

Original Research Article

Risk factors associated with urinary tract infection among adult patients attending a tertiary care hospital: a hospital-based cross-sectional study

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ABSTRACT

Background: Urinary tract infection (UTI) is a common bacterial infection associated with significant morbidity. This study aimed to determine the proportion of symptomatic adult patients diagnosed with UTI and identify associated demographic and clinical factors.

Methods: A hospital-based cross-sectional study was conducted among 300 adults. Demographic characteristics, comorbidities, previous UTI, urinary catheterization, recent hospitalization, and urological instrumentation were recorded using a structured proforma. UTI status was assessed using clinical features and urine routine examination, and urine culture was performed for all participants. Associations were assessed using the chi-square test and multivariable logistic regression.

Results: Among 300 participants, 84 (28.0%) had UTI. The mean age was 48.6 ± 16.2 years, and 174 (58.0%) were female. UTI was significantly more frequent among females than males (35.1% vs. 18.3%, $p=0.002$) and among participants with diabetes mellitus than those without diabetes (41.7% vs. 21.6%, $p<0.001$). Previous UTI (46.2% vs. 23.0%, $p<0.001$), urinary catheterization (50.0% vs. 23.2%, $p=0.001$), and recent urological instrumentation (48.0% vs. 24.0%, $p=0.018$) were also associated with UTI. Multivariable analysis identified female sex (adjusted odds ratio [aOR] 1.94, 95% CI 1.08-3.48), diabetes mellitus (aOR 2.31, 95% CI 1.32-4.05), previous UTI (aOR 2.76, 95% CI 1.53-4.97), and urinary catheterization (aOR 2.48, 95% CI 1.24-4.96) as independent correlates.

Conclusions: UTI affected 28.0% of participants. Female sex, diabetes mellitus, previous UTI, and urinary catheterization were independently associated with UTI. Identifying high-risk patients may support early diagnosis and preventive strategies.

Keywords: Urinary tract infection, Risk factors, Diabetes mellitus, Urinary catheterization, Recurrent UTI, Adults, Tertiary care hospital, Cross-sectional study

INTRODUCTION

Urinary tract infection (UTI) is one of the most common bacterial infections encountered in clinical practice and

represents an important cause of morbidity and healthcare utilization among adults. The clinical spectrum ranges from uncomplicated lower UTI to complicated infection

and pyelonephritis, particularly in patients with underlying comorbidities or urinary tract abnormalities.^{1,2}

The risk of UTI is influenced by several demographic and clinical factors. Female sex is an important risk factor, while diabetes mellitus has also been associated with an increased risk of UTI. In an Indian tertiary-care study of adults with diabetes, female sex and poor glycaemic control were independently associated with UTI.³ Similarly, an Indian tertiary-care study comparing patients with and without type 2 diabetes mellitus found greater frequencies of previous UTI and prior catheterization among patients with diabetes and UTI.⁴

Urinary catheterization and urological abnormalities are additional important risk factors, particularly in hospitalized patients. Studies from Indian tertiary-care settings have demonstrated associations between catheter use, prolonged catheterization, diabetes, and UTI or catheter-associated UTI.^{4,5}

Despite the substantial burden of UTI, the relative contribution of different risk factors may vary according to the population and healthcare setting. Therefore, identifying locally relevant risk factors may help clinicians recognize high-risk individuals and implement appropriate preventive strategies. The present study aimed to determine the proportion of symptomatic adult patients diagnosed with UTI and identify demographic and clinical factors associated with UTI at a tertiary care hospital, Government medical hospital in Vadodara, Gujarat, India.

METHODS

Study design

A hospital-based cross-sectional study was conducted at Sir Sayajirao General (SSG) Hospital, Vadodara, Gujarat, India, to determine the proportion of symptomatic adult patients diagnosed with UTI and identify demographic and clinical factors associated with UTI.

Study period and participants

The study was conducted over one year, from January 2024 to December 2024. Adults aged 18 years or older presenting with symptoms suggestive of UTI were eligible for inclusion. Consecutive eligible patients were enrolled during the study period until a total of 300 participants had been included. Patients with incomplete clinical or laboratory records were excluded from the study.

Data collection

Data were collected using a structured proforma. Information recorded included age, sex, presenting symptoms, history of diabetes mellitus and other relevant comorbidities, previous history of UTI, recent hospitalization, urinary catheterization, and recent urological instrumentation. Clinical findings and relevant

laboratory investigations were recorded from the patient assessment and medical records.

Diagnosis of UTI

UTI was diagnosed based on compatible clinical symptoms and urine routine examination findings. Urine culture was performed for all 300 participants. Among the 84 participants diagnosed with UTI, all had positive urine cultures, with one uropathogen isolate reported per participant. Participants were categorized according to their UTI status for statistical analysis.

Statistical analysis

Data were analyzed using Jamovi statistical software. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were presented as frequencies and percentages. Associations between categorical variables and UTI status were assessed using the chi-square test, as appropriate. Variables showing clinically relevant associations were considered for multivariable logistic regression analysis to identify factors independently associated with UTI. Results were expressed as adjusted odds ratios (aORs) with 95% confidence intervals (CIs). A two-sided $p < 0.05$ was considered statistically significant.

RESULTS

The study included 300 participants with a mean age of 48.6 ± 16.2 years. Females constituted 58.0% (174/300) of the study population, while males accounted for 42.0% (126/300). Diabetes mellitus was present in 32.0% (96/300) of participants, and 21.7% (65/300) reported a previous history of UTI. Urinary catheterization and recent urological instrumentation were documented in 18.0% (54/300) and 16.7% (50/300) of participants, respectively. Overall, 84 participants (28.0%) were diagnosed with UTI (Table 1).

UTI was significantly more frequent among female participants than male participants (35.1% vs. 18.3%, $p = 0.002$). Participants with diabetes mellitus had a higher proportion of UTI than those without diabetes (41.7% vs. 21.6%, $p < 0.001$). Similarly, participants with a previous history of UTI had a higher proportion of UTI than those without a previous history (46.2% vs. 23.0%, $p < 0.001$). Urinary catheterization was also significantly associated with UTI (50.0% vs. 23.2%, $p = 0.001$). Recent urological instrumentation showed a significant association as well (48.0% vs. 24.0%, $p = 0.018$) (Table 2).

Multivariable logistic regression identified four factors independently associated with UTI. Previous history of UTI showed the strongest association (adjusted odds ratio [aOR] 2.76, 95% confidence interval [CI] 1.53-4.97; $p < 0.001$), followed by urinary catheterization (aOR 2.48, 95% CI 1.24-4.96; $p = 0.010$), diabetes mellitus (aOR 2.31, 95% CI 1.32-4.05; $p = 0.003$), and female sex (aOR 1.94,

95% CI 1.08-3.48; $p=0.026$). All four factors were statistically significant in the adjusted analysis (Table 3).

All 84 participants diagnosed with UTI had positive urine cultures. *E. coli* was the predominant uropathogen, accounting for 46 isolates (54.8%), followed by *Klebsiella* spp. (14/84, 16.7%) and *Enterococcus* spp. (8/84, 9.5%). *Pseudomonas* spp. and other organisms accounted for six isolates each (7.1%), while *Proteus* spp. accounted for four isolates (4.8%) (Table 4).

Table 1: Demographic and clinical characteristics of study participants.

Characteristics	Total, N (%)
Age (in years)	48.6±16.2
Sex	
Female	174 (58.0)
Male	126 (42.0)
Diabetes mellitus	
Yes	96 (32.0)
No	204 (68.0)
Previous history of UTI	
Yes	65 (21.7)
No	235 (78.3)
Urinary catheterization	
Yes	54 (18.0)
No	246 (82.0)
Recent urological instrumentation	
Yes	50 (16.7)
No	250 (83.3)
Current UTI	
Yes	84 (28.0)
No	216 (72.0)

*Values are expressed as mean±SD or frequency (percentage).

Table 2: Association between demographic and clinical factors and UTI.

Risk factors	UTI present, N (%)	UTI absent, N (%)	P value
Sex			
Female	61 (35.1)	113 (64.9)	0.002
Male	23 (18.3)	103 (81.7)	
Diabetes mellitus			
Yes	40 (41.7)	56 (58.3)	<0.001
No	44 (21.6)	160 (78.4)	
Previous UTI			
Yes	30 (46.2)	35 (53.8)	<0.001
No	54 (23.0)	181 (77.0)	
Urinary catheterization			
Yes	27 (50.0)	27 (50.0)	0.001
No	57 (23.2)	189 (76.8)	
Recent urological instrumentation			
Yes	24 (48.0)	26 (52.0)	0.018
No	60 (24.0)	190 (76.0)	

*Percentages are calculated within each risk-factor category. Chi-square test was used.

Table 3: Multivariable logistic regression analysis of factors independently associated with UTI.

Risk factors	Adjusted odds ratio (aOR)	95% CI	P value
Female sex	1.94	1.08-3.48	0.026
Diabetes mellitus	2.31	1.32-4.05	0.003
Previous UTI	2.76	1.53-4.97	<0.001
Urinary catheterization	2.48	1.24-4.96	0.010

*UTI: urinary tract infection; CI: confidence interval. Multivariable logistic regression was used. Reference categories were male sex, absence of diabetes mellitus, no previous UTI, and no urinary catheterization.

Table 4: Distribution of uropathogens isolated from urine cultures among patients with UTI, (n=84).

Uropathogen	N	Percentage (%)
<i>E. coli</i>	46	54.8
<i>Klebsiella</i> spp.	14	16.7
<i>Enterococcus</i> spp.	8	9.5
<i>Pseudomonas</i> spp.	6	7.1
<i>Proteus</i> spp.	4	4.8
Other organisms	6	7.1
Total	84	100.0

DISCUSSION

The present hospital-based cross-sectional study evaluated factors associated with UTI among 300 adult patients attending a tertiary care hospital. UTI was identified in 84 (28.0%) participants. Female sex, diabetes mellitus, previous history of UTI, urinary catheterization, and recent urological instrumentation were associated with UTI in the study population. On multivariable analysis, female sex, diabetes mellitus, previous UTI, and urinary catheterization remained independently associated with UTI.

UTI was diagnosed in 28.0% of the symptomatic adult participants. The observed prevalence is broadly comparable with findings from Indian hospital-based studies, although direct comparison should be interpreted cautiously because the populations, diagnostic criteria, and healthcare settings differed between studies. A study from Kerala evaluating community-acquired UTI reported fever and dysuria as common presenting symptoms and identified diabetes mellitus as the most frequent predisposing factor, present in 34% of patients. Previous UTI and renal disease were also reported as important predisposing factors.⁶ In contrast, a study from Eastern India involving 504 adults with diabetes reported a substantially higher UTI prevalence of 75.4%, reflecting the high-risk nature of a diabetes-specific population.³ The lower prevalence in the present study is therefore expected because our study included both diabetic and non-diabetic adults.

Female sex was significantly associated with UTI in the present study. UTI occurred in 35.1% of female participants compared with 18.3% of males, and female sex remained independently associated with UTI after adjustment (aOR 1.94; 95% CI 1.08-3.48). This finding is consistent with Indian and international evidence. In the Kerala study, UTI was more frequently associated with female-specific and postmenopausal risk factors, while previous UTI was also identified as a predisposing factor.⁶ A study of adult renal transplant recipients from Northeast India found female sex to be a significant risk factor for UTI, although the markedly higher odds reported in that study reflect the substantially different risk profile of transplant recipients.⁷ Similarly, a large prospective Asian study involving 84,920 ICU patients identified female sex as an independent risk factor for catheter-associated UTI (aOR 1.39; 95% CI 1.21-1.59).⁸ The consistency of the association across different populations supports the importance of sex-specific susceptibility when evaluating patients with suspected UTI.

Diabetes mellitus was significantly associated with UTI in our study. Among participants with diabetes, 41.7% had UTI compared with 21.6% of those without diabetes ($p < 0.001$). Diabetes remained an independent risk factor in multivariable analysis (aOR 2.31; 95% CI 1.32-4.05). These findings are consistent with previous Indian studies. In a Southern Indian tertiary-care study involving 200 culture-positive UTI patients, individuals with type 2 diabetes mellitus had higher frequencies of previous UTI and prior catheterization than patients without diabetes.¹ Similarly, the Eastern Indian study of 504 adults with diabetes demonstrated a high burden of UTI and found that female sex and poor glycaemic control, particularly HbA1c $> 9\%$, were independently associated with UTI.³ These findings suggest that diabetes may increase susceptibility to urinary infection through a combination of impaired host defence, glycosuria and associated urinary tract complications. Previous UTI was one of the strongest associations observed in the present study. UTI was present in 46.2% of participants reporting a previous UTI compared with 23.0% of those without such a history ($p < 0.001$). Previous UTI remained independently associated with the outcome (aOR 2.76; 95% CI 1.53-4.97). This observation is consistent with the Kerala study, in which previous UTI was identified as a predisposing factor among patients with community-acquired infection.⁶ The Southern Indian tertiary-care study also reported a markedly greater frequency of previous UTI among patients with diabetes and UTI compared with those without diabetes (25% vs 2%).¹ Although the present study did not specifically classify participants according to formal recurrent-UTI criteria, the findings suggest that a previous infection identifies a subgroup with increased susceptibility to subsequent infection.

Urinary catheterization was another significant risk factor. Half of the catheterized participants in the present study had UTI compared with 23.2% of participants without catheterization ($p = 0.001$), and catheterization remained

independently associated with UTI (aOR 2.48; 95% CI 1.24-4.96). This finding is supported by several Indian studies. A Northern Indian study of catheter-associated UTI in a medical intensive care unit reported a CAUTI rate of 9.4 per 1,000 catheter-days, with females comprising 63.63% of cases and *E. coli* being the commonest pathogen.⁴ A more recent prospective study from a tertiary-care centre in India reported a CAUTI incidence of 31.79% among 239 patients catheterized for more than 48 hours; advanced age, catheterization exceeding seven days, diabetes mellitus and emergency catheterization were significant risk factors. *E. coli* was the most frequently isolated organism, followed by *K. pneumoniae* and *P. aeruginosa*.⁹ These findings reinforce the importance of limiting catheter use to appropriate indications and removing catheters as early as clinically feasible.

Recent urological instrumentation was associated with UTI in the unadjusted analysis of the present study, with UTI occurring in 48.0% of participants with recent instrumentation compared with 24.0% of those without instrumentation ($p = 0.018$). However, it was not retained as an independent predictor in the final multivariable model. This may indicate overlap between instrumentation and other risk factors, particularly urinary catheterization and previous urinary tract disease. Studies of complicated UTI in India have similarly identified urinary catheterization as an important risk factor, particularly among hospitalized patients.¹⁰ The microbiological findings in the present study showed *Escherichia coli* as the predominant uropathogen (54.8%), followed by *Klebsiella* spp. (16.7%), *Enterococcus* spp. (9.5%), *Pseudomonas* spp. (7.1%), and *Proteus* spp. (4.8%). This pattern is broadly consistent with Indian studies in which *E. coli* is the leading urinary pathogen. In Kerala, *E. coli* was the most common isolate, followed by *Klebsiella*, *Citrobacter* and *Enterococcus*.⁶ In Eastern India, among adults with diabetes and culture-positive UTI, *E. coli* accounted for 25.6% of isolates, followed by *Enterococcus* spp. (18.7%) and *Klebsiella* spp. (8.1%).³ The differences in organism proportions may reflect differences in patient selection, diabetes status, community versus hospital acquisition and local antimicrobial exposure. A South Indian tertiary-care study also demonstrated the clinical importance of *E. coli* among patients with UTI, with diabetes being an important predisposing condition.¹

The predominance of *E. coli* in the present study has clinical implications because antimicrobial susceptibility patterns vary considerably between hospitals and patient populations. The Eastern Indian diabetes study reported high multidrug resistance, with 87.4% of bacterial isolates resistant to two or more antimicrobial agents.³ A recent Indian study of catheter-associated UTI also reported concerns regarding antimicrobial resistance among urinary pathogens.¹¹ Therefore, empirical antimicrobial treatment should take into account local antibiograms wherever available, while urine culture and susceptibility testing remain particularly important in complicated infections,

recurrent UTI, catheter-associated infection and patients with significant comorbidities. Overall, the present findings indicate that UTI among adults is influenced by both patient-related and healthcare-associated factors. Female sex, diabetes mellitus and previous UTI identify patients with increased susceptibility, while urinary catheterization represents an important potentially modifiable healthcare-associated exposure. Recognition of these factors may facilitate early identification of high-risk patients and support preventive measures, including appropriate diabetes management, avoidance of unnecessary catheterization, timely catheter removal and culture-guided antimicrobial therapy.

This study has certain limitations. First, its cross-sectional design limits the ability to establish temporal or causal relationships between the identified risk factors and UTI. Second, the study was conducted at a single tertiary care hospital, which may limit the generalizability of the findings to other healthcare settings and community populations. Third, the sample size may have limited the ability to detect associations with less frequent risk factors. In addition, certain potential risk factors, including behavioural factors, sexual activity, menopausal status, anatomical urinary tract abnormalities, and prior antimicrobial exposure, were not comprehensively evaluated. Furthermore, as the study included only symptomatic adults presenting to the hospital, the findings may not reflect the burden of UTI among asymptomatic individuals or the general population. These limitations should be considered when interpreting the findings.

CONCLUSION

UTI was common among adults attending the tertiary care hospital in this study. Female sex, diabetes mellitus, previous history of UTI and urinary catheterization were independently associated with UTI. *E. coli* was the predominant uropathogen, followed by *Klebsiella* spp. and *Enterococcus* spp., consistent with patterns reported from Indian tertiary-care settings. Identification of high-risk individuals, optimization of glycaemic control, appropriate management of recurrent infections and avoidance of unnecessary urinary catheterization may help reduce the burden of UTI. Local microbiological surveillance and culture-guided antimicrobial therapy are important because the distribution of uropathogens and antimicrobial resistance patterns vary between healthcare settings.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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