean 49.4 years (intervention group) vs 52 years (control group) Type of hysterectomy: vaginal hysterectomy
Interventions	Treatment: 2 grams tinidazole (antiprotozoal) Control: placebo Route: oral Single/multiple doses: single Timing of doses: 12 hours preoperatively
Outcomes	Postoperative infection, early Pelvic infection Postoperative fever Need for therapeutic antibiotics Adverse effects (narrative data only) Length of hospital stay Follow-up: duration unclear
Funding	Not stated
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	States randomised; no details reported.

Dhar 1993 (*Continued*)

Allocation concealment (selection bias)	Unclear risk	"Only the hospital pharmacist had access to the protocol code before completion of the study"
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Placebo "matched for shape, size, colour and taste"
Incomplete outcome data (attrition bias) All outcomes	Low risk	1 participant excluded from analysis - reasons given
Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Dhar 1993a

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: 100 No. analysed: 98 Drop-outs/withdrawals: 2 (had tubo-ovarian abscess or malignancy found at surgery) Years of recruitment: 1986 to 1988 Setting: tertiary hospital, Chandigarh
Participants	Inclusion criteria: women scheduled for abdominal hysterectomy for benign conditions Exclusion criteria: preexisting infection; diabetes; obesity; renal, hepatic, or cardiac disease; antibiotic previous week or currently using corticosteroids Age: 43 to 44 years Type of hysterectomy: abdominal
Interventions	Treatment: 2 grams tinidazole (antiprotozoal) Control: placebo Route: oral Single/multiple doses: single Timing of doses: 12 hours preoperatively
Outcomes	Postoperative infection, early Pelvic infection Postoperative fever Need for therapeutic antibiotics Adverse effects (narrative data only) Follow-up: duration unclear
Funding	Not stated

Dhar 1993a (*Continued*)

Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	States randomised; method not described
Allocation concealment (selection bias)	Low risk	"Only the hospital pharmacist had access to the drug code before completion of the trial..."
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Placebo "matched for shape, size, colour and taste"
Incomplete outcome data (attrition bias) All outcomes	Low risk	Two participants excluded from analysis: reasons given
Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Duff 1982

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: "91 enrolled" No. analysed: 91 Drop-outs/withdrawals: none reported Years of recruitment: 1979 to 1981 Setting: army medical centre, USA
Participants	Inclusion criteria: all women undergoing abdominal hysterectomy for benign disease Exclusion criteria: antibiotics received in past 4 weeks, penicillin or cephalosporin allergy Age: 39 to 40 years Type of hysterectomy: abdominal
Interventions	Treatment: 1 gram cefoxitin (second-generation cephalosporin) Control: placebo Route: IV Single/multiple doses: multiple Timing of doses: 30 minutes preoperatively and 4 hours later

Duff 1982 (*Continued*)

Outcomes	Postoperative infection, early Abdomnal wound infection Urinary tract infection Pelvic infection Need for therapeutic antibiotics Adverse effects (narrative data only) Length of hospital stay
Funding	Not stated
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"Randomly allocated" - no details given
Allocation concealment (selection bias)	Low risk	"Only the hospital pharmacist routinely had access to the protocol code before completion of the study"
Blinding (performance bias and detection bias) All outcomes	Unclear risk	"Both the patient and the attending physician were blinded as to the medication assignment"; no additional details provided with respect to outcome assessment
Incomplete outcome data (attrition bias) All outcomes	Low risk	It appears that all participants randomised were analysed
Selective reporting (reporting bias)	Low risk	Outcome data available on all prespecified outcomes
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Egarter 1988

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: 120 "recruited" No. analysed: 120 Drop-outs/withdrawals: none Years of recruitment: not stated Setting: Austria
Participants	Inclusion criteria: women having vaginal hysterectomy without a repair, with or without salpingectomy Exclusion criteria: sensitivity to antibiotics, antibiotics in previous 72 hours, current infection, impaired liver or kidney function, fever Age: 45 to 46 years Type of hysterectomy: vaginal
Interventions	Treatment 1: 1800 mg clindamycin (lincosamide) Treatment 2: 1500 mg metronidazole (antiprotozoal) Control: placebo Route: IV Single/multiple doses: multiple Timing of doses: 30 to 60 minutes preoperatively, followed by 2 additional doses at 6-hourly intervals
Outcomes	Pelvic infection Urinary tract infection Postoperative fever Hospital length of stay Duration of follow-up: 4 to 6 weeks
Funding	Not stated
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	States "allocated at random" - no additional details
Allocation concealment (selection bias)	Unclear risk	Method not described
Blinding (performance bias and detection bias) All outcomes	Unclear risk	States "in the double-blind mode" - no additional details
Incomplete outcome data (attrition bias) All outcomes	Low risk	All participants recruited were analysed

Egarter 1988 (*Continued*)

Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Eron 1989

Methods	Design: randomised double-blinded No. randomised: 252 No. analysed: 202 Drop-outs/withdrawals: 50 (14 in treatment group 1 (see below), 18 in group 2, 19 in group 3), in most cases due to concurrent antibiotic therapy or failure to adhere to schedule Years of recruitment: not stated Setting: 2 centres, USA
Participants	Inclusion criteria: aged ≥ 18 years, scheduled for vaginal or abdominal hysterectomy with or without salpingo-oophorectomy Exclusion criteria: preoperative fever, infection, pregnancy, lactation, hypersensitivity to antibiotics, multiple drug allergies, renal impairment, antibiotics within past 72 hours or any investigational drug within past month Age: 40 to 41 years Type of hysterectomy: vaginal or abdominal
Interventions	Treatment 1: 1 gram cefocinid (second-generation cephalosporin), 3.5 to 4 hours preoperatively, single dose Treatment 2: 1 gram cefocinid, 0.5 to 1 hour preoperatively, single dose Treatment 3: 2 grams cefoxitin (second-generation cephalosporin), 0.5 to 1 hour preoperatively, then 6-hourly for 4 additional doses Route: IV or IM Single/multiple doses: single vs multiple
Outcomes	Postoperative infection - data not extractable for meta-analysis Abdominal wound infection Urinary tract infection - data not extractable for meta-analysis Pelvic infection Adverse effects (narrative data only) Hospital length of stay - data not extractable for meta-analysis
Funding	Partially funded by Smith Kline & French Laboratories
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**

Eron 1989 (*Continued*)

Random sequence generation (selection bias)	Unclear risk	"Randomly assigned" - no additional details given
Allocation concealment (selection bias)	Unclear risk	Method not described
Blinding (performance bias and detection bias) All outcomes	Low risk	"Patients and investigators (or other personnel performing patient evaluations) were not aware of which regimen was being administered"
Incomplete outcome data (attrition bias) All outcomes	High risk	Proportions of withdrawals not balanced between groups (17% vs 21% vs 23%)
Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Faro 1988

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: 114 No. analysed: 100 Drop-outs/withdrawals: 14 (5 in vaginal group had abdominal surgery, 1 had operation cancelled, 6 received additional antibiotics, 2 received inappropriate doses) Years of recruitment: not stated Setting: centre not stated but study took place in the United States
Participants	Inclusion criteria: women scheduled for elective vaginal hysterectomy. Exclusion criteria: not stated Age: mean 32 to 33 years Type of hysterectomy: vaginal
Interventions	Treatment 1: 4 grams mezlocillin Treatment 2: 2 grams cefoxitin Route: IV Single/multiple doses: multiple Timing of doses: first dose within 1 hour of surgery, second dose on return from recovery room, and third dose 6 hours later
Outcomes	Postoperative infection, early and early + late Pelvic infection Need for therapeutic antibiotics Length of hospital stay Follow-up: 6 weeks

Faro 1988 (*Continued*)

Funding	Miles Laboratories	
Notes		

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Computer-generated ... schedule"
Allocation concealment (selection bias)	Unclear risk	Method not described
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Described as double-blind - no details given
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Imbalance in proportions of exclusion (10 vs 4) but reasons for exclusion not stated by treatment group
Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Unclear risk	Insufficient information to make a conclusive judgement

Gall 1983

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: not stated No. analysed: 58 Drop-outs/withdrawals: not reported Years of recruitment: not reported Setting: University Medical Centre, USA
Participants	Inclusion criteria: patients undergoing abdominal hysterectomy invited to volunteer for study Exclusion criteria: not reported Age: not stated Type of hysterectomy: abdominal
Interventions	Treatment 1: cefoperazone (third-generation cephalosporin) 2 grams up to 1 hour preoperatively, then after 12 and 24 hours (with saline at 6-hourly intervals between doses) Treatment 2: cefamandole (second-generation cephalosporin) 2 grams up to 1 hour preoperatively, then 6-hourly for 4 doses Control: placebo up to 1 hour preoperatively, then 6-hourly for 4 doses

Gall 1983 (*Continued*)

	Route: IV Single/multiple doses: multiple Timing of doses: as above
Outcomes	Abdominal wound infection Pelvic infection Postoperative fever Adverse effects (narrative data only) Length of hospital stay
Funding	Cannot use LOS data - unable to pool data for the 2 cephalosporin interventions
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Insufficient information on random sequence generation
Allocation concealment (selection bias)	Unclear risk	Method not described
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Timing of placebo infusion matched active interventions, but no details as to whether it appeared identical; also, no details provided on outcome assessment
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not explicitly stated how many were randomised; no information about drop-outs or withdrawals
Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Hager 1989

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: 95 No. analysed: 85 Drop-outs/withdrawals: 10 (6 in treatment group 1, 4 in group 2: 3 did not have planned surgery, 3 had antibiotics within a week of surgery, 3 had antibiotics without clinical evidence of infection, 1 had inappropriate administration of a study drug, 1 had preexisting infection) Years of recruitment: not stated Setting: 3 centres, United States
Participants	Inclusion criteria: premenopausal women aged > 18 years scheduled for vaginal hysterectomy, no preexisting infection Exclusion criteria: antibiotics within past 7 days, allergy to study drugs, other conditions necessitating antibiotic prophylaxis, abnormal hepatic or renal function Age: > 18 years Type of hysterectomy: vaginal
Interventions	Treatment 1: 1 gram cefotaxime (third-generation cephalosporin) Treatment 2: 4 grams mezlocillin (penicillin) Route: IV Single/multiple doses: single Duration of course of antibiotics Timing of doses: 5 to 30 minutes preoperatively
Outcomes	Postoperative infection, early Pelvic infection Urinary tract infection Postoperative fever Adverse effects Hospital (postoperative) length of stay Follow-up: not stated
Funding	Not stated
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Described as randomised; no details given
Allocation concealment (selection bias)	Low risk	"Assignment from a random code maintained in hospital pharmacy" - probably remote allocation

Hager 1989 (*Continued*)

Blinding (performance bias and detection bias) All outcomes	Unclear risk	"Neither operating physician nor patient was are of which study antibiotic was used"; however, no details on outcome assessors were provided
Incomplete outcome data (attrition bias) All outcomes	Low risk	Drop-outs/withdrawals appear similar across groups; reasons given
Selective reporting (reporting bias)	Low risk	Outcome data available on all prespecified outcomes
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Hedican 1976

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: 70 No. analysed: 70 Drop-outs/withdrawals: none Years of recruitment: 1971 to 1972 Setting: university gynaecology and obstetrics department, USA
Participants	Inclusion criteria: women having elective vaginal hysterectomy Exclusion criteria: preoperative infection, taking antibiotics, allergy to study drugs, elevated blood urea Age: not stated Type of hysterectomy: vaginal
Interventions	Treatment: cephaloridine (first-generation cephalosporin) Control: placebo Route: IV, then IM Single/multiple doses: multiple Timing of doses: 1 gram IV at start of operation, 1 gram IM 5 hours postoperatively, 1 gram IM 12 hours postoperatively
Outcomes	Postoperative infection, early Pelvic infection
Funding	Lilly Company
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**

Hedican 1976 (*Continued*)

Random sequence generation (selection bias)	Unclear risk	State that "patients were numbered consecutively 1-70 and randomly assigned..."; no additional details reported
Allocation concealment (selection bias)	Low risk	Appears to be remote allocation - "patients were ... randomly assigned either the placebo or the study drug by the pharmacy"
Blinding (performance bias and detection bias) All outcomes	Unclear risk	"Following the completion of the study .. . the code was broken"; no details on outcome assessment provided
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Appears that all participants were analysed
Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Unclear risk	Insufficient information to make a conclusive judgement

Hemsell 1980

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: not stated No. analysed: 99 Drop-outs/withdrawals: not stated Years of recruitment: 1978 to 1979 Setting: hospital associated with university obstetrics and gynaecology department, United States
Participants	Inclusion criteria: premenopausal women having vaginal hysterectomy Exclusion criteria: allergy to study drugs, antibiotics within 48 hours of surgery, fever ($\geq$ 38°) within 24 hours of surgery Age: mean 30 to 33 years Type of hysterectomy: vaginal
Interventions	Treatment: 2 grams cefoxitin (second-generation cephalosporin) Control: placebo Route: IM Single/multiple doses: multiple Timing of doses: on call to operating room, then 6 hours and 12 hours postoperatively
Outcomes	Postoperative infection, early, late, and early + late Urinary tract infection Postoperative fever Adverse effects (narrative data - but only laboratory abnormalities reported, no clinical

Hemsell 1980 (*Continued*)

	outcomes) Asymptomatic infection Hospital length of stay
Funding	Partially funded by Merck, Sharp & Dohme Research Laboratory
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Described as randomised; no details given (see below under allocation concealment)
Allocation concealment (selection bias)	Low risk	States that "the women were assigned a study number upon inclusion in the study. ..this corresponded to that on a box containing...vials..."
Blinding (performance bias and detection bias) All outcomes	Low risk	"The code was not broken until the woman had been classified as morbid or no-morbid and had been examined 6 weeks after surgery"
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Proportions of withdrawals and reasons for withdrawals not reported
Selective reporting (reporting bias)	Low risk	Data available on all prespecified outcomes
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Hemsell 1983

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: 112 No. analysed: 100 Drop-outs/withdrawals: 12 (2 had positive urine cultures, 2 had no hysterectomy, 2 had vaginal hysterectomy, 5 needed antibiotics for other indications, 1 was incorrectly dosed) Years of recruitment: 1979 to 1980 Setting: Parkland Memorial Hospital, Dallas, Texas, USA
Participants	Inclusion criteria: women ≥ 18 years of age, consecutively admitted for elective abdominal hysterectomy Exclusion criteria: allergy to study drugs, antibiotics within previous 48 hours, UTI, fever (≥ 38°) in past 24 hours, gynaecological malignancy requiring radical hysterectomy,

Hemsell 1983 (*Continued*)

	pregnancy, serious systemic disease Age: 36 years Type of hysterectomy: abdominal
Interventions	Treatment: 2 grams cefoxitin (second-generation cephalosporin) Control: placebo Route: IM Single/multiple doses: multiple Timing of doses: on call to operating theatre, then 6 hours and 12 hours later
Outcomes	Abdominal wound infection Pelvic infection Postoperative fever Asymptomatic infection Hospital length of stay
Funding	Partially funded by Merck, Sharp & Dohme Research Laboratory, sponsored by Society for Gynecologic Investigation, United States
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Sequence was generated "according to a table of random numbers"
Allocation concealment (selection bias)	Low risk	States that "women were assigned consecutive numbers upon entry into the study. These corresponded to consecutively numbered kits...of study drug"
Blinding (performance bias and detection bias) All outcomes	Low risk	"The study remained blinded until all women were examined at a follow-up clinic visit"
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	12 drop-outs/withdrawals. Reasons given, but no indication which study group they were from. No ITT analysis
Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Hemsell 1984

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: 116 No. analysed: 112 Drop-outs/withdrawals: 4 (surgery cancelled after first dose (1), abdominal hysterectomy after examination under anaesthesia (1), inappropriate entry (2)) Year of recruitment: 1982 Setting: Parkland Memorial Hospital, United States
Participants	Inclusion criteria: premenopausal women scheduled for vaginal hysterectomy Exclusion criteria: allergy to study drugs, antibiotic therapy within 48 hours before surgery, fever (≥ 38°) in previous 24 hours, infection, any other condition that might preclude accurate evaluation of outcomes Age: mean 31 to 32 years Location: Parkland Memorial Hospital, Dallas, Texas, USA
Interventions	Treatment 1: 2 grams cefoxitin (second-generation cephalosporin) × 3 doses Treatment 2: 2 grams cefoxitin × 1 dose, then 2 doses of placebo Single/multiple doses: single vs multiple Route: first dose intramuscular, second and third doses IV Timing of doses: first dose on call to OR, then 2 more doses 6 hours and 12 hours later Follow-up: 3 to 6 weeks
Outcomes	Postoperative infection, early and early + late Pelvic infection Postoperative fever Adverse effects (narrative data only) Hospital length of stay
Funding	Merck, Sharp & Dohme Research Laboratories
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computer-generated random list sequence
Allocation concealment (selection bias)	Unclear risk	Reported that code not broken until last women had completed study - but not stated where code was held
Blinding (performance bias and detection bias) All outcomes	Unclear risk	States as blinded for participants, but not clear if blinded for practitioners; no information on outcome assessor

Hemsell 1984 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Does not report withdrawal per treatment group
Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Hemsell 1985

Methods	Design: randomised blinded No. eligible: not stated No. randomised: not explicitly stated No. analysed: 150 Drop-outs/withdrawals: not mentioned Years of recruitment: not stated Setting: United States (details not reported)
Participants	Inclusion criteria: women having elective abdominal hysterectomy "without standard exclusions" Exclusion criteria: not stated Age: not stated Type of hysterectomy: abdominal
Interventions	Treatment 1: 2 grams cefoxitin (second-generation cephalosporin) × 1 dose Treatment 2: 2 grams cefoxitin (second-generation cephalosporin) × 2 doses Treatment 3: 2 grams cefoxitin (second-generation cephalosporin) × 2 doses Route: IV Single/multiple doses: single vs multiple regimens Timing of doses: not stated
Outcomes	Postoperative infection, early and early + late Postoperative fever Need for therapeutic antibiotics Hospital length of stay - data for each group not extractable Follow-up: not stated, but states "no late infections observed for 149 women seen following surgery"
Funding	Drugs supplied by Merck, Sharp & Dohme
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**

Hemsell 1985 (*Continued*)

Random sequence generation (selection bias)	Unclear risk	Described as random - no additional details
Allocation concealment (selection bias)	Unclear risk	Method not reported
Blinding (performance bias and detection bias) All outcomes	Unclear risk	"With placebo blinding" - probably double-blinded; no additional information on outcome assessor
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	No information reported on withdrawals and reasons for withdrawals
Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Unclear risk	Little information about eligibility criteria - study applicability unclear

Hemsell 1985a

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: "51 women were entered" No. analysed: 51 Drop-outs/withdrawals: none reported Years of recruitment: not stated Setting: Parkland Memorial Hospital, Dallas, United States
Participants	Inclusion criteria: premenopausal women having vaginal hysterectomy Exclusion criteria: not stated Age: 30 to 31 years Type of hysterectomy: vaginal
Interventions	Treatment 1: 2 grams cefamandole (second-generation cephalosporin) 2 hours preoperatively, then 1 gram 6-hourly × 3 Treatment 2: 200 mg doxycycline (tetracycline) 2 hours preoperatively, then dextrose (placebo) 6-hourly × 3 Route: IV Single/multiple doses: single vs multiple Timing of doses: as above
Outcomes	Postoperative infection, early, late, and early + late Pelvic infection Postoperative fever Adverse effects (narrative data only) Hospital length of stay Follow-up: up to 6 weeks

Hemsell 1985a (*Continued*)

Funding	Pfizer Pharmaceuticals
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	States randomised; no additional details
Allocation concealment (selection bias)	Unclear risk	Method not reported
Blinding (performance bias and detection bias) All outcomes	Low risk	"The randomization code was not broken until the last woman attended the clinic"
Incomplete outcome data (attrition bias) All outcomes	Low risk	It appears that all women randomised were analysed
Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Unclear risk	Little information about eligibility criteria - study applicability unclear

Hemsell 1987

Methods	Design: randomised blinded No. eligible: not stated No. randomised: 237 No. analysed: 212 Drop-outs/withdrawals: 25 (18 did not have scheduled surgery, 6 had intraoperative antibiotics, 1 needed antibiotics postoperatively for pneumonia) Years of recruitment: 1983 to 1985 Setting: Parkland Memorial Hospital, Dallas, Texas, USA
Participants	Inclusion criteria: women having vaginal hysterectomy Exclusion criteria: antibiotic within previous 3 days, allergy to study drugs Age: 32 to 33 years Type of hysterectomy: vaginal
Interventions	Treatment 1: 1 gram cephazolin (first-generation cephalosporin) Treatment 2: 2 grams cephazolin *Study also compares cephalosporins against each other - data not included Route: IM Single/multiple doses: single Timing of doses: immediately before going to operating theatre

Hemsell 1987 (*Continued*)

Outcomes	Postoperative infection, late and early + late Pelvic infection Postoperative fever Adverse effects (narrative data only) Need for therapeutic antibiotics Hospital length of stay Cost of surgery (data relate only to direct healthcare costs, minus study drugs - data not included in this review)
Funding	Eli Lilly and Company
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computer-generated
Allocation concealment (selection bias)	Low risk	Reported that "vials completely wrapped with paper to obscure identification"
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Probably double-blinded but no additional details reported on outcome assessor
Incomplete outcome data (attrition bias) All outcomes	Low risk	Proportions of withdrawals and reasons for withdrawals balanced across groups
Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Hemsell 1989

Methods	Design: randomised blinded No. eligible: not stated No. randomised: 214 "evaluated" No. analysed: 207 Drop-outs/withdrawals: 7 (4 required antibiotics intraoperatively, 3 had prophylactic dose more than 10 minutes post incision) Year of recruitment: 1985 Setting: Parkland Memorial Hospital, Dallas, Texas, USA
Participants	Inclusion criteria: women scheduled for elective abdominal or vaginal hysterectomy Exclusion criteria: "routine exclusion criteria applied" Age: 36 to 39 years Type of hysterectomy: abdominal or vaginal
Interventions	Treatment 1: 2 grams cefoxitin (second-generation cephalosporin) in operating room before anaesthesia, plus 2 additional doses at 4 hours and 8 hours Treatment 2: 4 grams piperacillin (penicillin) in operating room before anaesthesia, plus 2 doses placebo at 4 hours and 8 hours Route: IV Single/multiple doses: single vs multiple Timing of doses: as above
Outcomes	Postoperative infection: early + late - narrative data only Postoperative fever (narrative data only) Adverse effects (narrative data only) Length of hospital stay (narrative data only) Costs - hospital costs only; data not included in this review Follow-up: 4 to 6 weeks
Funding	Lederle Laboratories, United States
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computer-generated (separate list for each surgical approach)
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Probably double-blinded, but no details reported on outcome assessor; reported that "antibiotic...labeled only with patient's name"; unclear whether this will affect blinding

Hemsell 1989 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Proportions of withdrawals not given per group, although reasons for withdrawal not reported
Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Unclear risk	Little information about eligibility criteria - study applicability unclear

Henriksson 1998

Methods	Design: randomised double blinded No. eligible: not stated No. randomised: 316 No. analysed: 291 primary analysis, 258 secondary (per protocol) analysis Drop-outs/withdrawals: 25 from primary analysis (15 case records not traceable, 4 hysterectomy not performed, 5 given wrong prophylaxis) Years of recruitment: not stated Setting: 3 tertiary centres, Sweden
Participants	Inclusion criteria: women scheduled for hysterectomy Exclusion criteria: antibiotics in previous 2 weeks, allergy to study drugs, taking anticoagulants or disulfiram, habitual alcohol abuse, breastfeeding Age: not stated Type of hysterectomy: abdominal
Interventions	Treatment: 500 mg metronidazole (antiprotozoal) Control: placebo Route: IV Single/multiple doses: multiple Timing of doses: during induction of anaesthesia, then 8 hours later
Outcomes	Postoperative infection, early Pelvic infection Wound infection Adverse effects (narrative data only) Follow-up: to 6 days postoperative
Funding	Not stated
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**

Henriksson 1998 (*Continued*)

Random sequence generation (selection bias)	Unclear risk	Described as randomised; no additional details
Allocation concealment (selection bias)	Low risk	Bottles for infusion "labeled identically and only distinguished by a code number"
Blinding (performance bias and detection bias) All outcomes	Low risk	Reported that "none of the investigators knew if the patient had got metronidazole or placebo"
Incomplete outcome data (attrition bias) All outcomes	Low risk	Primary analysis "based on all randomised patients from whom information was available"
Selective reporting (reporting bias)	Low risk	Outcome data available on all prespecified outcomes
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Holman 1978

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: not stated No. analysed: 206 Drop-outs/withdrawals: not stated Years of recruitment: not reported Setting: Grady Memorial Hospital, United States
Participants	Inclusion criteria: all women admitted for elective vaginal or abdominal hysterectomy Exclusion criteria: allergy to study drugs, fever in past 2 weeks, fever or infection on admission, antibiotics in past 2 weeks, requirement for antibiotics for other indications Age: mean (intervention vs control): 37.8 years vs 38.5 years (abdominal hysterectomy) ; 27.7 years vs 30.4 years (vaginal hysterectomy) Type of hysterectomy: abdominal or vaginal
Interventions	Treatment: cefazolin (first-generation cephalosporin), Control: placebo Route: first dose IM, then IM or IV Single/multiple doses: multiple Timing of doses: first dose on call to operating room, second dose on return from recovery room, third dose 6 hours later Follow-up: postoperative and "after discharge from the hospital"
Outcomes	Abdominal wound infection Urinary tract infection Pelvic infection

Holman 1978 (*Continued*)

	Need for systemic antibiotics Hospital length of stay (no SDs) *For abdominal hysterectomy, data separated into premenopausal and postmenopausal. For vaginal hysterectomy, only premenopausal data reported for most outcomes. Therefore, data related to postmenopausal vaginal hysterectomy (n = 6) not included in this review Follow-up: to hospital discharge
Funding	Smith Kline & French, Philadelphia, Pennsylvania, USA
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Random numbers table
Allocation concealment (selection bias)	Low risk	Reported that "patients were...assigned a study number...from a random table maintained by the pharmacy service"
Blinding (performance bias and detection bias) All outcomes	Low risk	Reported that "the code was not broken until the patient had been discharged and evaluated..."
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Proportions of withdrawals and reasons for withdrawals not reported
Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Houang 1984

Methods	Design:described as randomised; medical and nursing personnel not aware of study groups No. eligible: not stated No. randomised: 345 No. analysed: 295 Drop-outs/withdrawals: 50 (14 in treatment group 1, 18 in the other 2 groups (see below); reasons given included required antibiotics owing to intraoperative findings, did not have planned type of surgery, data missing at follow-up) Years of recruitment: 1982 to 1983 Setting: Chelsea Hospital for Women, London
Participants	Inclusion criteria: patients for elective vaginal or abdominal hysterectomy Exclusion criteria: not stated (2 patients with preop UTI excluded from analysis) Age: not stated Type of hysterectomy: abdominal or vaginal
Interventions	Treatment 1: 500 mg ampicillin + 500 mg penicillanic acid sulphone (penicillin) (with placebo suppository) Treatment 2: 500 mg ampicillin + 1 gram metronidazole (antiprotozoal) Control: placebo suppository Route: penicillin IV, metronidazole by rectal suppository Single/multiple doses: multiple Timing of doses: suppository 2 hours preoperatively, IV penicillin(s) immediately after induction of anaesthesia
Outcomes	Postoperative infections: early and early+ late Abdominal wound infection Urinary tract infection (2 participants with preop UTI excluded from analysis) Postoperative fever Follow-up: 6 weeks
Funding	Not stated
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Described as randomised; no additional details
Allocation concealment (selection bias)	Unclear risk	Method not reported
Blinding (performance bias and detection bias) All outcomes	Low risk	States that "the study was so designed that the medical and nursing personnel would not be aware of the group allocation of the patients studied"

Houang 1984 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Number of withdrawals per treatment group stated but reasons for withdrawals not reported by treatment groups
Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Houang 1984a

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: not stated No. analysed:46 Drop-outs/withdrawals: not reported Years of recruitment: 1983 onward Setting: Chelsea Hospital for Women, London *Study described as ongoing - this is preliminary publication only
Participants	Inclusion criteria: women scheduled for elective abdominal hysterectomy Exclusion criteria: not stated Age: not stated Type of hysterectomy: abdominal
Interventions	Treatment 1: piperacillin (penicillin) + placebo suppository Treatment 2: ampicillin (penicillin) + metronidazole (antiprotozoal) suppository Route: IV + rectal Single/multiple doses: multiple Timing of doses: suppository 2 hours preoperatively, followed by penicillin IV immediately after induction of anaesthesia
Outcomes	Abdominal wound infection Urinary tract infection Postoperative fever Follow-up: 6 weeks
Funding	Not stated
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**

Houang 1984a (*Continued*)

Random sequence generation (selection bias)	Unclear risk	Described as randomised; no additional details
Allocation concealment (selection bias)	Unclear risk	Method not reported
Blinding (performance bias and detection bias) All outcomes	Low risk	States that "the study was so designed that the medical and nursing personnel would not be aware of the group allocation of the patients studied"
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Proportions of withdrawals and reasons for withdrawals not reported across treatment groups
Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Jaffe 1985

Methods	Design: randomised placebo-controlled No. eligible: not stated No. randomised: 98 No. analysed:90 Drop-outs/withdrawals: 8 (2 for positive preoperative urine culture in treatment group; 3 for positive preoperative urine culture, 2 for malignancy, and 1 for protocol mistake in placebo group) Years of recruitment: not stated Setting: Meir General Hospital, Israel
Participants	Inclusion criteria: women admitted for elective abdominal hysterectomy for benign condition Exclusion criteria: antibiotics in previous 2 weeks, allergy to study drugs Age: 46 to 48 years Type of hysterectomy: abdominal
Interventions	Treatment 1: 15 mL co-trimoxazole (antiprotozoal): 12000 mg sulphamethoxazole, 240 mg trimethoprim Control: placebo Route: IV Single/multiple doses: single Timing of doses: infused during last 30 minutes before surgery
Outcomes	Urinary tract infection Postoperative fever

Jaffe 1985 (*Continued*)

	Adverse effects (narrative data only) Hospital length of stay
Funding	Not stated
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	States "randomly assigned" - no other details
Allocation concealment (selection bias)	Unclear risk	Method not described
Blinding (performance bias and detection bias) All outcomes	Unclear risk	States that "the placebo group received the placebo with the saline in the same manner"; no details reported on outcome assessor or evaluation of participants
Incomplete outcome data (attrition bias) All outcomes	High risk	Proportions of withdrawals and reasons for withdrawals not balanced across treatment groups
Selective reporting (reporting bias)	Low risk	Data available on all prespecified outcomes
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Janssens 1982

Methods	Design: randomised double blinded. Publication reports 2 separate studies (1 and 2), for which placebo data were pooled No. eligible: not stated No. randomised: not stated No. analysed: study 1: n = 53; study 2: n = 92 Drop-outs/withdrawals: not reported Years of recruitment: not stated Setting: St Elisabeth Hospital, Turnhout, Belgium
Participants	Inclusion criteria: "abdominal or vaginal hysterectomy patients" - but also states that patients with shaving culdotomy were eligible Exclusion criteria: not stated Age: not stated Type of hysterectomy: abdominal or vaginal

Janssens 1982 (*Continued*)

Interventions	Treatment 1: 1 to 2 grams tinidazole (antiprotozoal) Control: placebo Route: oral Single/multiple doses: study 1 = multiple, study 2 = single Study 1: first dose approximately 18 hours preoperatively, second dose 6 hours later, postoperative days 3, 4, and 5: 1 dose of 1 gram daily Study 2: single preoperative 2 gram dose given 6 to 8 hours preoperatively
Outcomes	Postoperative infection, early Study reports outcomes as "wound infection morbidity" (WIM). In this review, WIM grades 2 and 3 reported (i.e. those defined in review as "clinically relevant")
Funding	Not stated
Notes	Publication also describes third study - described as randomised with no mention of blinding

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	States that studies were randomised - no additional details
Allocation concealment (selection bias)	Unclear risk	Method not reported
Blinding (performance bias and detection bias) All outcomes	Low risk	States that "the double-blind code was broken only after completion in each of the two studies..."
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Proportions of withdrawals and reasons for withdrawals not reported across treatment groups
Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Unclear risk	Insufficient information to make a conclusive judgement

Kauer 1990

Methods	Design: randomised double-blinded No. eligible: 100 No. randomised: 78 No. analysed: 68 Drop-outs/withdrawals: 10 (2 in treatment group 1, 4 in each of treatment groups 2 and 3: 5 had asymptomatic bacteriuria, 3 were given an incorrect antibiotic, 2 had abdominal not vaginal surgery) Years of recruitment: not reported Setting: Roman Catholic Hospital, Groningen, The Netherlands
Participants	Inclusion criteria: women ≥ 20 years of age having vaginal hysterectomy Exclusion criteria: allergy to study drugs, antibiotics within 48 hours of surgery, preexisting infection Age: mean 55 to 60 years Type of hysterectomy: vaginal
Interventions	Treatment 1: 1500 mg cefuroxime (second-generation cephalosporin) Treatment 2: 500 mg metronidazole (antiprotozoal) Treatment 3: 1500 mg cefuroxime + 500 mg metronidazole Route: IV Single/multiple doses: single Timing of doses: 15 minutes preoperatively
Outcomes	Postoperative infection, early Urinary tract infection Pelvic infection Need for therapeutic antibiotics Adverse effects (narrative data only) Hospital length of stay Follow-up: duration not clearly stated
Funding	Not stated
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	States that sequence was generated through "table of random numbers"
Allocation concealment (selection bias)	Low risk	States that "patients were assigned by the hospital pharmacist..."
Blinding (performance bias and detection bias) All outcomes	Low risk	States "vial and colour of the solution being indistinguishable...the observer was unaware of the antibiotics used..."

Kauer 1990 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Low risk	Proportions of withdrawals and reasons for withdrawals fairly balanced across treatment groups
Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Ledger 1973

Methods	Design: randomised double-blinded No. women eligible: 164 No. women randomised: 100 No. women analysed: 100 Drop-outs/withdrawals: none Years of recruitment: 1970 to 1972 Setting: University of Michigan Medical Centre
Participants	Inclusion criteria: premenopausal women having vaginal hysterectomy Exclusion criteria: allergy to study drugs, high preoperative blood urea, already receiving prophylactic antibiotics, "vaginal approach was decided upon in the operating room" Age: mean 35 years Type of hysterectomy: vaginal
Interventions	Treatment: 1 gram cephaloridine (first-generation cephalosporin) Control: placebo Route: not stated Single/multiple doses: multiple Timing of doses: first dose on call to operating room, second dose on return from recovery room, third dose at bedtime night of operation
Outcomes	Postoperative infection, early Urinary tract infection Pelvic infection Postoperative fever Need for therapeutic antibiotics Hospital length of stay Follow-up: to hospital discharge *Also reports "other morbidity" - no separate data for "other serious infections"
Funding	Eli Lilly Company
Notes	
Risk of bias	

Ledger 1973 (*Continued*)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random numbers table
Allocation concealment (selection bias)	Low risk	States that allocation was "assigned by the pharmacy service" - probably remote allocation
Blinding (performance bias and detection bias) All outcomes	Low risk	States that "the code identifying placebo or active drug was broken only after the patient had been discharged and the clinical summary sheets...completed"
Incomplete outcome data (attrition bias) All outcomes	Low risk	Reported no drop-outs
Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Mathews 1977

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: "59 patients took part in the trial" No. analysed: 59 Drop-outs/withdrawals: none reported Years of recruitment: 1975 to 1976 Setting: Sheppey Hospital, UK
Participants	Inclusion criteria: women given appointments to be admitted for abdominal hysterectomy Exclusion criteria: prophylactic antibiotics considered essential or contraindicated, allergy to study drugs Age: not stated Type of hysterectomy: abdominal
Interventions	Treatment: 10 mL co-trimoxazole (sulphonamide), containing total of 800 mg sulphamethoxazole and 160 mg of trimethoprim Control: placebo Route: IV Single/multiple doses: single Timing of dose: immediately before surgery

Mathews 1977 (*Continued*)

Outcomes	Abdominal wound infection Urinary tract infection Pelvic infection Postoperative fever Need for therapeutic antibiotics Adverse effects (narrative data only) Follow-up: 6 weeks. However, only early data used, as unclear whether late data may overlap
Funding	One study author affiliated with Wellcome Foundation
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	States randomised; no additional details
Allocation concealment (selection bias)	Low risk	States that "the co-trimoxazole and placebo were supplied in random order in consecutively numbered boxes" - apparently used remote allocation
Blinding (performance bias and detection bias) All outcomes	Unclear risk	States that "ampoules of apparently identical fluid..." were administered; no additional details on outcome assessor were reported
Incomplete outcome data (attrition bias) All outcomes	Low risk	No withdrawals or losses to follow-up
Selective reporting (reporting bias)	Low risk	Data available on all prespecified outcomes
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Mathews 1979

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: not explicitly stated No. analysed: 50 Drop-outs/withdrawals: none reported Years of recruitment: 1975 to 1978 Setting: All Saints' Hospital, Chatham, UK
Participants	Inclusion criteria: women given appointments to be admitted for vaginal hysterectomy Exclusion criteria: prophylactic antibiotics considered essential or contraindicated, allergy to study drugs Age: mean 56 to 61 years Type of hysterectomy: vaginal
Interventions	Treatment: 10 mL co-trimoxazole (sulphonamide), containing total of 800 mg sulphamethoxazole and 160 mg trimethoprim Control: placebo Route: IV Single/multiple doses: single Timing of dose: at beginning of operation
Outcomes	Urinary tract infection Pelvic infection Postoperative fever Need for therapeutic antibiotics Adverse effects (narrative data only) Follow-up: 6 weeks (but only early data included in this review, as unclear whether early/late data overlap)
Funding	One study author affiliated with Wellcome Foundation
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Stated as randomised; no additional details
Allocation concealment (selection bias)	Low risk	States that conduct of study was as described in Mathews 1977 (see above)
Blinding (performance bias and detection bias) All outcomes	Unclear risk	States that conduct of study was as described in Mathews 1977 (see above)

Mathews 1979 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Proportions of withdrawals and reasons for withdrawal not reported across treatment groups
Selective reporting (reporting bias)	Low risk	Data available on all prespecified outcomes
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Mendelson 1979

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: not stated No. analysed: 66 Drop-outs/withdrawals: not reported Year of recruitment: 1977 Setting: Jewish General Hospital, Montreal, Canada
Participants	Inclusion criteria: women admitted for vaginal hysterectomy Exclusion criteria: sensitivity to study antibiotics; receipt of antibiotics, anti-infective therapy, or probenecid within past 2 weeks; autoimmune disease; impaired renal function; delivery or pregnancy termination within past 8 weeks; preexisting infection; conisation or dilatation and curettage within past 6 weeks Age: mean 53 years Type of hysterectomy: vaginal
Interventions	Treatment 1: 1 gram cephradine (first-generation cephalosporin); first dose preoperatively, then 6-hourly for 4 doses Treatment 2: 2 grams cephradine 1 hour preoperatively Control: placebo Route: IV Single/multiple doses: single vs multiple Timing of doses: 5 to 75 minutes before initial incision
Outcomes	Early or late postoperative infection UTI Pelvic infection Postoperative fever Follow-up: 2 to 4 weeks after discharge
Funding	ER Squibb and Sons
Notes	
Risk of bias	

Mendelson 1979 (*Continued*)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Described as randomised; no additional details
Allocation concealment (selection bias)	Unclear risk	Method not described
Blinding (performance bias and detection bias) All outcomes	Unclear risk	States "the placebo was a...material...with the identical appearance of the active drug"; no information on outcome assessor
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Proportions of withdrawals and reasons for withdrawal not reported across treatment groups
Selective reporting (reporting bias)	Unclear risk	Insufficient information to make a conclusive judgement
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Polk 1980

Methods	Design: randomised double-blinded; stratified by menopausal status No. eligible: 1511 underwent non-radical elective hysterectomy: reasons for non-participation stated No. randomised: 557 No. analysed: 515 Drop-outs/withdrawals: 52 (26 in each group started on therapeutic antibiotics by surgeon) Years of recruitment: 1976 to 1978 Setting: Boston Hospital for Women, Massachusetts, USA
Participants	Inclusion criteria: all women booked for elective, non-radical, abdominal or vaginal hysterectomy Exclusion criteria: active infection, use of antibiotics within past 2 weeks, pelvic surgery within 2 weeks, sensitivity to study drugs Age: mean 41 to 42 years Type of hysterectomy: abdominal or vaginal
Interventions	Treatment: cephazolin (first-generation cephalosporin) Control: placebo Route: IM Single/multiple doses: multiple Duration of course of antibiotics Timing of doses: first dose 1 to 2 hours preoperatively, 2 more doses at 6-hour intervals

Polk 1980 (*Continued*)

Outcomes	Abdominal wound infection Urinary tract infection Pelvic infection Postoperative fever Need for therapeutic antibiotics Adverse effects (narrative data only) Hospital length of stay Follow-up: 6 weeks
Funding	Eli Lilly and Company
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Described as randomised; stratified by menopausal status: no additional details
Allocation concealment (selection bias)	Unclear risk	Method not reported
Blinding (performance bias and detection bias) All outcomes	Low risk	States that "participants, their physicians and all investigators were blind to the allocation throughout the study"
Incomplete outcome data (attrition bias) All outcomes	Low risk	Proportions of withdrawals and reasons for withdrawal balanced across treatment groups
Selective reporting (reporting bias)	Low risk	Data available on all prespecified outcomes
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Schepers 1981

Methods	Design: randomised double-blinded (abstract only) No. eligible: not stated No. randomised: 107 No. analysed: 103 Drop-outs/withdrawals: 4 (reasons not reported) Years of recruitment: not stated Setting: The Netherlands

Schepers 1981 (*Continued*)

Participants	Inclusion criteria: premenopausal women undergoing abdominal hysterectomy Exclusion criteria: not stated Age: not stated Type of hysterectomy: abdominal
Interventions	Treatment: deposition (second-generation cephalosporin) Control: placebo Route: IV Single/multiple doses: multiple Timing of doses: first dose 30 minutes preoperatively, second dose 6 hours later
Outcomes	Postoperative infection Adverse effects (narrative data only) Follow-up: not stated
Funding	Not stated
Notes	No extractable data - no denominators

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Described as randomised; no additional details
Allocation concealment (selection bias)	Unclear risk	Method not described
Blinding (performance bias and detection bias) All outcomes	Unclear risk	States "double-blind"; no additional details
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Proportions of withdrawals and reasons for withdrawal/drop-out not reported
Selective reporting (reporting bias)	High risk	Data not available on all prespecified outcomes; thus evidence of selective reporting
Other bias	Unclear risk	Insufficient detail to determine risk

Smith 1984

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: 60 No. analysed: 59 Drop-outs/withdrawals: 1 (required prophylaxis for surgical complications) Years of recruitment: not stated Setting: UK hospital
Participants	Inclusion criteria: women admitted for abdominal hysterectomy Exclusion criteria: renal disease, allergy to study drugs, malignancy suspected Age: mean 41 years; range 26 to 58 years Type of hysterectomy: abdominal
Interventions	Treatment: 3 mL co-trimoxazole (trimethoprim 160 mg, sulphamethoxazole 800 mg) Control: placebo Route: IM Single/multiple doses: single (1 ampoule) Timing of doses: 1 hour before surgery
Outcomes	Postoperative infection, early Abdominal wound infection Pelvic infection Postoperative fever Adverse effects (narrative data only) Follow-up: 6 weeks (for UTI only)
Funding	Study author affiliation: Wellcome Foundation
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Stated as randomised; no additional details
Allocation concealment (selection bias)	Low risk	Allocation concealed; "consecutively numbered envelopes" used
Blinding (performance bias and detection bias) All outcomes	Unclear risk	States "the co-trimoxazole and placebo were supplied in ampoules containing 3 mls fluid...the placebo ampoule contained saline solution"; no information on outcome assessor
Incomplete outcome data (attrition bias) All outcomes	Low risk	1 withdrawal; reason given

Smith 1984 (*Continued*)

Selective reporting (reporting bias)	Low risk	Data available on all prespecified outcomes
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Stage 1982

Methods	Design: randomised double-blinded No. eligible: not stated No. randomised: unclear, but appears to be 284 (see drop-outs/withdrawals below) No. analysed: 273 Drop-outs/withdrawals: 11 from overall study (which included 199 caesarean section patients; data not in this review) due to incomplete records Years of recruitment: 1976 to 1978 Setting: 14 centres, United Stated
Participants	Inclusion criteria: women having vaginal or abdominal hysterectomy (women having caesarean section ineligible; data not included in this review) Exclusion criteria: preoperative infection, allergy to study drugs. Age: mean 35 to 42 years Type of hysterectomy: abdominal or vaginal
Interventions	Treatment: 1 gram cephradine (first-generation cephalosporin) Control: placebo Route: IV Single/multiple doses: multiple Timing of doses: first dose within 1 hour of surgery, second dose 4 hours later
Outcomes	Postoperative infection, early Abdominal wound infection Urinary tract infection Adverse effects Need for therapeutic antibiotics Hospital length of stay (no SDs given)
Funding	Not stated
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	States that "each investigator was provided with an individually randomised block of patient numbers"

Stage 1982 (*Continued*)

Allocation concealment (selection bias)	Low risk	Method not reported
Blinding (performance bias and detection bias) All outcomes	Low risk	States that "patients and investigators were blind to the allocation throughout the study"
Incomplete outcome data (attrition bias) All outcomes	Low risk	Although proportion of withdrawals and reasons for withdrawal were not reported for each treatment group, total withdrawals constitute a small fraction of participants randomised (4%)
Selective reporting (reporting bias)	Low risk	Data available on all prespecified outcomes
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

Vincelette 1983

Methods	Design: randomised double-blinded No. eligible: 197 abdominal, 49 vaginal No. randomised: 108 abdominal (89 declined to take part), ? 38 vaginal (11 refused to take part) No. analysed: 106 abdominal, 38 vaginal Drop-outs/withdrawals: 2 (1 in each abdominal group: 1 did not have hysterectomy, 1 had incorrect drug protocol) Years of recruitment: not stated Setting: Montreal General Hospital, Canada
Participants	Inclusion criteria: women consecutively admitted for elective abdominal hysterectomy Exclusion criteria: thyroid disease, antibiotics in past 2 weeks, pelvic inflammatory disease, pregnancy, physician preference for prophylaxis Age: mean 42 to 44 years Type of hysterectomy: abdominal or vaginal
Interventions	Treatment: 500 mg metronidazole (antiprotozoal) Control: placebo Route: IV Single/multiple doses: multiple Timing of doses: first dose on call to operating theatre, second and third doses at 6-hourly intervals
Outcomes	Abdominal wound infection Urinary tract infection Pelvic infection Other serious infection Postoperative fever Adverse effects

Vincelette 1983 (*Continued*)

	Need for therapeutic antibiotics Hospital length of stay Follow-up: 6 weeks
Funding	Medical Research Council of Canada and Rhône-Poulenc Pharma Inc
Notes	4 had neoplasm - may or may not be cervical intraepithelial neoplasia

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Study was reported as "randomly assigned" - no additional details
Allocation concealment (selection bias)	Unclear risk	Method not stated
Blinding (performance bias and detection bias) All outcomes	Unclear risk	States that "a double-blind clinical evaluation was performed." No information on outcome assessor reported
Incomplete outcome data (attrition bias) All outcomes	Low risk	Total withdrawals constitute a small fraction of participants randomised (2%)
Selective reporting (reporting bias)	Low risk	Data available on all prespecified outcomes
Other bias	Low risk	Baseline demographic characteristics similar between treatment groups

ITT: intention-to-treat
LOS: length of stay
SD: standard deviation

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Adno 1979	Antibiotics given > 12 hours preoperatively and 3 days postoperatively
Allen 1972	Antibiotics given for 72 hours postoperatively
Appelbaum 1978	Antibiotics given 24 hours preoperatively and 7 days postoperatively

(*Continued*)

Appelbaum 1980	Prophylaxis given for up to 48 hours postoperatively
Batres 1980	Prophylaxis were given for up to 4 days postoperatively. Only participants were blinded to treatment
Bian 1987	Prophylactic antibiotics given 48 hours before surgery
Bivens 1975	Prophylaxis given the night before surgery and postsurgical treatment continued for 48 hours
Britt 1978	Antibiotics given for 48 hours post surgery
Brouwer WK, Hoo2	Study methods did not indicate that blinding had been used
Brown 1986	Study methods did not indicate that blinding had been used. No placebo was used for the comparative group even though different regimens were provided
Brown 1988	Study not blinded for those administering treatment and for those assessing outcomes
Cartana J, Yarn2	Study methods did not indicate that blinding had been used
Chimura 1987	Postoperative antibiotics given for 5 days
Ciraru-Vigneron 1988	Study methods did not indicate that blinding had been used
de Lalla1993	Study methods did not indicate that blinding had been used
Ferrari 1980	Study methods did not indicate that blinding had been used: 1 group received no treatment and no placebo; some participants received therapeutic antibiotics during the course of the study
Fischbach 1988	Study methods did not indicate that blinding had been used. No placebo was used for the control group
Forney 1976	Provided antibiotics before conisation > 24 hours before hysterectomy
Friese 1988	Study methods did not indicate that blinding had been used
Friese 1989	Study methods did not indicate that blinding had been used
Fujiwara 1994	Study methods did not indicate that blinding had been used. No placebo was used for the control group
Goodlin 1974	Prophylactic given the night before surgery, then for 4 days postoperatively
Gordon 1982	Study methods did not indicate that blinding had been used
Harms 1987	Study methods did not indicate that blinding had been used
Haverkorn 1987	Postoperative antibiotics given up to 6 days postoperatively

(*Continued*)

Hayashi 2000	Postoperative antibiotics given for 2 to 3 days
Hemsell 1990a	No evidence of blinding
Huang 1987	Study methods did not indicate that blinding had been used. No placebo was used for the control group
Ireland 1982	Study was not blinded. No placebo was used for the control group
Jacobson 1982	Study procedure not double-blinded
Jennings 1978	Prophylaxis administered the night before the operation, then was carried on for > 48 hours postoperatively
Jones RN, Wojes2	Only a single-blinded study. Treatment regimens differed between groups
Jyothi 2010	Uncertain whether this was a true randomised controlled trial or a double-blinded study
Kauppila 1983	23% of participants not analysed
Khan 1981	More than 27% of women had repair of prolapse rather than hysterectomy
Knippenberger 1984	No dose information. Significant proportion of participants received additional postoperative antibiotics because of infectious disease
Kunz 1982	Quasi-randomised (alternating days, allocation according to even/odd dates)
Larsson 2002	Prophylaxis given the evening before surgery and for 7 days postoperatively
Littlejohn 1985	One group received IV and the other IM; no attempt made with placebo for blinding
Luke 1999	28% of participants not analysed
Maki 1984	Comparison of cephalosporins - no placebo group
Mamsen 1992	Participants with malignancy included - no separate data
Mangioni 1991	Study methods did not indicate that blinding had been used
Mansani 1984	In comparative study group, antibiotics were given for 5 days postoperatively
Manthorpe 1982	Antibiotics given 1 day preoperatively and 72 hours postoperatively
Marsden 1985	Antibiotics given 16 hours preoperatively and 72 hours postoperatively
Matkaris 1991	Comparison of cephalosporins - no placebo group
Mattheussens 1985	Study methods did not indicate that blinding had been used. No placebo was used for the comparative group even though different regimens were given

(*Continued*)

McDonald 1984	Study not blinded
McDonald 1988	Study not blinded; also, 1 of the treatment arms extended prophylactic antibiotics for 4 days
McGregor 1994	More than 30% of participants not analysed
Mele 1985	Prolonged antibiotic administration
Mele 1988	Prophylactic antibiotics given > 48 hours postoperatively
Mercer 1988	Study methods did not indicate that blinding had been used
Mickal 1980	Study methods did not indicate that randomisation had been used
Moroni 1979	Study methods did not indicate that blinding had been used. No placebo was used for the control group
Moroni 1984	No placebo and no blinding used
Mozzillo 1989	Study methods did not indicate that blinding had been used
Multicenter 1989	Interventions not relevant: cephalosporin vs cephalosporin (2 different generations similar in dose and route of administration)
Munck 1989	Participants included those undergoing hysterectomy for treatment of malignant disease
Ohm 1975	Antibiotic prophylaxis administered 24 hours before the operation, then for up to 5 days postoperatively
Ohm 1976	Treatment consisted of a 5-day course of antibiotics
Ohm MJ, Galask 2	Postoperative treatment consisted of a 5-day course of antibiotics
Ohm MJ, Galask 3	Antibiotic prophylaxis administered 24 hours before the operation, then for up to 5 days postoperatively
Olgiati 1980	Study methods did not indicate that blinding had been used
Oliva 1990	Study methods did not indicate that blinding had been used
Orr 1988	Study methods did not indicate that blinding had been used
Periti 1988	No placebo and no blinding used
Periti P, Mazze2	Treatment protocols differed for the 2 drugs; no attempt was made to blind this
Perri 1986	Antibiotic prophylaxis given up to 4 days postoperatively
Phoolcharoen 2012	Interventions not relevant: cephalosporin vs cephalosporin (2 different generations similar in dose and route of administration)

(*Continued*)

Popkin 1983	Comparison groups given prophylactic treatment the day before surgery. Blinding of treatment not attempted
Poulsen 1984	No blinding; control group given no placebo treatment
Poulsen HK, Bor2	Study methods did not indicate that blinding had been used
Queck 1991	Control group not given placebo; therefore, no attempt to blind groups
Rapp 1982	Prophylaxis administered the night before the operation, then carried on for 48 hours postoperatively
Rapp 1986	Different drug administration protocols employed. Therefore, no attempt to blind treatment groups
Regallo 1987	Study methods did not indicate that blinding had been used. No placebo mentioned even though different regimens were employed
Reggiori 1996	Study methods did not indicate that blinding had been used
Reggiori A, Rav2	In comparison group, antibiotics given for 6 days postoperatively. No attempt to blind participants or physicians
Regidor 2000	Open randomised study; therefore, not double-blinded
Roberts 1978	Study methods did not indicate that randomisation had been used
Roy 1982	Study methods did not indicate that blinding had been used
Roy 1984	In only 1 group, antibiotics were given postoperatively. No attempt was made to blind participants or physicians by using a placebo
Roy 1988	Study methods did not indicate that blinding had been used
Roy 1989	Study methods did not indicate that blinding had been used
Roy 1990	Study methods did not indicate that blinding had been used
Roy 1998	28% of participants not analysed
Santarelli 1988	Antibiotics given for 72 hours postoperatively
Savage 1984	Antibiotics given 4 to 12 hours before surgery and 3 days after surgery
Scarpignato 1980	Antibiotic prophylaxis carried on for 5 days postoperatively in 1 group. No blinding was employed
Siekmann 1983	Blinding status unclear

(*Continued*)

Simoes 2008	Not a double-blinded study
Stocklund 1980	Antibiotics given 12 hours before surgery and 5 days after surgery
Sutthijumroon 1990	Study not double-blinded
Suvonnakote 1988	Antibiotics given for > 24 hours post surgery
Szalay 1996	Participants and interventions not relevant; included participants with malignancy (abdominal hysterectomy); antibiotics given to 1 group for 3 days before surgery (vaginal hysterectomy)
Tarczali 1997	Study methods did not indicate that blinding had been used. No placebo was used for the control group
Tchabo 1985	Study methods did not indicate that blinding had been used. No placebo was used for comparative group even though different regimens were employed
Turano 1992	Open randomisation
van der Linden1993	Used open randomisation technique
Vecek 1993	No information on blinding
Voss 1989	Not double-blinded
Walker 1982	Prophylaxis given 12 to 16 hours before the operation
Wideman 1982	Blinding was not mentioned and placebo was not used
Zivny 1997	Study methods did not indicate that blinding had been used. No placebo was used for the comparative group even though different regimens were given

DATA AND ANALYSES

Comparison 1. Any antibiotic versus placebo

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Total postoperative infections - early and late	4		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Vaginal hysterectomy	4	610	Risk Ratio (M-H, Fixed, 95% CI)	0.28 [0.19, 0.40]
1.2 Abdominal hysterectomy	1	345	Risk Ratio (M-H, Fixed, 95% CI)	0.16 [0.06, 0.38]
2 Abdominal wound infection	11		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Abdominal hysterectomy	11	2434	Risk Ratio (M-H, Fixed, 95% CI)	0.64 [0.45, 0.92]
3 Urinary tract infection	16		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Vaginal hysterectomy	8	1790	Risk Ratio (M-H, Fixed, 95% CI)	0.58 [0.43, 0.77]
3.2 Abdominal hysterectomy	11	2547	Risk Ratio (M-H, Fixed, 95% CI)	0.39 [0.29, 0.51]
4 Pelvic infection	19		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
4.1 Vaginal hysterectomy	11	2010	Risk Ratio (M-H, Fixed, 95% CI)	0.28 [0.20, 0.39]
4.2 Abdominal hysterectomy	11	1883	Risk Ratio (M-H, Fixed, 95% CI)	0.50 [0.35, 0.71]
5 Other serious infections	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
5.1 Vaginal hysterectomy	1	146	Risk Ratio (M-H, Fixed, 95% CI)	0.2 [0.01, 4.10]
5.2 Abdominal hysterectomy	2	476	Risk Ratio (M-H, Fixed, 95% CI)	0.44 [0.12, 1.69]
6 Postoperative fever	16		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
6.1 Vaginal hysterectomy	9	1879	Risk Ratio (M-H, Fixed, 95% CI)	0.43 [0.34, 0.54]
6.2 Abdominal hysterectomy	11	2581	Risk Ratio (M-H, Fixed, 95% CI)	0.60 [0.51, 0.70]
7 Total adverse effects	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
7.1 Abdominal hysterectomy	2	430	Risk Ratio (M-H, Fixed, 95% CI)	1.8 [0.62, 5.18]
8 Need for therapeutic antibiotics	9		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
8.1 Vaginal hysterectomy	6	1309	Risk Ratio (M-H, Fixed, 95% CI)	0.51 [0.37, 0.68]
8.2 Abdominal hysterectomy	6	1359	Risk Ratio (M-H, Fixed, 95% CI)	0.74 [0.59, 0.93]
9 Length of hospital stay	9		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
9.1 Vaginal hysterectomy	4	853	Mean Difference (IV, Fixed, 95% CI)	-1.35 [-1.78, -0.92]
9.2 Abdominal hysterectomy	7	1510	Mean Difference (IV, Fixed, 95% CI)	-0.59 [-0.76, -0.43]

Comparison 2. Cephalosporin versus placebo

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Total postoperative infections - early and late	3		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Vaginal hysterectomy	3	265	Risk Ratio (M-H, Fixed, 95% CI)	0.29 [0.20, 0.42]
2 Abdominal wound infection	7		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Abdominal hysterectomy	7	1528	Risk Ratio (M-H, Fixed, 95% CI)	0.41 [0.25, 0.66]
3 Urinary tract infection	8		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Vaginal hysterectomy	5	499	Risk Ratio (M-H, Fixed, 95% CI)	0.71 [0.46, 1.08]
3.2 Abdominal hysterectomy	6	1668	Risk Ratio (M-H, Fixed, 95% CI)	0.42 [0.31, 0.58]
4 Pelvic infection	10		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only

4.1 Vaginal hysterectomy	6	1281	Risk Ratio (M-H, Fixed, 95% CI)	0.15 [0.09, 0.28]
4.2 Abdominal hysterectomy	7	1528	Risk Ratio (M-H, Fixed, 95% CI)	0.60 [0.39, 0.93]
5 Other serious infections	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
5.1 Vaginal hysterectomy	1	206	Risk Ratio (M-H, Fixed, 95% CI)	0.2 [0.01, 4.12]
5.2 Abdominal hysterectomy	1	220	Risk Ratio (M-H, Fixed, 95% CI)	0.33 [0.04, 3.16]
6 Postoperative fever	9		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
6.1 Vaginal hysterectomy	5	1028	Risk Ratio (M-H, Fixed, 95% CI)	0.37 [0.25, 0.54]
6.2 Abdominal hysterectomy	6	1463	Risk Ratio (M-H, Fixed, 95% CI)	0.62 [0.49, 0.77]
7 Total adverse effects	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
7.1 Abdominal hysterectomy	1	284	Risk Ratio (M-H, Fixed, 95% CI)	1.0 [0.06, 15.83]
8 Need for therapeutic antibiotics	5		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
8.1 Vaginal hysterectomy	3	863	Risk Ratio (M-H, Fixed, 95% CI)	0.55 [0.37, 0.81]
8.2 Abdominal hysterectomy	4	1138	Risk Ratio (M-H, Fixed, 95% CI)	0.79 [0.61, 1.01]
9 Length of hospital stay	5		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
9.1 Vaginal hysterectomy	2	657	Mean Difference (IV, Fixed, 95% CI)	-1.30 [-1.88, -0.72]
9.2 Abdominal hysterectomy	4	818	Mean Difference (IV, Fixed, 95% CI)	-0.43 [-0.67, -0.19]

Comparison 3. Penicillin versus placebo

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Total postoperative infections - early and late	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Vaginal hysterectomy	1	230	Risk Ratio (M-H, Fixed, 95% CI)	0.2 [0.02, 1.69]
1.2 Abdominal hysterectomy	1	230	Risk Ratio (M-H, Fixed, 95% CI)	0.32 [0.13, 0.76]
2 Abdominal wound infection	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Abdominal hysterectomy	2	450	Risk Ratio (M-H, Fixed, 95% CI)	0.17 [0.05, 0.56]
3 Urinary tract infection	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Vaginal hysterectomy	1	230	Risk Ratio (M-H, Fixed, 95% CI)	0.5 [0.05, 5.44]
3.2 Abdominal hysterectomy	2	450	Risk Ratio (M-H, Fixed, 95% CI)	0.63 [0.21, 1.87]
4 Pelvic infection	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
4.1 Vaginal hysterectomy	1	230	Risk Ratio (M-H, Fixed, 95% CI)	0.14 [0.01, 2.73]
4.2 Abdominal hysterectomy	1	220	Risk Ratio (M-H, Fixed, 95% CI)	1.33 [0.31, 5.82]
5 Other serious infections	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
5.1 Abdominal hysterectomy	1	220	Risk Ratio (M-H, Fixed, 95% CI)	0.14 [0.01, 2.73]
6 Postoperative fever	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
6.1 Vaginal hysterectomy	1	230	Risk Ratio (M-H, Fixed, 95% CI)	0.14 [0.01, 2.73]
6.2 Abdominal hysterectomy	2	450	Risk Ratio (M-H, Fixed, 95% CI)	0.94 [0.59, 1.49]

Comparison 4. Antiprotozoal versus placebo

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Abdominal wound infection	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Abdominal hysterectomy	2	462	Risk Ratio (M-H, Fixed, 95% CI)	0.71 [0.32, 1.57]
2 Urinary tract infection	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Vaginal hysterectomy	2	226	Risk Ratio (M-H, Fixed, 95% CI)	1.25 [0.51, 3.04]
2.2 Abdominal hysterectomy	1	146	Risk Ratio (M-H, Fixed, 95% CI)	1.0 [0.34, 2.96]
3 Pelvic infection	6		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Vaginal hysterectomy	4	375	Risk Ratio (M-H, Fixed, 95% CI)	0.36 [0.17, 0.75]
3.2 Abdominal hysterectomy	4	662	Risk Ratio (M-H, Fixed, 95% CI)	0.42 [0.22, 0.83]
4 Other serious infections	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
4.1 Vaginal hysterectomy	2	246	Risk Ratio (M-H, Fixed, 95% CI)	0.25 [0.03, 2.21]
4.2 Abdominal hysterectomy	1	146	Risk Ratio (M-H, Fixed, 95% CI)	1.0 [0.14, 6.91]
5 Postoperative fever	3		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
5.1 Vaginal hysterectomy	2	130	Risk Ratio (M-H, Fixed, 95% CI)	0.45 [0.21, 0.97]
5.2 Abdominal hysterectomy	1	100	Risk Ratio (M-H, Fixed, 95% CI)	0.39 [0.18, 0.85]
6 Total adverse effects	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
6.1 Abdominal hysterectomy	1	146	Risk Ratio (M-H, Fixed, 95% CI)	2.0 [0.63, 6.35]
7 Need for therapeutic antibiotics	3		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
7.1 Vaginal hysterectomy	2	196	Risk Ratio (M-H, Random, 95% CI)	0.55 [0.15, 1.95]
7.2 Abdominal hysterectomy	2	246	Risk Ratio (M-H, Random, 95% CI)	0.55 [0.15, 2.02]
8 Length of hospital stay	5		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
8.1 Vaginal hysterectomy	3	276	Mean Difference (IV, Fixed, 95% CI)	-0.86 [-1.22, -0.49]
8.2 Abdominal hysterectomy	3	358	Mean Difference (IV, Fixed, 95% CI)	-1.33 [-1.68, -0.97]

Comparison 5. Sulphonamides versus placebo

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Abdominal wound infection	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Abdominal hysterectomy	2	119	Risk Ratio (M-H, Fixed, 95% CI)	1.23 [0.35, 4.35]
2 Urinary tract infection	3		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Vaginal hysterectomy	1	50	Risk Ratio (M-H, Fixed, 95% CI)	0.36 [0.15, 0.84]
2.2 Abdominal hysterectomy	2	157	Risk Ratio (M-H, Fixed, 95% CI)	0.18 [0.06, 0.50]
3 Pelvic infection	3		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Vaginal hysterectomy	1	50	Risk Ratio (M-H, Fixed, 95% CI)	0.14 [0.01, 2.63]
3.2 Abdominal hysterectomy	2	119	Risk Ratio (M-H, Fixed, 95% CI)	0.11 [0.01, 0.84]
4 Postoperative fever	3		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
4.1 Vaginal hysterectomy	1	50	Risk Ratio (M-H, Fixed, 95% CI)	0.5 [0.26, 0.95]
4.2 Abdominal hysterectomy	2	157	Risk Ratio (M-H, Fixed, 95% CI)	0.63 [0.38, 1.04]
5 Length of hospital stay	5		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
5.1 Vaginal hysterectomy	3	276	Mean Difference (IV, Fixed, 95% CI)	-0.86 [-1.22, -0.49]
5.2 Abdominal hysterectomy	3	358	Mean Difference (IV, Fixed, 95% CI)	-1.33 [-1.68, -0.97]

Comparison 6. Cephalosporin + antiprotozoal versus placebo

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Abdominal wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Abdominal hysterectomy	1	406	Risk Ratio (M-H, Fixed, 95% CI)	1.0 [0.14, 7.03]
2 Urinary tract infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Vaginal hysterectomy	1	406	Risk Ratio (M-H, Fixed, 95% CI)	0.5 [0.24, 1.04]
2.2 Abdominal hysterectomy	1	406	Risk Ratio (M-H, Fixed, 95% CI)	0.27 [0.08, 0.96]
3 Pelvic infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Vaginal hysterectomy	1	406	Risk Ratio (M-H, Fixed, 95% CI)	0.05 [0.01, 0.37]
4 Postoperative fever	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
4.1 Vaginal hysterectomy	1	406	Risk Ratio (M-H, Fixed, 95% CI)	0.5 [0.34, 0.73]
4.2 Abdominal hysterectomy	1	406	Risk Ratio (M-H, Fixed, 95% CI)	0.79 [0.58, 1.09]
5 Need for therapeutic antibiotics	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
5.1 Vaginal hysterectomy	1	406	Risk Ratio (M-H, Fixed, 95% CI)	0.36 [0.19, 0.68]
5.2 Abdominal hysterectomy	1	406	Risk Ratio (M-H, Fixed, 95% CI)	0.38 [0.15, 0.94]
6 Length of hospital stay	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
6.1 Abdominal hysterectomy	1	406	Mean Difference (IV, Fixed, 95% CI)	-0.30 [-0.60, -0.00]

Comparison 7. Penicillin + antiprotozoal versus placebo

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Total postoperative infections - early and late	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Vaginal hysterectomy	1	230	Risk Ratio (M-H, Fixed, 95% CI)	0.2 [0.02, 1.69]
1.2 Abdominal hysterectomy	1	230	Risk Ratio (M-H, Fixed, 95% CI)	0.53 [0.26, 1.08]
2 Abdominal wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Abdominal hysterectomy	1	230	Risk Ratio (M-H, Fixed, 95% CI)	0.17 [0.04, 0.73]
3 Urinary tract infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Vaginal hysterectomy	1	230	Risk Ratio (M-H, Fixed, 95% CI)	0.5 [0.05, 5.44]
3.2 Abdominal hysterectomy	1	230	Risk Ratio (M-H, Fixed, 95% CI)	0.17 [0.04, 0.73]
4 Pelvic infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
4.1 Vaginal hysterectomy	1	230	Risk Ratio (M-H, Fixed, 95% CI)	0.14 [0.01, 2.73]
5 Postoperative fever	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
5.1 Vaginal hysterectomy	1	230	Risk Ratio (M-H, Fixed, 95% CI)	0.14 [0.01, 2.73]
5.2 Abdominal hysterectomy	1	230	Risk Ratio (M-H, Fixed, 95% CI)	0.1 [0.01, 0.77]

Comparison 8. Lincosamide versus placebo

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Urinary tract infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Vaginal hysterectomy	1	80	Risk Ratio (M-H, Fixed, 95% CI)	0.71 [0.25, 2.06]
2 Postoperative fever	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Vaginal hysterectomy	1	80	Risk Ratio (M-H, Fixed, 95% CI)	1.0 [0.06, 15.44]
3 Length of hospital stay	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
3.1 Vaginal hysterectomy	1	80	Mean Difference (IV, Fixed, 95% CI)	-0.40 [-0.77, -0.03]

Comparison 9. Cephalosporin versus penicillin

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Total postoperative infections - early and late	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Vaginal hysterectomy	2	470	Risk Ratio (M-H, Fixed, 95% CI)	1.04 [0.55, 2.00]
2 Abdominal wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Abdominal hysterectomy	1	220	Risk Ratio (M-H, Fixed, 95% CI)	0.33 [0.01, 8.09]
3 Urinary tract infection	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Vaginal hysterectomy	1	95	Risk Ratio (M-H, Fixed, 95% CI)	0.20 [0.01, 3.98]
3.2 Abdominal hysterectomy	1	220	Risk Ratio (M-H, Fixed, 95% CI)	1.0 [0.06, 15.79]
4 Pelvic infection	4		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
4.1 Vaginal hysterectomy	3	565	Risk Ratio (M-H, Fixed, 95% CI)	0.88 [0.47, 1.64]
4.2 Abdominal hysterectomy	1	220	Risk Ratio (M-H, Fixed, 95% CI)	0.5 [0.09, 2.67]
5 Other serious infections	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
5.1 Vaginal hysterectomy	1	114	Risk Ratio (M-H, Fixed, 95% CI)	2.90 [0.12, 69.68]
5.2 Abdominal hysterectomy	1	220	Risk Ratio (M-H, Fixed, 95% CI)	3.0 [0.12, 72.85]
6 Postoperative fever	4		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
6.1 Vaginal hysterectomy	3	565	Risk Ratio (M-H, Fixed, 95% CI)	0.82 [0.58, 1.15]
6.2 Abdominal hysterectomy	1	220	Risk Ratio (M-H, Fixed, 95% CI)	0.86 [0.42, 1.77]
7 Total adverse effects	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
7.1 Vaginal hysterectomy	2	451	Risk Ratio (M-H, Fixed, 95% CI)	0.95 [0.79, 1.14]
8 Need for therapeutic antibiotics	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
8.1 Vaginal hysterectomy	2	470	Risk Ratio (M-H, Fixed, 95% CI)	1.32 [0.88, 1.97]
9 Length of hospital stay	2		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
9.1 Vaginal hysterectomy	2	209	Mean Difference (IV, Fixed, 95% CI)	-0.47 [-0.97, 0.04]

Comparison 10. Cephalosporin versus tetracycline

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Total postoperative infections - early and late	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Vaginal hysterectomy	1	51	Risk Ratio (M-H, Fixed, 95% CI)	0.59 [0.20, 1.78]
2 Pelvic infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Vaginal hysterectomy	1	51	Risk Ratio (M-H, Fixed, 95% CI)	0.83 [0.25, 2.75]
3 Postoperative fever	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Vaginal hysterectomy	1	51	Risk Ratio (M-H, Fixed, 95% CI)	0.69 [0.13, 3.81]
4 Length of hospital stay	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
4.1 Vaginal hysterectomy	1	51	Mean Difference (IV, Fixed, 95% CI)	-0.20 [-1.11, 0.71]

Comparison 11. Cephalosporin versus antiprotozoal

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Total postoperative infections - early and late	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Vaginal hysterectomy	1	78	Risk Ratio (M-H, Fixed, 95% CI)	0.04 [0.00, 0.67]
2 Urinary tract infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Vaginal hysterectomy	1	78	Risk Ratio (M-H, Fixed, 95% CI)	0.05 [0.00, 0.81]
3 Pelvic infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Vaginal hysterectomy	1	78	Risk Ratio (M-H, Fixed, 95% CI)	0.17 [0.01, 4.03]
4 Postoperative fever	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
4.1 Vaginal hysterectomy	1	78	Risk Ratio (M-H, Fixed, 95% CI)	0.06 [0.01, 0.42]
5 Need for therapeutic antibiotics	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
5.1 Vaginal hysterectomy	1	78	Risk Ratio (M-H, Fixed, 95% CI)	0.03 [0.00, 0.44]
6 Length of hospital stay	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
6.1 Vaginal hysterectomy	1	78	Mean Difference (IV, Fixed, 95% CI)	-1.90 [-3.32, -0.48]

Comparison 12. Antiprotozoal versus lincosamide

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Urinary tract infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Vaginal hysterectomy	1	80	Risk Ratio (M-H, Fixed, 95% CI)	4.0 [0.47, 34.24]
2 Postoperative fever	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Vaginal hysterectomy	1	80	Risk Ratio (M-H, Fixed, 95% CI)	0.33 [0.01, 7.95]
3 Length of hospital stay	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
3.1 Vaginal hysterectomy	1	80	Mean Difference (IV, Fixed, 95% CI)	-0.20 [-0.60, 0.20]

Comparison 13. Cephalosporin + antiprotozoal versus cephalosporin only

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Postoperative fever	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Vaginal hysterectomy	1	78	Risk Ratio (M-H, Fixed, 95% CI)	0.5 [0.03, 7.68]
2 Length of hospital stay	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
2.1 Vaginal hysterectomy	1	78	Mean Difference (IV, Fixed, 95% CI)	0.30 [-0.43, 1.03]

Comparison 14. Cephalosporin + antiprotozoal versus antiprotozoal only

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Total postoperative infections - early and late	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Vaginal hysterectomy	1	78	Risk Ratio (M-H, Fixed, 95% CI)	0.04 [0.00, 0.67]
2 Urinary tract infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Vaginal hysterectomy	1	78	Risk Ratio (M-H, Fixed, 95% CI)	0.05 [0.00, 0.81]
3 Pelvic infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Vaginal hysterectomy	1	78	Risk Ratio (M-H, Fixed, 95% CI)	0.17 [0.01, 4.03]
4 Postoperative fever	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
4.1 Vaginal hysterectomy	1	78	Risk Ratio (M-H, Fixed, 95% CI)	0.06 [0.01, 0.42]
5 Need for therapeutic antibiotics	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
5.1 Vaginal hysterectomy	1	78	Risk Ratio (M-H, Fixed, 95% CI)	0.03 [0.00, 0.44]
6 Length of hospital stay	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
6.1 Vaginal hysterectomy	1	78	Mean Difference (IV, Fixed, 95% CI)	-1.60 [-3.11, -0.09]

Comparison 15. Penicillin + antiprotozoal versus penicillin only

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Total postoperative infections - early and late	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Vaginal hysterectomy	1	230	Risk Ratio (M-H, Fixed, 95% CI)	1.0 [0.06, 15.80]
1.2 Abdominal hysterectomy	1	230	Risk Ratio (M-H, Fixed, 95% CI)	1.67 [0.63, 4.43]
2 Abdominal wound infection	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Abdominal hysterectomy	2	276	Risk Ratio (M-H, Fixed, 95% CI)	1.0 [0.26, 3.85]
3 Urinary tract infection	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Vaginal hysterectomy	1	230	Risk Ratio (M-H, Fixed, 95% CI)	1.0 [0.06, 15.80]
3.2 Abdominal hysterectomy	2	276	Risk Ratio (M-H, Fixed, 95% CI)	1.5 [0.45, 5.01]
4 Postoperative fever	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
4.1 Abdominal hysterectomy	2	276	Risk Ratio (M-H, Fixed, 95% CI)	1.5 [0.63, 3.56]
5 Length of hospital stay	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only

5.1 Vaginal hysterectomy	1	78	Mean Difference (IV, Fixed, 95% CI)	-1.60 [-3.11, -0.09]

Comparison 16. Cephalosporin: early administration versus usual timing (both single dose)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Abdominal wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Abdominal hysterectomy	1	252	Risk Ratio (M-H, Fixed, 95% CI)	0.5 [0.03, 7.90]
2 Pelvic infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Vaginal hysterectomy	1	252	Risk Ratio (M-H, Fixed, 95% CI)	1.5 [0.16, 14.20]
2.2 Abdominal hysterectomy	1	252	Risk Ratio (M-H, Fixed, 95% CI)	1.5 [0.16, 14.20]

Comparison 17. Cephalosporin: one dose versus two doses

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Total postoperative infections - early and late	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Abdominal hysterectomy	1	150	Risk Ratio (M-H, Fixed, 95% CI)	0.67 [0.14, 3.18]
2 Postoperative fever	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Abdominal hysterectomy	1	150	Risk Ratio (M-H, Fixed, 95% CI)	2.0 [0.97, 4.13]
3 Need for therapeutic antibiotics	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Abdominal hysterectomy	1	150	Risk Ratio (M-H, Fixed, 95% CI)	9.90 [0.48, 202.43]

Comparison 18. Cephalosporin: one dose versus three doses

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Total postoperative infections - early and late	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Vaginal hysterectomy	1	116	Risk Ratio (M-H, Fixed, 95% CI)	0.5 [0.05, 5.36]
2 Pelvic infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Vaginal hysterectomy	1	116	Risk Ratio (M-H, Fixed, 95% CI)	0.5 [0.05, 5.36]
3 Postoperative fever	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Vaginal hysterectomy	1	116	Risk Ratio (M-H, Fixed, 95% CI)	0.91 [0.42, 1.97]
4 Length of hospital stay	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
4.1 Vaginal hysterectomy	1	116	Mean Difference (IV, Fixed, 95% CI)	-0.30 [-0.72, 0.12]

Comparison 19. Cephalosporin: one dose versus multiple doses

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Total postoperative infections - early and late	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Vaginal hysterectomy	1	44	Risk Ratio (M-H, Fixed, 95% CI)	5.0 [0.25, 98.52]
2 Urinary tract infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Vaginal hysterectomy	1	44	Risk Ratio (M-H, Fixed, 95% CI)	3.0 [0.13, 69.87]
3 Pelvic infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Vaginal hysterectomy	1	44	Risk Ratio (M-H, Fixed, 95% CI)	3.0 [0.13, 69.87]
4 Postoperative fever	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
4.1 Vaginal hysterectomy	1	44	Risk Ratio (M-H, Fixed, 95% CI)	5.0 [0.25, 98.52]

Comparison 20. Cephalosporin one gram versus two grams

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Total postoperative infections - early and late	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Vaginal hysterectomy	1	237	Risk Ratio (M-H, Fixed, 95% CI)	1.49 [0.25, 8.74]
2 Pelvic infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Vaginal hysterectomy	1	237	Risk Ratio (M-H, Fixed, 95% CI)	1.49 [0.25, 8.74]
3 Postoperative fever	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Vaginal hysterectomy	1	237	Risk Ratio (M-H, Fixed, 95% CI)	1.49 [0.43, 5.14]
4 Need for therapeutic antibiotics	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
4.1 Vaginal hysterectomy	1	237	Risk Ratio (M-H, Fixed, 95% CI)	1.49 [0.25, 8.74]
5 Length of hospital stay	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
5.1 Vaginal hysterectomy	1	237	Mean Difference (IV, Fixed, 95% CI)	-0.10 [-0.60, 0.40]

HISTORY

Date	Event	Description
18 March 2008	Amended	Converted to new review format
8 April 2003	New citation required and conclusions have changed	Made substantive amendments

CONTRIBUTIONS OF AUTHORS

Reuben Olugbenga Ayeleke selected studies, assessed risk of bias of included studies, extracted data, performed statistical analysis and interpreted data, and took the lead in writing the review.

Jane Marjoribanks wrote the protocol and reviewed and edited the draft of the review.

Selma Mourad selected studies, assessed risk of bias of included studies, extracted data, and contributed to writing this review.

Karim Calis reviewed drafts of the protocol, contributed to the Background section, and reviewed the draft review.

Vanessa Jordan commented on the protocol, contributed to the methods, and reviewed and edited the draft review.

DECLARATIONS OF INTEREST

ROA, JM, KC, and VJ have no interests to declare.

SM received a travel grant from Olympus for participating in the GETUP Gynecologic Endoscopy course (Rome 2016).

SOURCES OF SUPPORT

Internal sources

- University of Auckland, School of Medicine, Auckland, New Zealand.

External sources

- Ministry of Health, New Zealand.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

1. We have extensively updated the Methods of the review to reflect the latest methods, as recommended by the Cochrane Collaboration, including use of the Cochrane "Risk of bias" tool and GRADE methods to assess the quality of evidence. We have added more detail about our statistical methods (in keeping with current Cochrane recommendations and the RevMan format).

2. We planned to undertake subgroup analyses by surgical route, antibiotic type, and antibiotic regimen. We subgrouped our main analysis by surgical route. We decided we would not conduct the other two planned subgroup analyses but focused instead on head-to-head comparisons between different antibiotics and antibiotic regimens, as these are more informative than subgroup analyses, which consist of indirect comparisons.

3. We planned to report numbers needed to treat for an additional beneficial outcome (NNTBs) as an absolute measure but instead reported percentages, as these can be easily interpreted and are consistent with absolute measures (rates per thousand) displayed in the "Summary of findings" tables.

4. In our protocol, we planned to explore statistical heterogeneity when we included more than 10 trials in an analysis, by exploring methodological and clinical differences between them. In the review, we decided to explore substantial statistical heterogeneity (I^2 > 50%) by conducting sensitivity analyses by choice of statistical model and effect estimate, regardless of the number of trials included in an analysis. We planned to explore other clinical or methodological differences between studies only if we noted variation in the direction of effect.

5. We excluded from the review the following outcomes, which we had included in the protocol - asymptomatic infection, re-admission to hospital, and costs - because we decided that these three outcomes can be considered as proxies for our primary outcomes and would not be likely to assist clinical decision making.