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IMPACT OF CATHETER ASSOCIATED URINARY TRACT INFECTIONS IN HOSPITALIZED PATIENTS IN LAHORE

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Abstract

Background: *Catheter-associated urinary tract infections (CAUTIs) are among the most common hospital-acquired infections worldwide. They occur due to prolonged or improper use of indwelling urinary catheters and contribute significantly to patient morbidity, extended hospital stays, increased healthcare costs, and antibiotic use.*

Introduction: *Among the various HAIs, urinary tract infections (UTIs) are the most frequently reported, accounting for approximately 30–40% of all hospital-acquired infections worldwide. A substantial proportion of these infections are directly related to the use of indwelling urinary catheters, leading to the condition known as Catheter-Associated Urinary Tract Infection (CA-UTI).*

Objectives

To determine the frequency of CAUTIs in hospitalized patients and to assess the clinical and healthcare impact of CAUTIs, including length of hospital stay and complications.

Methodology: *This Cross- sectional study will be conducted in Shalamar Hospital Lahore. A total number of patients were included in the study is 138 patients with inclusion criteria was patients presented with patients who develop signs and/or symptoms of urinary tract infection (e.g., fever, dysuria, suprapubic pain, cloudy or foul-smelling urine) after catheter insertion, or who meet laboratory criteria for CAUTI. Non-probability convenient sampling technique were used. Data collection was performed through questionnaire and analyzed through Statistical Package of Social Sciences (SPSS) version 26.*

Result: *The study concludes that catheter-associated urinary tract infection (CAUTI) is an important concern among hospitalized patients, with 18.1% showing positive urine cultures. The risk of culture positivity was significantly associated with gender ($p = 0.021$) and, more importantly, with longer hospital stay ($p < 0.001$).*

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E. coli was the most frequently isolated organism, while 10.1% of patients had MDR organisms, indicating the importance of infection prevention and antimicrobial stewardship.
Overall, proper catheter insertion, regular catheter care, and early removal of unnecessary catheters are important measures to reduce CAUTI and its associated complications in hospitalized patients.

INTRODUCTION

Hospital-acquired infections (HAIs), also referred to as healthcare-associated infections, represent a major global challenge to patient safety, quality of care, and healthcare economics. These infections develop during the course of hospitalization and were neither present nor incubating at the time of patient admission. Among the various HAIs, urinary tract infections (UTIs) are the most frequently reported, accounting for approximately 30–40% of all hospital-acquired infections worldwide. A substantial proportion of these infections are directly related to the use of indwelling urinary catheters, leading to the condition known as Catheter-Associated Urinary Tract Infection (CA-UTI) (1).

Urinary catheterization is a common medical intervention used for monitoring urine output, relieving urinary retention, perioperative management, and care of critically ill or immobilized patients. Despite its clinical benefits, catheterization significantly increases the risk of infection, especially when catheters are used for prolonged periods or without strict adherence to aseptic techniques. CA-UTIs not only prolong hospital stay but also increase morbidity, mortality, antimicrobial use, and healthcare costs. Consequently, CA-UTIs are considered largely preventable infections, making them a key target for infection prevention and control programs(2).

Definition and Classification of CA-UTI

A Catheter-Associated Urinary Tract Infection is defined as a UTI that occurs in a patient who has had an indwelling urinary catheter in place for more than 48 hours prior to the onset of infection or develops symptoms within 48 hours of catheter removal. According to international guidelines, CA-UTI may be symptomatic or asymptomatic, with diagnosis based on clinical features, laboratory findings, and microbiological evidence(3).

CA-UTIs can be categorized into:

Asymptomatic bacteriuria, characterized by significant bacterial growth in urine without clinical symptoms. Symptomatic CA-UTI, presenting with fever, suprapubic tenderness, flank pain, dysuria, or altered mental status, particularly in elderly patients. Complicated CA-UTI, which may progress to pyelonephritis, bacteremia, or urosepsis. Among these, symptomatic and complicated CA-UTIs pose serious clinical consequences and are associated with increased mortality, especially in critically ill and immunocompromised patients.

Epidemiology and Global Burden

Most common device-associated infections in the hospital setting are CA-UTIs, especially in the ICU, surgical wards, and long-term care settings. As many as 25% of hospitalized patients are catheterized during their hospitalization and the risk of bacteriuria increases 3–10% per day of catheterization. After one week of catheterization, bacteriuria may occur in almost half of the patients and with long-term catheterization infection is almost inevitable. The burden of CA-UTI is even higher in developing countries including Pakistan due to limited infection control resources, over-crowding, inappropriate catheter use, and poor compliance to the catheter care protocols.

Additionally, delayed catheter removal and lack of regular surveillance further contribute to higher infection rates(4). Despite being preventable, CA-UTIs continue to occur at alarming rates, highlighting the need for local epidemiological data and targeted interventions.

Pathogenesis and Mechanism of Infection

The development of CA-UTIs is a complex process involving microbial colonization, host factors, and catheter-related mechanisms. The urinary catheter provides a direct pathway for microorganisms to enter the bladder, bypassing

natural host defense mechanisms such as urethral sphincters and regular urine flow.
Microorganisms can enter the urinary tract via:
Extra-luminal route, bacterial migration along catheter external surface from peri-urethral area.
Intraluminal route, through contamination of the catheter drainage system, often due to breaks in the closed system or improper handling.(4)
Once inside the urinary tract, microorganisms adhere to the catheter surface and form biofilms, which play a crucial role in the persistence and chronicity of CA-UTIs. Biofilms protect bacteria from host immune responses and significantly reduce the effectiveness of antimicrobial agents, leading to recurrent and difficult-to-treat infections.

Common Causative Microorganisms
CA-UTIs are mainly due to Uropathogenic bacteria, but fungi can also be involved, particularly in immunocompromised or critically ill patients. The following are the most common isolates:*Escherichia coli, Klebsiella species, Pseudomonas aeruginosa, Proteus mirabilis, Enterococcus species, Staphylococcus aureus, Candida species(5).*
Hospital-acquired strains often exhibit multidrug resistance (MDR), including resistance to beta-lactams, fluoroquinolones, and aminoglycosides. The emergence of extended-spectrum beta-lactamase (ESBL) producing organisms and carbapenem-resistant pathogens has further complicated the management of CA-UTIs, emphasizing the importance of antimicrobial stewardship.

Risk Factors Associated with CA-UTIs
Multiple patient-related, device-related, and healthcare-related factors contribute to the development of CA-UTIs. These include, Prolonged duration of catheterization, Female gender, Advanced age, Diabetes, mellitus, Immunosuppression, Critical illness and ICU admission, Inadequate catheter care and maintenance, Breaks in closed drainage systems, Poor hand hygiene practices among healthcare workers
Understanding these risk factors is essential for identifying high-risk patients and implementing preventive strategies.

Clinical and Economic Impact
CA-UTIs significantly increase patient morbidity and may lead to severe complications such as urosepsis, septic shock, and death. They are also associated with prolonged hospitalization, increased diagnostic investigations, and extensive antimicrobial therapy. From an economic perspective, CA-UTIs impose a substantial financial burden on healthcare systems due to increased treatment costs and extended hospital stays.
Moreover, inappropriate and excessive antibiotic use in CA-UTIs contributes to the global problem of antimicrobial resistance, further complicating patient management and limiting therapeutic options.(6)

LITERATURE REVIEW

2.1 Catheter-Associated Urinary Tract Infection

Urinary tract infection (UTI) is one of the most common healthcare-associated infections (HAIs) accounting for about 40% of all nosocomial infections worldwide. Most of these infections are associated with urinary catheterization. Catheter-associated urinary tract infection (CAUTI) is one of the most common hospital acquired infections. Indwelling urinary catheters are associated with about 70% of healthcare-associated UTIs and up to 95% of UTIs associated with intensive care units (ICUs). Nearly 20 % of patients receive urinary catheters during their hospital stay, especially in ICUs, long-term care facilities and rehabilitation units. (Zingg et al 2019)
The widespread use of urinary catheters contributes substantially to the global burden of infection. Approximately 96 million urethral catheters are sold annually worldwide, with almost one-quarter used in the United States alone.(Öztürk & Murt, 2020) Although urinary catheters provide essential clinical benefits for selected patients, prolonged catheterization significantly increases the risk of microbial colonization and subsequent infection.
CAUTIs have been linked with increased length of stay in hospital, increased healthcare costs, increased use of antimicrobial agents, and increased mortality and morbidity in patients. The reported case fatality rate of hospital-acquired bloodstream infections related to the urinary tract is approximately 32.8%. (Rubi et

al., n.d.)The financial burden is also considerable, with uncomplicated CAUTI costing approximately US$600 per episode and bloodstream-associated CAUTIs potentially costing >US$2,800 per episode. CAUTIs account for an estimated US$131 million in annual excess healthcare costs.

2.2 Epidemiology and Risk Factors The duration of catheterization remains the most significant risk factor for CAUTI. The risk of bacteriuria increases by approximately 3–7% for each day a catheter remains in situ. Female sex, prolonged hospitalization, diabetes mellitus, advanced age, impaired immunity, spinal cord injury, and inappropriate catheter care further increase susceptibility.(Shekelle et al., 1999)

A prospective clinical trial involving 482 hospitalized patients demonstrated that female patients and individuals not receiving antimicrobial therapy experienced significantly higher rates of CAUTI. Gram-negative bacterial infections and candiduria became increasingly common after seven days of catheterization, emphasizing the importance of minimizing catheter duration.

2.3 Microbiology of CAUTI. Escherichia coli remains the predominant pathogen responsible for healthcare-associated UTIs, accounting for approximately 18% of reported infections, followed by Staphylococcus aureus (12%) and Klebsiella species (9%). However, recent surveillance studies suggest changing microbiological patterns, particularly among patients with urinary tract-related bloodstream infections, where Enterococcus species (28.7%) and Candida species (19.6%) have emerged as leading pathogens.(Alebachew et al., 2025)

The increasing prevalence of multidrug-resistant organisms in device-associated infections poses a major therapeutic challenge. Long-term acute care hospitals have reported significantly higher rates of antimicrobial resistance compared with general hospital wards, emphasizing the need for antimicrobial stewardship and infection prevention measures.(Suetens et al., 2018)

2.4 Diagnosis of Catheter-Associated Urinary Tract Infection

The Infectious Diseases Society of America (IDSA) defines CAUTI as the presence of signs or symptoms compatible with urinary tract infection together with $\geq 10^3$ colony-forming units (CFU)/mL of one or more bacterial species obtained from a catheter urine specimen or a voided urine specimen collected within 48 hours after catheter removal.In contrast, catheter-associated asymptomatic bacteriuria (CA-ASB) is defined as $\geq 10^5$ CFU/mL in the absence of urinary symptoms. Current guidelines strongly recommend against routine screening or treatment of CA-ASB except in selected situations such as pregnancy or research settings.(Wiley et al., 2020)Clinical diagnosis should not rely on pyuria, cloudy urine, or foul-smelling urine alone, as these findings poorly differentiate CAUTI from asymptomatic bacteriuria. Likewise, pyuria should not be used as an indication for antimicrobial therapy because inappropriate treatment contributes to antimicrobial resistance and Clostridioides difficile infection.

2.5 Prevention Strategies

Evidence consistently demonstrates that reducing unnecessary catheterization and minimizing catheter duration are the most effective strategies for preventing CAUTI.A systematic review including 30 studies evaluated interventions designed to promote timely catheter removal. Meta-analysis of 11 studies demonstrated a 53% reduction in CAUTI rates when reminder systems or automatic stop orders were implemented (Rate Ratio = 0.47; 95% CI 0.30–0.64; p <0.001). Stop-order interventions also significantly reduced catheterization duration.(Meddings et al., 2014)

Current infection prevention guidelines advise against needless catheter insertion, keeping aseptic insertion techniques, maintaining closed drainage systems, performing regular catheter assessment and removing catheters as soon as clinically needed.Antimicrobial-coated urinary catheters were once thought to be a successful strategy, however recent randomized controlled trials have demonstrated modest effectiveness in avoiding symptomatic CAUTIs.(Majeed et al., 2019)Silver-coated catheters demonstrated a protective effect only among selected female patients not receiving antimicrobial therapy, while no overall reduction in infection rates was observed.

2.6 Diagnostic and Antimicrobial Oversight:
Recent evidence highlights diagnostic stewardship as an important component of CAUTI prevention. Inappropriate urine culture ordering frequently leads to unnecessary antimicrobial treatment of asymptomatic bacteriuria, artificially increasing reported CAUTI rates under National Healthcare Safety Network (NHSN) surveillance definitions.A quality improvement intervention involving 289,754 bed-days significantly reduced urine culture ordering from 41.2 to 12.0 cultures per 1,000 bed-days and simultaneously decreased overtreatment of asymptomatic bacteriuria from 1.6 to 0.4 cases per 1,000 bed-days. These improvements were sustained throughout the maintenance period without compromising patient safety.(Kalorin et al., 2022)
Consequently, recent international guidelines emphasize diagnostic stewardship, including restricting urine cultures to symptomatic patients, avoiding unnecessary antibiotic therapy, and improving adherence to evidence-based clinical criteria.

2.7 Emerging Role of the Urinary Microbiome
Advances in next-generation sequencing have challenged the traditional concept that urine is sterile. Studies have demonstrated that the urinary tract contains a diverse microbial community composed of resident bacteria collectively known as the urinary microbiome. Protective organisms such as Lactobacillus crispatus may inhibit colonization by uropathogens through competitive exclusion and modulation of the host immune response. Although the precise role of the urinary microbiome remains under investigation, future diagnostic and therapeutic strategies may focus on preserving or restoring beneficial microbial communities to prevent recurrent UTIs and CAUTIs.(Colautti et al., 2022)

2.8 Summary
Overall, research shows that CAUTI is still one of the most common and avoidable diseases linked to healthcare. Implementing diagnostic stewardship, encouraging antimicrobial stewardship, decreasing catheter use, and cutting catheter duration through reminder or stop-order systems are all consistently supported by the evidence. Behavioral and system-based therapies continue to reduce CAUTI incidence the most, despite technology advancements like urine microbiome research and antimicrobial-coated catheters showing promise.

Objective
To assess the prevalence, risk factors, and prevention practices associated with hospital-acquired catheter-associated urinary tract infections (CAUTIs) among hospitalized patient.
To analyze the clinical outcomes of patients who develop CAUTIs, including length of hospital stay and antibiotic use.

MATERIAL AND METHODS
This research was employed cross-sectional analytical to determine Hospital Acquired catheter associated Urinary Tract Infections.
This research was performed at SHALAMAR Hospital, Lahore.
The Cochran's formula for computing the size of sample is given below;

$$n = \frac{Z^2 \times p \times (1-p)}{d^2}$$
$$n = 138.24$$

n=138 patients
Non probability sampling technique will be used for this study, 4 months' study period.
Patients admitted to the hospital for at least 48 hours, to ensure infections are hospital-acquired. Patient of age 18 years or above are included in study.
Patients who had an indwelling urinary catheter in place before hospital admission, Patients whose urinary catheter remained in situ for less than 48 hours.
The ethical approval was obtained from the Institutional Review Board (IRB) of Superior University before commencing the study. The IRB was review the research proposal to ensure it adheres to ethical guidelines and protects participant rights.
Data were collected by patient detail including age, gender and patient history, patient charts or hospital records, collecting data on catheter insertion date, removal date, duration of catheterization, laboratory results, and signs of infection through questionnaire from SHALAMAR Hospital, Lahore.

Data Analysis: This data will be analyzed and verified by using the SPSS, version 26 SPSS Inc. Chicago, II, USA software. Diagnostic Odd ratio will be used to find out significant association among various variables. Continuous variables summarized as mean ± SD, Categorical variables as frequency and percentage, Chi-square test for categorical variables, independent t-test, or Mann–Whitney U for continuous variables. Logistic regression to identify independent predictors, $p < 0.05$ considered statistically significant,95%confidenceintervaluse

RESULTS

4.1 Table: *Distribution of Patients by Age Group (N = 138)*

Patient's Age	Frequency (n)	Percent (%)
Below 18	1	0.7
18–30	24	17.4
31–50	40	29
Above 50	73	52.9
Total	138	100

Figure 4.1: *Distribution of Patients by Age Group (N = 138)*

Table 4.2: *Distribution of Patients by Gender (N = 138)*

Gender	Frequency (n)	Percent (%)
Male	40	29
Female	98	71
Total	138	100

Table 4.3 : *Distribution of Patients According to Length of Hospital Stay (N = 138)*

Length of Hospital Stay	Frequency (n)	Percent (%)
Less than 5 days	37	26.8
5–10 days	70	50.7
More	31	22.5
Total	138	100

Figure 4.3: *Distribution of Patients According to Length of Hospital Stay (N = 138)*

Table 4.4 : *Distribution of Patients According to Duration of Catheter Placement (N = 138)*

Duration of Catheter Placement	Frequency (n)	Percent (%)
Less than 3 days	42	30.4
3–7 days	64	46.4
More than 7 days	32	23.2
Total	138	100

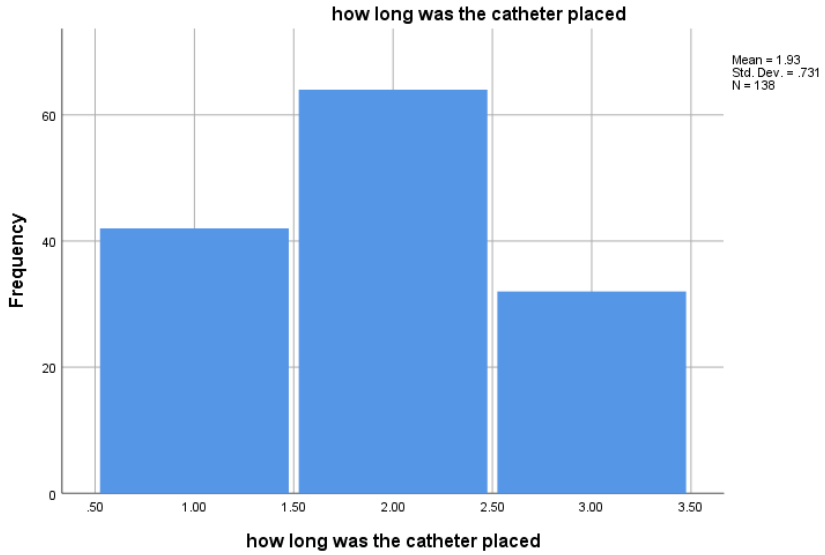


Figure 4.4: *Distribution of Patients According to Duration of Catheter Placement*

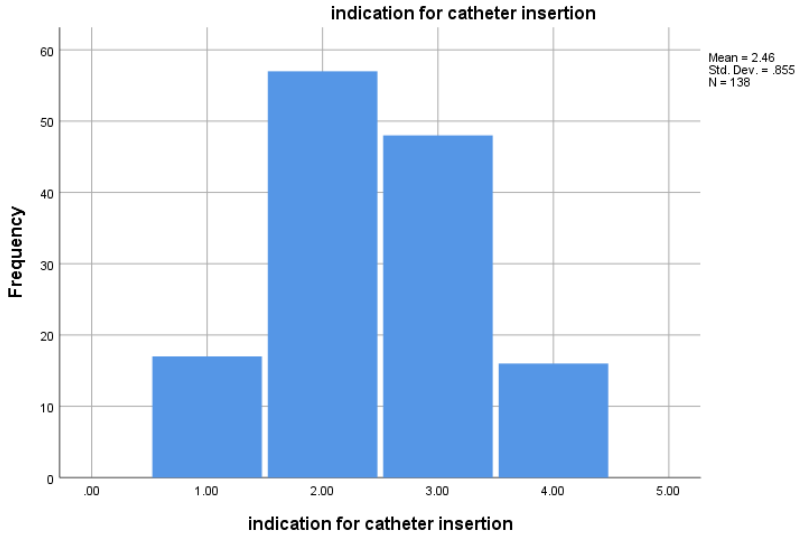


Figure 4.7: *Distribution of Patients According to Indication for Catheter Insertion*

Table 4.6: *Urine Culture Growth*

Urine Culture Growth	Frequency (n)	Percentage (%)
Yes (Positive)	25	18.1
No (Negative)	113	81.9
Total	**138**	**100.0**

Figure 4.6: *Urine Culture Growth.*

Table 4.6: *Day of Urine Culture Collection After Catheter Insertion*

Day After Catheter Insertion	Frequency (n)	Percentage (%)
≥ 48 hours	84	60.9
3–5 days	49	35.5
> 5 days	5	3.6

Day After Catheter Insertion	Frequency (n)	Percentage (%)
Total	138	100.0

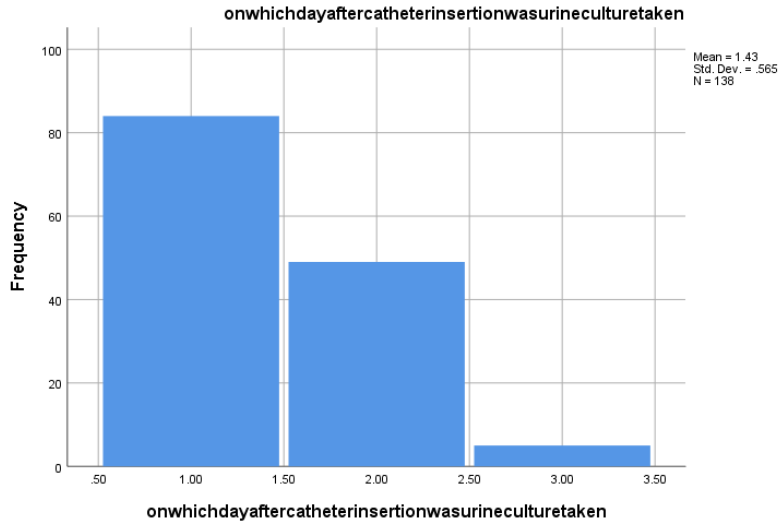


Figure 4.6: *Day of Urine Culture Collection After Catheter Insertion.*

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Table 4.7: *Association Between Gender and Urine Culture Growth*

Gender	Urine Culture Positive, n (%)	Urine Culture Negative, n (%)	Total, n (%)
Male	12 (30.0%)	28 (70.0%)	40 (100%)
Female	13 (13.3%)	85 (86.7%)	98 (100%)
Total	**25 (18.1%)**	**113 (81.9%)**	**138 (100%)**

Statistical Test

Statistical test	χ^2 value	df	p-value	Result
Pearson Chi-Square	5.363	1	**0.021**	**Significant**

Result: There was a **statistically significant association between gender and urine culture growth (p = 0.021)**, with positive culture growth being higher among males (30.0%) than females (13.3%).

Table 4.7: *length of hospital stays and urine culture growth*

Length of hospital stay	Urine Culture Positive, n (%)	Urine Culture Negative, n (%)	Total, n (%)
Less than 5 days	0 (0.0%)	37 (100.0%)	37 (100%)
5–10 days	9 (12.9%)	61 (87.1%)	70 (100%)
More than 10 days	16 (51.6%)	15 (48.4%)	31 (100%)
Total	**25 (18.1%)**	**113 (81.9%)**	**138 (100%)**

Statistical Test

Test	χ^2 value	df	p-value	Result
Pearson Chi-Square	**32.939**	2	**<0.001**	**Significant**

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There was a **statistically significant association between length of hospital stay and urine culture growth** (Pearson's $\chi^2 = 32.939$, df = 2, $p < 0.001$). No positive urine culture was observed among patients who stayed in the hospital for less than 5 days. Positive culture growth was observed in **9 (12.9%)** patients with a hospital stay of 5–10 days and **16 (51.6%)** patients who stayed for more than 10 days. Thus, **urine culture positivity increased with longer hospital stays**, with the highest proportion observed among patients hospitalized for more than 10 days.

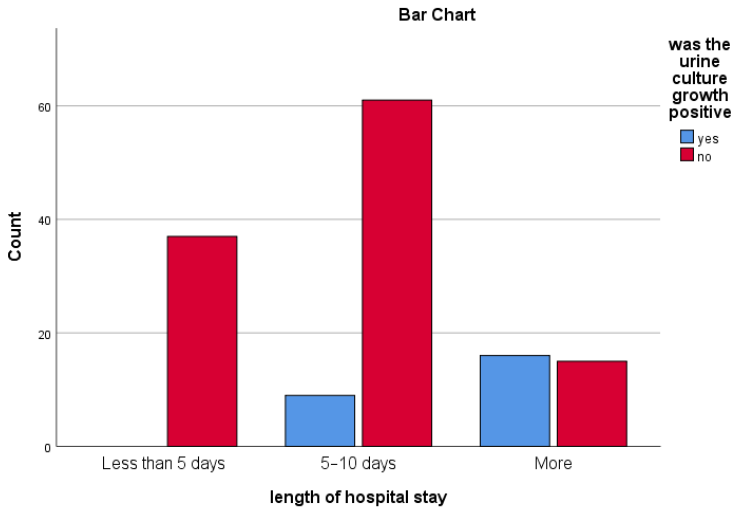


Table 4.8 : *Comparison of Factors Associated with Urine Culture Growth*

Variable	Category	Culture Positive, n (%)	Culture Negative, n (%)	Total, n (%)	χ^2	df	p-value
Gender	Male	12 (30.0%)	28 (70.0%)	40 (100%)	**5.363**	**1**	**0.021**
	Female	13 (13.3%)	85 (86.7%)	98 (100%)			
Length of hospital stay	< 5 days	0 (0.0%)	37 (100.0%)	37 (100%)	**32.939**	**2**	**<0.001**
	5–10 days	9 (12.9%)	61 (87.1%)	70 (100%)			
	> 10 days	16 (51.6%)	15 (48.4%)	31 (100%)			
Total		**25 (18.1%)**	**113 (81.9%)**	**138 (100%)**			

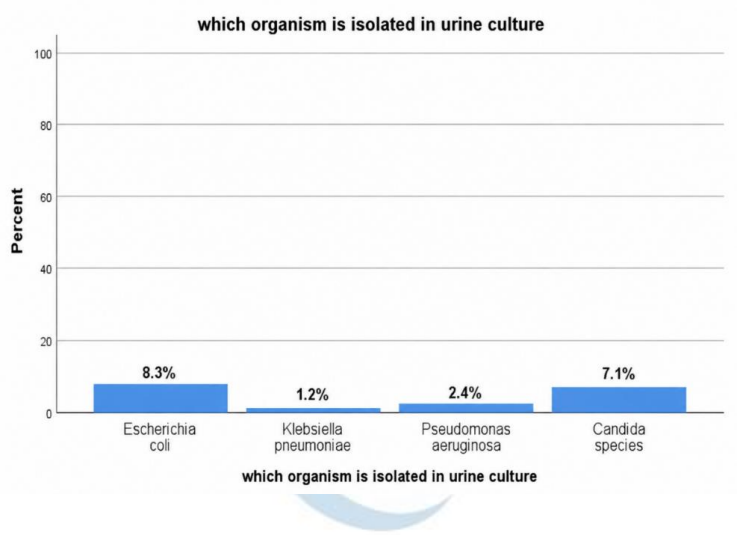
Both **gender** and **length of hospital stay** showed statistically significant associations with urine culture growth.

- **Gender:** Positive culture growth was higher among males (**30.0%**) than females (**13.3%**), with a significant association (**$\chi^2 = 5.363$, p = 0.021**).
- **Length of hospital stay:** Culture positivity increased markedly with longer hospitalization, from **0%** in patients staying <5 days to **51.6%** in those staying >10 days (**$\chi^2 = 32.939$, $p < 0.001$**).
- **Comparison:** Length of hospital stay demonstrated a **stronger statistical association** with urine culture positivity than gender, based on the larger chi-square statistic and smaller p-value.

Table 4.9: *Distribution of Organisms Isolated from Urine Culture*

Organism / Culture Result	Frequency (n)	Percentage (%)
Escherichia coli	10	8.3
Klebsiella pneumoniae	1	1.2

Organism / Culture Result	Frequency (n)	Percentage (%)
Pseudomonas aeruginosa	3	2.4
Candida species	9	7.1
Other	2	1.4
No growth	**113**	**81.9**
Total	**138**	**100.0**



Among the **138 patients**, urine culture growth was positive in **25 (18.1%)** patients, while **113 (81.9%)** showed no growth. Among the organisms isolated, ***Escherichia coli*** was the most frequently identified organism **(10, 8.3%)**, followed by ***Candida* species (9, 7.1%)**. ***Pseudomonas aeruginosa*** was isolated in **3 (2.4%)** patients, while **other organisms** were identified in **2 (1.4%)** patients. ***Klebsiella pneumoniae*** was isolated in **1 (1.2%)** patient. Overall, ***E. coli* was the predominant bacterial organism isolated from urine cultures** in this study.

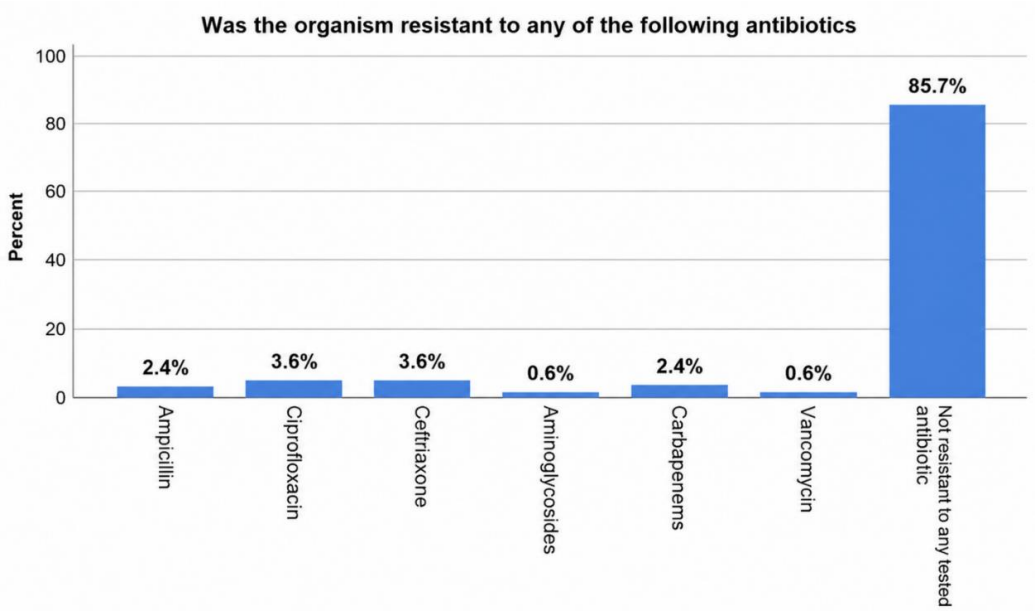


Figure 5.0: ***Antibiotic Resistance Pattern of Isolated Organisms.***

Among the **138 patients**, **119 (85.7%)** organisms were reported as **not resistant to any of the tested antibiotics**. Resistance to **ciprofloxacin and ceftriaxone** was the most frequently reported, with **5 (3.6%) cases each**, followed by resistance to **ampicillin** in **4 (2.9%)** cases and **carbapenems** in **3 (2.4%)** cases. Resistance to **aminoglycosides** and **vancomycin** was reported in **1 (0.7%) case each**.

Overall, the findings indicate that **most isolates (85.7%) were not resistant to any of the tested antibiotics**, while resistance was reported against individual antibiotics in a smaller proportion of cases.

Table 5.1: *Multidrug-Resistant (MDR) Status of Isolated Organisms*

MDR Status	Frequency (n)	Percentage (%)
Yes	13	10.1
No	115	84.1
Not reported	10	7.2
Total	**138**	**100.0**

Among the **138 patients**, **13 (10.1%)** had organisms classified as **multidrug-resistant (MDR)**. The majority, **115 (84.1%)**, were reported as **not multidrug-resistant**, while MDR status was **not reported for 10 (7.2%)** patients.

Overall, the findings indicate that **10.1% of the study population had MDR organisms**, whereas most cases **(84.1%)** were not classified as MDR.

DISCUSSION

The current study sought to assess hospitalized patients' experiences with catheter-associated urinary tract infections (CAUTI). 138 hospitalized patients with urinary catheters were included in the analysis.

The results offer details about patients' demographic traits, length of stay in the hospital and catheter use, reasons for catheter placement, rates of urine culture positivity, timing of urine culture sampling, bacteria and fungi identified, antibiotic resistance, and multidrug resistance patterns.

Demographic traits

In the current research, most patients were over 50 years old (52.9%), followed by those aged 31–50 years (29.0%), 18–30 years (17.4%), and under 18 years (0.7%). The higher number of older patients might be connected to their increased chances of hospitalization and need for invasive treatments. Hospitalized seniors may experience more intricate clinical issues that necessitate urinary catheter use and extended monitoring.

In terms of gender distribution, there were 98 (71.0%) female patients and 40 (29.0%) male patients. Consequently, females made up the greater share of the study group. The distribution of genders is crucial when analyzing the incidence of catheter-associated urinary infection since biological and clinical elements can affect vulnerability to urinary tract infections.

Duration of hospital stay and catheterization

The length of hospital stay indicated that 50.7% of patients were admitted for 5 to 10 days, whereas 26.8% had stays of fewer than 5 days, and 22.5% were hospitalized for over 10 days. Likewise, the highest percentage of patients (46.4%) had urinary catheters inserted for 3–7 days, followed by 30.4% who were catheterized for under 3 days and 23.2% who were catheterized for over 7 days.

These results are significant as extended hospital stays often present additional chances for catheter exposure and invasive interventions. Furthermore, patients needing extended catheterization may possess more serious underlying conditions or necessitate more vigilant observation, possibly heightening their susceptibility to infection. Rather than directly analyzing catheter duration in connection to culture positivity, the current research particularly demonstrated a statistically significant relationship between length of hospital stay and urine culture positivity.

Reasons for urinary catheter placement

The primary reason for inserting urinary catheters was surgical interventions (41.3%), followed closely by urine output monitoring (34.8%). Urinary retention represented 12.3%,

whereas 11.6% of catheters were placed in patients with limited mobility.

The significant rate of catheterization linked to surgical procedures shows that urinary catheters were commonly utilized in perioperative patient care. Tracking urine output was another significant indication, highlighting the necessity of precise urine measurement in hospitalized patients needing rigorous clinical observation. However, since urinary catheterization is an invasive procedure, proper indication and prompt removal are crucial elements in preventing CAUTI.

Positivity of urine culture and incidence of infection

Of the 138 patients in the study, 25 (18.1%) tested positive for urine cultures, while 113 (81.9%) showed no growth. The discovery that almost 20% of the patients examined had positive urine cultures suggests that urinary infection was a significant clinical observation in hospitalized patients with catheters. The fairly significant percentage of negative cultures, however, indicates that not every catheterized patient experienced culture-positive urinary infection throughout the study duration.

The timing for collecting urine cultures is also important. In this research, 60.9% of cultures were obtained at or beyond 48 hours post-catheter insertion, 35.5% were obtained after 3–5 days, and 3.6% were obtained after more than 5 days. This suggests that the majority of cultures were gathered following a minimum of 48 hours of catheter exposure, which is important for evaluating catheter-associated urinary infections.

Link between gender and positive urine culture

The cross-tabulation indicated that out of male patients, 12 of 40 (30.0%) had positive urine cultures, whereas for female patients, 13 of 98 (13.3%) tested positive. Even though females made up the larger part of the study group, the rate of culture positivity was greater among males in this dataset. The Pearson chi-square test revealed a statistically significant link between gender and urine culture positivity ($\chi^2 = 5.363$, $df = 1$, $p = 0.021$). This discovery indicates that gender could have affected the prevalence of culture-positive urinary infections in the population examined. However, as other factors such as age, prior disorders, duration of catheter use, and hospital characteristics may also influence the risk of infection, the results should be interpreted cautiously. Gender is not recognized as a distinct risk factor in the current analysis.

Connection between duration of hospitalization and urine culture positivity

A key finding of the study was the connection between hospital stay duration and positive urine cultures. None of the patients who were hospitalized for fewer than 5 days exhibited a positive culture. In a group of patients hospitalized for 5–10 days, 9 out of 70 had positive cultures, while in the group of patients who were hospitalized for more than 10 days, 16 out of 31 had positive cultures. Consequently, the ratio of positive cultures significantly rose as the duration of hospital stay extended. The Pearson chi-square test demonstrated a very significant statistical relationship ($\chi^2 = 32.939$, $df = 2$, $p < 0.001$). This result strongly indicates that extended hospitalization was linked to a higher chance of culture-positive urinary infection in this research. Extended hospital admissions can subject patients to extended catheter use, frequent healthcare interventions, and heightened chances for healthcare-related microorganisms to inhabit the urinary tract. Additionally, patients who stay hospitalized for extended durations may experience more severe or complex medical issues, which can further enhance their vulnerability.

Microbes obtained from urine cultures

The microbiological results indicated that Escherichia coli was the organism most often isolated, representing 10 cases (8.3%). Candida species were identified in 9 instances (7.1%), then Pseudomonas aeruginosa in 3 instances (2.4%), other organisms in 2 instances (1.4%), and Klebsiella pneumoniae in 1 instance (1.2%). In 113 instances, no organism was documented (81.9%).

The dominance of E. coli is significant as it signifies a frequent urinary pathogen. The detection of Pseudomonas aeruginosa and

Klebsiella pneumoniae indicates that hospitalized patients with catheters can be susceptible to various bacterial pathogens. The isolation of Candida species is also crucial in hospitalized patients with catheters, although the current dataset lacks adequate clinical details to differentiate colonization from significant clinical infection.

Resistance to antibiotics

The analysis of antibiotic resistance revealed that 85.7% of the entire study group were found to be susceptible to all of the tested antibiotics. Among the resistant isolates, the most common resistance was observed against ciprofloxacin and ceftriaxone, both at 3.6%, followed by ampicillin at 2.9%, carbapenems at 2.4%, and aminoglycosides and vancomycin, each at 0.7%. While most patients were not documented as resistant to the antibiotics assessed, recognizing resistance to frequently utilized antimicrobial agents is still clinically significant. Antimicrobial resistance can hinder the treatment of catheter-associated urinary infections and may restrict available options. The occurrence of carbapenem resistance, even at a relatively low rate in this dataset, warrants special attention since carbapenems are generally regarded as crucial medications for addressing severe infections.

Organisms resistant to multiple drugs

Concerning multidrug resistance, 13 patients (10.1%) were identified with multidrug-resistant organisms, whereas 115 (84.1%) were classified as non-MDR and 10 (7.2%) were not categorized.

The occurrence of MDR organisms in nearly one-tenth of the study group emphasizes a significant infection-control issue. MDR organisms can complicate treatment and potentially lead to longer hospital stays and increased healthcare costs. Thus, proper catheter maintenance, infection control measures, antimicrobial management, and prompt removal of unnecessary catheters are crucial strategies for decreasing the risk of healthcare-associated urinary infections and antimicrobial resistance.

CONCLUSION

With **18.1**% of hospitalized patients having positive urine cultures, the study concluded that catheter-associated urinary tract infection (CAUTI) is a significant problem. Gender ($p = 0.021$) and, more significantly, length of hospital stay ($p < 0.001$) were strongly correlated with the risk of culture positivity.

Antimicrobial stewardship and infection prevention are crucial, as evidenced by the fact that **10.1**% of patients had MDR pathogens and **E. coli** was the most commonly isolated organism.

All things considered, early catheter removal, routine catheter care, and correct catheter insertion are crucial steps in lowering CAUTI and its related consequences in hospitalized patients.

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