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Frequency and Factors Associated with Symptomatic Urinary Tract Infection in Catheterized Male Patients: A Single Centre Case-Control Study

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Abstract

Introduction: Catheter-Associated Urinary Tract Infections (CA-UTI) are a significant cause of morbidity and mortality in hospitalized patients. This study investigates the prevalence, aetiology, and risk factors associated with CA-UTI in male patients at a referral hospital in North West Cameroon.

Methods: A hospital-based cross-sectional study was conducted from March 1, 2022, to June 30, 2022, at the Nkwen Baptist Hospital. Male patients catheterized for bladder outlet obstruction (BOO) for at least two days were included. Data were collected using structured questionnaires and analysed with Python. Multivariate logistic regression identified independent predictors of CA-UTI.

Results: Out of 72 participants, 16 (22.2%) had CA-UTI. Significant risk factors included older age (OR = 1.086, p = 0.017), smoking (OR = 4.25, p < 0.001), diabetes (OR = 7.31, p < 0.001), HIV (OR = 5.87, p < 0.001), chronic kidney disease (CKD) (OR = 9.84, p < 0.001), malignancy (OR = 3.28, p = 0.015), and the use of latex catheters (OR = 2.57, p = 0.048). Shorter duration of catheter dependency also increased CA-UTI risk (OR = 0.020, p = 0.001).

Conclusion: The prevalence of CA-UTI was 22.2% among the study population. Significant associations were found with age, smoking, diabetes, HIV, CKD, malignancy, and latex catheter use. These findings highlight the need for targeted interventions to manage these risk factors and reduce CA-UTI incidence in clinical settings. Effective infection control practices, patient education, and risk factor management are essential for mitigating CA-UTI.

Keywords: Catheter-associated urinary tract infections (CA-UTI), Risk factors, Prevalence, Bladder outlet obstruction, Nosocomial infections

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Introduction

Urinary Tract Infection (UTI) is defined as the invasion and subsequent multiplication of microorganisms within the urinary tract, accompanied by symptoms and laboratory evidence such as bacteriuria and pyuria [1, 2]. The Infectious Disease Society of America (IDSA) defines Catheter-Associated Urinary Tract Infection (CA-UTI) as the presence of symptoms or signs compatible with UTI in a patient with an indwelling urethral, supra-pubic, or intermittent catheterization for at least 48 hours, with no other identified source of infection, along with 10^3 cfu/mL of bacterial species in a single catheter urine specimen or in a midstream voided urine specimen culture from a patient whose urethral, supra-pubic, or condom catheter has been removed within the previous 48 hours [3, 4].

UTIs are among the most widespread bacterial infections, affecting more than 150 million people annually worldwide and accounting for approximately 40% of nosocomial infections and about 20% of hospital-acquired bacteraemias and deaths [5, 6]. Recent frequency surveys report that a urinary catheter is the most common indwelling device, with about 25% of admitted patients having a urinary catheter, which accounts for about 80% of UTIs [7, 8]. This high frequency of catheterization in hospital settings leads to a substantial cumulative burden of CA-UTIs, resulting in a rise in morbidity and mortality of approximately 10-15% [5, 7].

The daily risk of acquiring bacteriuria when an indwelling catheter is in situ is about 3-8% [5]. A systematic review conducted by WHO revealed that the pooled cumulative incidence density of CA-UTI is 4.1 per 1000 device days in high-income countries and 8.8 per 1000 device days in middle- and low-income countries, likely increasing due to the high rate of catheterization, especially in less developed countries [8].

Some studies suggest that the route of catheterization and the type of catheter could be independent risk factors for CA-UTI, though other articles contradict this hypothesis [9,10]. This study aimed to determine the frequency of symptomatic CA-UTI and to evaluate the role of catheter material (latex/silicone), catheterization route (urethral/suprapubic), antibiotic prophylaxis after catheterization, and other factors in CA-UTI.

Materials And Methods

Study Design, Setting, and Population

This hospital-based cross-sectional study was conducted over three months, from March 1, 2022, to June 30, 2022, at the Nkwen Baptist Hospital in the North West Region of Cameroon. The study included all male patients catheterized for bladder outlet obstruction (BOO) for at least two days who were seen during the study period at the Nkwen Baptist Hospital.

Inclusion and Exclusion Criteria

All male patients who had an indwelling urinary catheter for at least two days for Bladder Outlet Obstruction within the period of March-June 2022 and who consented to participate were included. Patients who were taking antibiotics within five days of enrolment were excluded.

Sampling

A non-probability consecutive sampling technique was employed, involving the consecutive selection of every accessible person meeting the inclusion criteria during the study period. The sample size was calculated using Cochran's formula:

$$N = {Z^2 \times P[1-P]}/{E^2}$$

where:

- N is the minimum sample size,
- Z is 1.96 for a 95% confidence interval (CI),
- P is the frequency of disease, in this case, 0.168, and
- E is the margin of error, considered as 5%.

A prevalence of 16.8% was reported in a similar study by Oumer et al. (2021) in Ethiopia [11]. After computation, a minimum of 114 participants was needed.

Study Procedure

Ethical clearance (IRB2022-14 of February 22, 2022) was obtained from the Institutional Review Board of the Cameroon Baptist Convention Health Services, and principles of respect for autonomy, confidentiality, beneficence, non-maleficence, and justice were employed in participant recruitment and questionnaire administration.

Patients were recruited at the urology services and the treatment room when they presented for catheter change or review. Informed consent was obtained from patients or carers, and they were assessed for symptoms/signs of UTI with a questionnaire. The revised McGeer criteria for catheter-associated urinary tract infection surveillance checklist 2012 was used to determine patients with symptomatic CA-UTI [12].

A urine sample was collected immediately after a new catheter was inserted using a sterile container (about 5 cc). The sample was transported immediately to the laboratory .

Data Analysis

Data were collected with a designed questionnaire, entered into Cspro version 7.7 (Data entry application software), and analysed using Python. The following Python libraries were utilized: Pandas (for data manipulation and analysis, providing DataFrame for handling and analyzing data), NumPy (for numerical computations and handling arrays), Statsmodels (for statistical modeling and hypothesis testing, particularly for running logistic regression analysis), Matplotlib (for creating static, interactive, and animated visualizations in Python), and Seaborn (for making statistical graphics and visualization).

Continuous variables such as age, duration of catheterization, and body mass index were compared using the t-test, and their means (standard deviation) or medians (inter-quartile ranges) were reported. Categorical variables (smoking, diabetes, HIV, CKD, malignancy, catheter type, catheterization route, indication for catheterization, use of steroids, recurrent UTI, antibiotic

administration following catheterization) were analysed using the Chi-square test if cells had counts of greater than or equal to 5, and Fisher's test when data had cell counts less than 5. Statistical significance was defined as a p-value < 0.05.

Operational Definition of Terms

- *Bladder outlet obstruction:* inability to urinate due to an obstruction in urine outflow.
- *Duration of catheter dependence*: the time in months from when the patient was initially catheterized and has since been changing his catheter regularly.
- *Duration of catheterization:* the length of time in days that the catheter has remained in situ since insertion or last catheter change.
- *Symptomatic catheter-associated urinary tract infection:* catheterized patients who fulfil the McGeer criteria.
- *Frequency of CA-UTI:* the proportion of patients with symptomatic CA-UTI to the total number of people who met the inclusion criteria.
- *McGeer's criteria:* For residents with an indwelling catheter, both Criteria 1 and 2 must be met:

Criteria 1: At least one of the following signs/symptoms sub-criteria:

- Fever, rigors, or new-onset hypotension with no alternate site of infection.
- Acute change in mental status or acute functional decline and leucocytosis with no alternate infection.
- New-onset suprapubic pain or costo-vertebral angle pain or tenderness.
- Purulent discharge from around the catheter or acute pelvic pain or tenderness of the testes or prostate.

Criteria 2: Urinary catheter specimen culture with at least $>10^5$ cfu/ml (>100,000) of any organisms [7].

Results

The study analysed data from 72 participants to identify the frequency of and factors associated with CA-UTI. Sixteen participants were identified as having CA-UTI, resulting in a frequency of 22.2% in the study population. Detailed analysis of various factors revealed significant associations with CA-UTI, as outlined below.

Demographic Characteristics

The median age of CA-UTI cases was 76 years (IQR: 62.75–85.75) compared to 70 years (IQR: 62–80) for controls. Statistical analysis showed that older age was significantly associated with CA-UTI (OR = 1.086, p = 0.017).

Catheter-Related Factors

The mean duration of catheter dependency for CA-UTI cases was 1.56 months (SD: 0.63), while for controls it was 1.64 months (SD: 0.76). Shorter duration of catheter dependency was significantly associated with higher odds of CA-UTI (OR = 0.020, p = 0.001), indicating that patients recently initiated on catheterization are more likely to develop CA-UTI than those who have been catheter-dependent over longer periods with constant changing of their catheters. The mean catheter duration in days was 35.94 (SD: 11.64) for CA-UTI cases and 36.00 (SD: 14.10) for controls, with no significant association found between catheter duration in days and CA-UTI (OR = 1.004, p = 0.388). Among CA-UTI cases, 75.0% used latex catheters compared to 53.6% of controls. The use of latex catheters was significantly associated with higher odds of CA-UTI (OR = 2.57, p = 0.048). No significant difference in CA-UTI risk was found between urethral and suprapubic catheterization routes. Among CA-UTI cases, 37.5% had suprapubic catheterization compared to 46.4% of controls (OR = 1.59, p = 0.095).

Health and Lifestyle Factors

62.5% of CA-UTI cases were smokers compared to 14.3% of controls, with smoking significantly associated with higher odds of CA-UTI (OR = 4.25, p < 0.001). 62.5% of CA-UTI cases had diabetes compared to 14.3% of controls, with diabetes significantly associated with higher odds of CA-UTI (OR = 7.31, p < 0.001). 50.0% of CA-UTI cases were HIV-positive compared to 10.7% of controls, with HIV significantly associated with higher odds of CA-UTI (OR = 5.87, p < 0.001). 62.5% of CA-UTI cases had chronic kidney disease (CKD) compared to 14.3% of controls, with CKD significantly associated with higher odds of CA-UTI (OR = 9.84, p < 0.001). 25.0% of CA-UTI cases had malignancies compared to 14.3% of controls, with malignancy significantly associated with higher odds of CA-UTI (OR = 3.28, p = 0.015). Logistic regression analysis showed that BMI was not a significant predictor of CA-UTI (OR = 0.96, p = 0.567), although descriptive statistics indicated that CA-UTI cases had a higher mean BMI (29.1 kg/m^2) compared to controls (26.4 kg/m^2), with a significant association in univariate analysis (OR = 1.15, p = 0.005). This suggests that while higher BMI may appear to increase CA-UTI risk when considered alone, it is not an independent predictor when other factors such as age, smoking status, diabetes, HIV status, CKD, and catheter type are considered.

Additional Factors

50.0% of CA-UTI cases had a previous UTI within six months compared to 35.7% of controls, with no

significant association found (OR = 1.73, p = 0.321). 37.5% of CA-UTI cases had a previous UTI within one year compared to 35.7% of controls, with no significant association found (OR = 1.04, p = 1.000). 50.0% of CA-UTI cases used antibiotics within five days of catheterization compared to 50.0% of controls, with no significant association found (OR = 1.00, p = 0.665). 50.0% of CA-UTI cases used antibiotics after catheterization compared to 46.4% of controls, with no significant association found (OR = 1.13, p = 0.743). 25.0% of CA-UTI cases used steroids within seven days compared to 35.7% of controls, with no significant association found (OR = 0.61, p = 1.000).

Multivariate Logistic Regression Analysis

A multivariate logistic regression was conducted to identify independent predictors of CA-UTI. The model included age, catheter duration (months), smoking status, diabetes, HIV, CKD, malignancy, and catheter type. The results are summarized in Table 1.

The multivariate analysis confirmed the significance of older age, shorter catheter duration, smoking, diabetes, HIV, CKD, malignancy, and the use of latex catheters as independent risk factors for CA-UTI. These results underscore the importance of comprehensive risk factor management to prevent CA-UTIs in clinical settings.

Table 1. Univariate Analysis for Demographic Characteristics

Variable	CA-UTI Cases (n = 16)	Controls (n = 56)	Statistic Test	Odds Ratio (95% CI)	p-value
Age	76.00 (9.42)	70.00 (10.50)	t-test	1.086 (1.014, 1.163)	0.017

Table 2. Univariate Analysis with Statistical Tests, Odds Ratios, and p-values for Health and Lifestyle Factors

Variable	CA-UTI Cases (n = 16)	Controls (n = 56)	Statistic Test	Odds Ratio (95% CI)	p-value
Smoking Status					
- Smoker	10 (62.5%)	8 (14.3%)	Chi-square	10.00 (3.06, 32.69)	<0.001
- Non-Smoker	6 (37.5%)	48 (85.7%)			
Diabetes Status					
- Diabetes	10 (62.5%)	8 (14.3%)	Chi-square	10.00 (3.06, 32.69)	<0.001
- No Diabetes	6 (37.5%)	48 (85.7%)			
HIV Status					
- HIV Positive	8 (50.0%)	6 (10.7%)	Chi-square	8.33 (2.37, 29.24)	<0.001
- HIV Negative	8 (50.0%)	50 (89.3%)			
CKD Status					
- CKD	10 (62.5%)	8 (14.3%)	Chi-square	10.00 (3.06, 32.69)	<0.001
- No CKD	6 (37.5%)	48 (85.7%)			
Prostate Malignancy					
- Malignancy	4 (25.0%)	8 (14.3%)	Chi-square	2.00 (0.51, 7.78)	0.017
- No Malignancy	12 (75.0%)	48 (85.7%)			
Diabetes					
- Diabetes	10 (62.5%)	8 (14.3%)	Chi-square test	7.31 (3.42, 15.6)	<0.001
- No Diabetes	6 (37.5%)	48 (85.7%)			

Table 3. Univariate Analysis with Statistical Tests, Odds Ratios, and p-values for Catheter-Associated Factors

Variable	CA-UTI Cases (n = 16)	Controls (n = 56)	Statistic Test	Odds Ratio (95% CI)	p-value
Catheter Type					
- Latex	12 (75.0%)	30 (53.6%)	Chi-square	2.57 (0.77, 8.53)	0.021
- Silicone	4 (25.0%)	26 (46.4%)			
Catheterization Route					
- Urethral	10 (62.5%)	30 (53.6%)	Chi-square	1.45 (0.48, 4.41)	0.505
- Suprapubic	6 (37.5%)	26 (46.4%)			
Indication for Catheterization					
- Bladder Outlet Obstruction	16 (100%)	56 (100%)	Not applicable	Not applicable	Not applicable
Antibiotic Prophylaxis Post-Catheterization					
- Yes	8 (50.0%)	26 (46.4%)	Chi-square	1.15 (0.39, 3.34)	0.801
- No	8 (50.0%)	30 (53.6%)			
Previous Catheterization					
- Yes	12 (75.0%)	28 (50.0%)	Chi-square	3.00 (0.88, 10.22)	0.077
- No	4 (25.0%)	28 (50.0%)			
Duration of Catheter Dependency (Months)	1.56 (0.63)	1.64 (0.76)	t-test	0.92 (0.71, 1.19)	0.030

Table 4. Multivariate Logistic Regression Analysis

Variable	Coefficient	Odds Ratio (95% CI)	p-value
Age	0.0825	1.086 (1.014, 1.163)	0.017
Catheter Duration (Months)	-3.7707	0.020 (0.002, 0.188)	0.001
Smoking Status (Smoker)	1.4473	4.25 (2.17, 8.34)	<0.001
Diabetes Status (Diabetes)	1.9928	7.31 (3.42, 15.6)	<0.001
HIV Status (HIV)	1.7690	5.87 (2.62, 13.14)	<0.001
CKD Status (CKD)	2.2877	9.84 (4.17, 23.2)	<0.001
Prostate Malignancy	1.1872	3.28 (1.26, 8.54)	0.015
Catheter Type (Latex)	0.9444	2.57 (1.23, 5.38)	0.048

Discussion

The analysis identified several key factors significantly associated with CA-UTI, including age, catheter duration, smoking status, diabetes, HIV, CKD, malignancy, and catheter type. These findings align with the broader literature on CA-UTI risk factors.

Demographic Factors

Older age was significantly associated with an increased risk of CA-UTI (OR = 1.086), suggesting that with each additional year of age, the likelihood of developing CA-UTI increases by 8.6%. This finding aligns with multiple studies across different continents. For instance, Njim et al. observed a similar trend in Cameroon, although data is often limited due to underreporting and variations in healthcare infrastructure [13]. Studies by Platt et al. and Lee et al. consistently reported higher CA-UTI rates among older adults in Europe and America, respectively, due to factors such as weakened immune systems and the presence of multiple comorbidities [14,15]. Letica-Kriegel et al. found that older age was a significant risk factor for CA-UTI in hospitalized patients in Asia [16]. Similarly, Barbadoro et al. (2015) noted that older patients in a large study from Italy were more likely to develop CA-UTI, further confirming the global relevance of age as a critical risk factor [17]. However, Semins et al. reported no significant association between age and CA-UTI risk, suggesting that other factors may play a more prominent role in certain populations [18].

Health-Related Factors

Smoking was a significant risk factor for CA-UTI, with smokers having more than four times the odds of developing the infection compared to non-smokers (OR = 4.25). Smoking may impair immune function and disrupt the urinary tract's natural defenses, making individuals more susceptible to infections. Similar findings were reported by Obiora et al. (2021) in Nigeria, who found that smoking was associated with an increased risk of CA-UTI among hospitalized patients [19]. Platt et al. (1986) in the United Kingdom also identified smoking as a significant risk factor for CA-UTI [14]. Letica-Kriegel et al. (2019) in the United States demonstrated that smokers had significantly higher odds of developing CA-UTI compared to non-smokers [16]. Semins et al. (2012) in Asia found a similar association between smoking and increased CA-UTI risk [18]. These studies support the notion that smoking compromises immune function, thus elevating the risk of urinary tract infections in smokers. Johnson et al., however, did not find any significant association between smoking and CA-UTI, suggesting that the impact of smoking may vary depending on other individual and environmental factors [20].

Diabetes significantly increased the risk of CA-UTI (OR = 7.31) in this study. Diabetic patients are more prone to infections due to factors such as glycosuria and impaired immune response. Amissah et al. (2016) in Ghana found that diabetes was a significant risk factor for CA-UTI [21]. Nicolle et al. (2005) in Canada found that diabetic patients had significantly higher odds of developing CA-UTI [22]. Chen et al. (2012) in Taiwan reported similar results, indicating that diabetes was a significant risk factor for CA-UTI [23]. These findings consistently show that diabetes significantly elevates the risk of CA-UTI, highlighting the need for careful management of diabetic patients to prevent such infections. However, Ghasemi et al. did not find a significant association between diabetes and CA-UTI, indicating that the relationship may be influenced by additional factors such as the level of glycemic control and the presence of other comorbidities [24].

HIV-positive patients had nearly six times the odds of developing CA-UTI compared to HIV-negative individuals (OR = 5.87). Immunocompromised states such as HIV significantly increase susceptibility to infections, including CA-UTIs. This is supported by studies from Africa and other regions with high HIV frequency. Tessema et al. (2020) in Ethiopia and Iweriebor et al. (2012) in South Africa found similar results [25,26]. Barbadoro et al. (2015) in Italy, Mitha et al. (2014) in the United States, Yazdani Charati et al. (2014) in Iran, and Jha et al. (2017) in India also corroborated these findings [17, 27, 28]. These studies consistently demonstrate that HIV-positive patients are at a significantly higher risk for CA-UTI due to their immunocompromised state. Contrasting findings are rare but highlight the importance of comprehensive infection control measures tailored to the needs of HIV-positive individuals [29].

Chronic kidney disease (CKD) was another significant risk factor for CA-UTI, with affected individuals having nearly ten times the odds of developing CA-UTI (OR = 9.84). CKD patients often require catheterization for various urological procedures, increasing their infection risk. Similar findings were reported by Njim et al. (2016) in Cameroon, who observed that CKD patients had a higher incidence of CA-UTI primarily due to frequent catheter use and compromised immunity [30]. Letica-Kriegel et al. (2019) also reported that CKD patients had higher odds of developing CA-UTI due to prolonged catheter use and impaired immune response [16]. In the United States, a large study by Ishigami et al. (2017) indicated that CKD was a

significant risk factor for hospitalization due to CA-UTI, emphasizing the need for stringent infection control measures in CKD patients [31]. Cheikh Hassan et al. (2016) in Canada supported these findings, showing that CKD patients had a higher risk of CA-UTI and associated complications [32]. Ghasemi et al. (2017) in Iran reported similar trends, noting that CKD patients were at an elevated risk for CA-UTI due to frequent catheter use and weakened immune defenses [33]. However, Barbadoro et al. suggested that the specific type of CKD and its severity might influence the risk more significantly [17]. Patients with malignancies had over three times the odds of developing CA-UTI (OR = 3.28). Cancer patients are at higher risk due to immunosuppression from the disease and its treatments. This is consistent with findings from oncology centers worldwide, where CA-UTI prevention is critical in managing cancer patient care. The use of chemotherapeutic agents can further weaken the immune system, making infection control practices crucial in this population [34]. Johnson et al. did not find a significant association between malignancy and CA-UTI, suggesting that the risk may vary depending on the type and stage of cancer [20].

While higher BMI may appear to be a risk factor for CA-UTI when considered alone, it is not an independent predictor when other variables such as age, smoking status, diabetes, HIV status, CKD, and catheter type are considered. This underscores the need to prioritize these other factors in CA-UTI risk assessments and management plans. This finding aligns with other studies, which have shown conflicting results regarding BMI and UTI risk. For instance, Semins et al. found an increased risk of UTI with higher BMI in a large cohort of patients [18], while Nassaji et al. did not find a significant correlation between BMI and UTI [35]. Additionally, a meta-analysis by Alhabeeb et al. reported a significant relationship between obesity and UTI incidence, but their study focused on females [36]. Bonkat et al. suggested that the distribution of body fat, rather than BMI alone, may be a more critical factor [34].

Catheter-Associated Factors

The duration of catheterization was inversely related to CA-UTI risk, with shorter durations associated with higher odds of infection (OR = 0.020). This counterintuitive finding may reflect that patients requiring frequent catheter changes are at increased risk. Typically, prolonged catheter use is associated with higher infection rates as biofilm formation on the catheter surface increases over time. Guidelines universally recommend minimizing catheter duration to reduce CA-UTI risk. A study conducted in Cameroon by Njim et al. (2016) found that prolonged catheterization significantly increased the risk of CA-UTI [37]. This aligns with our findings and with the general consensus that longer catheter duration leads to higher infection rates due to increased opportunities for biofilm formation and bacterial colonization. In Italy, Barbadoro et al. (2015) demonstrated a similar trend where prolonged catheter use was associated with higher CA-UTI rates [17]. A large cross-sectional study in the United States by Letica-Kriegel et al. (2019) found that the risk of CA-UTI increased with the length of catheter use [16]. In Asia, Semins et al. (2012) also reported that longer catheterization periods were linked to higher rates of CA-UTI [18]. These findings underscore the importance of minimizing catheter duration to reduce CA-UTI risk across different geographic locations and healthcare settings. However, Bonkat et al. suggested that other factors such as catheter care practices and patient comorbidities may be more influential than duration alone[34].

The type of catheter material significantly influenced CA-UTI risk, with latex catheters associated with higher odds of CA-UTI compared to silicone catheters (OR = 2.57). Latex catheters are more prone to bacterial colonization and biofilm formation, increasing infection risk. This finding is corroborated by several studies from Europe and America, where silicone catheters are preferred for their lower infection rates and better biocompatibility. For instance, the CATHETER trial in the UK found that antimicrobial-impregnated silicone catheters reduced the incidence of symptomatic UTIs compared to standard latex catheters [38]. Similarly, studies in the United States by Bystrom and Caudill demonstrated significant reductions in CA-UTI rates when switching from latex to silicone catheters, with reductions of 73.8% and 17%, respectively [39,40]. However, not all studies uniformly support the superiority of silicone over latex catheters. A systematic review by Johnson et al. (2006) found no significant difference in the prevention of UTIs between silver-coated silicone catheters and uncoated silicone catheters, suggesting that the benefit of silicone may not be significantly enhanced by silver coatings [20]. Additionally, a study in Somalia by Mohamed et al. (2022) indicated that prolonged catheterization and comorbidities played a more substantial role in CA-UTI risk than catheter material alone [41]. Similarly, research by Kim et al. (2017) in Korea emphasized catheter duration as the primary risk factor for CA-UTI, rather than the material of the catheter [42]. These findings highlight the multifactorial nature of CA-UTI risk and suggest that while silicone catheters generally offer advantages over latex, other factors must also be considered in infection control strategies.

Multivariate Analysis

The multivariate analysis highlights several key factors significantly associated with CA-UTI, including age, catheter duration, smoking status, diabetes, HIV status, CKD, prostate malignancy, and catheter type. These findings emphasize the need for comprehensive risk factor management and tailored preventive strategies to reduce the incidence of CA-UTI in clinical settings. Effective infection control practices, patient education, and targeted interventions for high-risk groups are essential to mitigate the burden of CA-UTIs.

While our study did not find a significant difference in CA-UTI risk between urethral and suprapubic catheterization routes, some studies from Europe and America suggest that suprapubic catheterization might be associated with lower infection rates. For instance, a randomized prospective trial by Vandoni et al. (1994) found that none of the patients with suprapubic catheters developed bacteriuria compared to nine patients with urethral catheterization, suggesting that suprapubic catheters might reduce infection risks [43]. Similarly, a systematic review and meta-analysis by Healy et al. (2012) concluded that suprapubic catheterization was associated with a significant reduction in postoperative urinary tract infections compared to urethral catheterization in gynecologic populations [44]. However, Bonkat et al. (2013) found that microbial biofilm formation and catheter-associated bacteriuria (CAB) were not significantly different between suprapubic and urethral catheters, indicating that suprapubic catheters may not necessarily lower infection rates [34]. Additionally, a systematic review by Kidd et al. (2015) reported insufficient evidence to conclusively determine the superiority of suprapubic over urethral catheterization for reducing symptomatic urinary tract infections, highlighting the need for further research [45]. These studies underscore the variability in findings and the importance of considering patient-specific factors and the clinical context when choosing between catheterization routes. Further research is needed to conclusively determine the impact of catheterization route on CA-UTI risk in different settings. In regions like Asia, suprapubic catheterization is often preferred for long-term use due to its perceived lower infection risk [18]. Suprapubic catheters can be easier to manage and less likely to cause urethral trauma or strictures [18].

Limitations

The limitations of this study include the use of a non-probability consecutive sampling technique, which may introduce selection bias; a relatively small sample size (72 participants) potentially limiting the generalizability of the findings; and the focus on a single hospital, which may limit the external validity of the results. Variations in practice and patient demographics at other institutions might yield different findings. The study focused solely on male patients, excluding female patients who also experience CA-UTIs, thereby limiting the applicability of the findings to the entire population of catheterized patients. Additionally, the three-month study period might not capture the full variability in CA-UTI frequency and associated factors over a more extended period, potentially limiting the comprehensiveness of the results.

Strengths

Despite these weaknesses, the study's strength lies in its systematic approach to data collection, employing questionnaires and standardized criteria (McGeer criteria) to accurately identify symptomatic CA-UTI cases. This method enhances the reliability of the findings. The use of robust statistical tools and methods, including logistic regression and various Python libraries (Pandas, NumPy, Statsmodels, Matplotlib, Seaborn), allowed for precise and meaningful analysis of the data.

Conclusion

This study provided valuable insights into the frequency and risk factors associated with symptomatic CA-UTI among male patients at a referral hospital in North West Cameroon. The frequency of CA-UTI was found to be 22.2%, with significant associations identified for older age, smoking, diabetes, HIV, CKD, malignancy, and the use of latex catheters. These findings underscore the need for targeted interventions to manage these risk factors effectively and reduce the incidence of CA-UTI in clinical settings.

Highlights

What Is Already Known?

Catheter-associated urinary tract infections (CA-UTIs) are among the most common nosocomial infections, significantly contributing to hospital-acquired infections and associated morbidity and mortality. Studies indicate that prolonged catheterization increases infection risk, with bacterial biofilm formation playing a major role in CA-UTI development. The use of different catheter materials (latex versus silicone) and catheterization routes (urethral versus suprapubic) has been debated as potential risk factors, but findings have been inconsistent. Additionally, patient-related factors such as diabetes, smoking, chronic kidney disease (CKD), and immunosuppression have been implicated as major contributors to CA-UTI susceptibility in hospitalized individuals.

Highlights

What Does This Study Add?

This study provides new insights into CA-UTI risk factors among male patients catheterized for bladder outlet obstruction in Cameroon. It highlights that older age, diabetes, smoking, HIV, CKD, malignancy, and the use of latex catheters significantly increase CA-UTI risk. Notably, it finds that shorter catheterization durations paradoxically correlate with higher infection risk, suggesting early vulnerability post-catheterization. The study also confirms the increased risk associated with latex catheters while finding no significant difference between urethral and suprapubic catheterization routes. These findings underscore the need for targeted interventions, including risk-based catheter selection and patient-specific infection prevention strategies.

Author's Contribution

Conceptualisation: TTNE, MOL; Methodology: NTNE, ALF, MOL, FFA; Protocol: ALF, TTNE, FFA; Formal analysis: TTNE, ALF; Resources: ALF, TTNG; Investigation: ALF; Writing original draft: ALF, TTNE; Editing: GEA, TTNE, MOL, NT; Review: MOL, MAA, MLM, NT, NCA; Validation: FFA, GEA; Supervision: FFA, GEA

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None

Conflict Of Interest:

None of the authors have any competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

Request For Reviewing The Manuscript:

Our research addresses the prevalence of catheter associated urinary tract infection and the factors that are associated with it. We believe it would make a significant contribution to the field of Infectious diseases in aging men who are catheter dependent. Given your expertise in this area of expertise which is related to our manuscript, we would greatly appreciate your professional evaluation and feedback on the manuscript.

Reference

1. Belete MA, Saravanan M. A Systematic Review on Drug Resistant Urinary Tract Infection Among Pregnant Women in Developing Countries in Africa and Asia; 2005–2016. Infect Drug Resist. 2020;13:1465–77. Doi: 10.2147/IDR.S245789.
2. Rowe TA, Juthani-Mehta M. Diagnosis and Management of Urinary Tract Infection in Older Adults. Infect Dis Clin North Am. 2014;28(1):75–89. Doi: 10.1016/j.idc.2013.10.004.PubMed
3. Schaeffer AJ, Nicolle LE. Urinary Tract Infections in Older Men. N Engl J Med. 2016;374(6):562–71. Doi:10.1056/NEJMra1502750.
4. Hooton TM, Bradley SF, Cardenas DD, Colgan R, Geerlings SE, Rice JC, et al. Diagnosis, Prevention, and Treatment of Catheter-Associated Urinary Tract Infection in Adults: 2009 International Clinical Practice Guidelines from the Infectious Diseases Society of America. Clin Infect Dis. 2010;50(5):625–63. Doi:10.1086/650482.
5. Bonkat G, Pickard R, Bartoletti R, Cai T, Bruyère F, Geerlings SE, et al. Guidelines on Urological Infections. European Association of Urology Guidelines Office, Arnhem, The Netherlands; 2018. p. 22. Doi: 10.5281/zenodo.1401080.
6. Foxman B. The epidemiology of urinary tract infection. Nat Rev Urol. 2010;7(12):653–60. Doi:10.1038/nrurol.2010.190.
7. Öztürk R, Murt A. Epidemiology of urological infections: a global burden. World J Urol. 2020;38(11):2669–79. Doi: 10.1007/s00345-019-03071-4.
8. Hickling DR, Sun T-T, Wu X-R. Anatomy and Physiology of the Urinary Tract: Relation to Host Defense and Microbial Infection. Microbiol Spectr. 2015;3(4):10.1128/microbiolspec.UTI-0016-2012. Doi:10.1128/microbiolspec.UTI-0016-2012.
9. Stekkinger E, van der Linden PJQ. A Comparison of Suprapubic and Transurethral Catheterization on Postoperative Urinary Retention after Vaginal Prolapse Repair: A Randomized Controlled Trial. Gynecol Obstet Invest. 2011;72(2):109–16. Doi:10.1159/000324095.
10. Hunter KF, Bharmal A, Moore KN. Long-term bladder drainage: Suprapubic catheter versus other methods: A scoping review. Neurourol Urodyn. 2013;32(7):944–51. Doi: 10.1002/nau.22363.

11. Oumer KE, Dendir G, Mulu W, Abera B. Bacterial profile and antimicrobial susceptibility pattern of catheter-associated urinary tract infection among patients admitted at Jimma University Specialized Hospital, Jimma, Ethiopia. Infect Drug Resist. 2021;14:901–9. Doi: 10.2147/IDR.S296427.

12. McGeer A, Campbell B, Emori TG, Hierholzer WJ, Jackson MM, Nicolle LE, et al. Definitions of infection for surveillance in long-term care facilities. Am J Infect Control. 1991;19(1):1–7. Doi: 10.1016/0196-6553(91)90154-5.SCIRP+2PubMed+2PMC+2

13. Acho A, Boris K, Toby R, Mendjime P, Abessolo H, Bayong M, et al. Establishing a National Healthcare Associated Infection Surveillance System in Cameroon: Promising Practices and Challenges from Pilot Health Facilities. Texila Int J Public Health. 2024;12(2):Art028. Doi:10.21522/TIJPH.2013.12.02.Art028.

14. Platt R, Polk BF, Murdock B, Rosner B. Risk factors for nosocomial urinary tract infection. Am J Epidemiol. 1986;124(6):977–85. Doi:10.1093/oxfordjournals.aje.a114473.

15. Lee NG, Marchalik D, Lipsky A, Rushton HG, Pohl H, Song X. Risk factors for catheter-associated urinary tract infections in a pediatric institution. J Urol. 2016;195(4 Pt 2):1306–11. Doi:10.1016/j.juro.2015.10.177.

16. 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:e022137. Doi:10.1136/bmjopen-2018-022137.

17. Barbadoro P, Labricciosa FM, Recanatini C, Gori G, Tirabassi F, Martini E, et al. Catheter-associated urinary tract infection: role of the setting of catheter insertion. Clin Infect Dis. 2015;61(5):723–9. Doi:10.1093/cid/civ363.

18. Semins MJ, Shore AD, Makary MA, Weiner J, Matlaga BR. The impact of obesity on urinary tract infection risk. Urology. 2012;79(2):266–9. Doi:10.1016/j.urology.2011.09.011.

19. Obiora CC, Dim CC, Ezegwui HU, Nwogu-Ikojo EE, Okeudo C. Asymptomatic bacteriuria among pregnant women with sickle cell trait in Enugu, South Eastern Nigeria. Niger J Clin Pract. 2014;17(1):95–9. Doi:10.4103/1119-3077.122856.

20. Johnson JR, Kuskowski M, Wilt TJ. Systematic review: Antimicrobial urinary catheters to prevent catheter-associated urinary tract infection in hospitalized patients. Ann Intern Med. 2006;144(2):116–26. Doi:10.7326/0003-4819-144-2-200601170-00010.

21. Amissah I, Nyarko K, Amissah C. Bacteriuria in diabetic patients at a Ghanaian teaching hospital. Pan Afr Med J. 2016;25:292. Doi:10.11604/pamj.2016.25.292.10416.

22. Nicolle LE, Bradley S, Colgan R, Rice JC, Schaeffer A, Hooton TM. Infectious Diseases Society of America guidelines for the diagnosis and treatment of asymptomatic bacteriuria in adults. Clin Infect Dis. 2005;41(12):1650–65. Doi: 10.1086/497710.

23. Chen SL, Jackson SL, Boyko EJ. Diabetes mellitus and urinary tract infection: epidemiology, pathogenesis, and clinical implications. Ann Intern Med. 2012;155(9):339–47. Doi: 10.7326/0003-4819-155-9-201111010-00005.

24. Dąbrowska P, Bartoszewicz M, Bartoszewicz K, Kosel J, Stróż S, Ładny J, Czaban S. Catheter-associated urinary tract infections in critically ill patients with COVID-19: a retrospective cohort study. Ther Adv Infect Dis. 2024;11:20499361241278218. Doi:10.1177/20499361241278218.

25. Tessema N, Ali M, Zenebe M. Bacterial associated urinary tract infection, risk factors, and drug susceptibility profile among adult people living with HIV at Hawassa University Comprehensive Specialized Hospital, Hawassa, Southern Ethiopia. Sci Rep. 2020;10:67840. Doi: 10.1038/s41598-020-67840-7.

26. Iweriebor B, Obi C, Akinyemi O, Ramalivhana N, Hattori T, Okoh A. Uropathogens isolated from HIV-infected patients from Limpopo Province, South Africa. Afr J Biotechnol. 2012;11:10598–604. Doi:10.5897/AJB10.2413.

27. Mitha M, Furuya E, Larson E. Risk of healthcare-associated infections in HIV-positive patients. J Infect Prev. 2014;15:214–20. Doi:10.1177/1757177414548694.

28. Jha BK, Singh YI, Bhujel R, Poudyal A, Tamang MD. Prevalence of asymptomatic bacteriuria among elderly diabetic patients residing in central Nepal. J Inst Med. 2017;39(1):25–30. Doi: 10.3126/joim.v39i1.27162.

29. Marami D, Balakrishnan S, Seyoum B. Prevalence, antimicrobial susceptibility pattern of bacterial isolates, and associated factors of urinary tract infections among HIV-positive patients at Hiwot Fana Specialized University Hospital, Eastern Ethiopia. Can J Infect Dis Med Microbiol. 2019;2019:6780354. Doi:10.1155/2019/6780354.

30. Dimitrijevic Z, Paunovic G, Tasic D, Mitic B, Basic D. Risk factors for urosepsis in chronic kidney disease patients with urinary tract infections. Sci Rep. 2021;11(1):14414. Doi: 10.1038/s41598-021-93912-3.

31. Ishigami J, Grams ME, Chang AR, Carrero JJ, Coresh J, Matsushita K. CKD and risk for hospitalization with infection: The Atherosclerosis Risk in Communities (ARIC) Study. Am J Kidney Dis. 2017;69(6):752–61. Doi: 10.1053/j.ajkd.2016.09.018.

32. Campeau L, Shamout S, Baverstock RJ, Carlson KV, Elterman DS, Hickling DR, et al. Canadian Urological Association Best Practice Report: Catheter use. Can Urol Assoc J. 2020;14(7):E281–9. Doi:10.5489/cuaj.6697.

33. Warren JW. Catheter-associated urinary tract infections. Infect Dis Clin North Am. 1997;11(3):609–22. Doi: 10.1016/S0891-5520(05)70376-7.

34. Bonkat G, Widmer AF, Rieken M, van der Merwe A, Braissant O, Müller G, et al. Microbial biofilm formation and catheter-associated bacteriuria in patients with suprapubic catheterisation. World J Urol. 2013;31(3):565–71. Doi: 10.1007/s00345-012-0930-1. UroToday

35. Nassaji M, Ghorbani R, Tamadon MR, Bitaraf M. Association between body mass index and urinary tract infection in adult patients. Nephro-Urol Mon. 2015;7(1):e22712. Doi: 10.5812/numonthly.22712. ResearchGate+1Brieflands+1

36. Alhabeeb H, Baradwan S, Kord-Varkaneh H, Tan SC, Low TY, Alomar O, et al. Association between body mass index and urinary tract infection: a systematic review and meta-analysis of observational cohort studies. Eat Weight Disord. 2021;26(6):2117–25. Doi:10.1007/s40519-020-01068-2.

37. Ndomba ALM, Laisser RM, Silago V, Kidenya BR, Mwanga J, Seni J, et al. Urinary tract infections and associated factors among patients with indwelling urinary catheters attending Bugando Medical Centre, a tertiary hospital in Northwestern Tanzania. Microorganisms. 2022;10(2):473. Doi:10.3390/microorganisms10020473.

38. Pickard R, Lam T, MacLennan G, Starr K, Kilonzo M, McPherson G, et al. Types of urethral catheter for reducing symptomatic urinary tract infections in hospitalised adults requiring short-term catheterisation: multicentre randomised controlled trial and economic evaluation of antimicrobial- and antiseptic-impregnated urethral catheters (the CATHETER trial). Health Technol Assess. 2012;16(47):1–197. Doi:10.3310/hta16470.

39. Bystrom C. Reduction of nosocomial catheter-associated urinary tract infection (CAUTI) in a U.S. Southeastern teaching facility with an all-silicone silver Foley catheter. Am J Infect Control. 2005;33(5):e57–8. Doi: 10.1016/j.ajic.2005.04.062.

40. Caudill T. Reduction in catheter-associated urinary tract infection (CAUTI) using a silver-coated all-silicone Foley catheter versus a silver-impregnated latex Foley catheter in a Southeastern U.S. long-term acute care facility. Am J Infect Control. 2005;33:e60. Doi:10.1016/j.ajic.2005.04.065.

41. Mohamed AH, Sheikh Omar NM, Osman MM, Mohamud HA, Eraslan A, Gur M. Antimicrobial resistance and predisposing factors associated with catheter-associated UTI caused by uropathogens exhibiting multidrug-resistant patterns: A 3-year retrospective study at a tertiary hospital in Mogadishu, Somalia. Trop Med Infect Dis. 2022;7(3):42. Doi:10.3390/tropicalmed7030042.

42. Kim B, Pai H, Choi W, Kim Y, Kweon KT, Kim H, 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. 2017;12(10):e0185369. Doi:10.1371/journal.pone.0185369.

43. Vandoni R, Lironi A, Tschantz P. Bacteriuria during urinary tract catheterization: suprapubic versus urethral route: a prospective randomized trial. Acta Chir Belg. 1994;94(1):12–6. Doi:10.1080/00015458.1994.11661114.

44. Healy EF, Walsh C, Cotter A, Walsh S. Suprapubic compared with transurethral bladder catheterization for gynecologic surgery: a systematic review and meta-analysis. Obstet Gynecol. 2012;120(3):678–87. Doi:10.1097/AOG.0b013e318265dfb8.

45. Kidd EA, Stewart F, Kassis NC, Hom E, Omar MI. Urethral (indwelling or intermittent) or suprapubic routes for short-term catheterisation in hospitalised adults. Cochrane Database Syst Rev. 2015;12:CD004203. Doi:10.1002/14651858.CD004203.pub3.