# A Prospective Clinical Study on Catheter Associated Urinary Tract Infections (CAUTI) and Antibiotic Sensitivity Pattern

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## Abstract

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

**Methods:** This prospective study was done the Department of Microbiology, Nalanda Medical College and Hospital, Patna, Bihar, India for 1 year

Total 400 catheterized patients were included. Infection control nurse collected all the details like name of the patient, age, sex, date of catheterization, laboratory reports during her daily rounds. The diagnosis of CAUTI was done as per the CDC guidelines published in 2009. The selection criterion for the inclusion in the study was above 18 years and patients of both genders and who were put on Foley's catheter for at least 48 hours were included in the study.

**Results:** Out of 400 catheterized patients, 20 developed CAUTI. The overall incidence was 5%. Male patients were more than the female patients for catheterization. The most common uropathogens were *E. coli* (30%) and *Klebsiella pneumoniae* (30%) followed by *Pseudomonas aeruginosa* (20%) and *Acinetobacter* species (20%) from the cases of CAUTI. Bacterial uropathogens isolated from patients with CAUTI revealed the presence of multidrug resistant pathogens. Imipenem was the single best antibiotic for all pathogens except *Pseudomonas aeruginosa* where Amikacin was the drug of choice. The *Acinetobacter* species also showed very high resistance to all antibiotics except Imipenem.

**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.

**Keywords:** CAUTI, microorganism, antibiotic sensitivity.

## 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 catheter. 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[1]. 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)[2] 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 [3,4]. 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 along the external surface of the catheter or by ascending route through the lumen of the catheter [5]. 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 [6]. 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.

**Material and methods**

This prospective study was done the Department of Microbiology, Nalanda Medical College and Hospital, Patna, Bihar, India for 1 year, after taking the approval of the protocol review committee and institutional ethics committee.

Methodology

Total 400 catheterized patients were included. Infection control nurse collected all the details like name of the patient, age, sex, date of catheterization, laboratory reports during her daily rounds. The diagnosis of CAUTI was done as per the CDC guidelines published in 2009. The selection criterion for the inclusion in the study was above 18 years and patients of both genders and who were put on Foley's catheter for at least 48 hours were included in the study. No past history related to any sexually transmitted diseases and immunocompromised status was noted.

Urine was collected as per the guidelines described earlier for culture and sensitivity with aseptic precautions and was transported immediately to the laboratory in a sterile containe r[7].The unspun urine was subjected to gram stain, wet mount for the presence of pus cells and organisms. 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. The significant bacteriuria was $10^5$ cfu/ml was taken into consideration while confirmation as CAUTI. The identification and antibiotic sensitivity was done by the disc diffusion test as recommended by CLSI guidelines [8,10].

**Results**

Out of 400 catheterized patients, 20 developed CAUTI. The overall incidence was 5%. The age and sex wise distribution of catheterized patients is shown in Table 1. Male patients were more than the female patients for catheterization. Catheterization days ranged from 2 days to 10 days. The most common uropathogens were *E. coli* (30%) and *Klebsiella pneumoniae* (30%) followed by *Pseudomonas aeruginosa* (20%) and *Acinetobacter* species (20%) from the cases of CAUTI.

**Table 1: Gender and age distribution of patients**

| Age (years) | Male | Female |
|---|---|---|
| Below 25 | 34 | 17 |
| 25-35 | 79 | 26 |
| 35-45 | 75 | 23 |
| 45-55 | 70 | 20 |
| Above 55 | 42 | 14 |
| Total | 300 | 100 |

Bacterial uropathogens isolated from patients with CAUTI revealed the presence of multidrug resistant pathogens [11]. Imipenem was the single best antibiotic for all pathogens except *Pseudomonas aeruginosa* where Amikacin was the drug of choice. The *Acinetobacter* species also showed very high resistance to all antibiotics except Imipenem (Table 2).

**Table 2: Antibiotic resistance pattern of uropathogens isolated from catheter associated urinary tract infections (CAUTI) patients.**

| Name of uropathogen | Resistance pattern (%) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AMP | AM | IC | MRP | PIT | CZ | CAC | CAZ | GEN | CIP | AK | TOB | NET | CXM |
| *E. coli* | 83.33 | 100 | 0 | 0 | 16.67 | 83.33 | 33.33 | 66.67 | 16.67 | 50 | 16.67 | 16.67 | 16.67 | 83.33 |
| *K. pneumonia* | 100 | 100 | 0 | 16.67 | 33.33 | 100 | 50 | 83.33 | 66.67 | 100 | 33.33 | 50 | 33.33 | 100 |
| *P. aeruginosa* | 100 | 100 | 83.33 | 66.67 | 16.67 | 100 | 100 | 100 | 16.67 | 50 | 0 | 66.67 | 100 | 100 |
| *Acinetobacter* species | 100 | 100 | 0 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

AMP: Ampicillin; AM: Amoxicillin; IC: Imipenem; MRP: Meropenem; PIT: Piperacillin Tazobactum; CZ: Cefazolin; CAC: Ceftazidime Clavulanate; CAZ: Ceftazidime; GEN: Gentamicin; CIP: Ciprofloxacin; AK: Amikacin; TOB: Tobramycin; NET: Netilmicin; CXM: Cefuroxime

## 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. Catheter associated urinary tract infections (CAUTIs) are serious health affecting problems in hospitalized patient[12]. The most common bacteria causing CAUTIs in hospitalized patients includes *E.coli*, *K. pneumoniae*, *P. aeruginosa*, *E. faecalis*, and *Candida* species[13,14] . The overall incidence of CAUTI was 5 per 1000 catheter days which were below the benchmark set by this hospital infection control committee

(HICC) in the present study. Incidence is very low as compared to other studies [15,16]. The reason of the fluctuation in the rate of incidence in few months might be due to the untrained staff without the proper knowledge and practice about the infection prevention practices. The other major reason includes prolonged catheterization as a major risk factor for the development of CAUTI. In the present institute training has been imparted regularly for practicing preventive protocols for reducing the CAUTI and continuous monitoring of compliance about hand hygiene. The attack rates were displayed and shared with the staff in the monthly meetings. However, there are other studies which had shown very high incidence of CAUTI in catheterized patients [17,21].

The high incidence might be due to various reasons such as the gender of the patient, infection prevention policies which

includes aseptic task, catheter care, duration of catheterization, close drainage system etc. The infection prevention policies are stringent in this hospital which helped infection control team to keep low incidence of CAUTI in catheterized patients. This was achieved by frequent visits by infection control team members at different timings to catheterized patients daily to monitor the preventive bundles meticulously. The preventive bundles which were monitored during round include hand hygiene adherence, aseptic technique, close drainage system, placement of urobag below waist and catheter care etc.

The uropathogens isolated from CAUTI cases were found to be multidrug resistant. These findings correlate with various other studies [22,24]. where multidrug resistant uropathogens were isolated. In the present study the most resistant uropathogens were *Pseudomonas aeruginosa* and *Acinetobacter* species. which showed the high resistance to multiple antibiotics including imipenem and Meropenem.

Increase in the antibiotic resistance amongst the uropathogens indicates that they are hospital acquired and thus difficult to treat. This will be more dangerous if infection prevention practices are not followed during care of the catheterized patients. The chances of transmission of these multi drug resistant are high if health care workers do not follow preventive practices meticulously. In the present study the incidence is much lower because of continuous monitoring and training of the staff.

## 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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