

Determinants of Prolonged Antibiotic Therapy in Patients with Urinary Tract Infection

Esrat Jahan¹, Tarana Pervin^{2*} , Sumaya Jabin Tanny³, Swarupa Das⁴, Tasmia Maliha⁵, Anannya Das⁶

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*Corresponding author



ABSTRACT

Background: Urinary tract infection (UTI) is among the most common bacterial infections worldwide and remains a major cause of antibiotic utilization. Although shorter antibiotic courses are recommended for many patients, prolonged therapy is frequently observed, potentially contributing to antimicrobial resistance, increased healthcare costs, and adverse drug effects. Identifying factors associated with extended antibiotic duration is essential for optimizing treatment strategies and promoting antimicrobial stewardship. Aim of the study: The study aimed to determine the clinical, demographic, and antibiotic-related factors associated with prolonged antibiotic therapy among patients with urinary tract infection. **Methods & Materials:** This cross-sectional observational study was conducted in the Department of Pharmacology and Therapeutics in collaboration with the Department of Medicine at Mymensingh Medical College Hospital, Bangladesh, from January 2025 to December 2025. A total of 385 adult patients with clinically diagnosed UTI receiving systemic antibiotic therapy were included. Patients were categorized into standard-duration therapy (≤ 10 days) and prolonged therapy (> 10 days) groups. Sociodemographic characteristics, clinical factors, previous UTI history, comorbidities, and antibiotic-related variables were collected. Data were analyzed using IBM SPSS Statistics version 26.0. Logistic regression analyses were performed to identify independent predictors of prolonged antibiotic therapy, with $p < 0.05$ considered statistically significant. **Results:** Among 385 patients, 68 (17.66%) received prolonged antibiotic therapy. Patients receiving prolonged therapy had significantly higher mean age (57.5 ± 19.2 vs 52.4 ± 18.1 years, $p = 0.038$), longer symptom duration (16.2 ± 5.1 vs 10.8 ± 5.4 days, $p < 0.001$), higher prevalence of diabetes mellitus (48.53% vs 28.08%, $p = 0.002$), and previous UTI history (39.71% vs 22.40%, $p = 0.005$). Persistent symptoms were the most common reason for prolonged therapy (39.71%). Multivariable logistic regression demonstrated that symptom duration > 14 days (aOR=4.12, 95% CI: 2.22–7.65, $p < 0.001$), diabetes mellitus (aOR=2.01, 95% CI: 1.13–3.59, $p = 0.018$), intravenous antibiotic therapy (aOR=2.62, 95% CI: 1.10–6.27, $p = 0.031$), and previous UTI history (aOR=1.79, 95% CI: 1.01–3.18, $p = 0.046$) were independent predictors of prolonged treatment. **Conclusion:** Prolonged antibiotic therapy in UTI patients was primarily associated with delayed symptom presentation, diabetes mellitus, recurrent infection history, and intravenous antibiotic use. Early recognition of high-risk patients and implementation of evidence-based antibiotic stewardship strategies may help optimize treatment duration, reduce unnecessary antibiotic exposure, and limit the development of antimicrobial resistance.

Keywords: Urinary tract infection; Antibiotic duration; Prolonged antibiotic therapy; Antimicrobial stewardship; Diabetes mellitus; Antibiotic prescribing; Risk factors

1. Assistant Professor (C.C), Department of Pharmacology and Therapeutics, Central Medical College, Cumilla, Bangladesh
2. Assistant Professor (CC), Department of Pharmacology and Therapeutics, Delta Medical College Hospital, Dhaka, Bangladesh (ORCID: 0009-0009-7134-2650)
3. Assistant Professor (CC), Department of Pharmacology and Therapeutics, Monowara Sikder Medical College and Hospital, Shariatpur, Bangladesh
4. M Phil pharmacology, Lecturer, Dental Pharmacology, Mymensingh Medical College, Mymensingh, Bangladesh
5. MPhil, Pharmacology and Therapeutics, Dhaka, Bangladesh
6. Lecturer, Department of Pharmacology & Therapeutics, Bangladesh Medical College, Dhaka, Bangladesh

INTRODUCTION

Urinary tract infection (UTI) is one of the most common bacterial infections affecting individuals of all age groups and represents a major cause of healthcare visits worldwide [1]. It occurs when microorganisms, predominantly bacteria, invade and multiply within the urinary tract, leading to infection of the urethra, bladder, ureters, or kidneys. UTIs are broadly classified into uncomplicated and complicated infections [2,3]. Uncomplicated UTIs generally occur in otherwise healthy individuals without structural or functional abnormalities of the urinary tract, whereas complicated UTIs are associated with factors such as diabetes mellitus, urinary obstruction, renal impairment, immunosuppression, catheterization, or recurrent infection [4,5]. Depending on clinical presentation, UTIs may also be categorized as lower urinary tract infections, such as cystitis, and upper

urinary tract infections, such as pyelonephritis [6]. UTIs impose a substantial global disease burden, particularly among women, older adults, and individuals with underlying comorbidities [7]. It is estimated that approximately 50–60% of women experience at least one UTI during their lifetime, making it one of the most prevalent bacterial infections among females [8]. The burden is particularly significant in developing regions, where delayed healthcare-seeking behavior, limited diagnostic facilities, and inappropriate antibiotic use contribute to recurrent infections and treatment complications [9]. Antibiotic therapy remains the cornerstone of UTI management; however, the optimal duration of treatment continues to be a clinical challenge. While shorter antibiotic courses are generally recommended for uncomplicated infections to minimize antimicrobial resistance and adverse effects,

prolonged therapy may be required in patients with complicated infections, persistent symptoms, recurrent episodes, or underlying risk factors. Unnecessary extension of antibiotic duration increases healthcare costs, exposes patients to medication-related complications, and contributes significantly to the global emergence of antimicrobial resistance [10,11]. Several clinical and demographic factors may influence the duration of antibiotic treatment among UTI patients. Advanced age is associated with increased risk of complicated infections due to age-related immune changes and higher prevalence of comorbidities. Diabetes mellitus is another important risk factor, as hyperglycemia can impair immune function, increase bacterial growth, and predispose patients to recurrent or persistent infections. Previous UTI history may also affect treatment decisions because recurrent infections are often

associated with resistant organisms and incomplete symptom resolution. Additionally, delayed presentation with prolonged symptoms may lead clinicians to prescribe extended antibiotic courses due to concerns regarding treatment failure [12,13]. The choice of antibiotic and route of administration may also contribute to treatment duration. Broad-spectrum antibiotics, including fluoroquinolones and intravenous antimicrobial agents, are often selected for patients with suspected complicated infections or severe clinical presentations [14]. Unnecessary continuation of antibiotics may accelerate antimicrobial resistance. Understanding factors associated with prolonged therapy is essential for targeted interventions. Despite the high burden of UTI, limited data exist on determinants of extended antibiotic use, especially in developing settings. Identifying high-risk patients can improve individualized treatment and reduce unnecessary antimicrobial exposure. Therefore, this study was conducted to evaluate the determinants associated with prolonged antibiotic therapy among patients with urinary tract infection, focusing on demographic characteristics, clinical factors, comorbid conditions, previous infection history, and antibiotic-related variables.

METHODS & MATERIALS

This cross-sectional observational study was conducted in the Department of Pharmacology and Therapeutics in collaboration with the Department of Medicine at Mymensingh Medical College and Mymensingh Medical College Hospital, Mymensingh, Bangladesh. The study was carried out over a one-year period from January 2025 to December 2025. The study included 385 adult patients (≥18 years) with a clinical diagnosis of UTI who were prescribed systemic antibiotic therapy. Patients were categorized into two groups according to the total duration of antibiotic treatment:

Standard-duration therapy (n=317): Patients who received antibiotic treatment for ≤10 days.

Prolonged antibiotic therapy (n=68): Patients who received antibiotic treatment for >10 days.

Inclusion Criteria

- Adult patients aged ≥18 years.
- Clinically diagnosed urinary tract infection.
- Prescribed at least one antibiotic for UTI management.
- Patients attending the outpatient Department of Medicine.

Exclusion Criteria

- Patients diagnosed with orchitis, epididymitis, or acute bacterial prostatitis.
- Patients receiving antibiotics for infections other than UTI.
- Pregnant or lactating women because of different treatment protocols.
- Patients with incomplete or illegible clinical or prescription records.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board of Mymensingh Medical College, Bangladesh (Approval No. MMC/IRB/2025/789; Date: 26 June 2025). Written informed consent was obtained from all participants before enrollment. Confidentiality of patient information was maintained throughout the study.

Data Collection

Data were collected using a pretested semi-structured questionnaire through face-to-face interviews and review of outpatient prescriptions and clinical records. The questionnaire was developed according to the study objectives and refined after pretesting. Sociodemographic data, including age, sex, residence, and marital status, were recorded. Clinical information comprised the duration of urinary symptoms before presentation, history of diabetes mellitus, and previous episodes of urinary tract infection (UTI). Details of antibiotic therapy were also collected, including the antibiotic class prescribed (cephalosporins, fluoroquinolones, nitrofurantoin, tetracyclines, or other commonly prescribed agents), route of administration (oral or intravenous), and type of prescription (brand-name or generic). The total duration of antibiotic therapy was documented for each participant, and patients were

subsequently categorized into standard-duration therapy (≤10 days) or prolonged therapy (>10 days). For patients receiving prolonged antibiotic treatment, the documented reasons for extending therapy were also recorded.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were presented as mean ± standard deviation (SD), while categorical variables were expressed as frequencies and percentages. Comparisons between patients receiving ≤10 days and >10 days of antibiotic therapy were performed using the independent-samples Student's t-test for continuous variables and the Chi-square test for categorical variables. Univariate logistic regression analysis was initially performed to identify factors associated with prolonged antibiotic therapy (>10 days). Variables that were clinically relevant or demonstrated statistical significance in the univariate analysis were subsequently included in a multivariable logistic regression model to determine independent predictors of prolonged antibiotic therapy. The strength of associations was reported as odds ratios (ORs) and adjusted odds ratios (AORs) with corresponding 95% confidence intervals (CIs). A p-value of <0.05 was considered statistically significant.

RESULT

A total of 385 UTI patients were included; 317 received antibiotics for ≤10 days and 68 required >10 days of therapy. Patients with prolonged therapy were older (57.5±19.2 years vs 52.4±18.1 years, p=0.038). Females predominated in both groups (58.82% vs 53.00%). The prolonged therapy group had a longer symptom duration before treatment (16.2±5.1 days vs 10.8±5.4 days, p<0.001). Diabetes mellitus (48.53% vs 28.08%, p=0.002) and previous UTI history (39.71% vs 22.40%, p=0.005) were significantly more common among patients requiring >10 days of antibiotics (Table I).

Table I
Baseline characteristics of study participants (n=385).

Variables	≤10 days (n=317)		>10 days (n=68)		p-value
	n	%	n	%	
Age (years), mean ± SD	52.4 ± 18.1		57.5 ± 19.2		0.038
Female gender	168	53.00	40	58.82	0.392
Rural residence	249	78.55	59	86.76	0.118
Married	265	83.60	62	91.18	0.111
Duration of symptoms (days), mean ± SD	10.8 ± 5.4		16.2 ± 5.1		<0.001
Existing diabetes mellitus	89	28.08	33	48.53	0.002
Previous UTI history	71	22.40	27	39.71	0.005

Cephalosporins were the most commonly prescribed antibiotics in both groups but were significantly higher among patients receiving ≤ 10 days of therapy (53.63% vs 38.24%, $p=0.021$). Fluoroquinolone use was more frequent in the prolonged therapy

group (36.76% vs 22.71%, $p=0.019$), as was tetracycline use (16.18% vs 7.89%, $p=0.041$). Nitrofurantoin use was comparable (8.82% vs 15.77%). Oral therapy was predominant in the shorter-duration group (94.64%), while intravenous

therapy was significantly higher among patients requiring prolonged treatment (16.18% vs 5.36%, $p=0.003$) (*Table II*).

Table II

Antibiotic-related characteristics according to treatment duration ($n=385$).

Variables	≤ 10 days ($n=317$)		>10 days ($n=68$)		p-value
	n	%	n	%	
Cephalosporin	170	53.63	26	38.24	0.021
Fluoroquinolone	72	22.71	25	36.76	0.019
Nitrofurantoin	50	15.77	6	8.82	0.143
Tetracycline	25	7.89	11	16.18	0.041
Oral therapy	300	94.64	57	83.82	0.003
Intravenous therapy	17	5.36	11	16.18	
Brand-name prescription	266	83.91	61	89.71	0.235

The mean antibiotic duration differed by class, with tetracyclines showing the longest duration (10.3 ± 3.2 days), followed by

fluoroquinolones (9.5 ± 3.0 days), cephalosporins (8.5 ± 2.4 days), and nitrofurantoin (7.8 ± 2.1 days) (*Table III*).

Table III

Duration of antibiotic therapy by antibiotic class.

Antibiotic class	Mean duration (days)	SD
Cephalosporin	8.5	2.4
Fluoroquinolone	9.5	3
Nitrofurantoin	7.8	2.1
Tetracycline	10.3	3.2

Among patients receiving >10 days of therapy, persistent symptoms were the most common reason for prolongation (39.71%),

followed by diabetes mellitus (26.47%), recurrent UTI (17.65%), suspected

complicated UTI (10.29%), and physician preference (5.88%) (*Table VI*).

Table VI

Reasons for prolonged antibiotic therapy ($n=68$).

Reason	Frequency (n)	Percentage (%)
Persistent symptoms	27	39.71
Diabetes mellitus	18	26.47
Previous recurrent UTI	12	17.65
Suspected complicated UTI	7	10.29
Physician preference	4	5.88

Univariate analysis identified several factors associated with prolonged antibiotic therapy. Age ≥ 60 years increased the likelihood of prolonged treatment (OR=1.84, 95% CI: 1.05–3.23, $p=0.034$). Diabetes mellitus (OR=2.40, 95% CI: 1.39–4.15, $p=0.002$) and previous UTI history

(OR=2.28, 95% CI: 1.28–4.07, $p=0.005$) were significantly associated with prolonged therapy. Fluoroquinolone use (OR=1.98, 95% CI: 1.12–3.50, $p=0.018$) and intravenous antibiotic administration (OR=3.35, 95% CI: 1.48–7.58, $p=0.004$) also increased the odds. Symptom duration

>14 days was the strongest predictor, showing nearly five-fold higher odds of prolonged therapy (OR=4.86, 95% CI: 2.69–8.77, $p<0.001$) (*Table V*).

Table V

Univariate analysis of factors associated with prolonged antibiotic therapy (>10 days).

Variables	Odds Ratio (OR)	95% CI	p-value
Age ≥ 60 years	1.84	1.05–3.23	0.034
Female sex	1.26	0.74–2.14	0.393
Rural residence	1.79	0.87–3.68	0.114
Diabetes mellitus	2.4	1.39–4.15	0.002
Previous UTI	2.28	1.28–4.07	0.005
Fluoroquinolone prescription	1.98	1.12–3.50	0.018
IV antibiotic	3.35	1.48–7.58	0.004
Symptom duration >14 days	4.86	2.69–8.77	<0.001

In multivariable logistic regression analysis, symptom duration >14 days remained the strongest independent determinant of

prolonged antibiotic therapy (adjusted OR [aOR]=4.12, 95% CI: 2.22–7.65, $p<0.001$). Diabetes mellitus was independently

associated with prolonged therapy (aOR=2.01, 95% CI: 1.13–3.59, $p=0.018$), along with previous UTI history

(aOR=1.79, 95% CI: 1.01–3.18, p=0.046). Intravenous antibiotic therapy was also identified as an independent predictor of prolonged treatment (aOR=2.62, 95% CI: 1.10–6.27, p=0.031) (Table VI).

Table VI
Multivariable logistic regression for determinants of prolonged antibiotic therapy.

Variables	Adjusted OR	95% CI	p-value
Age ≥60 years	1.58	0.89–2.82	0.118
Diabetes mellitus	2.01	1.13–3.59	0.018
Previous UTI	1.79	1.01–3.18	0.046
Fluoroquinolone prescription	1.74	0.98–3.08	0.058
Intravenous therapy	2.62	1.10–6.27	0.031
Symptom duration >14 days	4.12	2.22–7.65	<0.001

DISCUSSION

Urinary tract infection (UTI) remains one of the most frequently encountered bacterial infections in clinical practice, and inappropriate prolongation of antibiotic therapy may contribute to antimicrobial resistance, increased healthcare costs, and unnecessary drug-related adverse effects [15]. This study evaluated the determinants associated with prolonged antibiotic therapy (>10 days) among 385 patients with UTI and identified several demographic, clinical, and treatment-related factors influencing treatment duration. In the present study, patients receiving prolonged antibiotic therapy were significantly older compared with those treated for ≤10 days (57.5±19.2 years vs 52.4±18.1 years, p=0.038). Although age ≥60 years showed a significant association in univariate analysis (OR=1.84, 95% CI: 1.05–3.23, p=0.034), this association was not retained after multivariable adjustment (aOR=1.58, 95% CI: 0.89–2.82, p=0.118). Older age is commonly associated with prolonged treatment due to increased prevalence of comorbidities, altered immune response, recurrent infections, and a higher likelihood of complicated UTI. However, the current findings suggest that age alone may not independently determine antibiotic duration when other clinical factors are considered [16,17]. A significant association was observed between longer symptom duration and prolonged antibiotic use. Patients requiring >10 days of therapy had a significantly longer duration of symptoms before treatment initiation (16.2±5.1 days vs 10.8±5.4 days, p<0.001). In univariate analysis, symptom duration >14 days was the strongest predictor of prolonged therapy (OR=4.86, 95% CI: 2.69–8.77, p<0.001), and it remained independently associated in multivariable analysis (aOR=4.12, 95% CI: 2.22–7.65, p<0.001). This finding indicates that delayed presentation or persistent symptoms may lead clinicians to extend antibiotic courses due to concerns regarding treatment failure or underlying complicated infection [18]. Diabetes mellitus was another important determinant of prolonged antibiotic therapy. Patients receiving longer treatment had a significantly higher prevalence of diabetes mellitus compared with those receiving shorter therapy (48.53% vs 28.08%, p=0.002). Diabetes

was associated with more than two-fold increased odds of prolonged therapy in univariate analysis (OR=2.40, 95% CI: 1.39–4.15, p=0.002) and remained significant after adjustment (aOR=2.01, 95% CI: 1.13–3.59, p=0.018). Similar findings have been reported in previous studies, where diabetes was identified as a risk factor for complicated UTI due to impaired host defense mechanisms, increased bacterial persistence, and higher risk of recurrent infection [19]. Previous history of UTI was also significantly associated with longer antibiotic duration. A previous UTI history was present in 39.71% of patients treated for >10 days compared with 22.40% among those treated for ≤10 days (p=0.005). Previous UTI increased the likelihood of prolonged therapy in both univariate analysis (OR=2.28, 95% CI: 1.28–4.07, p=0.005) and multivariable analysis (aOR=1.79, 95% CI: 1.01–3.18, p=0.046). Recurrent infections may influence physician decision-making, leading to extended treatment courses because of concerns regarding resistant organisms or incomplete eradication of infection [20]. Regarding antibiotic selection, cephalosporins were the most commonly prescribed agents in both groups, accounting for 53.63% of patients receiving ≤10 days of therapy and 38.24% of those receiving >10 days (p=0.021). In contrast, fluoroquinolone use was significantly higher among patients requiring prolonged therapy (36.76% vs 22.71%, p=0.019). Fluoroquinolone prescription was associated with prolonged treatment in univariate analysis (OR=1.98, 95% CI: 1.12–3.50, p=0.018), although it showed borderline significance after adjustment (aOR=1.74, 95% CI: 0.98–3.08, p=0.058). Fluoroquinolones are frequently used for complicated or recurrent UTIs, which may explain their association with longer treatment duration [21,22]. The route of antibiotic administration also influenced treatment duration. Intravenous antibiotic therapy was significantly more frequent among patients treated for >10 days (16.18% vs 5.36%, p=0.003). IV therapy demonstrated a strong association with prolonged treatment in univariate analysis (OR=3.35, 95% CI: 1.48–7.58, p=0.004) and remained an independent predictor in multivariable analysis (aOR=2.62, 95% CI:

1.10–6.27, p=0.031). This may reflect greater disease severity, complicated infections, or inadequate initial response requiring extended antimicrobial management [23,24]. The mean duration of antibiotic therapy varied according to antibiotic class. Tetracycline had the longest mean treatment duration (10.3±3.2 days), followed by fluoroquinolone (9.5±3.0 days), cephalosporin (8.5±2.4 days), and nitrofurantoin (7.8±2.1 days). Among patients requiring prolonged therapy, persistent symptoms were the most common reason (39.71%), followed by diabetes mellitus (26.47%), previous recurrent UTI (17.65%), suspected complicated UTI (10.29%), and physician preference (5.88%). These findings indicate that prolonged antibiotic use was mainly driven by clinical complexity rather than prescribing preference alone [25,26].

LIMITATIONS

This study had several limitations. As a single-center observational study, the findings may not be fully generalizable to other healthcare settings or populations. The cross-sectional design limited the ability to establish causal relationships between identified factors and prolonged antibiotic therapy. Microbiological parameters, including urine culture results and antimicrobial susceptibility patterns, were not analyzed, which may have influenced treatment duration decisions. Additionally, variations in physician prescribing practices and clinical judgment could not be completely controlled. Larger multicenter prospective studies incorporating microbiological and follow-up data are recommended.

CONCLUSION

This study identified several important determinants associated with prolonged antibiotic therapy among patients with urinary tract infection. Prolonged treatment was independently associated with symptom duration exceeding 14 days, diabetes mellitus, previous UTI history, and intravenous antibiotic administration. Persistent symptoms were the most common reason for extending therapy, followed by diabetes-related concerns and recurrent infection history. These findings highlight the importance of early diagnosis,

appropriate risk assessment, and antimicrobial stewardship in optimizing antibiotic duration. Individualized treatment strategies targeting high-risk patients may reduce unnecessary antibiotic exposure, minimize antimicrobial resistance, and improve clinical outcomes while ensuring adequate management of complicated urinary tract infections.

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CONFLICT OF INTEREST

None declared

ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

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