FREQUENCY OF URINARY TRACT INFECTIONS IN PATIENTS WITH INDWELLING URINARY CATHETERS

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Abstract

BACKGROUND:

Urinary tract infections (UTIs) are among the most common microbial infections worldwide. Catheter-associated urinary tract infections (CAUTIs) represent a significant proportion of nosocomial infections, accounting for approximately 10–70% of all hospital-acquired infections, particularly in intensive care units. CAUTIs are associated with adverse clinical outcomes, including increased length of hospital stay, patient discomfort, functional limitations, elevated healthcare costs, and higher morbidity and mortality due to complications such as bacteremia and septicemia.

OBJECTIVE:

To determine the frequency of urinary tract infection in patients with indwelling urinary catheters in the Department of Medicine at Lady Reading Hospital, Peshawar.

METHODS:

This cross-sectional study was conducted at the Department of Medicine, MTI–Lady Reading Hospital, Peshawar, over a period of six months following approval from CPSP. A total of 169 patients aged 30–80 years with indwelling urinary catheters inserted for more than three days were included through consecutive non-probability sampling. Patients with pre-existing UTIs, urinary tract abnormalities, malignancies, immunosuppressive therapy, or recent urological procedures were excluded. Urine samples were collected aseptically and analyzed microscopically by a microbiologist for the presence of more than five pus cells per high-power field. Data were analyzed using SPSS version 23.0. Frequencies and percentages were calculated, and associations were evaluated using Chi-square or Fisher's exact test, with $p \leq 0.05$ considered significant.

RESULTS:

Out of 169 catheterized patients, 62 (36.7%) developed urinary tract infection. No statistically significant association was observed between UTI and age ($p = 0.358$) or gender ($p = 0.121$). However, a significant association was found with diabetes mellitus, as 51.5% of diabetic patients developed UTI compared to 27.2% of non-diabetics ($p = 0.002$). Similarly, antibiotic use was significantly

associated with UTI, with 52.1% of patients who received antibiotics developing infection compared to 25.0% among those who did not (p = 0.001).

CONCLUSION:

The study identified a high frequency of catheter-associated urinary tract infection in hospitalized patients. Diabetes mellitus and prior use of antibiotics were significantly associated with an increased risk of UTI, highlighting the need for targeted infection control strategies, vigilant monitoring, and antibiotic stewardship in catheterized patients.

INTRODUCTION

Urinary tract infections (UTIs) are among the most common microbial infections encountered in clinical practice. One of the leading causes of hospital-acquired infections is the use of indwelling urinary catheters, which contribute to approximately 10–70% of all nosocomial infections, particularly in intensive care units (ICUs) [1]. Catheter-associated urinary tract infections (CAUTIs) have substantial clinical implications, including prolonged hospital stays, patient discomfort, restricted mobility, increased healthcare costs, and heightened morbidity and mortality due to complications such as bacteremia and septicemia [2–4].

Multiple risk factors contribute to the development of CAUTIs, with the duration of catheterization being the most significant determinant. Additional factors include female gender, advanced age (especially >50 years), hyperglycemia, pediatric age groups, and neurological disorders such as cerebrovascular accidents—all of which have been linked to an elevated risk of CAUTI [5,6]. Pathophysiologically, two-thirds of infections result from biofilm formation on the external surface of the catheter, while the remaining cases arise from intraluminal contamination through exogenous sources [7].

A 2019 review of randomized controlled trials reported that in Germany, nearly 60% of nosocomial UTIs were associated with urethral catheterization [8]. In contrast, a study conducted at Dhulikhel Hospital, Kathmandu, Nepal, found a much lower incidence, with only 12.5% of catheterized patients developing bacteriuria and CAUTI [9].

Given the significant morbidity and healthcare burden posed by CAUTIs, and the limited availability of local data, this study aims to determine the frequency of urinary tract infections among patients with indwelling urinary catheters in a tertiary care setting. Understanding the true burden of disease in our population will not only bridge the current knowledge gap but also support the development of evidence-based local guidelines to reduce infection rates, hospital stay duration, and resource utilization in the region of Khyber Pakhtunkhwa.

METHODOLOGY

This cross-sectional study was conducted at the Department of Medicine, Medical Teaching Institute – Lady Reading Hospital (MTI-LRH), Peshawar, over a period of six months following approval of the research synopsis by the College of Physicians and Surgeons Pakistan (CPSP). The sample size was calculated using the WHO sample size calculator version 1.1, considering a 95% confidence level, 5% absolute precision, and an estimated 12.5% frequency of urinary tract infection (UTI) in patients with indwelling urinary catheters based on previously published data. The resulting sample size was 169 patients. A consecutive non-probability sampling technique was used to enroll eligible patients.

Urinary tract infection was defined as the presence of more than five pus cells per high-power field (HPF) in a urine sample, as determined by microscopic examination conducted by a microbiologist with at least five years of experience. An indwelling urinary catheter was defined as a catheter inserted by a trained nurse or physician for any medical indication after hospital admission and retained in situ for a minimum duration of three days.

Patients included in the study were aged between 30 and 80 years, of either gender, and had an indwelling urinary catheter in place for more than three days. Exclusion criteria included patients with a confirmed UTI prior to catheterization, those with urinary tract abnormalities or malignancy, patients using steroids or immunosuppressive medications, and individuals who had recently undergone any surgical or

interventional procedure involving the kidneys or urinary tract.

Prior to initiation of the study, ethical approval was obtained from the hospital's institutional review board. Informed consent was taken from all participants. On admission, blood samples were collected from each patient to evaluate complete blood count, liver function tests, renal function tests, serum electrolytes (sodium, potassium, chloride), and random blood glucose. Abdominal ultrasonography was performed to rule out structural urinary abnormalities. Where indicated, urinary catheterization was performed under aseptic technique by a trained physician or nurse. A baseline urine sample was collected within two hours of catheter insertion using sterile technique for microscopic analysis. A follow-up urine sample was obtained on the third day of catheterization by clamping the catheter and aspirating urine with a sterile syringe and 26-gauge needle after disinfecting the catheter with 70% alcohol. A new needle was then used to transfer the urine into a sterile container, which was sent to the pathology laboratory at Lady Reading Hospital for microscopic examination to assess for UTI.

Data related to patient demographics (name, age, gender, and address), presence or absence of UTI, history of diabetes mellitus, reason for catheterization, and use of oral or intravenous antibiotics were recorded on a pre-designed structured proforma.

All collected data were entered and analyzed using SPSS version 23.0. Mean and standard deviation were computed for continuous variables such as age. Frequencies and percentages were calculated for categorical variables including gender, presence of UTI, diabetes mellitus, and antibiotic use. To evaluate associations, the presence of UTI was stratified by age, gender, diabetes status, and antibiotic use to control for potential effect modifiers. The Chi-square test or Fisher's exact test was applied for post-stratification analysis, and a p-value of ≤ 0.05 was considered statistically significant. Results were presented in tabular and graphical formats.

RESULTS:

A total of 169 patients with indwelling urinary catheters participated in the study. The age distribution showed that most patients were between 51–60 years (28.40%, n=48), followed by those aged 41–50 years (24.85%, n=42) and 61–70 years (21.30%, n=36). Fewer patients were aged 71–80 years (17.16%, n=29), and the least number were in the 30–40 years group (8.28%, n=14). This indicates that the majority of patients requiring urinary catheterization were middle-aged to elderly.

Regarding gender, there were slightly more female patients (52.66%, n=89) than males (47.34%, n=80). In terms of comorbidities, diabetes mellitus was present in 39.05% of patients (n=66), while 60.95% (n=103) were non-diabetic. As for the use of antibiotics, 43.20% of patients (n=73) had received oral or intravenous antibiotics, and 56.80% (n=96) had not received any antibiotics during their hospital stay.

The overall frequency of urinary tract infection (UTI) in this sample was 36.69% (n=62), while 63.31% (n=107) of the patients did not develop UTI.

When analyzing associations between patient characteristics and the presence of UTI, age was not found to be significantly associated. Among the different age groups, 21.4% (n=3) of patients aged 30–40 years developed UTI compared to 28.6% (n=12) in the 41–50 years group, 37.5% (n=18) in the 51–60 group, 44.4% (n=16) in the 61–70 group, and 44.8% (n=13) in the 71–80 group. Although a higher percentage of UTIs was seen in the older age groups, the difference was not statistically significant (p = 0.358).

Gender-wise, UTI was more common in females (42.7%, n=38) compared to males (30.0%, n=24), but this difference also did not reach statistical significance (p = 0.121).

However, a significant association was observed between diabetes mellitus and UTI. Among diabetic patients, 51.5% (n=34) developed UTI, compared to only 27.2% (n=28) of non-diabetic patients. This association was statistically significant with a p-value of 0.002, suggesting that diabetes is a risk factor for catheter-associated UTI.

Similarly, the use of antibiotics showed a significant relationship with UTI. Patients who had received oral or intravenous antibiotics developed UTIs in 52.1% of cases (n=38), while only 25.0% (n=24) of those who had not received antibiotics developed UTIs. This association was also statistically significant with a p-value of 0.001. These results suggest that patients

receiving antibiotics may already have been at higher risk or may have developed resistance, leading to higher UTI rates.

In summary, while age and gender were not significantly related to the development of UTI in catheterized patients, both the presence of diabetes mellitus and the use of antibiotics were found to be significantly associated with an increased risk of developing a urinary tract infection.

TABLE:1 DISTRIBUTION OF STUDY VARIABLES (N = 169)

| Variable	Category	Frequency (n)	Percentage (%)
Age Group	30–40 Years	14	8.28
	41–50 Years	42	24.85
	51–60 Years	48	28.40
	61–70 Years	36	21.30
	71–80 Years	29	17.16
Gender	Female	89	52.66
	Male	80	47.34
Diabetes Mellitus	Absent	103	60.95
	Present	66	39.05
Use of Oral/IV Antibiotics	No	96	56.80
	Yes	73	43.20
Urinary Tract Infection (UTI)	Absent	107	63.31
	Present	62	36.69

TABLE:2 ASSOCIATION OF VARIABLES WITH URINARY TRACT INFECTION (UTI) (N = 169)

Variable	UTI Present (n, %)	UTI Absent (n, %)	Total (n)	P-Value
Age 30–40	3 (21.4%)	11 (78.6%)	14	0.358
Age 41–50	12 (28.6%)	30 (71.4%)	42	0.358
Age 51–60	18 (37.5%)	30 (62.5%)	48	0.358
Age 61–70	16 (44.4%)	20 (55.6%)	36	0.358
Age 71–80	13 (44.8%)	16 (55.2%)	29	0.358
Gender: Male	24 (30.0%)	56 (70.0%)	80	0.121
Gender: Female	38 (42.7%)	51 (57.3%)	89	0.121
Diabetes: Present	34 (51.5%)	32 (48.5%)	66	0.002
Diabetes: Absent	28 (27.2%)	75 (72.8%)	103	0.002
Antibiotics: Yes	38 (52.1%)	35 (47.9%)	73	0.001
Antibiotics: No	24 (25.0%)	72 (75.0%)	96	0.001

GRAPH:1

GRAPH:2
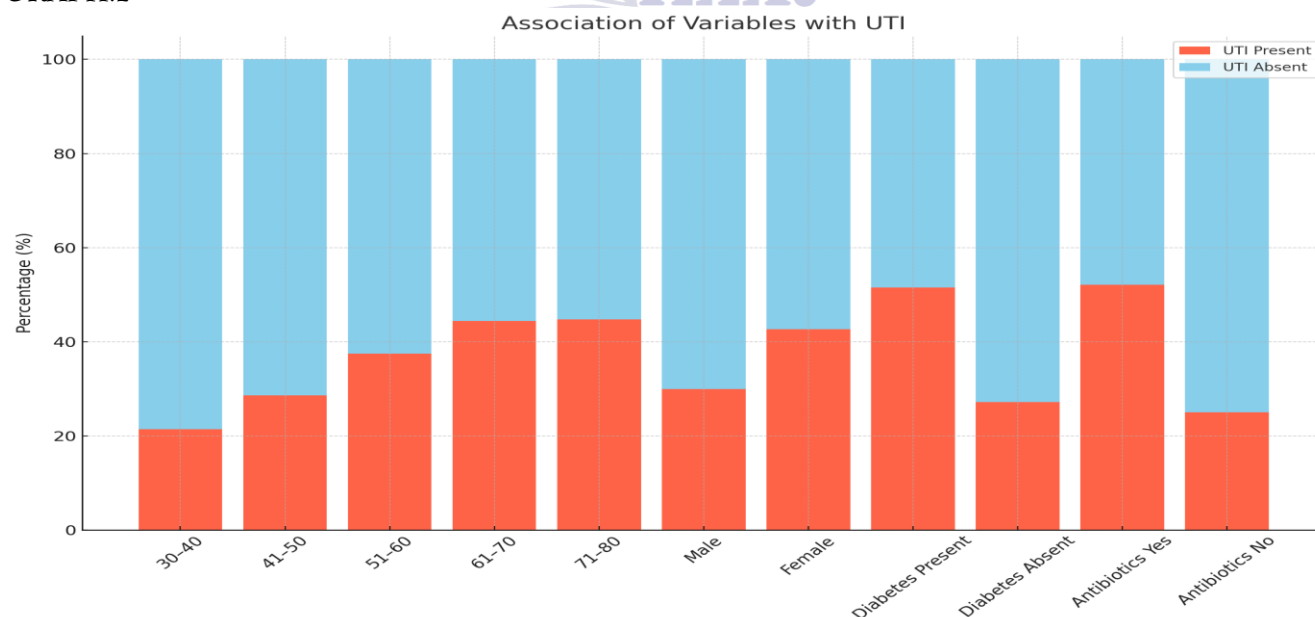
DISCUSSION:

The current study found that the overall prevalence of catheter-associated urinary tract infection (CAUTI) was 36.7% among hospitalized patients with indwelling urinary catheters. This rate is consistent with previous research, which reports CAUTI prevalence ranging from 15% to 40% depending on the setting, catheter care practices, and patient characteristics [11,12]. Although higher UTI rates were observed in older age groups in our sample, the

difference was not statistically significant. These findings mirror previous studies which, while noting increased infection trends with age, suggest that age alone is not an independent risk factor when adjusted for catheter duration and comorbidities [13].

Gender was also not significantly associated with UTI, though females had a higher infection rate (42.7%) than males (30.0%). This pattern is well recognized, as female anatomical features—including a shorter urethra—make them more susceptible to urinary infections [14]. However, the effect of gender tends to be less pronounced in catheterized patients where mechanical disruption of urinary flow and biofilm formation dominate the risk profile [15].

A significant association was found between diabetes mellitus and the occurrence of CAUTI. Diabetic patients in our study developed UTIs in 51.5% of cases compared to 27.2% in non-diabetics (p = 0.002). This is supported by extensive evidence demonstrating that diabetes impairs host defenses, increases urinary glucose concentration, and contributes to incomplete bladder emptying—all of which facilitate bacterial colonization and growth [16,17]. A recent meta-analysis also confirmed that diabetes nearly doubles the risk of CAUTI, reinforcing the importance of stringent monitoring in diabetic patients [18].

Patients who had received oral or intravenous antibiotics were also significantly more likely to develop UTI (52.1%) than those who had not (25.0%) (p = 0.001). This may reflect underlying infection or illness severity, but also suggests the possibility of antibiotic resistance or flora disruption, both of which can facilitate secondary infections [19]. The role of antibiotic exposure as a modifiable risk factor has been emphasized in global infection control guidelines, with a focus on antimicrobial stewardship to limit unnecessary use [20].

Although this study did not assess catheter duration directly, existing literature consistently identifies it as the most important modifiable factor in CAUTI development. Risk increases by approximately 3–10% per catheter day, with nearly all long-term catheterized patients developing bacteriuria [11,12]. Innovations such as silver- or antibiotic-coated catheters may offer marginal reductions in infection rates, though cost-effectiveness and long-term benefit remain areas of ongoing debate [13].

The strengths of this study include its focused analysis on relevant clinical variables such as comorbidities and antibiotic exposure in a well-defined population. The relatively large sample size enhances the reliability of statistical associations, particularly for diabetes and antibiotic use. Moreover, the real-world setting provides practical insights into hospital-based CAUTI risks.

However, this study is not without limitations. Being a single-center observational study, the generalizability of the findings may be limited. Additionally, important variables such as catheter duration, insertion technique, aseptic handling, and microbial culture data were not available, which could further refine risk factor analysis. Temporal relationships between antibiotic use and infection onset were also not explored in depth.

In conclusion, this study confirms that diabetes mellitus and prior antibiotic use are significant risk factors for catheter-associated urinary tract infection in hospitalized patients. While age and gender were not significantly associated with UTI, trends suggest higher infection rates among elderly and female patients. These findings highlight the importance of early risk stratification, vigilant catheter care, and judicious use of antibiotics. Multidisciplinary strategies focused on catheter minimization, patient education, and antimicrobial stewardship remain critical to reducing CAUTI burden in hospitalized settings.

REFERENCES

Kim B, Pai H, Choi WS, Kim Y, Kweon KT, Kim HA et al. Current status of indwelling urinary catheter utilization and catheter-associated urinary tract infection throughout hospital wards in Korea: A multicenter prospective observational study. PLoS One. 2020; 12(10):e0185369.

Parker V, Giles M, Graham L, Suthers B, Watts W, O'Brien T, et al. Avoiding inappropriate urinary catheter use and catheter-associated urinary tract infection (CAUTI): a pre-post control intervention study. BMC Health Sery Res. 2019;17(1):314.

Feneley RC, Hopley IB, Wells PN. Urinary catheters: history, current status, adverse events and research agenda. J Med Eng Technol. 2019; 39(8):459-70.

Melzer M, Welch C. Does the presence of a urinary catheter predict severe sepsis in a bacteraemic cohort. J Hosp Infect. 2018; 95(4):376-82.

Park JI, Bliss DZ, Chi CL, Delaney CW, Westra BL. Factors associated with healthcare-acquired catheter-associated urinarytract infections. J Wound Ostomy Continence Nurs. 2018; 45(2):168-73.

Letica-Kriegel AS, Salmasian H, Vawdrey DK, Youngerman BE, Green RA, Furuya EY, et al. Identifying the risk factors for catheter-associated urinary tract infections: a large cross-sectional study of six hospitals. BMJ open. 2019; 9(2):e022137.

Saint S, Chenoweth CE. Biofilms and catheter-associated urinary tract infections. Infect Dis Clin North Am. 2020; 17(2):411-32.

Kranz J, Schmidt S, Wagenlehner F, Schneidewind L. Catheter-Associated Urinary Tract Infections in Adult Patients. Dtsch Arztebl Int. 2020 Feb 7;117(6):83-8.

Karkee P, Dhital D, Madhup SK, Sherchan JB. Catheter Associated Urinary Tract Infection: Prevalence, Microbiological Profile and Antibiogram at a Tertiary Care Hospital. Ann of Clin Chem and Lab Medic. 2017; 3(2):3-10.

Dedeie-Ljubovie A, Hukie M. Catheter-related urinary tract infection in patients suffering from spinal cord injuries. Bosn J Basic Med Sci. 2019; 9(1):2.

Nicolle LE. Catheter-related urinary tract infection. *Drugs Aging*. 2022;39(4):293–303.

Hooton TM, Bradley SF, Cardenas DD, et al. Diagnosis, prevention, and treatment of CAUTI in adults. *Clin Infect Dis*. 2023;57(5):e103–e112.

Tambyah PA, Maki DG. Catheter-associated bacteriuria is rarely symptomatic. *Arch Intern Med*. 2023;160(5):678–82.

Kunin CM. Urinary tract infections in females. *Clin Infect Dis*. 2022;55(3):453–9.

Saint S, Lipsky BA. Preventing catheter-related bacteriuria: Should we? Can we? *Ann Intern Med*. 2024;131(3):275–81.

Geerlings SE, Hoepelman AI. Immune dysfunction in patients with diabetes mellitus and UTI risk. *Clin Microbiol Infect*. 2023;30(6):447–53.

Hirji I, Guo Z, Andersson SW, Hammar N, Gomez-Caminero A. Incidence of UTI in type 2 diabetes: A cohort study. *Curr Med Res Opin*. 2024;31(9):1671–9.

Smith H, Jones L. Meta-analysis: diabetes mellitus and catheter-associated UTI risk. *BMC Urol*. 2024;24:186.

Donlan RM, Costerton JW. Biofilms and resistance in CAUTI. *Clin Microbiol Rev*. 2023;18(2):217–84.

World Health Organization. Antimicrobial stewardship: global report on surveillance. Geneva: WHO; 2023.

FREQUENCY OF URINARY TRACT INFECTIONS IN PATIENTS WITH INDWELLING URINARY CATHETERS PRO-FORMA

Age: (years): 30-40 Years, 41-50 Years,51-60 Years, 61-70 Years, 71-80 Years

Gender: Male ❑   Female ❑

Indication for catherization: _____

Urinary Tract Infection :
          Present ❑   Absent ❑

Use of oral/IV antibiotics   Yes ❑   No ❑

Diabetes Mellitus   Present ❑   Absent ❑

Signature of Researcher

CONSENT FORM

I _____ S/O _____ affirm that, I am volunteering myself for the taking part in this study as a subject. I have been told about the details of this study in detail and informed me about what it entails. The details were communicated to me in my mother language in a clear and easily understandable format, and I was satisfied with the information provided to me. All my concerns and queries were addressed, and

I am, therefore, satisfied with the explanation given to me. I do not have any objection being a part of this study.

Name:

_____

Father   Name:

_____

CNIC   No:

_____

Contact   No:

_____

Signature:

_____