Section: General Medicine

Original Research Article

A STUDY OF URINARY TRACT INFECTION IN BLADDER CATHETERISED PATIENTS

Gautham Sakthivel[1], Gauthaman C S[2], Sadiqa Nasreen Hifzour Rahaman[3]

[1]Assistant Professor, Department of General Medicine, Chettinad Hospital and Research Institute, Chettinad Academy of Research and Education, Tamilnadu, India.
[2]Associate Professor, Department of General Medicine, Government Kilpauk medical college, Tamilnadu, India.
[3]Assistant Professor, Department of General Medicine, Sri Manakula Vinayagar Medical College & Hospital, Puducherry, India.

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Corresponding Author:
Dr. Gauthaman C S,
Email: kirangautham@yahoo.com.

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Abstract

Background: Catheter-associated urinary tract infections (CAUTI) are the commonest nosocomial infections worldwide. Hence, the present study aimed to assess the patient and catheter-related factors contributing to urinary tract infection (UTI). **Materials and Methods:** The study included 106 patients who had been catheterised for various reasons. The patient's medical histories and physical examinations were meticulously documented. Blood samples were obtained and analysed for blood sugar, urea, serum creatinine, serum electrolytes, and total blood count. Urine samples with organism growth of > 103 were regarded as significant and were reported positive by the microbiologist, and drug sensitivity patterns were created and reported for those samples. If the urine culture and sensitivity report on the fourth day was culture negative, a comparable urine sample was collected on the eighth day. **Results:** The risk of CAUTI is more common in people with diabetes 19 (55.8%). 25% of patient culture was positive and sensitive on day 4, whereas 37% on day 8. Incidences of CAUTI on day 4 was 24.52%, and on day eight it was 12.26%. Fever was the main symptom (25%), and CAUTI was found more common in patients with a total TLC count between 10,000-15,000, blood sugar levels of > 300 mg/dl, haemoglobin levels less than 10g/dl and creatinine of more than 1.2 mg/dl. The maximum sensitivity for E coli, Klebsiella, Staphylococcus aureus and Citrobacter was reported by Piperacillin tazobactam, Amikacin, Vancomycin and Piperacillin tazobactam. **Conclusion:** The reduction in the duration of catheterisation, rigorous diabetes control, and sterile precautions in the insertion and maintenance of indwelling catheters can help to avoid CAUTI.

INTRODUCTION

The indwelling urinary catheter is an essential feature of numerous medical procedures. According to the National Health Care Safety Network (NSHN), an indwelling catheter is any tube put into the urine bladder through the urethra, excluding suprapubic catheters and nephrostomy tubes.[1] The urinary tract is the foremost common location of nosocomial disease. Most of these diseases take after instrumentation of the urinary tract, primarily urinary catheterisation, and are a major source of resistant nosocomial pathogens.[2] CAUTI (catheter-associated urinary tract) is the most frequent nosocomial infection, accounting for roughly 30-40% of all institutionally acquired infections globally. An indwelling catheter is linked to two to five percent of all urinary tract infections.[3] The Centres for Disease Control and Prevention (CDC) defines it as any urinary tract infection in a patient with an indwelling catheter at the time of infection or within 48 hours before the onset of infection. There is no set time limit for the catheter to be in place for a urinary tract infection to be classified as CAUTI.[4-6]

Asymptomatic bacteremic and symptomatic urinary tract infections are all possible CAUTIs. CAUTI is linked to a high rate of morbidity and can cause genitourinary complications, including pyelonephritis, cystitis, prostatitis, epididymal-orchitis, as well as systemic problems such as spinal osteomyelitis, septic arthritis, endocarditis, endophthalmitis, and meningitis.1 Approximately 3% of all catheterised patients will develop bacteremia. CAUTI complications result in a longer stay in the hospital, as well as higher costs,

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morbidity, and mortality. According to the Centers for Disease Control and Prevention, CAUTI causes a 2.8-fold increase in morbidity and mortality and a 1-3-day increase in hospitalisation time. The significance of CAUTI in terms of cost is best demonstrated by CMS (Medicare) data in the United States, which estimated the yearly cost of CAUTI to be between $340 and $450 million.[7-8]

Asymptomatic bacteriuria frequently triggers antibiotic therapy, and CAUTI is one of the most common causes of drug-resistant nosocomial infection. The conversion of sterile urine to bacteriuria is estimated to occur at a rate of 3-10 percent daily. Although precise indications for catheter usage have been found, catheters are frequently overused in most hospitals. Kass and Schneiderman originally documented the role of indwelling catheters in urinary tract infections in 1957, and most investigations to elucidate the pathophysiology of CAUTI were conducted in the 1970s and 1980s.[9] However, even in this modern era of enhanced health care, innovative technologies, and early patient discharge, CAUTI still accounts for most nosocomial infections. Understanding the risk factors for catheter-associated urinary tract infections is critical for incorporating preventative efforts into our patients' everyday care. This study aims to assess the patient and catheter-related factors that contribute to urinary tract infection to aid in treating the infection and decrease the burden of this disease.

MATERIALS AND METHODS

The study was carried out at the Government Chengalpattu Medical College Hospital, for one year, from October 2020 to September 2021, on 106 patients. The study included patients who had been catheterised for various reasons, and patients were included from medical wards such as Neuromedicine, General Medicine, and the Intensive care unit and from wards such as General Surgery and Orthopaedics. They were enrolled after receiving ethical committee approval and informed consent from the patients or their families.

Inclusion Criteria

For patients of either sex, aged from 20 to 90 years, various factors, including trauma, can cause patients with fractures femur, hip dislocation, and paraplegia, patients with cerebrovascular accidents (CVAs), degenerative diseases of the nervous system, and various types of meningitis and encephalopathy were included.

Exclusion Criteria

Patients with a positive urine culture and sensitivity on the day of catheterisation and patients whose catheters were removed before the fourth day for various reasons, such as the patient's general condition improving, absconding from the ward, defying medical advice, or dying. Patients who had their catheter removed before the eighth day had negative urine culture and sensitivity results on the fourth day for various reasons, such as improving their general condition, absconding from the ward, going against medical advice, or dying. Female patients with ultrasonography evidence of pelvic inflammatory disorders and symptoms suggestive of atrophic vaginitis and elderly male patients with prostatic hypertrophy, and elderly male patients with prostatic hypertrophy were excluded.

Methodology

The patient's medical histories and physical examinations were meticulously documented. Any previous history of chronic diseases such as diabetes, hypertension, heart disorders, prior history of catheterisation, or other diseases was elicited and noted. Blood samples were obtained and analysed for blood sugar, urea, serum creatinine, serum electrolytes, and total blood count. The results of an abdominal ultrasonogram were also reported.

After strict aseptic precautions, the urinary bladder was catheterised using an adult-size Foley catheter. The first drained urine sample was taken straight from the rubber tubing end and sent for regular urine analysis, culture and sensitivity testing, and examination of the reports. Patients were checked for general physical status on day four following catheterisation, and a history of fever, dysuria, and stomach pain was taken down. After detaching the draining tube, a urine sample was obtained directly from the catheter, and the sample was analysed.

Urine samples with organism growth of > 103 were regarded as significant and were reported positive by the microbiologist, and drug sensitivity patterns were created and reported for those samples. The reports were then used to conduct our research. If the urine culture and sensitivity report on the fourth day was culture negative, a comparable urine sample was collected on the eighth day, and the sample was sent for the same analysis as on the fourth day. The reports were then used to conduct our research. The data was entered into the master chart, and the reports were analysed.

Statistical Analysis

The data was gathered and entered into an Excel file. Frequency means percentages, standard deviations, chi-square coefficients of correlation, and p-values were determined using the SPSS-18 software. The significance of a difference between two quantitative variables was calculated using the Chi-square test, and a p-value of less than 0.05 was considered significant.

RESULTS

The male predominance was reported at 62 (58%) with a mean age of 47.4±15.6 years and a maximum patient of 23 (21.7%) in the age group of 50 to 59. The risk of CAUTI is more common with people with diabetes 19 (55.8%) and renal failure 11 (45.8%) co-morbidity. The indication catheterisation showed acute encephalopathy as the main 20

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(18.8%) indication, followed by acute CVA was reported in 18 (16.98%) patients (Table 1).

Table 1: Observation of demographic

Parameters	Observations	
	Frequency (%)	
Gender		
Male	62(58.49%)	-
Female	44 (41.51%)	-
Age group (Years)		-
20-29	13 (12.3%)	-
30-39	23 (21.7%)	-
40-49	22 (20.8%)	-
50-59	23 (21.7%)	-
60-69	17 (16.0%)	-
70-79	5 (4.7%)	-
80-89	3 (2.8%)	-
Mean Age Years, (Mean ±SD)	47.4±15.6	
Co-morbidities	Frequency (%)	CAUTI Frequency (%)
DM	34 (32.1%)	19 (55.8%)
SHTN	40 (37.7%)	16 (37.5%)
TB	5 (4.7%)	1 (20%)
Malignancy	2 (1.9%)	1 (50%)
RF	24 (22.6%)	11 (45.8%)
Distribution of Diagnosis	Frequency (%)	
Acute cva	18 (16.98%)	
Acute encephalopathy	20 (18.86%)	-
Acute meningoencephalitis	8 (7.54%)	-
Abdominal surgery	12 (11.3%)	-
Malignancy	2 (1.88%)	-
Compressive myelopathy	9 (8.49%)	-
Fracture both bones leg	5 (4.71%)	-
Fracture of neck of femur	8 (7.54%)	-
Hip dislocation	6 (5.66%)	-
OPC poisoning/ Respiratory failure	4 (3.77%)	-
Transverse myelitis	7 (6.60%)	-
Traumatic paraplegia	7 (6.60%)	-

Table 2: Urine culture and sensitivity reports

Urine culture and sensitivity reports	Frequency (%)	Significance
At the end of day 4		
Yes	26 (25%)	χ 2=27.509
No	80 (75%)	P<0.001
At the end of day 8		
Yes	39 (37%)	χ 2=60.377
No	67 (63%)	P<0.001
Distribution of symptoms	Frequency (%)	Significance
Fever		
Yes	10 (9.4%)	χ 2=69.774
No	96 (90.6%)	P<0.001
LUTS		
Yes	8 (7.5%)	χ 2=76.415
No	98 (92.5%)	P<0.001
Suprapubic Pain		
Yes	8 (7.5%)	χ 2=76.415
No	98 (92.5%)	P<0.001
Loin Pain		
Yes	7 (6.6%)	χ 2=79.823
No	106 (93.4%)	P<0.001
Urine Turbidity		
Yes	6 (5.7%)	χ 2=83.358
No	100 (94.3%)	P<0.001

Among the 106 patients, 26 showed urine culture and sensitivity positive on day 4. Of these 26 patients, 11 were males, and 15 were females. Out of 80 patients with negative urine cultures on day 4, 13 became positive on day 8 (12%). The percentage of increase in the incidence of catheter-associated UTI from day 4 to day 8 was 16%. Of 62 male patients, 11 were urine culture and sensitivity positive on day 4(42%), and 5 (38%) were positive on day 8. Out of 44 female patients, 15 (58%) were culture and sensitivity positive on days 4 and 8 were positive on day 8 (62%). The incidence of CAUTI was seen in 23 (52%) and 16 (25%) males. The incidence of CAUTI

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on days four and eight also showed more female preponderance than males. Fever was seen as a major symptom in patients 25%, followed by Lower Urinary Tract, reported in 21% of patients (Table 2).

Table 3: Urine culture positivity

Urine culture positivity		Frequency (%)
On day 4 of catheterisation (n=26)	Asymptomatic patients	17(65%)
	Symptomatic patients	9(35%)
On day 8 of catheterisation (n=13)	Asymptomatic patients	9(69%)
	Symptomatic patients	4(31%)

Among the 26 positive patients on day 4, 9(35%) were symptomatic, and 17 (65%) were asymptomatic. Whereas all patients who were positive on day 8, 4(31%) patients were symptomatic and 9(69%) (Table 3, Figure 1).

Table 4: Correlation of TLC count, RBS, HB and Creatinine with CAUTI

Parameters		Observations of CAUTI	
TLC (count)		Day 4	Day 8
Levels (1000)	Frequency (%)	Frequency (%)	Frequency (%)
1-5	7 (6.6%)	0 (0%)	1 (0.9%)
5-10	55 (51.9%)	9 (8.5%)	6 (5.7%)
10-15	32 (30.2%)	10 (9.4%)	2 (1.9%)
15-20	11 (10.4%)	6 (5.7%)	4 (3.8%)
20-25	1 (0.9%)	1 (0.9%)	0 (0%)
RBS (mg/dL)			
Levels (00)			
<100	11 (10.4%)	2 (18%)	2 (18%)
100-200	64 (60.4%)	9 (14%)	7 (10%)
200-300	12 (11.3%)	6 (50%)	0 (0%)
300-400	15 (14.2%)	8 (53%)	1 (6%)
400-500	4 (3.8%)	1 (25%)	3 (75%)
HB (g/dl)			
Levels			
5-7.5	9 (8.5%)	2 (1.9%)	0 (0%)
7.5-10	32 (30.2%)	14 (13.2%)	2 (1.9%)
10-12.5	38 (35.8%)	9 (8.5%)	8 (7.5%)
12.5-15	26 (24.5%)	1 (0.9%)	2 (1.9%)
15-20	1 (0.9%)	0 (0%)	1 (0.9%)
Creatinine (mg/dl)			
Levels			
0.5 -1.0	24 (22.6%)	6 (5.7%)	1 (0.9%)
1.0-1.5	49 (46.2%)	9 (8.5%)	11 (10.4%)
1.5-2.0	9 (8.5%)	4 (3.8%)	0 (0%)
2.0-2.5	5 (4.7%)	1 (0.9%)	0 (0%)
2.5+	19 (17.9%)	6 (5.7%)	1 (0.9%)

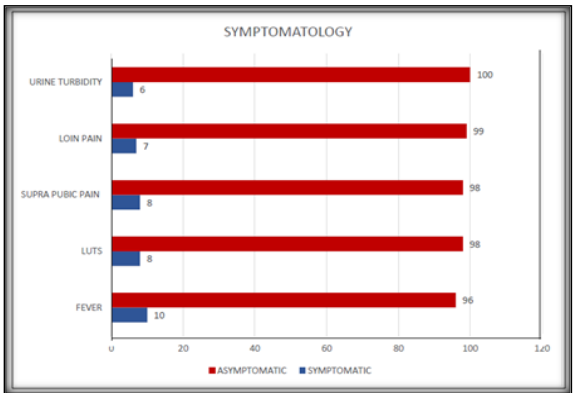

Figure 1: Observation of Symptomatology of CAUTI

CAUTI was found to be more common in patients with a total TLC count between 10,000-15,000 of about 38% on day four and common in patients with a total count between 5,000-10,000 of about 46% on day 8. The highest risk of CAUTI was seen in patients with blood sugar levels of > 300 mg/dl. Nineteen patients have blood sugar values of >300 mg/dl. Out of 19 patients, 13(68%) became urine culture positive on day 4 and 4(32%) patients on day 8. The risk of CAUTI among patients with haemoglobin levels less than 10g/dl was 44%, and in patients with more than 10g/dl was 32% (Table 4).

Table 5: Microbiological flora of urine culture-positive isolates

Organism		Observations of CAUTI		Significance
		Day 4	Day 8	
Name of organism	Frequency (%)	Frequency (%)	Frequency (%)	
Candida	2 (1.9%)	1 (3%)	2 (5%)	χ 2=256.868 df=7 P<0.001
Citrobacter	4 (3.8%)	3 (12%)	4 (10%)	
E.coli	13 (12.3%)	9 (35%)	13 (34%)	
Enterococcus	3 (2.8%)	2 (8%)	3 (7%)	

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Klebsiella	9 (8.5%)	7 (27%)	9 (23%)	
Proteus	3 (2.8%)	1 (3%)	3 (7%)	
Staph aureus	5 (4.7%)	3 (13%)	5 (14%)	

The incidence of CAUTI in patients with S. creatinine of more than 1.2 mg/dl was 42% compared to 33% in patients with S. creatinine of more than 1.2 mg/dl. Among 26 urine culture-positive isolates on day 4, Escherichia coli was reported in a maximum of 9 (35%) cultures, whereas at the end of day 8, 13(34%) isolates were Escherichia coli positive. Escherichia coli was the most common organism isolated, constituting 34%, followed by Klebsiella sps. Constituting 23%. The organism growth within the subjects was statistically significant (P<0.001) (Table 5).

The maximum sensitivity for E coli was reported by Piperacillin tazobactum 13 (100%). However, maximum sensitivity for Klebsiella was reported by Amikacin and Piperacillin tazobactam 8(88%). The drug sensitivity to Staphylococcus aureus and Citrobacter was observed maximum in Vancomycin (5) and Piperacillin tazobactam (4), respectively (Table 6).

Table 6: Observation of drug sensitivity and resistance patterns

	E. coli (13)		Klebsiella (9)	
DRUGS	**SENSITIVITY (%)**	**RESISTANT (%)**	**SENSITIVITY (%)**	**RESISTANT (%)**
Amikacin	12(92%)	1(8%)	8(88%)	1(11%)
Cefotaxime	4(30%)	9(70%)	4(44%)	4(44%)
Norfloxacin	5(38%)	8(61%)	7(77%)	2(22%)
Nitrofuran toin	11 (85%)	2(15%)	4(44%)	5(55%)
Imipenem	8(61%)	0%	5(55%)	0%
Meropenem	4(30%)	0%	1(11%)	0%
Piperacillin tazobactum	13(100%)	0%	8(88%)	1(11%)
Gentamicin	7(58%)	3(23%)	7(77%)	2(22%)
Cotrimoxazole	12(92%)	1(8%)	4(44%)	4(44%)
	Staphylococcus aureus (5)		Citrobacter (4)	
Amikacin	4(80%)	1 (20%)	3(75%)	1(25%)
Ampicillin	3 (60%)	1 (20%)	0 (0%)	0 (0%)
Cefotaxime	1(20%)	1 (20%)	2 (50%)	1 (25%)
Norfloxacin	3 (60%)	2 (40%)	3 (75%)	1 (25%)
Nitrofurantoin	1 (20%)	0 (0%)	1 (25%)	3 (75%)
Imipenem	0 (0%)	0 (0%)	4 (100%)	0 (0%)
Meropenem	0 (0%)	0 (0%)	2 (50%)	0 (0%)
Vancomycin	5 (100%)	0 (0%)	0 (0%)	0 (0%)
Piperacillin tazobactum	0 (0%)	0 (0%)	4 (100%)	0 (0%)
Linezolid	4 (80%)	0 (0%)	0 (0%)	0 (0%)
Gentamicin	0 (0%)	0 (0%)	2 (50%)	1 (25%)
Tetracycline	1 (20%)	0 (0%)	0 (0%)	0 (0%)
Cotrimoxazole	3 (60%)	2 (20%)	3 (75%)	1 (25%)

DISCUSSION

The most prevalent nosocomial infection is UTI, with catheterisation being the most common cause. Foley catheterisation was linked to 80% of nosocomial infections and, in some cases, all.[1-2] The purpose of this study was to determine the incidence, sex risk, microbiological pattern, drug sensitivity, symptomatology, the impact of catheterisation days, and the impact of associated co-morbid conditions on the development of urinary tract infections in patients who underwent catheterisation at Government Chengalpattu hospital.

In this study, 106 patients, of 62 were males and 44 were females, with a mean age of 47.4±15.6 years and with maximum patients 23 (21.7%) in the age group of 50 to 59 years. These findings in the present study follow earlier studies. The most common indication for which bladder catheterisation was done was acute encephalopathy, followed by an acute cerebrovascular accident. Of all 26 (24.52%) patients were urine culture positive on day four; on day eight, it was 39 (37%), and this was consistent with the studies done by Tambyah et al., where it was 30 % on day 4.10 The percentage of increase in incidence of catheter-associated UTI from day 4 to day 8 was 16%, and this was consistent with a study by Foster, where the risk of infection increased by 3 to 5% for each day of catheterization.[11]

The incidence of UTI among males in our study was 25%, and that in females was 52%, and this was consistent with studies done by Tambyah et al., which showed that females have a higher risk for catheter-associated urinary tract infection.10 The most common organism producing catheter-associated urinary tract infections in our study was Escherichia coli (34%), followed by Klebsiella pneumoniae (23%) and Staphylococcus aureus (14%). These findings in the present study are consistent with earlier reported studies.[12]

In our study, common organisms like Escherichia coli were highly sensitive to Piperacillin Tazobactum in 100% of cases, followed by Amikacin and Cotrimoxazole in 92%. Also, it shows high resistance to common antibiotics such as Cefotaxime in 70% of cases and resistance to Norfloxacin in 61% of cases. Piperacillin Tazobactum shows the highest sensitivity of 100% to E. coli and 88% to Klebsiella sps. Staphylococcus-isolated patients are 100% sensitive to Vancomycin and Linezolid. The highest sensitivity for Citrobacter isolates is to Imipenem and Piperacillin Tazobactum, and this was

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consistent with the studies done by Stickler et al., where there was increased resistance to the commonly used antibiotics.[13]

In our study, 67 % of urine culture-positive patients were asymptomatic, which was inconsistent with the Tambyah et al. study, where more than 90% of catheter-associated UTI patients were asymptomatic.[10] Among symptomatology, fever is the most common symptom in about 26% of patients. In our study, all the patients were put on antibiotics from day one of catheterisation. But still, the risk of urinary tract infection in catheterised patients was 37%, consistent with studies where the risk of infection was around 30% without any prophylactic antibiotics.[14] This shows no role for prophylactic antibiotics in catheter-associated UTI, and this was consistent with studies done by Warren et al. which showed that there was no role for prophylactic antibiotics in catheter-associated urinary tract infection.[15]

In our study, the risk of catheter-associated UTI in patients with haemoglobin < 10 g/dl was higher by about 44% than in patients with > 10g/dl. The risk of CAUTI among renal failure patients with a serum creatinine of > 1.2 mg/dl is higher than those with a serum creatinine of < 1.2 mg/dl. In our study, the risk of catheter-associated urinary tract infection in diabetes mellitus patients (56%) was more than the non-diabetic patients (27%), and this was consistent with studies done by Raz et al. where they showed an increased risk of catheter-associated urinary tract infection in diabetic patients.[16]

CONCLUSION

Urinary tract infection is common in catheterised patients; around 37% developed CAUTI. The risk of catheter-associated urinary tract infection increases with the number of days of catheterisation. Females have a higher risk for catheter-associated UTIs than males. Escherichia coli was the commonest organism than Klebsiella sps. in producing catheter-associated UTI in this study. Commonly used antibiotics showed increased resistance to organisms causing catheter-associated UTI in our study. Amikacin was sensitive to most catheter-associated UTIs. Most catheter-associated urinary tract infection patients were asymptomatic without signs of fever, loin pain, or LUTS. Patients with risk factors like diabetes mellitus and renal failure risk developing catheter-associated UTIs more than non-diabetics. Patients who are anaemic are more prone to develop catheter-associated urinary tract infections.

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