CUA Guidelines on antibiotic prophylaxis for urologic procedures

Marko Mrkobrada, MD;[*] Ivan Ying, MD, FRCPC;[*] Stephanie Mokrycke, BSc;[*] George Dresser, MD, FRCPC;[*] Sameer Elsayed, MD, FRCPC;[*] Varunkumar Bathini, MD, FRCSC;[†] Erin Boyce, BA MLIS;[*] Patrick Luke, MD, FRCSC[†]

[*]Department of Medicine, Schulich School of Medicine, London Health Science Centre, London, ON; [†]Department of Surgery, Schulich School of Medicine, London Health Science Centre, London, ON

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Introduction

Need for guidelines

Guidelines are available for the use of antimicrobial prophylaxis in open operative procedures to prevent postoperative wound infections.[1] However, the field of urology uses unique surgical approaches to treat various urologic conditions. Quite often, our approach does not require incisions; instead we use transluminal (endoscopy and catheter manipulation), transrectal (biopsy of the prostate) and/or completely non-invasive (extracorporeal shock wave lithotripsy [ESWL]) techniques. In urologic procedures, infections may arise not only from skin or rectal flora, but also from organisms in the vicinity of the operative site (i.e., struvite stones, subclinical prostatitis, pre-existing Foley catheters and stents). The sequelae of these infections can have devastating consequences, including significant morbidity and even death.

The American Urological Association provides a Best Practice Policy Statement of Urologic Surgery Antimicrobial Prophylaxis.[2] To provide a Canadian perspective, the Canadian Urological Association (CUA) Guidelines Committee approached our panel to provide rigorous evidence-based guidelines on the use of antimicrobial prophylactic therapy in urologic procedures that would be applicable in Canada. We concentrated our efforts on areas unique to urology, including urinary tract manipulation, stone surgery, endoscopic surgery and transrectal biopsy of the prostate (TURP). The evidence was then assessed and presented according to best standards of practice.

Methods

Objectives

Our objective was to develop a set of evidence-based guidelines for the use of antibiotic prophylaxis during urologic procedures. A panel of clinicians and librarians was assembled, and the following pertinent clinical areas were identified:

- Antibiotic prophylaxis for transrectal biopsy of the prostate (TRBP)
- Antibiotic prophylaxis for ESWL
- Antibiotic prophylaxis for non-ESWL stone manipulation procedures (percutaneous nephrolithotomy [PCNL] and ureteroscopy)
- Antibiotic prophylaxis for urologic endoscopic procedures, excluding stone manipulation
- Antibiotics for TURP

The panel selected these areas because they focus on clinical questions specific to the discipline of urology, and for which there is a lack of published evidence-based guidelines.

Systematic review methods

With the aid of a librarian experienced in medical literature searches, a panelist performed a literature review to identify high-quality systematic reviews on the topic. If no systematic review was identified, one was performed according to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines.[3]

Eligibility criteria

We included only randomized controlled trials (RCTs) that evaluated antibiotic prophylaxis prior to urologic procedures

in patients who did not have a known pre-procedural infection.

Information sources

A librarian experienced in conducting systematic reviews in the healthcare field assisted us in conducting our search. We electronically searched the following bibliographic databases: EMBASE (January 1980 to October 2012), Medline (January 1950 to October 2012) and All evidence-based medicine (EBM) reviews (ACP Journal Club, Database of Abstracts of Reviews of Effects, Cochrane Central Register of Controlled Trials, Health Technology Assessment, Cochrane Database of Systematic Reviews, National Health Service Economic Evaluation and Cochrane Methodology Register, from inception of database to October 2012). There was no language restriction. We identified relevant papers from the grey literature by consulting with experts in the field. Our searches were supplemented by reviewing the reference lists of all citations that met our final inclusion criteria.

Study selection

We entered the retrieved citations into RefMan v12, and duplicate records were removed. Two investigators independently screened the title and abstract of the citations. If either investigator felt that a citation might be relevant, it was marked for full-text retrieval. Two investigators independently evaluated the retrieved full-text articles for eligibility. Cohen's kappa statistic was used to quantify agreement between the investigators. Disagreements were resolved through a consensus process of having the two reviewers discuss their decisions, and a third investigator was consulted in case of an impasse to provide a final decision.

Data collection

Two reviewers independently abstracted the data from included trials. Any disagreement in the abstracted data between the two reviewers was resolved through the same consensus process used in study selection.

The following data items were abstracted from the articles included in the systematic review: Demographic data, study interventions and the study outcomes of mortality, bacteriuria, bacteremia, urinary tract infection, fever, septicemia, pyuria and adverse events. We used the study's definition of the outcome.

Risk of bias

We assessed for the risk of bias in the included trials by determining the adequacy of allocation concealment, along with blinding of the trial participants, care providers, and outcome assessors. We also assessed whether the trial was terminated prematurely due to benefit, and whether the analysis was conducted according to the intention-to-treat principle. We also used the GRADE (Grading of Recommendations Assessment, Development and Evaluation) approach to assess the quality of evidence.[4]

Statistical analyses

For each trial outcome, we calculated the relative risk (RR) to summarize the outcomes for patients treated with antibiotics versus placebo or no treatment. For all relative risks, we determined 95% confidence intervals. We pooled results using a random-effects model. We quantified statistical heterogeneity using the I2 statistic. We interpreted an I2 value of 0% to 25% as low heterogeneity, 25% to 50% as moderate heterogeneity, and greater than 50% as high heterogeneity. The risk of publication bias across trials was assessed using funnel plots.

Development of evidence-based guideline recommendations

The panel convened to make a draft of the guideline recommendations. This draft was presented to the CUA Guidelines Committee.

Guideline findings and recommendations

Antibiotic prophylaxis for transrectal prostate biopsy

Results of literature search

Our literature search identified recently-published systematic review of high methodological quality based upon the PRISMA Statement.[5] We based our recommendations on the findings of this systematic review.

Results of the systematic review

The systematic review identified a total of 9 RCTs (3599 patients) comparing antibiotics with control treatment.[5] Fluoroquinolones were studied most frequently (5 RCTs, 1188 patients).

There was a high incidence of adverse infection-related events in patients undergoing TRPB without antibiotic prophylaxis. Compared with untreated controls, antibiotics significantly reduced the rates of bacteriuria (14.8% vs. 3.9%); bacteremia (8.6% vs. 2.1%); fever (10.8% vs. 4.0%); urinary tract infection (UTI) (9.0% vs. 3.3%); and hospitalization (3.3% vs. 0.3%). No adverse events related to antibiotic prophylaxis were recorded.

Length of antibiotic prophylaxis

With respect to short (1 day) versus long (3 days) course regimens, the only significant difference was a decreased incidence of bacteriuria in the 3-day group. However, the differences between the groups were not significant with regards to bacteremia, fever, UTI and hospitalization. In the analysis between single dose and multiple doses, multiple doses were associated with significantly reduced rates of bacteriuria, without any effect on other outcomes. Also, there was no difference between oral versus systemic administration of the antibiotics.

Antibiotic class

In studies comparing different classes of antibiotics (i.e., fluoroquinolones, sulfonamides, or piperacillin/tazobactam versus other antibiotics), there were no differences in outcomes. The best evidence exists for quinolones as they were the most commonly utilized and analyzed, and had the largest number of patients included in the various trials. With emerging quinolone resistances, novel approaches using multi-agent and perirectal cultures to determine appropriate antibiotic selection have been used.[6,7] Although further RCTs are required before recommending this approach universally, we recommend that patients with increased risk of harboring resistant organisms (previous history of urosepsis, or multiple treatments with antibiotics) should have perirectal culture swabs performed prior to biopsy.

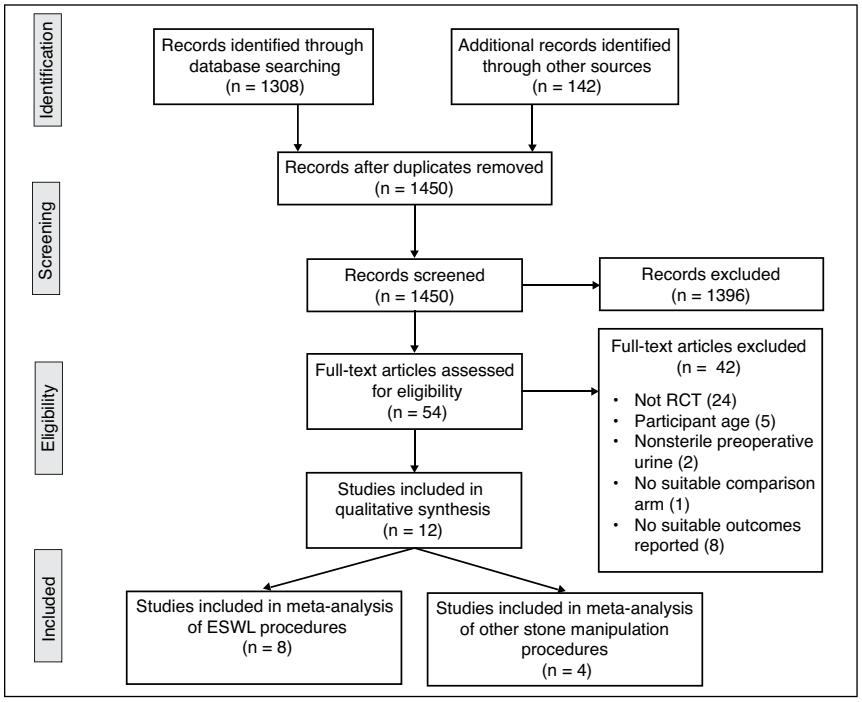

Fig. 1. Study selection flowsheet for extracorporeal shock wave lithotripsy and other stone manipulation procedures. RCT: randomized controlled trial.

Utility of pre-procedural enema

With regards to antibiotics versus enema or antibiotic versus antibiotic *and* enema, only 4 trials were analyzed with limited number of patients in each trial. There was no evidence that pre-procedural enemas affected infection rates.

Guideline recommendations

There is a high risk of adverse infection-related events in patients undergoing TRPB, and prophylactic antibiotics are recommended for these patients (Grade A, Level of Evidence IA). Most studies investigated the use of fluoroquinolones; single dose or short-courses of antibiotics appear to be as effective as the longer course regimens. There was insufficient evidence for efficacy of pre-procedural enemas to recommend their routine use. The choice of specific agent for prophylaxis should be based, in part, on the local epidemiology of drug resistance in potential uropathogens (Grade D, Level of Evidence IV). In patients at increased risk of harboring resistant organisms, perirectal culture swabs prior to TRPB should be considered.

Antibiotic prophylaxis for ESWL

Methods of literature search

We included all RCTs comparing the use of antibiotic prophylaxis versus control. Study participant inclusion criteria involved adults with preoperative sterile urine who underwent ESWL. We excluded participants with positive preoperative urine cultures. The primary outcomes of interest were postoperative infectious complications of UTI, fever, or any other serious infectious complication. We excluded trials that did not report on these outcomes of interest.

Results of the systematic review

The literature search identified 1450 citations, and we selected 54 articles for full-text retrieval (Fig. 1). Eight met the eligibility criteria for final inclusion in the systematic review.[8-15]

Eight controlled trials randomized a total of 940 study participants (Table 1). The incidence of UTI and fever were 4.2% and 3.4%, respectively. Antibiotic prophylaxis in patients undergoing ESWL (Fig. 2, Fig. 3) was not associated with a statistically significant difference in the risk of post-procedural UTI (RR 0.76, 95% CI, 0.39 to 1.48, $p = 0.42$), or an inci-

Table 1. Study characteristics of trials investigating antibiotic prophylaxis for ESWL

Author	Year	Procedure	N_{tot}	Control	Antibiotic	Route	Total dose (mg)	Dosing regimen
Bierkens	1997	ESWL	177	Placebo	Ciprofloxacin	IV	200	1 dose 30 min before surgery
					Cefuroxime	IV	200	1 dose 30 min before surgery
						PO	3000	2 doses/day for 6 days after surgery
						IV	750	1 dose 30 min before surgery
						IV	750	1 dose 30 min before surgery
						PO	3000	2 doses/day for 6 days after surgery
Claes	1989	ESWL	181	No treatment	Amoxicillin/ clavulanate	IV	2000/200	1 dose 30 min before surgery
Dejter	1989	ESWL	49	Placebo	Norfloxacin	PO	2000	1 dose every 12 hours beginning 48 hours before surgery
Ghazimoghaddam	2011	ESWL	150	No treatment	Co-trimoxazole	PO	400/80	Unclear
					Nitrofurantoin	PO	100	Unclear
Herrlinger	1987	ESWL	64	No treatment	Azlocillin	IV	5000	1 dose 30 min before surgery continued until 6 to 8 hours after surgery
Knipper	1989	ESWL	50	No treatment	Enoxacin	PO	400	1 dose 1 hour before surgery
Pettersson	1989	ESWL	149	No treatment	Trimethoprim + sulfamethoxazole	PO	1280/6400	1 dose 24 hours before surgery + 2 doses/day for 7 days from surgery
					Methenamine hippurate	PO	8000	1 dose 24 hours before surgery + 3 doses/day for 7 days from surgery
Rigatti	1989	ESWL	120	No treatment	Aztreonam	IM	3000	3 doses beginning 8 hours before surgery

dence of fever (RR 0.26, 95% CI, 0.06 to 1.10, $p = 0.07$). No adverse events related to antibiotic prophylaxis were recorded in these studies. The overall quality of evidence was moderate as judged by the GRADE criteria.

Antibiotic class

Fluoroquinolones were the most commonly studied antibiotics (3 trials). Third-generation, second-generation and first-generation cephalosporins, penicillin, aminoglycosides and sulfa-based antibiotics were each studied once. Studies varied in terms of dose, route and timing of administration in the treatment arms.

Guideline recommendations

Pre-procedural antibiotics do not significantly reduce the risk of UTI and fever in patients undergoing ESWL, but should be considered in patients at high risk of infectious complications (Grade B, Level of Evidence IB). Patients with large stone burden, associated pyuria, history of pyelonephritis, and adjunctive operative procedure including stent, nephrostomy insertion, PCNL or ureteroscopy are at a higher risk of developing pyelonephritis post-ESWL.[2] The choice of specific agent for prophylaxis should be based, in part, on the local epidemiology of drug resistance in potential uropathogens (Grade D, Level of Evidence IV).

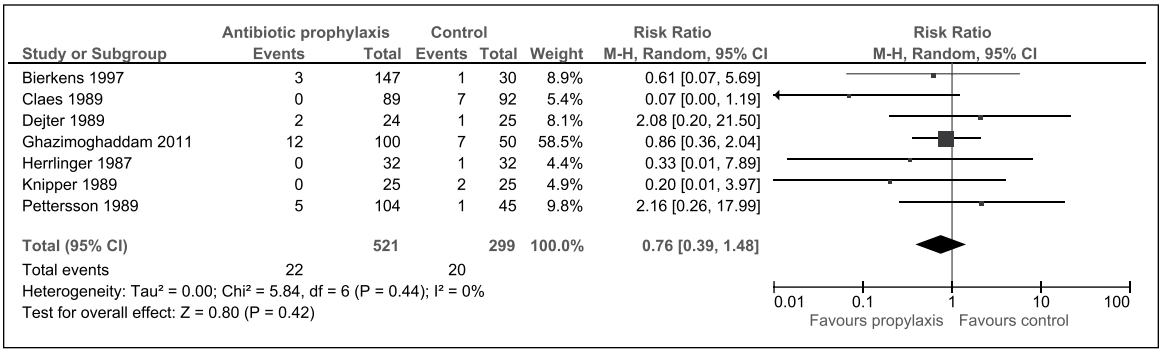

Fig. 2. Forest plot of relative risk of urinary tract infection with antibiotic prophylaxis for extracorporeal shock wave lithotripsy.

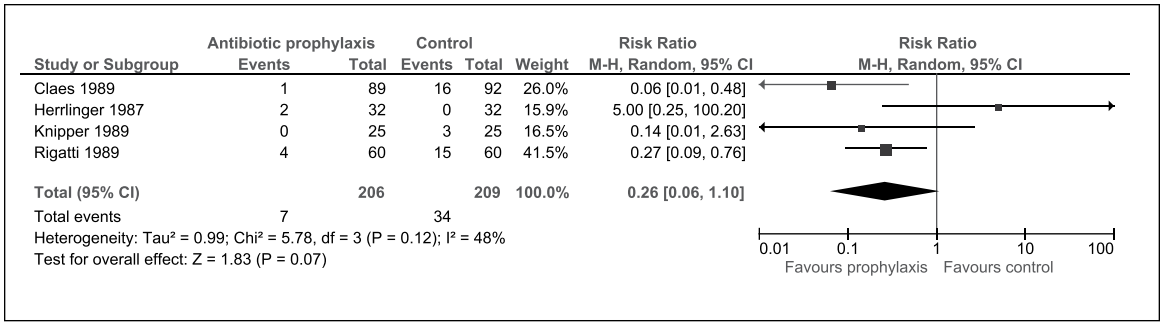

Fig. 3. Forest plot of relative risk of fever with antibiotic prophylaxis for extracorporeal shock wave lithotripsy.

Antibiotic prophylaxis for stone manipulation procedures

Methods of literature search

We included all RCTs comparing the use of antibiotic prophylaxis versus control. Study participant inclusion criteria involved adults with preoperative sterile urine who underwent PCNL, percutaneous stone removal or ureteroscopic stone removal. We excluded participants with positive preoperative urine cultures. The primary outcomes of interest were postoperative infectious complications of UTI, fever, or any other serious infectious complication. We excluded trials that did not report on these outcomes of interest.

Results of systematic review

The literature search identified 1450 citations, and we selected 47 articles for full-text retrieval (Fig. 1). Of the 54 articles, 4 met the eligibility criteria for final inclusion in the systematic review: 2 trials studied ureteroscopy,[16,17] 1 trial studied PCNL[18] and 1 studied both ureteroscopy and PCNL.[19] The 5 controlled trials randomized a total of 448 study participants (Table 2), with 349 patients having ureteroscopy and 99 patients having PCNL.

The incidence of UTI and fever in the non-antibiotic groups were 33.4% and 21.7%, respectively. Antibiotic prophylaxis in patients undergoing non-ESWL stone manipulation procedures (Fig. 4, Fig. 5) was associated with a statistically significant difference in the risk of post-procedural UTI (RR 0.30, 95% CI, 0.15 to 0.58, $p < 0.001$), but was not associated with a significant reduction in the incidence of fever (RR 0.38, 95% CI, 0.12 to 1.21, $p = 0.10$). No adverse events related to antibiotic prophylaxis were recorded in these studies. The overall quality of evidence was moderate as judged by GRADE criteria.

Antibiotic class

Fluoroquinolones were studied in 2 trials, third-generation cephalosporins, first-generation cephalosporins, and aminoglycosides were each examined in single trials. Study interventions varied in terms of dose, route and timing of administration in the treatment arms.

Guideline recommendations

Antibiotics reduce the risk of UTI following non-ESWL stone manipulation procedures, and there is a trend towards a reduction in the incidence of fever. We recommend that peri-procedural antibiotics should be considered in patients undergoing ureteroscopy and PCNL (Table 2) (Grade A, Level of Evidence IA). The choice of specific agent for prophylaxis should be based, in part, on the local epidemiology of drug resistance in potential uropathogens (Grade D, Level of Evidence IV).

Table 2. Study characteristics of trials investigating antibiotic prophylaxis for non-ESWL stone manipulation procedures

Author	Year	Procedure	N_{tot}	Control	Antibiotic	Route	Total dose (mg)	Dosing Regimen
Aghamir	2011	TUL	114	No treatment	Cefazolin	IV	1,000	1 dose 1 hour before surgery
Fourcade	1990	TUL & PCNL	120	Placebo	Cefotaxime	IV	1,000	1 dose at induction
Pertek	1992	PCNL	50	Placebo	Amikacin	IV	22.5 mg/kg	1 dose 12 hours before surgery + 1 dose at induction + 1 dose 12 hours after surgery
Sobek	1994	TUL	51	No treatment	Ciprofloxacin	IV	300	1 dose 1 hour before surgery + 1 dose after surgery + 1 dose the day after surgery

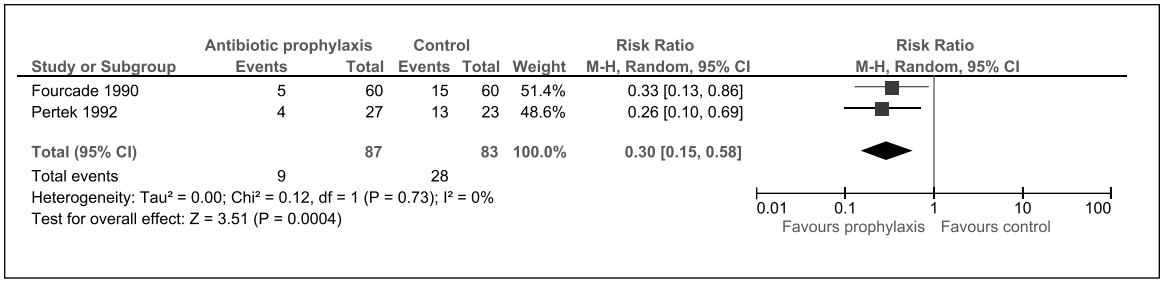

Fig. 4. Forest plot of relative risk of urinary tract infection with antibiotic prophylaxis for non- extracorporeal shock wave lithotripsy stone manipulation procedures.

Antibiotic prophylaxis for urologic endoscopic procedures excluding treatment of renal calculi

Results of literature search

We included all RCTs comparing the use of antibiotic prophylaxis versus control. Study participant inclusion criteria involved adults with sterile urine analyses who underwent endoscopic urologic procedures (cystoscopy, urodynamic studies or transurethral resection of the bladder tumour [TURBT]). Although there is a lack of literature regarding retrograde pyelography and stent insertions and l urethrotomy, the authors believe that the need for peri-procedural prophylaxis would be addressed by the guidelines in this section. Studies that included participants with positive preoperative urine cultures were excluded. The primary outcomes of interest were postoperative infectious complications of UTI, fever, or any other serious infectious complication. We excluded trials that did not report on these outcomes of interest.

The literature search identified 4946 citations, and we selected 140 articles for full-text retrieval (Fig. 6). Of the 140 articles, 4 met the eligibility criteria for final inclusion in the systematic review.[20-23] One trial addressed cystoscopy, and 3 trials addressed urodynamic studies. Although we did seek to include trials of antibiotic prophylaxis before TURBT procedures, we did not identify any trials that met our inclusion criteria.

Results of the systematic review

The 4 trials randomized a total of 2556 study participants (Table 3). There was a high incidence of adverse infection-related events in patients undergoing endoscopic urologic or catheter manipulation procedures without antibiotic prophylaxis, as UTI was documented in 10.9% of patients. Fever was not reported as an outcome in any trial.

Antibiotic prophylaxis use in patients undergoing endoscopic urologic procedures was associated with a strong trend towards a decrease in the risk of UTIs (Fig. 7), although the 95% confidence intervals did cross the line of unity (RR 0.42, 95% confidence interval [CI] 0.18 to 1.01, $p = 0.05$). No adverse events related to antibiotic use were reported. The overall quality of evidence was moderate as judged by the GRADE criteria.

Antibiotic class

Fluoroquinolones (1 trial), trimethoprim (1 trial) and ceftriaxone (1 trial) were studied, and all studies showed a trend towards a decreased risk of post-procedural UTI.

Guideline recommendations

Pre-procedural antibiotics show a strong trend towards reducing the risk of UTI, but not fever, after endoscopic urologic procedures. No adverse events associated with antibiotics were reported. Pre-procedural antibiotics should

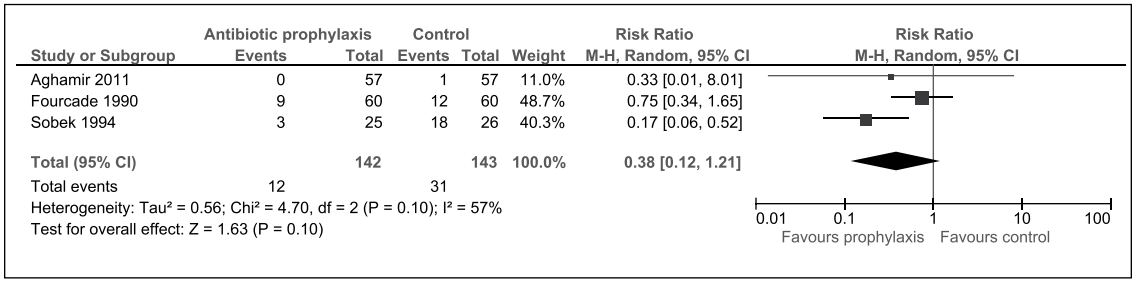

Fig. 5. Forest plot of relative risk of fever with antibiotic prophylaxis for non- extracorporeal shock wave lithotripsy stone manipulation procedures.

Table 3. Study characteristics of trials investigating antibiotic prophylaxis for urologic procedures requiring tissue manipulation

Author	Year	Procedure	N_{tot}	Control	Antibiotic	Route	Total dose (mg)	Dosing regimen
Coptcoat	1988	Urodynamic study	82	No treatment	Trimethoprim	PO	200	Prior to procedure
Darouiche	1994	Urodynamic study	40	Placebo	Ciprofloxacin	PO	3000	Twice daily for 3 days, starting 2 days before procedure
Jimenez Cruz	1993	Cystoscopy	2172	No treatment	Ceftriaxone	IM	1000	Prior to procedure
Siracusano	2008	Urodynamic study	262	Placebo	Norfloxacin	PO	400	12 hours before procedure

be considered in patients at high risk of infectious complications (Grade C, Level of Evidence IB). The choice of specific agent for prophylaxis should be based, in part, on the local epidemiology of drug resistance in potential uropathogens (Grade D, Level of Evidence IV).

Antibiotics for TURP

Results of literature search

Our literature search identified a recently-published systematic review of high methodological quality.[24] We based our recommendations on the findings of this systematic review.

Results of the systematic review

The systematic review identified a total of 28 trials (4694 patients) comparing antibiotics versus placebo.

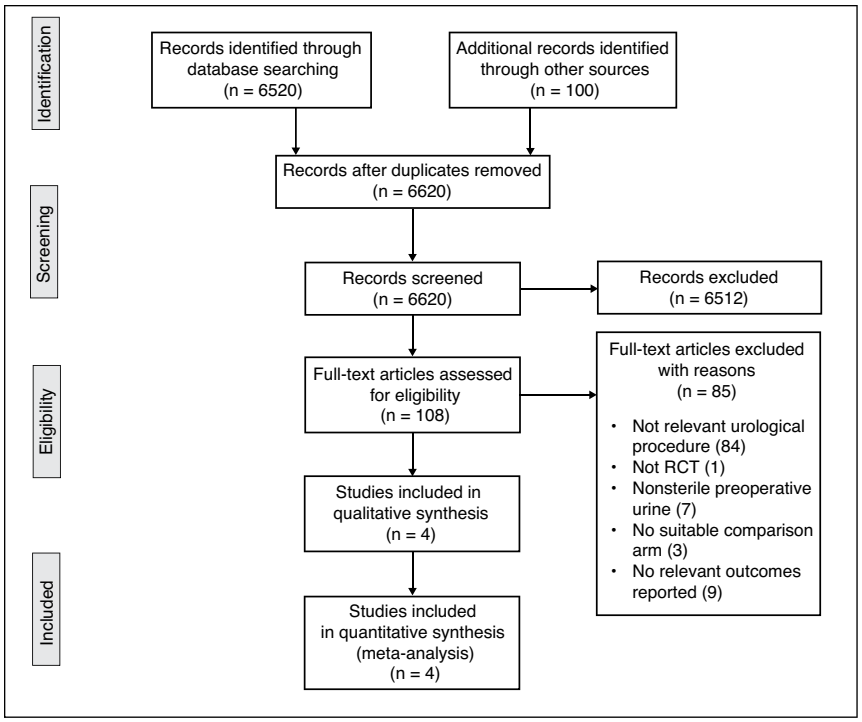

Fig. 6. Study selection flowsheet for urologic endoscopic procedures.

There was a high incidence of adverse infection-related events in patients undergoing TURP without antibiotic prophylaxis: bacteriuria in 23.4% of patients, bacteremia in 4.0% of patients, and fever in 26.9% of patients. Antibiotics significantly reduced the rates of bacteriuria (RR 0.34, 95% CI 0.30 to 0.40); bacteremia (RR 0.84, 95% CI 0.71 to 0.99) and fever (RR 0.25, 95% CI 0.11 to 0.56). No adverse events related to antibiotic prophylaxis were recorded in these studies.

Antibiotic class

In studies comparing different classes of antibiotics, there were no differences in outcomes. Third-generation cephalosporins were most frequently studied (9 trials).

Guideline recommendations

Due to the reduction in the risk of febrile UTI after TURP procedures, we recommend the use of prophylactic antibiotics prior to TURP (Table 4). (Grade A, Level of Evidence IA). The choice of specific agent for prophylaxis should be based, in part, on the local epidemiology of drug resistance in potential uropathogens (Grade D, Level of Evidence IV).

Discussion

After performing a comprehensive literature review, we have provided executive summaries on the best evidence supporting the use of prophylactic antimicrobials in common urologic procedures. All summaries specifically relate with patients with sterile preoperative urine cultures. If bacteria are found in the cultures, we strongly recommend preoperative eradication of the infection with a full course of antibiotics according to culture sensitivities.

The evidence suggests that antibiotics are useful for the prevention of fever and UTIs for most urologic surgeries and procedures.

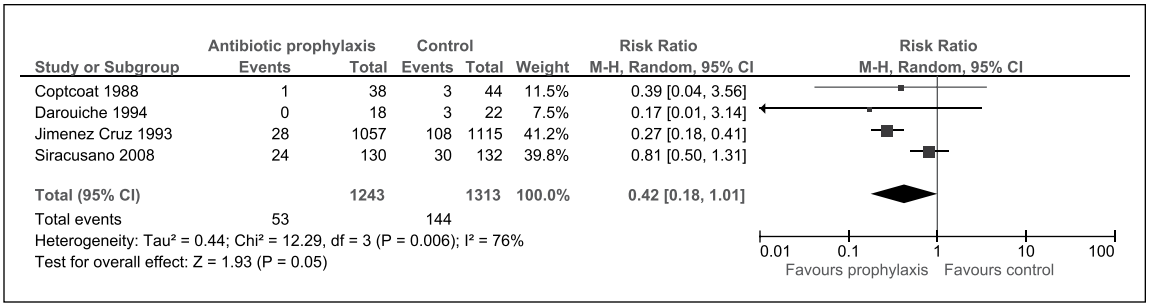

Fig. 7. Forest plot of relative risk of urinary tract infection with antibiotic prophylaxis for urologic endoscopic procedures.

Table 4. Study characteristics of trials investigating antibiotic prophylaxis for TURP

Author	N_{tot}	Antibiotic	Route	Dose (mg)	Dosing regimen
Charton	100	Netilmicin	IM	150	1 hour prior to surgery
Childs	47	Ceftriaxone	IV	1000	1 hour prior to surgery
Desai	40	Enoxacin	IM	200	1 dose 2–4 hours prior and 3 doses postoperatively
Fair	61	Carbenacillin	PO/IV	764/2000	Night before surgery and QID for 10 days IV during surgery
Finklestein	129	Ceftriaxone	IV	1000	1 hour prior to surgery
Harvey	162	Cotrimoxazole	PO	100	After catheter removal for 10 days
Nielsen	10	Cefoxitin	IM	1000	2–4 hours preoperatively and TID as long as catheter remains
Qvist	88	Cefotaxime	IV	2000	1 hour prior to procedure
Rocca Rosetti	192	Aztreonam	IV	1000	Prior to procedure and 2 doses postoperatively
Slavis	107	Cefonicid	IM	1000	1 hour prior
Bannister	61	Septra, pivmecillinam	PO	2 tablets/200	BID for 3 days postoperatively/TID for 3 days postoperatively
Botto	167	Cefotaxime	IV	1000	Prior and 2 doses post-procedure
Charton	100	Mezlocillin	IV	2000	1 hour prior to surgery
Conn	200	Cephradine	IM	1500	1 hour prior and 1 dose after surgery and 1 hour before catheter removal
Ferrie	58	Cefuroxime	IM	1500/750	Before surgery and 6 doses postoperatively
Gibbons	100	Kanamycin	IM	500	1 hour prior and TID after surgery until catheter removal
Gonzalez	90	Cephalothin/Cephalexin	IV/PO	1000/500	1 dose preoperatively and 4 dose postoperatively/QID for 10 days postoperatively
Hargreave	795	Ceftazidime	IV	1000	Prior to procedure and daily until catheter removal
Holl	100	Nitrofurantoin or Septra	PO	1 tablet	1 day prior and 10 days after catheter removal
Houle	110	Cefoperazone	IV	2000	1 day prior and 2 doses post-op
Matthew	87	Nitrofurantoin	PO	100	6 hours preoperatively and TID for 10 days postoperatively
Morris	101	Kanamycin/Septra	IM/PO	1000/2 tablets	1 dose prior /BID for 3 weeks postoperatively
Raz	101	Ceftriaxone	IV	1000	1 dose prior and 1 dose prior to catheter removal
Scholz	139	Ceftriaxone	IV	1000	1–2 hours prior
Stricker	100	Gentamicin/ Ampicillin	IV	80/1000	1 dose prior
Taylor	308	Temocillin	IV	1000	1 dose prior and 2 dose postoperatively
Viitanen	599	Ceftriaxone/ Septra	IV/IV	2000/800/160	1 dose prior and 1 dose prior
Weiss	223	Nitrofurantoin	PO	200	QID for 5–10 days postoperatively

Adapted from Qiang et al.[25] TURP: transurethral resection of the prostate; IM: intramuscular; IV: intravenous; PO: oral administration.

Multiple classes of antibiotics were studied, although no class demonstrated superiority. The overall quality of literature supporting antibiotic use in general was moderate.

In this guideline, it would be remiss not to mention the stark lack of reporting of adverse outcomes, including drug toxicity, such as the development of Clostridium difficile colitis, and the development of antimicrobial drug resistance. Additionally, the American Heart Association no longer recommends urologic prophylaxis to prevent endocarditis in at-risk patients.[25] The adoption of formal antimicrobial stewardship programs (ASPs) in many medical centres will serve to guide the judicious use of antimicrobials for urologic peri-procedural prophylaxis.[26] ASP activities in this regard should be based on a prospective audit and feedback mechanism, the use of antimicrobial order forms, dose optimization strategies, and formulary restriction or pre-authorization for specific procedures, with or without computerized support. The impact of the ASP strategies on patient safety and outcome must be continually evaluated. The decision to select a specific agent for prophylaxis will be based, in part, on the local epidemiology of drug resistance in potential uropathogens. The CUA recommends that the institution's microbiology/infectious disease team develop a formal ASP in developing preferred regimens for prophylaxis.

Although the duration of prophylaxis was not assessed in this review, the American Society of Health System Pharmacists, Infectious Diseases Society of America (IDSA), the Surgical Infection Society (SIS), and Society for Healthcare Epidemiology of America (SHEA) recommend a shorter peri-procedural/perioperative course of antimicrobials involving a single dose or continuation for less than 24 hours.[27] Risk factors for post-procedural infections may include obesity, extremes of age, nutritional status, diabetes mellitus, immunosuppressive therapy or immunosuppressed state.[27]

Conclusion

Although these guidelines were created to influence clinical decisions on a day to day basis, it is important to consider the impact of antibiotic use on our medical system and our individual patients.

Competing interests: Dr. Mrkobrada, Dr. Ying, Dr. Mokrycke, Dr. Dresser, Dr. Elsayed, Dr. Bathini, Dr. Boyce and Dr. Luke all declare no competing financial or personal interests.

This paper has been peer-reviewed.

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Correspondence: Dr. Patrick Luke, 339 Windermere Rd, PO Box 5339, London ON N6A 5A5; patrick.luke@lhsc.on.ca