

ASSESSMENT OF THE ROLE OF PROPHYLACTIC ANTIBIOTICS IN PREVENTING URINARY TRACT INFECTIONS FOLLOWING UROLOGICAL PROCEDURES: A RANDOMIZED CONTROLLED TRIAL

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**Abstract:** Urinary tract infection (UTI) can be considered one of the most frequent bacterial infections, and among the main indications for antibiotic use, in children. UTIs affect as much as 2% of the population admitted to community hospitals. **Objective:** The main objective of this randomized control trial was the assessment of the role of prophylactic antibiotics in preventing urinary tract infections following urological procedures. **Methods:** This randomized control trial was conducted at Sheikh Zayed Medical College/Hospital, Rahim Yar Khan from February 2023 to February 2024. Data were collected from 185 patients. Data were collected at baseline, immediately post-procedure, and during follow-up visits at 7, 14, and 30 days postoperatively. Baseline data included demographic information, medical history, and details of the urological procedure. **Results:** Data were collected from 185 patients according to inclusion and exclusion criteria. The average ages were  $55.2 \pm 12.3$  and  $54.8 \pm 11.9$  years, respectively. Both groups had a comparable gender distribution with approximately 70% male and 30% female. BMI was also similar, with averages of  $26.7 \pm 4.5$  for the intervention group and  $26.9 \pm 4.3$  for the control group. The intervention group (n=93) had 7 patients (7.5%) who experienced antibiotic-related adverse events, while the control group (n=92) reported no adverse events (0%). **Conclusion:** It is concluded that prophylactic antibiotics significantly reduce the incidence of postoperative urinary tract infections in patients undergoing urological procedures.

**Keywords:** Prophylactic antibiotics, Urinary tract infection (UTI), Urological procedures, Randomized control trial, Postoperative infection prevention

## Introduction

Urinary tract infections (UTIs) are a common and significant complication following urological procedures, affecting patient outcomes and increasing healthcare costs. These infections can cause the patients to remain in the hospital longer, be sicker, and potentially die from sepsis in instances of severe infection. Therefore, the prevention of UTIs in the perioperative period has become an important issue for concern among urologists and other related healthcare givers (1). UTI could be discussed as one of the most prevalent bacterial infections and one of the main reasons for antibiotic prescription in children (2). UTIs are diagnosed in up to 2% of the population admitted to community hospitals. 8% children per annum in the developed countries, though the resultant incidences range from 8% to 30% (3). Independent predictors of recurrent UTIs in children include anatomical abnormalities of the urinary tract such as VUR, UPJ obstruction, urethral valves, renal duplication, constipation, abnormal voiding bladder dysfunction or funnel Weston-Baby macros impedance, neurogenic bladder, gender, and poor toilet training (4). Nonetheless, it should be realized that acute septic complications are rare, which is why patients with first-time UTIs may have permanent renal scarring in 15% of cases,

and overall in 40%. Renal dysfunction impacts patient health through circumstances such as proteinuria, hypertension, and decreased kidney function. However, debate arises about the effectiveness of performing CAP in patients (5). New studies with high methodological quality observed a small advantage of CAP in the prevention of recurrence, but exclusively in certain subpopulations of patients and with no impact on renal scar formation (6). Concerning the second, the cases of using antibiotics inappropriately enhance the further dissemination of antimicrobial resistance of CA-UTIs, which is already a severe problem and decreases the effectiveness of accessible antibiotics (7). For instance, in a European study carried out in Italy, these researchers showed that the resistance rates to amoxicillin and trimethoprim-sulfamethoxazole were already at 50% in outpatient and inpatient populations. Patients with comorbidities were seen in 8% of cases, and infections caused by MDR pathogens were seen in 6.7% of cases (8). Prophylactic antibiotics have been widely used as a preventive measure to reduce the incidence of postoperative UTIs. The reasons for applying them are to achieve the bacterial population within the urinary tract during as well as after operations, which would otherwise contribute to infection (9). An important part of

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this evaluation is the analysis of directives from representative worldwide urology organizations, including the AUA and EAU (10). These guidelines offer clinical practice recommendations and evidence-based practice while stressing situations that require clinical decision-making in the general application of knowledge (11). In addition, the assessment will look at the meta-analyses and the randomized control trial results to ascertain comparative findings with and without antibiotic prophylaxis and the effectiveness of the preventive measures (12). The endemic emergence of antibiotic resistance bugs now presents a major threat to the use of prophylactic antibiotics. The excess and incorrect use of antibiotics can be a reason for the evolution of antibiotic-resistant strains, thus affecting their use and possibly causing more complex and not easily curable infections. This marks the need for proper antibiotic prescription to avoid fostering resistance but at the same time preventing infections from occurring (13).

**Objective**

The main objective of this randomized control trial was the assessment of the role of prophylactic antibiotics in preventing urinary tract infections following urological procedures.

**Methodology**

This randomized control trial was conducted at Sheikh Zayed Medical College/Hospital, Rahim Yar Khan from February 2023 to February 2024. Data were collected from 185 patients.

Patients aged 18-75 years undergoing elective urological procedures, such as cystoscopy, prostatectomy, or nephrectomy were included in the study. Patients with a history of chronic kidney disease, known antibiotic allergies, active infections at the time of surgery, and recent antibiotic use within two weeks before the procedure were excluded from the study.

Data were collected at baseline, immediately post-procedure, and during follow-up visits at 7, 14, and 30 days postoperatively. Baseline data included demographic information, medical history, and details of the urological procedure. The intervention group received prophylactic antibiotics, while the control group received a placebo. Both patients and healthcare providers were blinded to the group assignments to eliminate bias in treatment administration and outcome assessment. The intervention group received a single dose of a broad-spectrum antibiotic, typically a fluoroquinolone or a cephalosporin, administered intravenously 30 minutes before the urological procedure. The specific antibiotic was chosen based on hospital guidelines and patient allergy profiles. The control group received a placebo that matched the appearance and administration method of the antibiotic. The primary outcome measure was the incidence of postoperative UTIs within 30 days following the procedure. UTIs were diagnosed based on clinical symptoms (e.g., dysuria, frequency, urgency) and confirmed by positive urine cultures. Follow-up data included clinical symptoms, urine culture results, and any adverse events.

Statistical analysis was performed using SPSS v29. Comparisons between the intervention and control groups were made using chi-square tests for categorical variables and t-tests for continuous variables.

**Results**

Data were collected from 185 patients according to inclusion and exclusion criteria. The average ages were  $55.2 \pm 12.3$  and  $54.8 \pm 11.9$  years, respectively. Both groups had a comparable gender distribution with approximately 70% male and 30% female. BMI was also similar, with averages of  $26.7 \pm 4.5$  for the intervention group and  $26.9 \pm 4.3$  for the control group. The prevalence of diabetes mellitus, hypertension, prior UTI history, and smoking rates were nearly identical between the groups

**Table 01: Demographic data of patients**

Characteristic	Intervention Group (n=93)	Control Group (n=92)
Age (years)	55.2 ± 12.3	54.8 ± 11.9
Male (%)	65 (69.9%)	63 (68.5%)
Female (%)	28 (30.1%)	29 (31.5%)
BMI (kg/m <sup>2</sup> )	26.7 ± 4.5	26.9 ± 4.3
Diabetes Mellitus (%)	20 (21.5%)	18 (19.6%)
Hypertension (%)	25 (26.9%)	24 (26.1%)
Prior UTI History (%)	15 (16.1%)	14 (15.2%)
Smoker (%)	30 (32.3%)	31 (33.7%)
<b>Procedure Type</b>		
- Cystoscopy (%)	35 (37.6%)	34 (37.0%)
- Prostatectomy (%)	30 (32.3%)	29 (31.5%)
- Nephrectomy (%)	28 (30.1%)	29 (31.5%)

In the intervention group, 5.4% of patients developed postoperative UTIs, whereas 19.6% of patients in the control group experienced UTIs. Specifically, postoperative UTIs occurred in 5.7% of cystoscopy patients, 3.3% of

prostatectomy patients, and 7.1% of nephrectomy patients in the intervention group. In contrast, the control group had higher UTI rates with 23.5% in cystoscopy patients and 17.2% in both prostatectomy and nephrectomy patients.

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**Table 02: Types of Urological Procedures and Associated UTI Incidence**

Procedure Type	Intervention (n=93)	Group	Postoperative (Intervention)	UTIs	Control (n=92)	Group	Postoperative (Control)	UTIs
Cystoscopy	35		2 (5.7%)		34		8 (23.5%)	
Prostatectomy	30		1 (3.3%)		29		5 (17.2%)	
Nephrectomy	28		2 (7.1%)		29		5 (17.2%)	
Total	93		5 (5.4%)		92		18 (19.6%)	

The intervention group (n=93) had 7 patients (7.5%) who experienced antibiotic-related adverse events, while the control group (n=92) reported no adverse events (0%).

**Table 03: Adverse events related to antibiotics**

Group	Total Patients	Antibiotic-Related Events	Adverse	Percentage (%)
Intervention	93	7		7.5
Control	92	0		0

The intervention group (n=93) had an average hospital stay of 2.5 days, which was shorter compared to the control group's (n=92) average stay of 3.1 days.

**Table 04: Length of hospital stay**

Group	Total Patients	Average Hospital Stay (days)
Intervention	93	2.5
Control	92	3.1

In the intervention group (n=93), 2 patients (2.2%) developed antibiotic-resistant infections, whereas the control group (n=92) had no cases of antibiotic-resistant infections (0%).

**Table 05: Antibiotic-Resistant Infections**

Group	Total Patients	Antibiotic-Resistant Infections	Percentage (%)
Intervention	93	2	2.2
Control	92	0	0

**Discussion**

This randomized controlled trial provides significant evidence supporting the use of prophylactic antibiotics to prevent urinary tract infections (UTIs) following urological procedures. The findings showed a lower frequency of the development of postoperative UTIs in patients who received antibiotics for prevention as opposed to their counterparts who received placebos. The first of the study's findings revealed that in the intervention group, few patients developed postoperative UTIs; the rate was 5. Hence, the use of prophylactic antibiotics is recommended in the prevention of postoperative UTIs as supported in the research studies and the current evidence-based practice protocols (14). Possible factors as to why the UTI rate was reduced include the effects of the antibiotics that were effective in giving the tissues a chance to clear bacteria during and soon after the procedures and hence discouraging the implantation of infections. The number of antibiotic-related AE's identified in the intervention group was 7. 5% serious adverse events are noted, and none of them are considered to be severe (15). This supposition implies that the deployment of drugs for the prevention of infection in certain surgical procedures is generally innocuous and acceptable to patients. Some adverse events were described as moderate but glanceable temporary and mainly manifested as gastrointestinal symptoms (nausea and diarrhea). The information obtained presents similar reactions typical for the antibiotics used and the role of recognizing and preventing further negative outcomes is

accentuated as well (16). The intervention group of patients spent on average 2. 5 days in the hospital more than the control group of patients, 3. 1 day. This decrease in the hospital stay period not only empowers the patients by reducing their likelihood of being affected by complications arising from hospital admittance but also holds direct ramifications on patterns of resource consumption in the health sector (17). Reduced hospitalizations also imply a reduction in the cost of caring for patients in a hospital and increased availability of beds to other patients. Another effect often attached to the application of prophylactic antibiotics is the possibility of acquiring antibiotic resistance. In this study, 2. One of the findings of this research study was that while only 2% of the patients in the intervention group developed antibiotic-resistant infections the control group recorded no such cases. Although the result is not significant, it establishes the fact that there is a need to exercise a lot of precautions when administering antibiotics. The optimal choice of the antibiotic, restriction of the duration of antibiotic therapy, and knowledge about the resistance patterns are the key components of the rational antibiotic policy aiming to reduce the emergence of resistance (18). The findings of this study have important clinical implications. The significant reduction in postoperative UTI rates supports the routine use of prophylactic antibiotics for patients undergoing urological procedures. However, clinicians should consider individual patient risk factors, the type of procedure, and local antimicrobial resistance patterns when deciding on

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prophylactic antibiotic regimens. Modifying antibiotic use to specific patient needs can maximize the benefits while minimizing risks.

### Conclusion

It is concluded that prophylactic antibiotics significantly reduce the incidence of postoperative urinary tract infections in patients undergoing urological procedures. The benefits of decreased infection rates and shorter hospital stays outweigh the risks of mild adverse events and potential antibiotic resistance. These findings support the continued use of prophylactic antibiotics in urological surgeries.

### Declarations

#### Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

#### Ethics approval and consent to participate.

Approved by the department concerned. (IRBEC-00283 dated 11/21)

#### Consent for publication

Approved

#### Funding

Not applicable

### Conflict of interest

The authors declared an absence of conflict of interest.

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