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Original Research Article

Prevalence, risk factors, causative organism and antibiotic susceptibility of catheter associated urinary tract infections

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ABSTRACT

Background: The most common nosocomial infection is catheter-associated urinary tract infection (CAUTI), with a 3-7% daily risk of developing CAUTI in acute care settings. This study's goal was to identify the prevalence, risk factors, causative organism of CAUTI and understanding the organism's current antimicrobial agent sensitivity profile.
Methods: Total 120 patients participated in a prospective and observational study conducted at Adichunchanagiri Hospital, Karnataka. Reviewing and evaluating patient case sheets, laboratory results, and treatment charts of participants who were hospital inpatients provided data needed for the study. Microsoft Excel was used to enter the data and version 28 of SPSS to analyze the data. Statistical significance was determined by using a P-value of less than 0.05.
Results: It was discovered that 12.5% of HAI cases were linked to catheter use. The most prevalent microbial agent in the current investigation was *E. coli* (41.7%). According to the current study, women are more likely than men to get UTIs. An underlying medical condition was found to have a strong correlation with UTIs in the current investigation. For CAUTI, drug resistance to cefotaxime and tigecycline was noted.
Conclusions: The study suggested that gender, age extremes, use of antibiotics, length of stay in intensive care unit, diabetes mellitus, immunosuppressive medication, and indwelling urinary devices are the major risk factors for CAUTI. *E. coli* was the most common microbiological agent in the current study. Therefore, to assist doctors in the treatment and management of CAUTIs, ongoing surveillance of antimicrobial resistance patterns is required.

Keywords: Antimicrobial resistance, CAUTI, Nosocomial infections, UTI

INTRODUCTION

Hospital Acquired Infections (HAI), also known as 'Nosocomial Infections', is one of the frequent avoidable negative patient outcomes in healthcare settings. Healthcare associated infections (HAIs) affect innumerable patients and are the most common barrier of healthcare world widely, which complicates the clinical care, increase length of hospital stays. Nosocomial urinary tract infections (NUTI) remain as a major contributor to the over-all prevalence or incidence of nosocomial infections.[1]

Among which, catheter associated urinary tract infections (CAUTI) are the most frequent nosocomial infections with the daily risk of developing CAUTI being 3-7%. It constitutes for over 30% of all device associated, healthcare-associated infections and 23% of hospital-acquired infections (HAI) in intensive care units (ICU). Serious complications of CAUTI is that these patients

become a pool of multidrug resistant organisms that can result in more serious HAI.[2]

Epidemiological and etiological characteristics of hospital acquired infections show dissimilarity among countries and likewise among different hospitals in the same country. A prevalence survey conducted under the World Health Organization (WHO) in 55 hospitals of 14 countries representing 4 WHO Regions (Europe, Eastern Mediterranean, South-East Asia and Western Pacific) showed an average of 8.7% of hospital patients had nosocomial infections.[3]

The seven hospitals in the global infection control consortium had cumulative CAUTI infection rates of 1.41 per 1000 catheter days across seven Indian cities.[4] NI is a major factor in higher rates of morbidity, mortality, and financial burden in hospitals and other healthcare facilities. The incidence of NI varied between 3.6 and 12% in high-income countries and between 5.7 and 19.1% in low- and middle-income countries, according to the majority of studies that provided data.[5] The main cause of increased morbidity, mortality, and expense burden in hospitals and other healthcare facilities is nosocomial infections (NI). The majority of studies that reported NI incidence found that it ranged from 3.6 to 12% in high-income countries to 5.7 to 19.1% in low- and middle-income countries. Indwelling catheters were present in 45-79% of adult critical care unit patients, 17% of medical ward patients, 23% of surgical ward patients, and 9% of rehabilitation unit patients, according to the NHSN 2011 surveillance report. In healthcare facilities, the use of indwelling urethral catheters is therefore very common.[6]

Hence, we are conducting this study to know the incidence, risk factors, causative organism and antibiotics utilization pattern towards urinary catheter associated Nosocomial infection in patients admitted to tertiary care teaching hospital.

METHODS

We conducted a prospective observational study in Adichunchanagiri Hospital and Research Center, BG Nagar, Karnataka for a period of 6 months from May 2022-October 2022 were 120 patients participated in the study. Patients admitted to wards with 48 hours of urinary catheterization met the study's inclusion criteria. Patients under the age of 14, those who had a positive urine culture prior to catheterization, and those who had under 48 hours of catheterization were not included the study.

CAUTI was diagnosed according to the CDC recommendations. Age, sex, prior medical history, causative organism, and the pattern of use of antibiotic were all acquired from the patient before the data was entered and evaluated in Microsoft excel 2019. All participants in the study provided their informed permission.

The study received the AH and RC (Adichunchanagiri hospital and research centre) institutional ethical committee's approval. Data was analyzed using SPSS 28.0 (IBM) software. Chi square test was performed for the analysis of relation between categorical variables. P value of <0.05 was taken as a cut-off point to determine the presence of a statistically significant association. Descriptive statistics like mean and standard deviation for continuous data. Frequency and percentage if data is categorical was done.

RESULTS

Gram negative bacteria were linked to the majority of CAUTI infections. It was found that *E. coli* bacteria were linked to the majority of CAUTI infections. The second most frequent species found were *Klebsiella* species (Table 1).

Table 1: Association of causative organism with urinary catheter.

Causative organisms	Frequency	Percentage (%)	P value
Acinetobacter baumanni	1	8.3	0.001*
E-coli	5	41.7	
Klebsiella species	3	25	
Pseudomonas aeruginosa	2	16.7	
Staphylococcus aureus	1	8.3	

*Statistical significance set at 0.05

Twelve out of the 120 patients tested positive for CAUTI. wherein there were nine (75%) female patients and three (25%) male patients. As a result, female patients had higher infection rates than male patients (Table 2).

Table 2: Gender distribution in CAUTI.

Sex	Frequency	Percentage %	X^2 value	P value
Male	3	25	10.67	0.384
Female	9	75		
Total	12	100		

X^2=Chi square value, statistical significance set at 0.05

Comorbid conditions like hypertension (41.7%), diabetes (25%) and hypothyroidism (8.3%) were more common in patients with CAUTI) (Table 3).

It was discovered that CAUTI patients were heavily prescribed ceftriaxone. Meropenem, linezolid, and piperacillin tazobactam came next (Table 4).

The bulk of *Acinetobacter baumanni* were found to be ceftriaxone (33.3%) sensitive, *E. coli* (71.4%) sensitive to tobramycin, *Klebseilla* species (50%) sensitive to

nitrofurantoin, *Pseudomonas aeruginosa* (66.7%) sensitive to cotriomazole, and *Staphylococcus aureus* (50%) sensitive to naldixic acid (Table 5).

Table 3: Comorbidities associated with CAUTI.

Comorbidities	Frequency	%	X^2 value	P value
Hypothyroidism	1	8.3	46.23	0.001*
Type 2DM	3	25		
Asthma	0	0		
Hypertension	5	41.7		

X^2=Chi square value, statistical significance set at 0.05

Table 4: Antibiotic during catheterization interval CAUTI.

Antibiotics	Frequency	X^2 value	P value
Ceftriaxone	9	52.9	0.001*
Meropenem	5		
Linezolid	5		
Piperacillin tazobactam	2		
Azithromycin	3		
Mocef	1		
Doxycyline	1		

X^2=Chi square value, statistical significance set at 0.0

Table 5: Distribution of sensitivity of antibiotics among CAUTI.

Antibiotics	*Acinetobacter baumanni (%)*	*E coli (%)*	*Klebsiella* species *(%)*	*Pseudomonas aeruginosa (%)*	*Staphylococcus aureus (%)*
Amikacin	0	0	0	40	20
Ampicillin	12.5	0	37.5	12.5	12.5
Ceftazidime	0	25	37.5	0	0
Cefotaxime	0	55.6	33.3	0	0
Colistin	0	0	0	50	50
Gentamycin	50	0	0	0	0
Meropenem	0	0	0	0	50
Naldixic acid	7.7	38.5	23.10	15.4	0
Tobramycin	0	0	37.5	25	0
Norfloxacin	10	50	30	10	0
Amoxyclav	0	50	30	0	10
Ceftriaxone	0	41.7	25	16.7	0
Ciprofloxacin	25	0	0	25	0
Piperacillin tazobactam	0	0	0	0	0
Nitrofurantoin	11.1	44.4	0	22.2	11.1
Levofloxacin	0	0	40	0	0
Tigecyline	25	0	75	0	0
Cefipime	0	0	66.7	33.3	0
Cotrimoxazole	8.3	41.7	25	0	8.3
Impenem	0	0	0	0	0
Olfloxacin	7.1	35.7	21.4	14.3	7.1

Table 6: Distribution of resistance of antibiotics among CAUTI.

Antibiotics	*Acinetobacter baumanni (%)*	*E. coli (%)*	*Klebseilla* species (%)	*Pseudomonas aueraginosa (%)*	*Staphylococcus aureus (%)*
Amikacin	0	0	0	40	20
Ampicillin	12.5	0	37.5	12.5	12.5
Ceftazidime	0	25	37.5	0	0
Cefotaxime	0	55	33.3	0	0
Colistin	0	0	0	50	50
Gentamycin	50	0	0	0	0
Meropenem	0	0	0	0	50
Naldixic acid	7.7	38	23.1	15	0
Tobramycin	0	0	37.5	25	0
Norfloxacin	10	50	30	10	0
Amoxyclav	0	50	30	0	10
Ceftriaxone	0	41.7	25	16.7	0

Continued.

Antibiotics	*Acinetobacter baumanni (%)*	*E. coli (%)*	*Klebseilla* species (%)	*Pseudomonas aueraginosa (%)*	*Staphylococcus aureus (%)*
Ciprofloxacin	25	0	0	25	0
Piperacillin/ tazobactam	0	0	0	0	0
Nitrofurantoin	11	44	0	22.2	11.1
Levofloxacin	0	0	40	0	0
Tigecycline	25	0	75	0	0
Cefepime	0	0	66.7	33.3	0
Cotrimoxozole	8	41.7	25	0	8.3
Impenem	0	0	0	0	0
Ofloxacin	7	35.7	21.4	14.3	7.10

A considerable proportion of *Acinetobacter baumanni* exhibits resistance to gentamycin (50%), *E. coli* to cefotaxime (55.6%), *Klebseilla* species to tigecyline (75%), *Pseudomonas aeruginosa* to colistin (50%), and *Staphylococcus aureus* to colistin (50%) (Table 6).

DISCUSSION

The main causes of death in hospitalized patients are nosocomial infections. The occurrence of the infections and their effective characteristics must be thoroughly understood for the control of nosocomial infections in health and medical facilities to be effective.[7] Prevalence data from the current investigation show that 12.5% of HAI were connected to catheter use. A WHO report claims that in hospitals, the prevalence of acquired infections ranges from 5.7% to 19.1% in poor nations. The frequency of CAUTI was discovered to be 10%.

According to a study done in Iran, nurses are not adequately trained in nosocomial infection control. The high prevalence of catheter-induced UTI in Iran necessitates training initiatives that emphasize performance evaluation. Risk variables linked to a rise in bacteriuria and bacteremia in the ICU include gender, extremes in age, antibiotic use, duration of stay, diabetes mellitus, immunosuppressive medication, and indwelling urinary devices.[8]

The current study found that women often experience more UTIs than males. The incidence of UTI in women is equally high, according to studies by Kolawole and Laupland.[9,10] Women's short urethras and their close proximity to the rectum may account for this discrepancy.[11] The findings of the current study demonstrated a direct correlation between age and UTI, with 66.6% of patients being over the age of 50. A study by Rafiei shown that the prevalence rate of UTI increases with aging.[12] In the current study, longer catheter use was associated with a higher rate of UTI. Other studies have verified these findings.[13]

In the current investigation, a strong link between UTI and the existence of an underlying illness was discovered. Additionally, diabetes (25%) was the second most prevalent underlying condition in our study among patients with CAUTI. According to a study by Rezai et al, diabetic people have a higher risk of infection. Another study revealed that diabetes patients had an increased risk of developing UTIs, which were accompanied by glycosuria and immune system impairment.[8]

In the present study, the administration of antibiotics (ceftriaxone 57.5%) before catheterization had no effect on reducing UTI. Similarly, study by Rezai et al, showed the same. In contrast, Crouzet et al reported different results.

The NHSN data also shows *Escherichia coli* as the major culpable pathogen, accounting for 70% of the total isolates.[14] In contrast, in a study by Taneja et al, *Klebsiella* was the most common microbial agent for UTI, followed by *E.coli*, *Enterobacter*, and *Pseudomonas aeruginosa*.[15] *Klebsiella* species (25%) was the second most common pathogen in this study. Vinoth et al, Karina et al, and Kazi et al, also noted a similar pattern.[2] In our present study, *Acinetobacter baumani* and *Staphylococcus aureus* was found to be 8.3% respectively. Growing issue, particularly in the ICU setting, is the antimicrobial resistance of uropathogens. The majority of the *Acinetobacter baumanni* in this investigation are sensitive. *Klebseilla* species are sensitive to nitrofurantoin, tobramycin, and ceftriaxone. *E.coli* are also sensitive to these drugs. Co-trimoxazole is susceptible to *Pseudomonas aeruginosa*.

Major limitation of our study is that it focuses on a single tertiary care hospital, as such, our findings are likely not generalizable to India’s more resource limited healthcare settings and it was not possible to include fungal pathogens. Urine and blood cultures were performed only in cases of suspected CAUTI, so we could have missed subclinical episodes.

CONCLUSION

The risk of antibiotic resistance is disturbingly high among CAUTI’s, which are also the most frequent cause of subsequent bloodstream infections and healthcare-

associated illnesses. If medical workers do not strictly adhere to preventive measures, there is a considerable risk of the spread of these multidrug resistant pathogens. According to present study, gram negative bacteria such as *E. coli*, *Klebsiella* species, and pseudomonas aeruginosa were the most commonly linked to CAUTI. The management of CAUTI should be based on understanding the etiology of the bacteria involved as well as their patterns of antibiotic resistance, as the majority of isolates had greater rates of resistance to routinely administered antimicrobials. Our study opens the door for related studies to be carried out and suggested for developing clinical guidelines for CAUTI.

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