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Adherence to European Association of Urology Guidelines on Prophylactic Antibiotics: An Important Step in Antimicrobial Stewardship

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Abstract

Background: The evolution of resistant pathogens is a worldwide health crisis and adherence to European Association of Urology (EAU) guidelines on antibiotic prophylaxis may be an important way to improve antibiotic stewardship and reduce patient harm and costs.
Objective: To evaluate the prevalence of antibiotic-resistant bacterial strains and health care costs during a period of adherence to EAU guidelines in a tertiary referral urologic institution.
Design, setting, and participants: A protocol for adherence to EAU guidelines for antibiotic prophylaxis for all urologic procedures was introduced in January 2011. Data for 3529 urologic procedures performed between January 2011 and December 2013 after protocol introduction were compared with data for 2619 procedures performed between January 2008 and December 2010 before protocol implementation. The prevalence of bacterial resistance and health care costs were compared between the two periods.
Outcome measurements and statistical analysis: The outcome measures were the proportion of resistant uropathogens and costs related to antibiotic consumption and symptomatic postoperative infection. We used χ^2 and Fisher's exact tests to test the significance of differences.
Results and limitations: The proportion of patients with symptomatic postoperative infection did not differ (180/3529 [5.1%] vs 117/2619 [4.5%]; $p = 0.27$). A total of 342 isolates from all patients with symptomatic postoperative infections were analysed. The rate of resistance of *Escherichia coli* to piperacillin/tazobactam (9.1% vs 5.4%; $p = 0.03$), gentamicin (18.3% vs 11.2%; $p = 0.02$), and ciprofloxacin (32.3% vs 19.1%; $p = 0.03$) decreased significantly after protocol introduction. The defined daily dose (DDD) use of ciprofloxacin fell from 4.2 to 0.2 DDD per 100 patient-days after implementation ($p < 0.001$). Antibiotic drug costs (€76 980 vs €36 700) and costs related to postoperative infections (€45 870 vs €29 560) decreased following introduction of the protocol ($p < 0.001$).

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Conclusions: Adherence to EAU guidelines on antibiotic prophylaxis reduced antibiotic usage without increasing post-operative infection rate and lowered the prevalence of resistant uropathogens.
Patient summary: We analysed the impact of adherence to European Association of Urology guidelines on antibiotic prophylaxis for all surgical urologic procedures on the prevalence of infections and resistant bacterial strains and on costs. We found that adherence to the guidelines reduced the rate of bacterial resistance, in particular against piperacillin/tazobactam, gentamicin, and ciprofloxacin, and reduced costs without increasing the risk of postoperative infection after urologic procedures. We recommend adherence to the guidelines as an important part of antibiotic stewardship programmes.

1. Introduction

Use of antibiotic prophylaxis before urologic surgical procedures is a recognised strategy to prevent postoperative infections [1]. However, prophylaxis use should be risk-adjusted according to the procedure to ensure that harms in terms of bacterial resistance in an individual and society do not outweigh the benefits [2,3]. The European Association of Urology (EAU) guidelines on urologic infections summarise evidence supporting the routine use of antibiotic prophylaxis for specific urologic procedures, and use the evidence to set out recommendations on whether or not to use preoperative prophylaxis for urologic procedures categorized according to risk categories for postoperative infection [2]. Adherence to the EAU guidelines is not universal, with considerable unwarranted variation among countries, regions, and types of hospital for preoperative prophylaxis and the agents used [3]. An additional problem is extended duration of antibiotic administration after a surgical procedure without any infective indication. This encourages the development of multidrug-resistant organisms, including strains resistant to newer agents [4], poorer clinical outcomes, and higher treatment costs [1,5]. A number of national and international governmental organizations have reported on the emerging threat of multiresistant bacteria, particularly for the main uropathogen, *Escherichia coli* [6]. To respond to this threat, a number of health care systems have instituted antibiotic stewardship programmes to promote appropriate use of antibiotics, improve patient outcomes, reduce microbial resistance, and decrease the spread of infections caused by multidrug-resistant organisms [7]. These programmes involve enforcement and monitoring of adherence to relevant evidence-based guidelines on antibiotic use, which can have patient benefits and can lead to significant cost reductions [8]. According to this evidence there is an urgent need for reappraisal of the use of antibiotic prophylaxis in each urology department. Against this background, with the hypothesis that introduction of an institutional policy of adherence to EAU guidelines would reduce the risk of emerging resistant bacteria and reduce costs without increasing the risk of postoperative infection, we investigated the following questions. Does adherence to EAU guidelines reduce antimicrobial resistance in uropathogens? Does adherence to EAU guidelines reduce costs related to antibiotic use and postoperative infection?

2. Patients and methods

2.1. Study design

In January 2011 a new departmental protocol for adherence to EAU guidelines on antibiotic prophylaxis was implemented in our institution. Before the protocol was initiated, an educational and training meeting for all urologists was held to demonstrate the protocol and ensure understanding regarding effective implementation. The EAU guideline used for this study was the version edited in 2010 [9]. An investigator (T.C.) performed monthly ward audits with a review of all patient charts to ensure adherence to the protocol among urologists. We prospectively collected all clinical and microbiological data including resistance patterns of implicated pathogens for all infectious complications in all patients undergoing surgical urologic procedures performed from January 2011 to December 2013. Similar data were retrospectively recorded from the clinical records for patients who underwent surgical urologic procedures between January 2008 and December 2010.

2.2. Study population and data collection

From January 2011 to December 2013, all patients attending our centre for surgical urologic procedures ($n = 3584$) were prospectively enrolled in the study. This cohort was compared with a cohort of patients treated ($n = 2698$) between January 2008 and December 2010, before the protocol was implemented.

2.3. Surgical antibiotic prophylaxis protocol

A midstream voided urine specimen was collected before hospital admission and a standard culture test was performed before starting prophylaxis. All patients with positive results for the urine culture were treated according to susceptibility testing and such patients were excluded from the analysis. After discharge all patients were monitored for 1 wk to evaluate all infectious complications related to the procedure after antibiotic prophylaxis. A 1-wk interval was chosen to increase the likelihood of capturing all infections only attributable to the surgical procedure, as events occurring later than 1 wk were deemed unlikely to be related to infection at the time of surgery [1]. All events were evaluated at the routine follow-up visit 30 d after discharge [1]. The resistance patterns of all isolated microorganisms were closely followed and empirical therapy was adjusted accordingly.

2.4. Study data collection

After implementation of the protocol, all data required were collected during the postoperative period by reviewing clinical records. Data items included date of birth, sex, history of urinary tract infections (UTIs), body mass index, American Society of Anesthesiologists score, surgical wound

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