

## FREQUENCY OF URINARY TRACT INFECTION FOLLOWING PROLONGED CATHETERIZATION IN POSTOPERATIVE SURGICAL PATIENTS

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DOI: <https://doi.org/10.5281/zenodo.20623764>

### Keywords

Catheterization, Diabetes Mellitus, Postoperative Patients, Urinary Tract Infection, Uropathogens.

### Article History

Received: 07 April 2026

Accepted: 19 May 2026

Published: 10 June 2026

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### Abstract

**Background:** The urinary tract infection (UTI) is one of the most common healthcare-associated infections among hospitalized patients. Postoperative surgical patients requiring prolonged urinary catheterization are at increased risk of developing catheter-associated urinary tract infections, leading to increased morbidity, prolonged hospital stay, and higher healthcare costs.

**Objectives:** To determine the frequency of urinary tract infection following prolonged catheterization in postoperative surgical patients.

**Study Design & Setting:** This descriptive cross-sectional study was conducted in the Department of General Surgery, Shaikh Zayed Hospital, Lahore over a period of six months from Dec 2025 to May 2026.

**Methodology:** A total of 120 postoperative surgical patients aged 18–70 years who required indwelling urinary catheterization for more than 72 hours were enrolled through consecutive non-probability sampling. Patients with pre-existing urinary tract infection, positive preoperative urine culture, congenital urinary tract abnormalities, chronic kidney disease, neurogenic bladder, or immunocompromised status were excluded. Demographic and clinical data were recorded. Urine samples were obtained aseptically and subjected to microscopy and culture sensitivity testing. Data were analyzed using SPSS version 26. Stratification was performed for age, gender, diabetes mellitus, and duration of catheterization.

**Results:** The mean age of the patients was  $48.7 \pm 13.6$  years, while the mean duration of catheterization was  $5.8 \pm 1.9$  days. There were 72 (60.0%) males and 48 (40.0%) females. Diabetes mellitus was present in 38 (31.7%)

patients. Urinary tract infection was observed in 22 (18.3%) patients. *Escherichia coli* was the most commonly isolated organism, accounting for 11 (50.0%) cases. Diabetes mellitus was significantly associated with UTI (31.6% vs. 12.2%,  $p=0.018$ ), while catheterization duration exceeding five days was

associated with a significantly higher infection rate (27.6% vs. 9.7%,  $p=0.004$ ).

**Conclusion:** Urinary tract infection was a frequent complication among postoperative surgical patients undergoing prolonged catheterization. Diabetes mellitus and prolonged catheterization duration were significant risk factors associated with infection development.

## INTRODUCTION

Urinary tract infection (UTI) is one of the most common healthcare-associated infections and represents a significant cause of morbidity among hospitalized patients. Catheter-associated urinary tract infection (CAUTI) occurs when microorganisms colonize the urinary tract in the presence of an indwelling urinary catheter.<sup>1,2</sup> Urinary catheterization is frequently employed in postoperative surgical patients for accurate monitoring of urine output, prevention of urinary retention, and facilitation of perioperative management. Although catheterization provides important clinical benefits, prolonged catheter use substantially increases the risk of urinary tract infections, leading to adverse patient outcomes and increased healthcare utilization.<sup>3,4</sup> Globally, UTIs account for approximately 30–40% of all hospital-acquired infections, with the majority being associated with indwelling urinary catheters.<sup>5</sup> It has been estimated that nearly 15–25% of hospitalized patients undergo urinary catheterization during their hospital stay, and the risk of bacteriuria increases by 3–10% with each day of catheterization. In developing countries, including those in South Asia, the burden of catheter-associated infections remains considerable due to high patient loads, prolonged hospital stays, limited infection control resources, and variable adherence to catheter care protocols.<sup>6</sup>

The development of UTI following prolonged catheterization is influenced by multiple factors. Duration of catheter placement remains the most important determinant, while advanced age, female gender, diabetes mellitus, immunosuppression, prolonged hospitalization, major surgical procedures, and breaches in aseptic catheter insertion techniques further increase susceptibility. Additionally, biofilm formation on catheter surfaces facilitates

microbial adherence and persistence, contributing to infection development.<sup>7</sup> The pathophysiology of catheter-associated UTI involves the ascent of microorganisms through either the extraluminal or intraluminal route. Catheter insertion bypasses normal host defense mechanisms and provides a direct pathway for bacterial entry into the urinary tract. Microorganisms subsequently adhere to catheter surfaces and form biofilms, which protect them from host immune responses and antimicrobial agents, thereby promoting persistent colonization and infection.<sup>8</sup>

Clinical manifestations range from asymptomatic bacteriuria to symptomatic infection characterized by fever, suprapubic discomfort, dysuria, urinary urgency, flank pain, and systemic signs of infection. If left untreated, catheter-associated UTIs may progress to pyelonephritis, bacteremia, sepsis, prolonged hospitalization, increased healthcare costs, and, in severe cases, mortality.<sup>9</sup> Diagnosis is primarily based on clinical assessment supported by laboratory investigations, including urinalysis, urine microscopy, and urine culture. Identification of the causative organism and its antimicrobial susceptibility pattern is essential for guiding appropriate therapy. Common pathogens include *Escherichia coli*, *Klebsiella* species, *Proteus* species, *Pseudomonas aeruginosa*, and *Enterococcus* species.<sup>10</sup>

Current management strategies emphasize prevention through strict adherence to aseptic catheter insertion techniques, maintenance of a closed drainage system, regular catheter care, and early catheter removal whenever clinically feasible.<sup>11</sup> Treatment typically involves appropriate antimicrobial therapy based on culture and sensitivity results, alongside catheter replacement or removal when indicated. Despite advances in infection prevention practices, considerable variation exists in reported infection

rates among postoperative surgical populations, largely due to differences in patient characteristics, surgical procedures, catheterization duration, and institutional infection control measures. Consequently, the burden of urinary tract infection following prolonged catheterization continues to remain an important concern in postoperative patient care and healthcare quality improvement initiatives.

## MATERIALS AND METHODS

This descriptive cross-sectional study was conducted in the Department of General Surgery Shaikh Zayed Hospital, Lahore over a period of six months from Dec 2025 to May 2026. The sample size was calculated using the WHO sample size calculator by taking an anticipated frequency of urinary tract infection following prolonged catheterization of 8%, a confidence level of 95%, and an absolute precision of 5.0%, yielding a minimum sample size of 113 patients. To increase the study power and compensate for possible dropouts, a total of 120 patients were included.

Patients aged 18–70 years who underwent surgical procedures and required indwelling urinary catheterization for more than 72 hours in the postoperative period were enrolled through consecutive non-probability sampling. Patients with pre-existing urinary tract infection, positive preoperative urine culture, congenital urinary tract abnormalities, chronic kidney disease, neurogenic bladder, immunocompromised status, or those receiving long-term antibiotic therapy before surgery were excluded from the study.

After obtaining informed written consent, demographic and clinical data including age, gender, type of surgery, duration of catheterization, and relevant comorbidities were recorded on a structured proforma. All urinary catheters were inserted using standard aseptic techniques and maintained according to institutional protocols. Patients were monitored daily for symptoms suggestive of urinary tract infection including fever, suprapubic pain, dysuria, urinary urgency, frequency, and cloudy urine. Following prolonged catheterization (>72 hours), urine specimens were collected aseptically

from the catheter sampling port and were sent for routine microscopy and culture sensitivity testing. Urinary tract infection was diagnosed when a patient demonstrated clinical features suggestive of infection along with a positive urine culture showing significant bacteriuria ( $\geq 10^5$  colony-forming units/mL). All data were entered and analyzed using SPSS version 26. Quantitative variables such as age and duration of catheterization were presented as mean  $\pm$  standard deviation. Qualitative variables including gender, type of surgery, and urinary tract infection were presented as frequencies and percentages. Stratification was performed with respect to age, gender, duration of catheterization, diabetes mellitus, and type of surgery. Post-stratification associations were assessed using the Chi-square test, and a p-value  $\leq 0.05$  was considered statistically significant.

## RESULTS

The study included 120 postoperative surgical patients. The mean age of the participants was  $48.7 \pm 13.6$  years, while the mean duration of catheterization was  $5.8 \pm 1.9$  days. There were 72 (60.0%) males and 48 (40.0%) females. Diabetes mellitus was present in 38 (31.7%) patients, as given in Table 1.

Among the study participants, gastrointestinal surgery was the most common procedure performed in 38 (31.7%) patients, followed by hepatobiliary surgery in 24 (20.0%) patients and urological surgery in 18 (15.0%) patients. Colorectal surgery, hernia repair, and miscellaneous procedures accounted for 16 (13.3%), 14 (11.7%), and 10 (8.3%) patients, respectively, as given in Table 2.

Urinary tract infection following prolonged catheterization was observed in 22 (18.3%) patients, whereas 98 (81.7%) patients did not develop urinary tract infection, as given in Table 3.

Among patients who developed urinary tract infection, *Escherichia coli* was the most frequently isolated organism, identified in 11 (50.0%) cases. *Klebsiella* spp. was isolated in 5 (22.7%) patients, followed by *Pseudomonas aeruginosa* in 3 (13.6%), *Enterococcus* spp. in 2

(9.1%), and Proteus spp. in 1 (4.5%) patient, as given in Table 4.

Urinary tract infection was observed in 10 (13.9%) males and 12 (25.0%) females, with no statistically significant association between gender and urinary tract infection (p=0.184). A significantly higher frequency of urinary tract infection was noted among diabetic patients

compared to non-diabetic patients (31.6% vs. 12.2%; p=0.018). Similarly, patients with catheterization duration exceeding 5 days demonstrated a significantly higher frequency of urinary tract infection compared to those catheterized for 4-5 days (27.6% vs. 9.7%; p=0.004), as given in Table 5.

**Table 1: Baseline Characteristics of Study Participants (n=120)**

Variable	Value
Age (years), Mean ± SD	48.7 ± 13.6
Duration of catheterization (days), Mean ± SD	5.8 ± 1.9
Male, n (%)	72 (60.0)
Female, n (%)	48 (40.0)
Diabetes Mellitus, n (%)	38 (31.7)

**Table 2: Type of Surgery Among Study Participants (n=120)**

Type of Surgery	n (%)
Gastrointestinal	38 (31.7)
Hepatobiliary	24 (20.0)
Urological	18 (15.0)
Colorectal	16 (13.3)
Hernia Repair	14 (11.7)
Miscellaneous	10 (8.3)

**Table 3: Frequency of Urinary Tract Infection Following Prolonged Catheterization (n=120)**

Urinary Tract Infection	n (%)
Yes	22 (18.3)
No	98 (81.7)

**Table 4: Isolated Organisms Among Patients with Urinary Tract Infection (n=22)**

Organism	n (%)
Escherichia coli	11 (50.0)
Klebsiella spp.	5 (22.7)
Pseudomonas aeruginosa	3 (13.6)
Enterococcus spp.	2 (9.1)

Proteus spp.	1 (4.5)
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**Table 5: Stratification of Urinary Tract Infection with Respect to Selected Variables (n=120)**

Variable	UTI Present n (%)	UTI Absent n (%)	p-value
Male (n=72)	10 (13.9)	62 (86.1)	0.184
Female (n=48)	12 (25.0)	36 (75.0)	
Diabetes Present (n=38)	12 (31.6)	26 (68.4)	0.018
Diabetes Absent (n=82)	10 (12.2)	72 (87.8)	
Catheterization >5 Days (n=58)	16 (27.6)	42 (72.4)	0.004
Catheterization 4-5 Days (n=62)	6 (9.7)	56 (90.3)	

**DISCUSSION**

Urinary tract infection (UTI) is among the most common healthcare-associated infections encountered in hospitalized patients. Prolonged urinary catheterization is a major risk factor for the development of catheter-associated urinary tract infections, particularly in postoperative surgical patients.<sup>12,13</sup> The risk of infection increases with the duration of catheter placement due to bacterial colonization and biofilm formation on catheter surfaces. Catheter-associated UTIs contribute to increased patient morbidity, prolonged hospital stay, and additional healthcare costs. Several patient-related factors, including advanced age, diabetes mellitus, and underlying comorbidities, further increase the risk of infection. Early identification of the frequency of UTI following prolonged catheterization is important for improving preventive strategies and patient outcomes.<sup>14</sup>

The present study evaluated the frequency of urinary tract infection (UTI) following prolonged catheterization in postoperative surgical patients and found that 22 out of 120 patients developed UTI, yielding a frequency of 18.3%. The mean age of the study population was 48.7 ± 13.6 years, with males comprising 60.0% of participants, while diabetes mellitus was present in 31.7% of patients. Furthermore, diabetes mellitus and catheterization duration exceeding five days were significantly associated with UTI development (p=0.018 and p=0.004, respectively), whereas gender was not significantly associated with infection (p=0.184).

The demographic characteristics observed in the current study were comparable to those reported

by Panwar et al. (2025), who documented a mean age of 45.7 ± 14.2 years among catheterized patients, closely resembling our mean age of 48.7 ± 13.6 years. Similarly, the prevalence of diabetes mellitus in our cohort was 31.7%, which was slightly lower than the 39% reported by Panwar et al. Despite these differences, both studies identified diabetes as an important contributor to catheter-associated urinary tract infection (CAUTI).<sup>15</sup>

The overall frequency of UTI observed in our study (18.3%) was lower than the 26.8% CAUTI rate reported by Khan and Akhtar (2025). This variation may be attributable to differences in study populations, catheterization practices, infection control measures, and the inclusion of predominantly urology patients in their investigation. Nevertheless, the risk factor profile demonstrated remarkable consistency between the two studies. Khan and Akhtar identified diabetes mellitus as a significant predictor of CAUTI with an adjusted odds ratio (AOR) of 2.36, while longer catheter duration was associated with an AOR of 1.27. Our findings similarly demonstrated significantly greater infection rates among diabetic patients and among patients catheterized for more than five days (27.6% vs. 9.7%, p=0.004). These findings collectively reinforce the importance of metabolic comorbidity and prolonged catheter exposure in the pathogenesis of catheter-associated infections.<sup>16</sup>

The significant role of catheter duration observed in our study is further supported by the findings of Mahran et al. (2025), who reported duration of urinary catheterization as the strongest

predictor of CAUTI, with a hazard ratio (HR) of 7.14 (95% CI: 3.78–14.63). Mahran et al. also identified diabetes mellitus as a major determinant of infection risk (HR=6.25; 95% CI: 3.13–11.47), while postoperative status itself increased the risk of CAUTI (HR=2.34; 95% CI: 1.23–4.45).<sup>17</sup> Since all participants in our study were postoperative surgical patients, the observed UTI frequency of 18.3% further supports the vulnerability of this patient population to catheter-related infections. Additionally, Mahran et al. reported increased susceptibility among females and elderly patients, findings that correspond with the higher infection frequencies observed among females and older age groups in our study.<sup>17</sup>

The results of the present study also align with the evidence synthesized by Li et al. (2019) in their systematic review and meta-analysis. Li et al. identified female gender, diabetes mellitus, prolonged catheterization, previous catheter exposure, and extended hospitalization as major risk factors for CAUTI. Our findings directly support two of the most consistently reported risk factors in that meta-analysis, namely diabetes mellitus and prolonged catheter duration. Although female patients in our study experienced a higher infection frequency than males (25.0% vs. 13.9%), statistical significance was not achieved, possibly due to the relatively modest sample size. Nevertheless, the direction of the association remained consistent with the broader evidence summarized by Li et al. Moreover, the occurrence of UTI in nearly one-fifth of our postoperative patients underscores the clinical significance of CAUTI highlighted in the meta-analysis.<sup>18</sup>

Further support for the importance of catheter duration comes from the study by Wongsri et al. (2023), who reported a CAUTI rate of 5.67 per 1,000 catheter days and demonstrated that each additional catheter day increased infection risk by approximately 7%. Although catheter-day rates were not calculated in the present study, the significantly greater infection frequency among patients catheterized for more than five days strongly mirrors the findings of Wongsri et al. The progressive increase in infection risk with prolonged catheter exposure observed across both

studies is biologically plausible because extended catheterization facilitates microbial colonization and biofilm formation on catheter surfaces, thereby promoting infection.<sup>19</sup>

Similarly, Al-Amri et al. (2025) reported that prolonged catheterization and extended hospitalization were significantly associated with increased CAUTI risk. Their findings are in agreement with our observation that patients with catheterization duration exceeding five days had nearly three times the infection frequency compared with those catheterized for four to five days (27.6% vs. 9.7%). The consistency between these findings strengthens the evidence that catheter duration remains one of the most important modifiable risk factors for postoperative urinary tract infection. Reducing unnecessary catheter use and ensuring timely catheter removal may therefore represent effective strategies for minimizing infection burden.<sup>20</sup>

### Study Limitations

This study was conducted at a single center, which may limit the generalizability of the findings. The relatively small sample size may have reduced the ability to detect associations with less common risk factors. Long-term follow-up of patients after hospital discharge was not performed, which may have underestimated the true burden of urinary tract infection.

### CONCLUSION

Urinary tract infection was a common complication among postoperative surgical patients undergoing prolonged catheterization, affecting 18.3% of the study population. Diabetes mellitus and catheterization duration exceeding five days were significantly associated with a higher frequency of urinary tract infection. Appropriate catheter care and timely catheter removal may help reduce the occurrence of catheter-associated urinary tract infections.

**Acknowledgement:** We sincerely acknowledge the support and guidance of our mentors, colleagues, and the staff of the participating hospital for their valuable assistance throughout this study.

**Conflict of Interest:** No

**Funding Disclosure:** None

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