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Original Research Article

Catheter associated urinary tract infection in an acute care setting of a tertiary care centre in South India

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ABSTRACT

Background: Catheter associated UTI is a serious cause of morbidity and mortality in intensive care unit (ICU) patients. Hence, authors undertook the present study to know the prevalence of catheter associated urinary tract infections (CAUTI) in medical ICU patients of tertiary care centre and to know the antibiotic resistance pattern of the causative organisms.
Methods: A one-year prospective study was carried out from September 2015 to August 2016. Demographic data from the catheterized patients were collected daily and scrutinized for the signs and symptoms as per CDC criteria for confirmation as CAUTI. Relevant antimicrobial resistance data of etiologic agents were also collected to ascertain the prevalent resistance pattern.
Results: The overall incidence of CAUTI was 14.69 per 1000 catheterized days in the present study. Out of the 37 diagnosed CAUTI cases, 12 (32.4%) were males and 25 (67.6%) were females with maximum patients being between 40 to 60 years of age. The commonest uropathogens was *Escherichia coli* (n=26) followed by *K. pneumoniae* (n=5). Both *Escherichia coli* and *Klebsiella pneumoniae* isolates were found to be 100% resistant to cefotaxime, ceftazidime and cefuroxime. *Pseudomonas aeruginosa* and *Acinetobacter* species were least common etiological culprits and demonstrated complete resistance to all the tested antibiotics.
Conclusions: In the present study the prevalence of CAUTI is much higher which needs to be rectified by continuous monitoring and training of the staff in implementation of infection control practices in a proactive manner.

Keywords: Antimicrobial resistance, CAUTI, *Escherichia coli*

INTRODUCTION

Catheter associated urinary tract infections (CAUTI) are the most frequent nosocomial infections with the daily risk of developing CAUTI being 3-7% in the acute care settings.[1] It constitutes for over 30% of all device-associated, healthcare-associated infections and 23% of hospital-acquired infections (HAI) in intensive care units (ICU).[2] Apart from increasing hospital stay and cost, CAUTI is associated with increased morbidity and mortality.[3,4] More importantly, these patients become reservoir of multidrug resistant organisms that can result in more serious HAI.[5]

To lower down the incidence of CAUTI, many scientific societies, like CDC, Centre for Disease Control and Prevention (CDCP), Society of Healthcare Epidemiology of America (SHEA), etc have outlined appropriate

preventive recommendations.[6,7] All health care personals should abide by these policies to reduce the incidence of CAUTI, thus contributing to the improved safety of patients and lower the costs of treatment.

With this background, authors undertook this study to provide an insight regarding the prevalence of CAUTI and its etiologic agents in ICU patients in a tertiary care institute. This study will serve as a guide to the clinicians in the selection of appropriate antimicrobial agents for prophylaxis and empiric therapy of CAUTI. It will also provide a scope for determining any non-compliance with the preventive recommendations and also improvising the infection control policy of the hospital.

METHODS

A one-year (September 2015 to August 2016) prospective study was performed in the 16-beded medical ICU of Maharaja institute of medical sciences, Nellimarla, Vizianagaram, Andhra Pradesh. All patients with indwelling urinary catheters hospitalised for longer than 48 hours were included in the study. Patients with symptoms of urinary tract infections prior to catheterization were excluded. Data was collected daily, as per a standard proforma, at the same time of each day. The diagnosis of CAUTI was done as per the CDC guidelines.[8] Prior to catheter change or removal from each patient, 10 ml of urine was obtained from the distal edge of the catheter tube (after cleaning with an antiseptic) using a sterile needle and syringe.[9,10] The sample was carefully dispensed into a sterile container and transported to the microbiology laboratory for analysis. Urine microscopy was performed on uncentrifuged catheter urine specimen to detect the presence of leukocytes, erythrocytes and other cells. The unspun urine was also subjected to Gram stain. With the calibrated loop, urine was cultured on blood agar media for quantitative analysis to assess the microbial counts. MacConkey agar media was also plated and incubated aerobically at 37° C for 24-48 hours.

A urine culture was considered positive with more than or equal to 10^5 organisms/ml of urine, with no more than two species of micro-organisms. Bacteria were identified according to conventional biochemical techniques.[11] Antibiotic sensitivity was done by the Kirby Bauer disc diffusion test as recommended by CLSI guidelines.[12] All data were tabulated and analysed using Microsoft Excel 2010. Catheter utilization rate was calculated by dividing the total number of device days by the total number of patient days. Rate of CAUTI per 1000 device days were calculated by dividing the total number of CAUTIs by the total number of catheter days and multiplying the result by 1000. One-tailed Fischer's Exact test was used for computing the p-value. A p-value <0.05 was considered as statistically significant.

RESULTS

During the study period of 1 year, a total of 337 patients were catheterized in the institute's medical ICU for an aggregate of 3321 patient days. The catheter utilization rate was 0.75. Table 1 depicts month-wise data regarding patient days, urinary catheter days, number of CAUTI cases and prevalence of CAUTI per 1000 catheter days.

Table 1: Monthly distribution of CAUTI.

Month	Patient days	Urinary catheter days	Number of cases of CAUTI	Prevalence of CAUTI per 1000 catheter days
September 2015	248	202	4	19.8
October 2015	256	194	3	15.46
November 2015	291	212	3	14.15
December 2015	302	215	4	18.6
January 2016	276	208	3	14.42
February 2016	269	193	2	10.36
March 2016	305	218	2	9.17
April 2016	327	245	4	16.32
May 2016	235	192	3	15.62
June 2016	274	213	3	14.08
July 2016	307	221	4	18.1
August 2016	231	196	2	10.2
Total	3321	2509	37	14.69

The overall CAUTI rate was 14.69 %. Out of the 37 diagnosed CAUTI cases, 12 (32.4%) were males and 25 (67.6%) were females and this difference was statistically significant (p=0.0235). Maximum patients were between 40 to 60 years of age followed by more than 60 years age group. Least number of patients were between the age

group of 18-39 years (Table 2). The uropathogens isolated in this study and their antibiotic resistance pattern is outlined in Table 3 and 4. The commonest causative uropathogens of CAUTI in the study was found to be *Escherichia coli* (n=26) and this association was found to be statistically significant (p = 0.010). The second commonest etiology was found to be *Klebsiella pneumoniae* (n=5) followed by *Enterococcus* species (n=4), *Klebsiella oxytoca* (n=3). Least common organism was found to be *Pseudomonas aeruginosa* and *Acinetobacter* species.

In the present study, *Escherichia coli* isolates were found to be 100% resistant to cefotaxime, ceftazidime, amoxycillin-clavulanic acid and cefuroxime followed by ofloxacin (92%), cotrimoxazole (61%), gentamicin (46%), nitrofurantoin and amikacin (38%), imipenem (38%) and meropenem (23%). *Klebsiella pneumoniae* isolates were found to be 100% resistant to cefotaxime, ceftazidime, cefuroxime and amoxiclav followed by cotrimoxazole and ofloxacin (80%), gentamicin (60%), amikacin (40%) and nitrofurantoin, imipenem and meropenem (20%). *Klebsiella oxytoca* isolates were found to be 100% resistant to cefotaxime, ofloxacin, amoxiclav. The isolates were found to be 100% sensitive to nitrofurantoin. *Pseudomonas aeruginosa* was found to be 100% resistant to cefotaxime, ceftazidime, piperacillin and aztreonam while the isolate was found to be sensitive to imipenem, meropenem, amikacin, ofloxacin, piperacillin tazobactam and cefepime. *Enterococcus spp.* were found to be 100% resistant to tetracyclines and high-level gentamicin while found to be 100% sensitive to vancomycin and linezolid.

Table 2: Gender distribution of CAUTI patients.

Age (years)	Male	Female
18-40	2	5
40-60	5	12
> 60	5	8
Total	12	25

Table 3: Uropathogens related to CAUTI.

Uropathogen	Numbers
Escherichia coli	26
Klebsiella pneumoniae	5
Klebsiella oxytoca	3
Pseudomonas aeruginosa	1
Acinetobacter baumanii	1
Enterococcus species	4

Table 4: Antibiotic resistance pattern of uropathogens related to CAUTI.

Name of uropathogens	Resistance pattern (%)																		
	Nitrofurantoin	Imipenem	Meropenem	Amikacin	Cefotaxime	Ofloxacin	Ceftazidime	Amoxiclav	Gentamicin	High level gentamicin (120 µg)	Cefuroxime	Cotrimoxazole	Tetracycline	Vancomycin	Linezolid	Piperacillin	Piperacillin Tazobactam	Cefepime	Aztreonam
E. coli	38	30	23	38	100	92	100	100	46	NT	100	61	NT	NT	NT	NT	NT	NT	NT
K. pneumoniae	20	20	20	40	100	80	100	100	60	NT	100	80	NT	NT	NT	NT	NT	NT	NT
K. oxytoca	0	66	66	33	100	100	100	100	33	NT	100	33	NT	NT	NT	NT	NT	NT	NT
P. aeruginosa	NT	0	0	0	100	0	100	NT	0	NT	NT	NT	NT	NT	NT	100	0	0	100
A. baumanii	NT	100	0	100	100	100	100	100	100	NT	NT	100	100	NT	NT	100	100	100	NT
Enterococcus spp.	25	NT	NT	NT	NT	75	NT	50	NT	100	NT	NT	100	0	0	NT	NT	NT	NT

DISCUSSION

In the present study, prevalence of CAUTI per 1000 device days was 14.69, which is quite higher than those

reported by National Healthcare Safety Network (NHSN) system.[13] Another study from South India have also reported similar high CAUTI prevalence rate of 13.63%.[14] International Nosocomial Infection Control Consortium (INICC) had reported CAUTI rate of 7.1 in 422 ICUs of 36 developing countries from January 2004 to December 2009.[15] Rosenthal et al, and Leblebicioglu et al, have stated that the difference in rate of nosocomial infections may be observed in developed and developing countries, due to better hygiene practices among health personals.[15,16]

One of the host factors that predisposes to catheter associated UTI is advanced age and this study validated the same. More than 80% of patients in this study were above the age of 40 years. Females were also predominantly affected in this study in accordance to the general dictum. Taiwo and Aderounmu reported males to be more affected.[17] Few Indian authors have also observed male predominance in their study cohort.[18,19]

The present study has shown *Escherichia coli* as the most frequently isolated uropathogen, similar to the findings of Sangamithra et al, Vinoth et al, and Kakaria et al.[18-20] The NHSN data also shows *Escherichia coli* as the major culpable pathogen, accounting for 70% of the total isolates.[13] Laupland et al, also demonstrated *Escherichia coli* as the most common etiological agent of CAUTI.[21] *Escherichia coli* has the capacity to adapt and survive in urinary tract by producing several virulence factors and hence are the frequent culprits. *Klebsiella* species was the second most common pathogen in this study cohort. Vinoth et al, Karina et al, and Kazi et al, also noted a similar pattern.[19,22,23] *Enterococcus* species (4/37, 10.8%) was the only Gram-positive uropathogens isolated from CAUTI cases in this study. Chawla et al, found *Acinetobacter* species as the most common causative organism of CAUTI in their patients.[24] In this study, however, *Acinetobacter baumanii* was isolated from a single case only. Other authors have found *Candida* species as one of the most frequently isolated organisms from CAUTI cases but according to CDC NHSN definition of UTI, Candida and other yeasts are excluded.[8,18,25-27]

Antimicrobial resistance amongst the uropathogens is an ever-increasing problem, especially in ICU setting. In the current study, multidrug resistance was observed in all isolates. This is in accordance to other studies wherein a high degree of resistance was noted in all the isolates.[10,23,25,28] Authors found *Escherichia coli* isolates to be sensitive to meropenem followed by imipenem and nitrofurantoin. The two species of *Klebsiella* were found to have similar resistance pattern and were found to be more resistant than *Escherichia coli* isolates. *Klebsiella pneumonia* exhibited a high degree of resistance to all antimicrobials except imipenem, meropenem and nitrofurantoin to which most of it was susceptible. *Enterococcus* isolates were found to be highly sensitive to vancomycin and linezolid while were resistant to amoxyclav, tetracycline and ofloxacin. *Pseudomonas aeruginosa* and *Acinetobacter baumanii* isolate showed resistance to all the drugs tested.

CONCLUSION

Hospital acquired uropathogens have increased antibiotic resistance and thus are difficult to treat. The chances of transmission of these multidrug resistant organisms are high if health care workers do not follow preventive practices meticulously. In the present study the prevalence of CAUTI is much higher because of lack of continuous monitoring and training of the staff particularly in ICU setups where morbidly ill patients get admitted. Active Infection control team, an efficient institutional infection control surveillance policy for non-compliances, strict adherence to preventive bundle practices and constant monitoring will bring down the prevalence rate of CAUTI. The most common practices shall include hand hygiene, close drainage, aseptic insertion and catheter care along with daily need assessment. This study showed high resistance in all uropathogens which is a concern for all. Empiric treatment with antibiotics should be in accordance to prescribed national guidelines as far as possible so that there will be a decrease in emergence of multidrug resistant uropathogens particularly in hospital setups. This study provides a scope for similar studies to be undertaken in this institute taking larger sample size so that a clearer picture can be obtained regarding the true prevalence of CAUTI.

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