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## Original Research Article

# A study on catheter associated urinary tract infections (CAUTI) and antibiotic sensitivity pattern of uropathogens causing CAUTI from a tertiary care hospital

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## ABSTRACT

**Introduction:** Catheter-associated urinary tract infections (CAUTI), remains the commonest hospital-acquired infection (HAI). This emphasizes the need to implement and monitor effective infection control programs to reduce the risk of CAUTI.

**Objectives:** Aim of the present study was to determine the etiology with antibiotic susceptibility and also to calculate CAUTI rate.

**Materials and Methods:** The Patients admitted in intensive care unit (ICU), Rajarajeswari Medical College and Hospital who were on urinary catheter insertion for >48 hours from 1 August, 2019 to 30 September, 2019 were included in the study. Under aseptic conditions urine samples were collected from clinically suspected cases of CAUTI, the samples were processed in the department of Microbiology, as per standard protocols. Uropathogens were isolated, identified and subjected to antibiotic sensitivity test. CAUTI rate was calculated and results were noted.

**Results:** Among 460 patients on catheter in ICU, 28(6%) patients developed clinical signs or symptoms of UTI. Of 28 urine samples cultured, 4(14%) yielded growth of single organism [Escherichia coli (3), Klebsiella (1)] and 24(86%) showed no evidence of growth. 2300 catheter days were obtained of 460 patients on indwelling catheter in ICU. Thus CAUTI rate was 1.74 per 1000 catheter days over a 2 month period.

**Discussion and Conclusion:** CAUTI remained a great burden to patient safety and a challenge to the infection control team. Implementation of proper care bundles and continuous education to health care workers plays a key role in reducing the CAUTI rates, thereby decreasing the morbidity and hospital stay to the patients.

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## 1. Introduction

Catheter associated Urinary tract infection (CAUTI) is the most common among the device associated infections acquired from the hospital settings. Among hospital acquired UTIs, approximately 75% are associated with a urinary catheters. Between 15-25% of hospitalized patients receive urinary catheters during their hospital stay leading to Catheter Associated Urinary Tract Infections (CAUTI) where care bundles are not practiced.<sup>1</sup> Catheter-associated

urinary tract infections (CAUTI) according to the centers of disease control and prevention(CDC) is defined as UTI where an indwelling urinary catheter was in place for more than two calendar days on the date of event (day 1 being the day of device placement).<sup>2</sup> Multiple risk factors can affect the occurrence of CAUTI. These include quality of aseptic technique, duration of catheterization, appropriate hand hygiene and care of catheter.<sup>3,4</sup> The urethral catheter is the most prevalent cause of nosocomial infections and gram-negative bacteremia. The duration of catheterization is directly related to the development of infection. Bacteria can easily invade the lower urinary tract

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along the external surface of the catheter or by ascending route through the lumen of the catheter.<sup>5</sup> CAUTI can lead to complications such as prostatitis, epididymitis, and orchitis in males, and cystitis, pyelonephritis, gram-negative bacteremia, endocarditis, vertebral osteomyelitis, septic arthritis, endophthalmitis, and meningitis. Complications associated with CAUTI cause discomfort to the patient, prolonged hospital stay, and increased cost and mortality. In addition, hospital acquired CAUTIs are often due to multidrug resistant strains which require higher antibiotics.<sup>6</sup> The present study was done to assess the incidence of CAUTI in a tertiary care hospital, to identify the uropathogens associated with it and to detect the antibiotic sensitivity pattern in the isolated organisms. This plays a significant role in initiating appropriate antibiotics which decreases complications and hospital stay and also helps the infection control team to implement proper care bundles which reduces the hospital stay of patients there by reducing the morbidity and mortality.

## 2. Objectives

The present study was taken to identify the uropathogens causing CAUTI, determining their susceptibility pattern and also to calculate CAUTI rate.

## 3. Materials and Methods

The study was conducted in Microbiology Department, Rajarajeshwari Medical College and Hospital for the period of 2 months, 1 August, 2019 to 30 September, 2019. The Patients admitted in intensive care unit (ICU), Rajarajeshwari Medical College and Hospital who were on urinary catheter insertion for >48 hours from 1 August, 2019 to 30 September, 2019 were included in the study.

The patients were screened for inclusion and exclusion criteria. The criteria being considered are as follows:

### 3.1. Inclusion criteria

Patients on Foley's catheter for at least 48 hours will be included in the study.

### 3.2. Exclusion criteria

1. Patients with history of sexually transmitted diseases.
2. Immunocompromised patients.

Institutional Ethical Committee (IEC) clearance was obtained before beginning of the study. Patients on Foley's catheter in the hospital, who accepted to be a part of the study, were approached, IEC clearance certificate was shown to the patients and their consent was obtained.

### 3.3. Case report form

The following data is collected from the patients in whom CAUTI is suspected, and satisfying the inclusion and exclusion criteria by means of the specially constructed case report form, including the following:

1. Demographic data: Name, age, sex, occupation, address, phone number.
2. History included, date of admission to the hospital, date of insertion of indwelling catheter, number of days with the catheter, disease data, treatment data and personal history.

### 3.4. Sample collection

Urine samples were collected from clinically suspected cases of CAUTI in a sterile wide mouthed universal container taking aseptic precautions with a sterile disposable syringe after cleaning and clamping the catheter tube. The samples were immediately sent to the microbiology department for culture and sensitivity testing.

### 3.5. Processing the sample

The urine samples were subjected to wet mount for evaluating the presence of pus cells, epithelial cells, RBCs and microorganisms. Semi-quantitative culture of urine samples was done by calibrated loop method on 5% sheep blood agar and CLED agar (cystine–lactose–electrolyte-deficient agar and incubated in aerobic conditions at 37°C for 24–48 hours. The urine cultures of colony count >10<sup>5</sup> colony forming units (CFU)/ml with no more than two species of microorganisms were considered as positive for CAUTI and cultures showing growth of more than two types of bacteria were considered contaminated. Positive cultures were identified by various biochemical reactions like nitrate test, catalase test, oxidase test, Methyl red test, voges –Proskauer test indole test, citrate test, triple sugar iron test, urease test, suga (glucose, lactose, sucrose, mannitol, fructose) fermentation tests, arginine dehydroxylation, decarboxylation of lysine and ornithine.<sup>7</sup> Antibiotic susceptibility testing was performed by Kirby-Bauer's disk diffusion method on Mueller-Hinton agar as per the CLSI guidelines.<sup>8</sup> The antibiotics tested were ampicillin, amikacin, nitrofurantoin, cotrimoxazole, imipenam, ceftraxazone, cefotaxime, cefaxitine, ceftazidime, cefuroxime, ciprofloxacin, gentamycin, netilmicin, and norfloxacin. The CAUTI rate per 1000 urinary catheter days is calculated by dividing the number of CAUTIs by the number of catheter days and multiplying the result by 1000.

## 4. Results

460 patients were on admitted in ICUs were on indwelling catheter, with catheter days ranging from 4–8 catheter

days on an average for each patient. Out of 460, 28(6%) patients developed clinical signs or symptoms of UTI after 2 calendar days from the time of insertion of indwelling urinary catheter. Of 28 urine samples cultured, 4(14%) were culture positive and 24(86%) showed no evidence of growth. Culture isolate from four urine samples were identified as *Escherichia coli*(3) and *Klebsiella* (1). Both were sensitive to third and fourth generation of cephalosporins, aminoglycosides and carbapenems and resistant to ciprofloxacin and nitrofurantoin. A sum total of 2300 catheter days were obtained in the study period. CAUTI rate was 1.74 per 1000 catheter days over a 2 month period

## 5. Discussion

CAUTIs pose a significant burden on patients, both in terms of morbidity and mortality. Catheter-associated urinary tract infections (CAUTI) continue to be among the most common hospital acquired infections. Apart from increased morbidity and mortality there is a significant increase in length of stay in hospital and higher hospital costs for patients and health systems. In our study, out of 460 patients admitted in ICUs, 28(6%) patients developed clinical signs or symptoms of UTI after 2 calendar days from the time of insertion of indwelling urinary catheter. Of 28 urine samples cultured, 4(14%) were culture positive and 24(86%) showed no evidence of growth. In our study among the uropathogens isolated from CAUTI Gram negative bacilli were more predominant. *Escherichia coli* was the most common organism 3 (34.61%) followed by *Klebsiella* 1 (21.15%). This is similar to the study done by Nandini. M.S\* et al,<sup>4</sup> Bagachi et al,<sup>9</sup> Kazi et al<sup>10</sup> Jayashri et al.<sup>11</sup> *Escherichia coli* remain the common bacterial isolate for patients who develop symptoms of UTI in a short course catheterization (3-5days). Enterobacteriaceae showed resistance to fluoroquinolones, which is the commonly used drug for urinary tract infection. This is similar to the study done by nandini et al. In our study, the incidence of CAUTI was 1.74 per 1000 catheter days which correlates with pooled mean CAUTI rate of 0 to 4 per 1000 catheter days of NHSN (National healthcare safety network)report this is in contrast to the study done by Arunagiri Ramesh et al,<sup>12</sup> where in the incidence of CAUTI was found to be 16 per 100 catheterization Duszyńska et al<sup>13</sup> reported a CAUTI rate of 6.44, 6.84, 7.16 per 1000 catheter days for the years 2012, 2013 and 2014, respectively from Poland. Incidence density of 9.6 per 1000 ICU days was found at Calgary by Laupland and colleagues.<sup>14</sup> In this study lower rate of CAUTI was due to compliance towards adherence of infection control practices, hand hygiene and implementation of catheter care bundle. This indicates measures like meticulous intervention in the form of avoiding unnecessary urinary catheters, maintaining aseptic precautions at the time of

insertion and removal of the catheters, appropriate catheter maintenance practices, early catheter removal unless it is otherwise indicated, well defined antibiotic policy and properly guided infection control programs can reduce the extent of multidrug-resistant pathogen not only in CAUTI patients but also for the hospital in general.

## 6. Conclusion

To summarize, the findings from our study as well as other studies indicate that CAUTI has become a great threat to patient safety worldwide, remains as a challenge and emphasize the importance of active infection control programs to be implemented for surveillance of infection. Implementation of infection control practices is necessary for prevention and control of CAUTI. Usage of antimicrobial agents in suspected cases of CAUTI may be withheld in ICUs till microbiology reports are made available unless absolute need for empirical therapy is required in order to avoid emergence of resistant strains. So appropriate measures of educating the paramedical staff, strict infection control practices and an appropriate antibiotic policy, proper guided bundle care for both procedure and maintenance of catheter are the need of the hour to prevent the CAUTI which in turn can lessen the economic burden, work loss, and mental stress.

## 7. Source of Funding

None.

## 8. Conflict of Interest

None.

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