CAGS AND ACS EVIDENCE BASED REVIEWS IN SURGERY. 37

Is there a role for prophylactic antibiotics in the prevention of urinary tract infections following Foley catheter removal in patients having abdominal surgery?

C. Suzanne Cutter, MD
Steven R. Kelly, MD
Peter W. Marcello, MD
John E. Mahoney, MD
Lindsay E. Nicolle, MD
Robin S. McLeod, MD
for the Members of the Evidence Based Reviews in Surgery Group*

*The CAGS/ACS Evidence Based Reviews in Surgery Group comprises Drs. N.N. Baxter, K.J. Brasel, C.J. Brown, P. Chaudhury, C.S. Cutter, C.M. Divino, E. Dixon, L. Dubois, G.W.N. Fitzgerald, H.J.A. Henteleff, A.W. Kirkpatrick, S. Latosinsky, A.R. MacLean, T.M. Mastracci, R.S. McLeod, A.M. Morris, L.A. Neumayer, L.K. Temple and Ms. M.E. McKenzie.

Correspondence to:
Ms. Marg McKenzie, RN
Administrative Coordinator, EBRS
Mount Sinai Hospital, L3-010
60 Murray St., PO Box 23
Toronto ON M5T 3L9
fax 416 586-5932
mmckenzie@mtsinai.on.ca

DOI: 10.1503/cjs.009911

The term "evidence-based medicine" was first coined by Sackett and colleagues as "the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients."[1] The key to practising evidence-based medicine is applying the best current knowledge to decisions in individual patients. Medical knowledge is continually and rapidly expanding. For clinicians to practise evidence-based medicine, they must have the skills to read and interpret the medical literature so that they can determine the validity, reliability, credibility and utility of individual articles. These skills are known as critical appraisal skills, and they require some knowledge of biostatistics, clinical epidemiology, decision analysis and economics, and clinical knowledge.

Evidence Based Reviews in Surgery (EBRS) is a program jointly sponsored by the Canadian Association of General Surgeons (CAGS) and the American College of Surgeons (ACS) and is supported by an educational grant from ETHICON and ETHICON ENDO-SURGERY, both units of Johnson & Johnson Medical Products, a division of Johnson & Johnson and ETHICON Inc. and ETHICON ENDO-SURGERY Inc., divisions of Johnson & Johnson Inc. The primary objective of EBRS is to help practising surgeons improve their critical appraisal skills. During the academic year, 8 clinical articles are chosen for review and discussion. They are selected for their clinical relevance to general surgeons and because they cover a spectrum of issues important to surgeons, including causation or risk factors for disease, natural history or prognosis of disease, how to quantify disease, diagnostic tests, early diagnosis and the effectiveness of treatment. A methodological article guides the reader in critical appraisal of the clinical article. Methodological and clinical reviews of the article are performed by experts in the relevant areas and posted on the EBRS website, where they are archived indefinitely. In addition, a listserv allows participants to discuss the monthly article. Surgeons who participate in the monthly packages can obtain Royal College of Physicians and Surgeons of Canada Maintenance of Certification credits and/or continuing medical education credits for the current article only by reading the monthly articles, participating in the listserv discussion, reading the methodological and clinical reviews and completing the monthly online evaluation and multiple choice questions.

We hope readers will find EBRS useful in improving their critical appraisal skills and in keeping abreast of new developments in general surgery. Four reviews are published in condensed versions in the *Canadian Journal of Surgery* and 4 are published in the *Journal of the American College of Surgeons*. For further information about EBRS, please refer to the CAGS or ACS websites. Questions and comments can be directed to the program administrator, Marg McKenzie, at mmckenzie@mtsinai.on.ca.

Reference

1. Evidence-Based Medicine Working Group. Evidence-based medicine. *JAMA* 1992;268:2420-5.

Selected Article

Pfefferkron U, Sanlav L, Mouldenhauer J, et al. Antibiotic prophylaxis at urinary catheter removal prevents urinary tract infections. A prospective randomized trial. *Ann of Surg* 2009;249:573–75.

Abstract

Question: Does the use of antibiotic prophylaxis at urinary catheter removal reduce the rate of urinary tract infection? **Design:** Randomized controlled trial. **Setting:** Single centre in Basel, Switzerland. **Patients:** A total of 239 patients between January 2005 and September 2007 were randomly assigned into 2 groups by an online randomization generator. **Intervention:** Patients undergoing elective abdominal surgery with planned perioperative urethral catheterization were assigned at admission to receive either 960 mg of trimethoprim-sulfamethoxazole orally the night before and twice on the day of catheter removal or no antibiotic prophylaxis. Urinary cultures were obtained before and 3 days after catheter removal. **Main outcome measures:** Occurrence of symptomatic urinary tract infection (based on the Centers for Disease Control and Prevention definitions) after catheter removal. **Results:** Patients who received antibiotic prophylaxis experienced significantly fewer urinary tract infections than those who did not (5 of 103 [4.9%] v. 22 of 102 [21.6%], $p < 0.001$; number needed to treat 6). Patients who received antibiotic prophylaxis also had less significant bacteriuria 3 days after catheter removal than those who did not (17 of 103 [16.5%] v. 42 of 102 [41.2%], $p < 0.001$). **Conclusion:** Antibiotic prophylaxis with trimethoprim-sulfamethoxazole at the time of urinary catheter removal significantly reduces the rate of symptomatic urinary tract infections and bacteriuria in patients who undergo abdominal surgery and perioperatively receive transurethral urinary catheters.

Commentary

Most patients undergoing major abdominal surgery have a urinary catheter inserted at the time of surgery that is maintained postoperatively to monitor urine output and because of the possibility of urinary retention. However, urethral catheters are invasive devices and are one of the most common causes of nosocomial infections. The prevalence of bacteriuria increases by 3%–10% per day after catheter insertion.[1] Not only does this cause morbidity, the diagnosis and treatment of urinary tract infections also increase patient care costs.

The epidemiology of bacteriuria during urethral catheterization is well documented, and there is consensus that asymptomatic bacteriuria should not be treated while the catheter is in situ.[2–4] In contrast, it is not clear whether it should be treated after catheter removal. Harding and colleagues[5] showed that two-thirds of women with asymptomatic bacteriuria while catheters were in situ continued to harbour bacteria 2 weeks after catheter removal; of these women, one-quarter experienced a symptomatic urinary tract infection (UTI). Additionally, there is no consensus on whether antibiotics should be prescribed prophylactically at the time of the catheter removal to prevent UTIs. A survey of urologists, geriatricians, microbiologists, infection control nurses and continence advisors in the UK found that 19% of respondents prescribe antibiotics in all cases when the catheter is removed, 41% prescribe antibiotics in selected cases (e.g., presence of prosthesis, immunosuppression) and 40% never prescribe antibiotic prophylaxis.[6]

There has been 1 small, underpowered trial where the aim was to determine whether ciprofloxacin given at the time of urinary catheter removal would decrease the incidence of subsequent UTI.[7] Forty-eight patients were randomly assigned to receive ciprofloxacin or placebo. Four (16%) patients in the ciprofloxacin group experienced UTIs compared with 3 (13%) in the placebo group. The failure to show a significant difference in the rate of UTIs may be because only 1 dose of antibiotics was given, because the infections were caused by *Enterococci*, which were resistant to ciprofloxacin, or because the trial was underpowered.

Thus, the trial by Pfefferkorn and colleagues[8] attempts to answer this important question. Patients undergoing abdominal surgery were randomly assigned to receive antibiotic prophylaxis with trimethoprim-sulfamethoxazole or ciprofloxacin at the time of catheter removal (treatment group) or to receive no treatment (control group). In contrast to the previous study by Wazait and colleagues,[7] patients in the treatment group received 3 doses of antibiotics (1 dose the night before catheter removal and 2 doses the day of removal). Most patients underwent open colorectal resections. More than 90% of patients in both groups received epidural analgesia postoperatively for an average of 5–6 days. Urinary catheters were left in situ until the epidural was removed, with a mean length of catheter placement of 6.5 days in the treatment group and 7 days in the control group. Post–catheter removal UTIs occurred in 5 of 103 (4.9%) patients who received prophylaxis compared with 22 of 102 (21.6%) patients in the control group ($p < 0.001$). The number needed to treat was 6 (i.e., 6 patients would have to be prescribed prophylactic antibiotics to prevent 1 UTI).

Whereas it appears that all patients should receive oral antibiotics around the time of urinary catheter removal, there are some issues to consider. First, overall, the trial by Pfefferkorn and colleagues[8] was well done. The sample size was calculated to detect a 10% decrease in the rate of symptomatic UTIs. Patients were similar in both groups. There was no blinding, but a urologist who was unaware of

the treatment group assessed whether the patient had a symptomatic UTI. Of concern, however, is that the authors did not perform an intention-to-treat analysis. Also, 34 patients were excluded from analysis because they received prolonged perioperative antibiotics ($n = 2$) or postoperative antibiotics ($n = 21$) or because they did not complete all of the examinations ($n = 11$). Ideally, all but those who received extra antibiotics (23 of the 34 excluded patients) should have been included in the analysis. However, the validity of the trial is probably not jeopardized because the proportion of patients excluded was relatively small (15%), and they were distributed fairly evenly between the groups.

There are also issues that might limit the generalizability of the trial results. First, about 20% of patients in the control group experienced UTIs, a rate that is higher than one would expect. A recent review of the American College of Surgeons National Surgical Quality Improvement Project (NSQIP) found that only 2.6%–4.1% of patients experienced postoperative UTIs after colorectal resections.[9] Some of the differences in the reported rates between the 2 studies might be because of the intensity of the follow-up in the trial by Pfefferkron and colleagues,[8] but nevertheless the baseline rate in the trial seems high. Second, the pre-eminent approach to limiting morbidity from UTIs caused by urinary catheters is to remove the catheters as soon as possible, and this does not seem to have been the practice at this centre. The current literature suggests that urinary catheters can be safely removed 1–2 days after a colorectal resection, even with a thoracic epidural in place.[10,11] The current shift to "fast-track surgery" includes the early removal of urinary catheters, which has reduced the rate of UTIs from 24% to 4%.[12] One might also question whether the benefits of routine prophylaxis outweigh the harms. A number needed to treat of 6 means that 6 patients would receive antibiotic prophylaxis to prevent the occurrence of 1 symptomatic UTI. Thus, 18 doses of antibiotic would be given prophylactically to 6 people compared with 6 doses to 1 patient requiring antibiotics for treatment of a UTI (assuming a 3-day therapeutic course of treatment twice daily). The difference in cost is relatively small. However, prescribing prophylaxis routinely might lead to the emergence of antimicrobial resistance in the institution as well as development of *Clostridium difficile* colitis in a small proportion of patients. On the other hand, many patients undergoing major abdominal surgery are elderly, and UTIs can cause significant morbidity, including sudden confusion and loss of appetite and delayed hospital discharge, in elderly patients.

Thus, whereas this study suggests that antibiotics given at the time of catheter removal might be worthwhile in patients with a urinary catheter indwelling for a long time, further research is needed to address the question of the risk of symptomatic UTIs and the management of asymptomatic bacteriuria at the time of catheter removal. In particular, long-term studies in larger cohorts of patients are required to systematically address the question of emergence of antimicrobial resistance and the long-term consequences of routine prescription of antibiotics after catheter removal. In the meantime, surgeons should be vigilant in removing catheters as soon as possible, and within 24–48 hours in most patients who have had major abdominal procedures. Antibiotic prophylaxis may be indicated in patients who have a catheter in situ for a long period of time.

Competing interests: None declared.

References

1. Nidel-Weise BS, Van den Broek PJ. Antibiotic policies for short-term catheter bladder drainage in adults. *Cochrane Databases Syst Rev* 2005;(3):CD005428.
2. Warren JW. Catheter associated urinary tract infections. *Infect Dis Clin North Am* 1997;11:609-22.
3. Sedor J, Mullholland SG. Hospital-acquired urinary tract infections associated with the indwelling catheter. *Urol Clin North Am* 1999;26:821-8.
4. Warren JW, Anthony WC, Hoopes JM, et al. Cephalexin for susceptible bacteriuria in aftebrile, long-term catheterized patients. *JAMA* 1982;248:454-8.
5. Harding GKM, Nicolle LE, Ronald AR, et al. How long should catheter-acquired urinary tract infection in women be treated? A randomized controlled study. *Ann Intern Med* 1991;114:713-9.
6. Wazait HD, Van der Meullen J, Patel HRH, et al. Antibiotics on urethral catheter withdrawal: a hit and miss affair. *J Hosp Infect* 2004;58:297-302.
7. Wazait HD, Patel HR, Van der Meullen JHP, et al. A pilot randomized double blind placebo controlled trial on the use of antibiotics on urinary catheter removal to reduce the rate of urinary tract infection: the pitfalls of cirprofloxacin. *BJU Int* 2004;94:1048-50.
8. Pfefferkom U, Sanlav L, Modenhauer J, et al. Antibiotic prophylaxis at urinary catheter removal prevents urinary tract infections. A prospective randomized trial. *Ann Surg* 2009;249:573-5.
9. Senagore AJ, Stulberg JJ, Byrnes J, et al. A national comparison of laparoscopic vs. open colectomy using the national surgical quality improvement project data. *Dis Colon Rectum* 2009;52:183-6.
10. Zaouter C, Kaneva P, Carli F. Less urinary tract infection by earlier removal of bladder catheter in surgical patients receiving thoracic epidural analgesia. *Reg Anesth Pain Med* 2009;34:542-8.
11. Zmora O, Madbouly K, Tulchinsky H, et al. Urinary bladder catheter drainage following pelvic surgery — Is it necessary for that long? *Dis Colon Rectum* 2010;53:321-6.
12. Zargar-Shoshtari K, Connolly AB, Israel LH, et al. Fast-track surgery may reduce complications following major colonic surgery. *Dis Colon Rectum* 2008;51:1633-40.