ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 09 | September - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

RISK FACTORS CONTRIBUTING TO CATHETER-ASSOCIATED URINARY TRACT INFECTIONS: A HOSPITAL-BASED CROSS-SECTIONAL STUDY

Microbiology

Dr. Swati Sahai* Assistant Professor, Department Of Microbiology, MIMER Medical College & Dr. BSTR Hospital, Talegaon (D), Pune-410507, Maharashtra. *Corresponding Author

Dr. David Agatha Professor, Department Of Microbiology, Madras Medical College, Chennai.

ABSTRACT

Background: Catheter-associated urinary tract infections (CAUTIs) remain the most frequently encountered hospital-acquired infections. Their occurrence is influenced by multiple clinical and demographic risk factors. **Objective:** This study aimed to explore the relationship between symptomatic CAUTI and commonly reported high-risk variables. **Methods:** A cross-sectional analysis was carried out over a 12-month period, enrolling 100 patients with indwelling urinary catheters. Symptomatic CAUTI was identified using established diagnostic criteria. Potential contributing factors such as age, sex, duration of catheterization, diabetes, immunosuppressive therapy, and underlying medical conditions were examined for association. **Results:** The incidence of CAUTI was calculated at 25.67 per 1,000 catheter days. The highest frequency was noted among patients aged 71–80 years. Diabetes mellitus was strongly associated with infection, conferring nearly six-fold higher odds. Similarly, neurological disorders (Odds Ratio 5.16) and respiratory diseases (Odds Ratio 6.44) were significant risk factors. Patients with pre-existing urological or nephrological conditions demonstrated the greatest vulnerability, with an odds ratio of 13.27. **Conclusion:** Identifying individuals at increased risk of CAUTI is essential for guiding preventive strategies. Limiting catheter duration, optimizing glycemic control, and ensuring adherence to aseptic practices during insertion and maintenance are key measures. Incorporating a structured "catheter care bundle" may further decrease infection rates.

KEYWORDS

catheter-related infections, hospital associated infection, nosocomial infection, urinary tract infection, risk factors, CAUTI

INTRODUCTION

Healthcare-associated infections (HAIs) are recognized worldwide as a major public health concern, contributing significantly to both morbidity and mortality among hospitalized patients [1]. By definition, an HAI is a clinical infection that manifests after 48 hours of hospital admission, provided it was not present or incubating at the time of entry. These infections are usually caused by organisms endemic to the hospital environment and are often used as indicators of healthcare quality [2].

Urinary tract infection (UTI) is the most common type of nosocomial infection, accounting for nearly 35% of all reported cases [3]. Among these, over 80% are related to the use of indwelling urinary catheters, and are therefore categorized as catheter-associated urinary tract infections (CAUTIs) [3]. Globally, it is estimated that more than 100 million urinary catheters are inserted annually—equivalent to nearly 200 catheters every minute [4,5]. Around one in four hospitalized patients undergo catheterization, and although clinically necessary in many situations, this intervention remains the leading cause of hospital-acquired UTI [6]. Studies have shown that 75–80% of all nosocomial UTIs occur after catheter insertion [7]. In intensive care units (ICUs), CAUTI is particularly common due to prolonged hospital stays, frequent use of broad-spectrum antibiotics, multiple comorbidities, and a higher rate of invasive procedures. In developing countries, both the incidence of HAIs and the prevalence of antimicrobial resistance are reported to be three to five times higher than international benchmarks [8].

Several risk factors have been identified in the development of CAUTI. Duration of catheterization is one of the most significant, with infection risk increasing by approximately 5% with each additional day the catheter remains in place. Catheters may be classified as short-term (<28 days) or long-term (>28 days), with the latter associated with markedly higher risk. Female gender is another important factor, as the shorter urethra and its close anatomical relationship to the perirectal area facilitate the entry of pathogens. In men, the risk rises after the age of 60, largely due to prostatic enlargement and incomplete bladder emptying. Other well-documented predisposing conditions include diabetes mellitus, chronic neurological and respiratory illnesses, and urological or nephrological disorders. Immunosuppression, such as with steroid therapy, further increases susceptibility [9,10].

Despite well-established preventive strategies-including limiting catheter use, adhering to aseptic insertion techniques, and maintaining appropriate catheter care-CAUTI continues to represent a major proportion of healthcare-associated infections. A detailed understanding of the relative importance of these risk factors is therefore essential to guide targeted interventions and reduce the burden on healthcare systems.

MATERIAL AND METHODS

Objective:

The primary aim of this study was to evaluate the association of symptomatic catheter-associated urinary tract infection (CAUTI) with various high-risk factors.

Ethical Consideration:

Approval of the Institutional Ethics Committee was obtained before starting the study. Informed written consent was taken from all the patients included in the study.

Study Design: Cross-sectional study

Study Duration: One year- October 2014 to September 2015

Sample Size: 100 patients

Study Group: Patients admitted to medical ICU and put on Foley's catheter

Place Of Study:

The study was conducted at the Institute of Microbiology, Madras Medical College in association with Medical ICU, Rajiv Gandhi Government General Hospital, Chennai.

Inclusion Criteria:

- Age ≥ 18years
- Patient admitted to IMCU and put on Foley's catheter.

Exclusion Criteria:

- Patients <18 years of age
- Patients catheterised prior to admission in ICU
- Those patients, whose Foley's catheter were removed or who were discharged/ expired before 3rd day of catheterization
- Those who were confirmed to have UTI on Day 1
- Pregnancy

Study Procedure:

Data were collected using a structured, predesigned questionnaire. Information included demographic details (name, age, sex, address, inpatient number, and admission date), presenting complaints, past medical and personal history, comorbidities, immunocompromised status, physical examination findings, and clinical diagnoses.The indication for Foley's catheterization was documented for every patient. Patients were diagnosed with symptomatic CAUTI based on established standard guidelines [11,12].

RESULTS

Statistical Analysis: The primary outcome of interest was the development of symptomatic CAUTI. Explanatory variables included demographic factors (such as age and gender) as well as clinical characteristics (such as comorbidities, steroid use, and catheter care practices). Descriptive statistics were expressed as frequencies and percentages. Associations between explanatory factors and CAUTI were analyzed using odds ratios with 95% confidence intervals (CI). The chi-square test was used to determine statistical significance. Data analysis was performed using Microsoft Excel and IBM SPSS (version 21).

Study Population: A total of 100 patients were included in the final analysis. The overall incidence rate of CAUTI was calculated as 25.67 cases per 1,000 catheter days.

Age And Gender Distribution: The age distribution of participants showed that the largest proportion (33%) were between 18 and 30 years. Other age groups were distributed as follows: 31–40 years (24%), 41–50 years (18%), 51–60 years (11%), 61–70 years (10%), and 71–80 years (4%). In terms of gender, males constituted 57% of the study population and females 43%.

Duration Of Catheterization: The majority of patients (85%) had catheters in place for 8–14 days. In comparison, 11 patients (11%) were catheterized for 1–7 days, while 4 patients (4%) required catheterization for 15–21 days. All cases of catheterization were found to have valid clinical indications.

Incidence Of Symptomatic CAUTI: During hospitalization, 26 patients (26%) developed symptomatic CAUTI. Among these, 19 cases (73%) occurred on the 14th day of catheterization, four cases (15.3%) on the 10th day, and three cases (11.5%) on the 21st day. The descriptive analysis of risk factors for symptomatic CAUTI is presented in **Figure 1**.

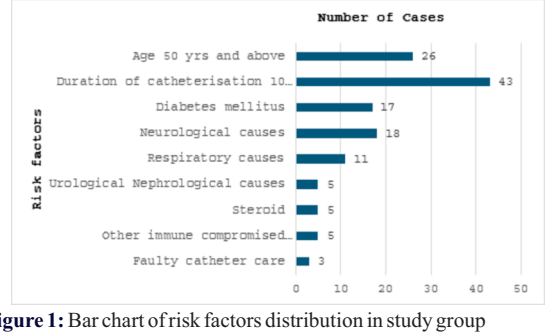

Figure 1: Bar chart of risk factors distribution in study group

Risk Factor Analysis:

- **Age:** The occurrence of CAUTI was highest in the age group 71–80 years. However, no statistically significant association was observed between age and infection (Table 1).

Table 1: Association Between Age Groups And CAUTI In Study Group (N=100)

Parameter	Symptomatic CAUTI		Chi square value	P value
	Yes	No		
Age groups				
18 to 30 yrs	5 15.15%	28 84.85%	10.722	0.057
31 to 40 yrs	5 20.83%	19 79.17%		
41 to 50 yrs	8 44.44%	10 55.56%		
51 to 60 yrs	3 27.3%	8 72.7%		
61 to 70 yrs	2 20.0%	8 80.0%		
71 to 80 yrs	3 75.0%	1 25.0%		

- Patients ≥50 years of age had 1.38 times the odds of developing CAUTI compared to those <50 years, but this was not significant (p = 0.5, 95% CI: 0.51–3.71).
- **Gender:** Females had 2.2 times higher risk of developing CAUTI than males (p = 0.07, 95% CI: 0.90–5.55).
- **Duration of Catheterization:** None of the patients catheterized for less than 10 days developed CAUTI.
- **Steroid Use:** Patients on steroid therapy had 1.97 times higher odds of infection, though this was not statistically significant (p = 0.464, 95% CI: 0.311–12.519).
- **Catheter Care:** Faulty catheter care was associated with 1.44 times greater risk of CAUTI, though this too was not statistically significant (p = 0.769, 95% CI: 0.125–16.574) (Table 2).

Table 2: Patient Personal And Clinical Factors Influencing In Study Group (N=100)

Parameter	Symptomatic CAUTI		Odds ratio	Chi square value	P value	95% CI	
	Yes	No				Lower	Upper
I. Age: 50yrs and above							
Yes	8	18	1.383	0.415	0.519	0.515	3.713
	30.77%	69.23%					
No	18	56					
	24.32%	75.68%					
II. Gender							
Female	15	28	2.240	3.094	0.079	0.903	5.559
	34.88%	65.12%					
Male	11	46					
	19.30%	80.70%					
III.Duration of catheterisation ≥10days							
Yes	26	17	-	46.574	0.000	0.273	0.572
	60.47%	39.53%					
No	0	57					
	0.00%	100.00%					
IV. Steroid use							
Yes	2	3	1.972	0.536	0.464	0.311	12.519
	40.00%	60.00%					
No	24	71					
	25.26%	74.74%					
V. Faulty catheter care							
Yes	1	2	1.440	0.086	0.769	0.125	16.574
	33.3%	66.7%					
No	25	72					
	25.8%	74.2%					

Comorbidities:

- Diabetes mellitus was a significant predictor, with nearly six-fold higher odds of CAUTI (OR 5.98, p < 0.001, 95% CI: 1.97–18.13).
- Neurological diseases were also strongly associated (OR 5.16, p = 0.002, 95% CI: 1.75–15.15).
- Respiratory illnesses such as COPD conferred an increased risk (OR 6.44, p = 0.003, 95% CI: 1.70–24.35).
- Urological and nephrological disorders showed the strongest association, with an odds ratio of 13.27 (p = 0.003, 95% CI: 1.4–124.99).

Table 3: Association Between Morbidity And Symptomatic Cauti In Study Group (N=100)

Parameter	Symptomatic CAUTI		Odds ratio (OR)	Chi square value	P value	95% CI	
	Yes	No				Lower	Upper
VI. Diabetes Mellitus							
Yes	10	7	5.982	11.469	0.001	1.973	18.138
	58.82%	41.18%					
No	16	67					
	19.28%	80.72%					
VII. Neurological causes							
Yes	10	8	5.156	9.966	0.002	1.754	15.157
	55.56%	44.44%					
No	16	66					
	19.51%	80.49%					
VIII. Respiratory causes							
Yes	7	4	6.447	9.099	0.003	1.707	24.353
	63.6%	36.4%					
No	19	70					
	21.35%	78.65%					
IX. Urological Nephrological causes							
Yes	4	1	13.273	7.977	0.005	1.409	124.994
	80.00%	20.00%					

No	22	73					
	23.16%	76.84%					
X. Other immunocompromised conditions							
Yes	2	3	1.972	0.536	0.464	0.311	12.519
	40.00%	60.00%					
No	24	71					
	25.26%	74.74%					

- Other immunocompromised states did not show statistically significant risk (Table 3).

Taken together, diabetes, neurological illness, respiratory conditions, and urological/nephrological disorders emerged as statistically significant predictors of symptomatic CAUTI in this cohort.

DISCUSSION

Catheter-associated urinary tract infection (CAUTI) is the most frequently reported device-related nosocomial infection. In this study, 100 patients admitted to the medical ICU were monitored for the development of symptomatic CAUTI, with only symptomatic cases being included in the final analysis.

The incidence of CAUTI in our cohort was 26%, corresponding to a rate of 25.67 per 1,000 catheter days. This rate is consistent with findings from several Indian and international studies, though reported values vary widely. For instance, Angshuman Jana et al. (2015) reported an incidence of 31.85% [13], while Neha Garg et al. (2015) observed a rate of 20% [14]. Priya Datta et al. (2014) documented a rate of 10.75% [15], whereas Pooja et al. (2014) reported 32.14% [16]. Other studies, such as those by Kamat et al. (2009) [17], C.M. Poudel et al. (2008) [10], and Al Jebouri et al. (2006) [18], found rates of 33.6%, 54%, and 28.1%, respectively. At AIIMS, Delhi, Habibi et al. (2008) reported CAUTI as 24% of nosocomial UTIs, equivalent to 11.3 per 1,000 catheter days [19]. Similarly, Mexican ICU data showed a rate of 21.79% [20], and a multi-country survey of eight developing nations estimated that CAUTI comprised 29% of all device-associated infections [21]. This variation underlines the importance of generating institution-specific surveillance data to guide infection control strategies.

In our study, the majority of patients (33%) were young adults aged 18–30 years, while older patients (≥50 years) showed a slightly higher risk of developing CAUTI (OR 1.38). Female patients had more than twice the risk compared to males (OR 2.2), although neither age nor gender reached statistical significance. Similar findings were reported by Priya et al. [15], Meric et al. [22], and Agrawal et al. [23], who also noted no significant correlation with these demographic factors.

Duration of catheterization emerged as an important determinant. Most of our patients (85%) were catheterized for 8–14 days. Among those catheterized for 14 days, 86.3% developed infection, while 75% of patients catheterized for 21 days became infected. None of the patients catheterized for fewer than 10 days developed CAUTI. This confirms earlier observations by Priya Datta et al. [15] and Angshuman Jana et al. [13], who also reported a strong association between prolonged catheterization and infection risk. Extended ICU stay and longer catheter duration increase exposure to multidrug-resistant organisms present in the hospital environment, thereby predisposing patients to infection.

Faulty catheter care was identified as a possible risk factor in this study, although the association was not statistically significant. However, several published reports suggest that inadequate aseptic precautions and poor catheter handling practices are important contributors to CAUTI burden [9,10].

Comorbid conditions demonstrated a strong and statistically significant association with CAUTI in this study. Diabetes mellitus was associated with nearly six-fold increased risk (OR 5.98), consistent with findings by Priya Datta et al. [15]. Patients with neurological disorders and chronic respiratory conditions such as COPD also had significantly higher risks (OR 5.16 and OR 6.44, respectively). The strongest association was noted among patients with underlying urological or nephrological disorders (OR 13.27). These observations emphasize the role of patient-related factors, in addition to procedural aspects, in influencing susceptibility to infection.

Taken together, our findings highlight that while CAUTI incidence is influenced by catheterization practices, host factors such as diabetes, chronic illness, and organ-specific disease substantially increase the risk. Regular surveillance, strict adherence to aseptic techniques, and targeted interventions for high-risk groups are critical for reducing CAUTI rates in ICUs.

CONCLUSION

This cross-sectional study highlights symptomatic catheter-associated urinary tract infection (CAUTI) as one of the most common healthcare-associated infections in critically ill patients. The findings emphasize that prolonged duration of catheterization and the presence of comorbidities—particularly diabetes mellitus, neurological conditions, respiratory illnesses, and urological or nephrological disorders—significantly increase the risk of infection.

Preventive measures should therefore focus on rationalizing catheter use. Catheterization must be undertaken only when clinically justified, and the device should be removed as soon as it is no longer required. In cases where catheterization is necessary for more than 14 days, replacement or alternative methods such as condom catheters should be considered. Greater emphasis on proper catheter care practices, strict aseptic technique during insertion and maintenance, and regular evaluation of the necessity of catheterization are key strategies to reduce the incidence of CAUTI. Implementing these measures as part of structured infection-control protocols can substantially lower the burden on healthcare systems.

REFERENCES

1. Ananthanarayan R, Paniker CJ. Textbook of Microbiology. 9th ed. Hyderabad: Universities Press; 2013. p. 644.
2. Elsayed EA, Fouad SA, Elany MG, Hashem HR. Diagnosis of healthcare-associated infection in adult patients admitted in internal medicine hospital of Cairo University. Med J Cairo Univ. 2012;80(1):41–5.
3. Forbes BA, Sahm DF, Weissfeld AS. Bailey & Scott's Diagnostic Microbiology. 13th ed. St. Louis: Mosby Elsevier; 2013. p. 919–30.
4. Saint S, Wiese J, Amory JK, Bernstein ML, Patel UD, Zemencuk JK, et al. Are physicians aware of which of their patients have indwelling urinary catheters? Am J Med. 2000;109(6):476–80.
5. Griffiths R, Fernandez R. Strategies for the removal of short-term indwelling urethral catheters in adults. Cochrane Database Syst Rev. 2007;(2):CD004011. doi:10.1002/14651858.CD004011.
6. Wazait HD, Patel HRH, Veer V, Kelsey M, van der Meulen JHP, Miller RA, et al. Catheter-associated urinary tract infections: prevalence of uropathogens and pattern of antimicrobial resistance in a UK hospital (1996–2001). BJU Int. 2003;91(9):806–9.
7. Anthony O, Oluwalana OT, Bolatito O, Olaniran O, Adesola O, Ot A. Urinary pathogens and their antimicrobial susceptibility in patients with indwelling urinary catheter. Sierra Leone J Biomed Res. 2010;2(1):47–53.
8. Dogru A, Sargin F, Celik M, Sagiroglu AE, Goksel MM, Sayhan H. The rate of device-associated nosocomial infections in a medical surgical intensive care unit of a training and research hospital in Turkey: one-year outcomes. Jpn J Infect Dis. 2010;63(2):95–8.
9. Centers for Disease Control and Prevention. Device-associated module: CAUTI. Atlanta: CDC; 2014 [cited 2025 Aug 22]. Available from: http://www.cdc.gov/nhsn/pdfs/pscmanual/7psccauticurrent.pdf
10. Poudel CM, Baniya G, Pokhrel BM. Indwelling catheter-associated urinary tract infection. J Inst Med. 2008 Dec;30(3):.
11. Sahai S, Vasanthi S, Agatha D. Bacteriological profile of catheter-associated urinary tract infection in medical intensive care unit. Int J Sci Res. 2024 Sep;13(9):3–6. Available from: http://dx.doi.org/10.36106/ijsr/3203274
12. Sahai S, Kumar A. Role of Candida in catheter-associated urinary tract infection. Int J Curr Res Rev. 2018 Oct;10(20):5–19. Available from: http://dx.doi.org/10.31782/IJCRR.2018.10204
13. Jana A, Pal NK, Majumdar A, Mitra J, Jana A, Biswas S, et al. Device-associated infection rates and median length of acquiring device-associated infection in an intensive therapeutic unit of an Indian hospital. J Med Trop. 2015;17(2):97–102.
14. Garg N, Shukla I, Rizvi M, Ahmed SM, Khatoon A, Khan F. Microbiological profile and antibiotic sensitivity pattern of bacterial isolates causing urinary tract infection in intensive care unit patients in a tertiary care hospital in Aligarh region, India. Int J Curr Microbiol App Sci. 2015;Special Issue 1:163–72.
15. Datta P, Rani H, Chauhan R, Gombar S, Chander J. Health-care-associated infections: risk factors and epidemiology from an intensive care unit in northern India. Indian J Anaesth. 2014;58(1):30–5.
16. Patel P, Garala RN. Bacteriological profile and antibiotic susceptibility pattern (antibiogram) of urinary tract infections in paediatric patients. J Res Med Dent Sci. 2014;2(1):.
17. Kamat US, Ferreira A, Amonkar D, Motghare DD, Kulkarni MS. Epidemiology of hospital-acquired urinary tract infections in a medical college hospital in Goa. Indian J Urol. 2009;25(1):76–80.
18. Al-Jebouri OAH. The relationship between urinary calculi types and urinary tract infections among patients in Tikrit district [MSc thesis]. Tikrit: College of Medicine, Tikrit University; 2006.
19. Habibi S, Wig N, Agarwal S, Sharma SK, Lodha R, Pandey RM, et al. Epidemiology of nosocomial infections in medicine intensive care unit at a tertiary care hospital in northern India. Trop Doct. 2008;38(4):233–5.
20. Ramirez-Barba EJ, Rosenthal VD, Higuera F, Oropeza MS, Hernández HT, López MS, et al. Device-associated nosocomial infection rates in intensive care units in four Mexican public hospitals. Am J Infect Control. 2006 May;34(4):244–7.
21. Rosenthal VD, Maki DG, Salomao R, Moreno CA, Mehta Y, Higuera F, et al. Device-associated infections in 55 intensive care units of 8 developing countries. Ann Intern Med. 2006;145(8):582–91.
22. Agarwal R, Gupta D, Ray P, Aggarwal AN, Jindal SK. Epidemiology, risk factors and outcome of nosocomial infections in a respiratory intensive care unit in North India. J Infect. 2006;53(2):98–105.
23. Meric M, Willke A, Caglayan C, Toker K. Intensive care unit-acquired infections: incidence, risk factors and associated mortality in a Turkish university hospital. Jpn J Infect Dis. 2005;58(5):297–302.