

Catheter-associated Urinary Tract Infection Surveillance in Intensive Care Units in a Tertiary Care Hospital: A Pilot Study

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ABSTRACT

Catheter-associated urinary tract infections (CAUTI) develop either during or after placement of a urinary catheter. CAUTI has been shown to increase patient morbidity and mortality, increase in the length of stay, and add to the cost of care. It is preventable provided appropriate protocols are meticulously followed.

Aims and objectives: This pilot study was conducted over a two month period to determine the rates of CAUTI in the intensive care units of a tertiary care hospital.

Materials and methods: One hundred samples from CAUTI cases were studied for their microbiological profile and antibiotic sensitivity pattern.

Study: Descriptive study.

Results: It was observed that out of 100 samples collected after obtaining informed consent from the Medical Intensive Care Unit (MICU) and Surgical Intensive Care Unit (SICU), 3 cases were reported positive for CAUTI. The sex ratio indicated higher rates for males and lesser for females. *Candida albicans* was present as a main pathogen followed by *Escherichia coli*. The overall rate of CAUTI for the two months was 5 per 1000 device days. But this study indicates that precautionary measures need to be properly implemented for preventing CAUTI.

Keywords: *Candida albicans*, CAUTI, Device Days, *E. coli*.

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INTRODUCTION

The study of device associated healthcare associated infections (DA-HAI) in the intensive care units (ICU) forms an important aspect in the prevention of healthcare-associated infections.¹ In developing nations like India, the amount of data that is available is insufficient to identify the risk factors and improve health standards.

The rates of HAIs in the ICU are 3 to 5 times higher than that of other care areas in the hospitals.^{2,3} Thus, it becomes important to identify the cause and nature of the infections and devise effective treatment measures to reduce the risk of DA-HAIs. Our focus was exclusively on dealing with the rates of CAUTI.

Catheter-associated urinary tract infections (CAUTI) has been defined as an Urinary Tract Infection (UTI) where an indwelling urinary catheter was in place for >2 calendar days on the date of the event, with the day of device placement being Day 1, and an indwelling urinary catheter was in place on the date of an event or the day before.⁴

The rate of device associated infections is on the rise nowadays due to lack of proper research on the subject. The DA-HAIs can lead to discomfort to patients, prolongation of hospital stay, increased cost and mortality rate.⁵ In developing countries like India, scientific literature on DA-HAIs based on standard definitions are scarce.⁶

Device associated healthcare associated infections (DA-HAI) can easily be tackled with the right knowledge and proper preventive measures. By identifying the cause, the rates of infections, their microbiological profile and antibiotic sensitivity, an almost accurate picture and overall analysis of these infections can be obtained. Infection control practitioners and intensivists can utilize this data and devise effective strategies to prevent the spread of device associated infections in hospitals. Thereby, reducing the burden on patients and improving the health standards in general.⁷

A research carried out in the ICUs of a tertiary care hospital in Jaipur, India to determine the rates of DA-HAIs concluded that the rates for CAUTI and CLABSI were 1.50 and 2.74 infections per 1000 device days respectively.⁸

A similar study carried out in a teaching hospital in rural Gujarat, India suggested that the rates for CAUTI were 0.6 infections per 1000 catheter days and 0.48 infections per 1000 central lines days for CLABSI.⁹

Serum tumor marker such as the beta subunit of human chorionic gonadotropin (beta-hCG), alpha-fetoprotein (AFP) and Lactate dehydrogenase (LDH) have an important role in the management of patients with testicular cancer, contributing to diagnosis, staging and risk assessment, evaluation of response to therapy. Early detection of LDH is recommended for patients with metastatic disease.²

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High inguinal orchiectomy is the standard initial treatment for the suspected testicular tumor. Appropriate integration of surgery, chemotherapy and radiation therapy in treatment has led to high cure rates. The introduction of Cisplatin-based chemotherapy has revolutionized the management of testicular tumors, with considerable improvement in response rates and excellent outcome reported even in the presence of metastatic.

MATERIALS AND METHODS

This prospective cohort study, an 8-week pilot DA-HAI surveillance all patient of an adult, pediatric and newborn patients admitted to the ICUs of a tertiary care hospital was conducted during July and August 2015 after obtaining Institutional Ethics Committee clearance.

The inclusion and exclusion criteria were in accordance with that of the CDC-NHSN definitions for CAUTI.⁴

Patients' informed consent was taken before sample collection. The parameters for the isolation, growth, and identification of bacteria are as per standard SOPs of the Microbiology lab at RRMCH and H.

Sampling, Culture and Antibiotic Sensitivity Testing Procedure for CAUTI

In suspected CAUTI cases—a urine sample was aseptically aspirated from the sampling port of the urinary catheter and cultured quantitatively.⁶ Samples that were received were examined under wet-mount preparation. Cultures were inoculated on-CLED agar and McConkey's agar, chocolate agar. growth if any, on the media; were stained with gram's stain and examined under a microscope. They were identified as either gram-positive cocci or gram-negative bacilli. The following biochemical tests carried out to identify the bacteria: indole test, citrate test, oxidase test, catalase test, urease test, mannitol motility and triple sugar iron medium. Antibiotic sensitivity was done on Mueller-Hinton agar by Kirby-Bauer Disc Diffusion method as per CLSI 2014 guidelines. Samples were processed according to the standard operative procedure.

Quality Control

Standard ATCC strains were used. Hospital Infection Control Committee (HICC) and treating physicians were duly informed of the results. Subject data were kept confidential.

CAUTI Rate Calculation

Calculation of rates of DA-HAIs was done as per the formula given by 'The National Accreditation Board for Hospitals and Healthcare Providers'. The formula adopted was as follows:

Catheter-associated urinary tract infections (CAUTI)–
(Number of urinary catheter associated UTI's in a month/
Number of urinary catheter days in that month) × 1000.

RESULTS

During the two month time period, 100 urine samples were collected from the medical ICU (MICU) and Surgical ICU (SICU) of a tertiary care hospital. A total of 3 cases were reported positive for CAUTI (Table 1).

It is clear from the above data that only 3 of the samples were positive for CAUTI and the negative samples were 97.

Sex distribution in the 3 positive cases for CAUTI was also determined (Table 2). The results showed that out of the 3 cases that were tested positive for CAUTI, 2 were males and 1 was a female patient. It is evident that 66.6% of the positive cases were males and 33.3% were females. This implies that the number of males affected were more than twice the number of females affected.

The number of affected persons in MICU and SICU were also studied and it was observed that the number of cases reported from the MICU were twice the number of cases in SICU (Table 3).

The pathogens associated with the 3 positive samples for CAUTI were identified and the results are presented in Table 4.

It was observed that *Candida albicans* was present as a main pathogen occurring in 50% of the cases followed by *Escherichia coli*.

Table 1: Number of positive and negative samples obtained for CAUTI

Result	Numbers	percentage
Positive for CAUTI	3	89.8
Negative	97	57.6
Total	100	32.2

Table 2: Demographic data of positive cases for CAUTI

Sex	Numbers	Percentage
Male	2	66.6
Female	1	33.3

Table 3: Occurrence of CAUTI in MICU and SICU

Site of Sampling	Positive numbers	Percentage
MICU	2	66.6
SICU	1	33.3

Table 4: Pathogens identified from CAUTI Cases

Organism	Number of isolates	Percentage
<i>Candida albicans</i>	2	66.6
<i>Escherichia coli</i>	1	33.3

Calculation of Rates of CAUTI

CAUTI = (Number of urinary catheter associated UTI's in a month/Number of urinary catheter days in that month) × 1000.

For the 2 months of July and August: $3/600 \times 1000 = 5/1000$ device days.

Antibiotic Sensitivity

Escherichia coli was sensitive to: Nitrofurantoin, Ertapenem, Meropenem and Imepenem.

DISCUSSION

This is a cross sectional descriptive study where, active DA-HAI surveillance study conducted in the MICU and SICU of a tertiary care hospital. The study was conducted in order to determine the rates of DA-HAIs and thus provide an outline for the infection control teams to identify the causes and come up with strategic measures to cut down the rates of infection in critical care units.

During the two month period we were able to obtain 100 urine samples from ICUs for testing based on the inclusion criteria. Out of the 100 samples thus obtained three samples were found to be positive for CAUTI. This indicates that patients are at risk, though numbers are less. But nonetheless this is a cause for concern for hospital infection control practices. The ICU's remain the epitome of hospital associated infections.

A similar study carried out in a teaching hospital in rural Gujarat, India suggested that the rates for CAUTI were 0.6 infections per 1000 catheter days.⁹ However in the present study 100 samples were obtained out of all catheters inserted and the patients were selected based on inclusion criteria which involved cases from ICU which were referrals to a tertiary care centre, hence the high rates of CAUTI.

The incidence of CAUTI was found to be markedly more in males than in females (Table 2). The male patients admitted in SICU had urinary catheter inserted for more than 5 device days, this along with the fact that there were more cases from MICU (Table 3), could explain why the male:female ratio is high.

Samples that were obtained from Medicine and Surgery intensive care units and it was found that the number of cases positive for CAUTI were more in the MICU. The MICU reported about three-fourth of the cases that were positive for CAUTI. This could be due to the fact that the number of patient days in the MICU is more than that in the SICU, thereby, substantially increasing the days the catheter was inserted concurrently increasing risk of infection.

A study conducted in 398 ICUs in Shanghai, China concluded that the DA-HAIs in their ICUs pose a far greater threat to patient safety when compared to ICU's of USA. The study conducted for a period of 5 years and 4 months, the rates for CAUTI.¹⁰

About three-fourth the cases of CAUTI were caused due to *Candida albicans*. Being a normal commensal of the body, this particular species has had increased chances of causing CAUTI owing to the fact that the patients admitted to the ICUs are in an immunocompromised state and the presence of an indwelling catheter would only provide new route for growth.

The overall rate of CAUTI for two months was 5 per 1000 device days. This is a significant rate for CAUTI may be attributed to a variety of causes including location in high risk areas, i.e., ICUs, tertiary care with high turnover of patients, improper hand hygiene, prolonged usage of urinary catheters.

LIMITATIONS

However, since this pilot study was conducted only for a period of two months it is difficult to conclude that the rates would be the same during a longer period of study. Also, it was difficult to compare the rates obtained in this study with those obtained in other research papers.

RECOMMENDATIONS

To control infections in hospitals because of DA-HAIs, the first step to be taken is setting up to set up of a meaningful discussion between infection control team and treating physicians which implements the necessary infection control guidelines and maintains a record of the rates of DA-HAIs. The importance of hand hygiene and catheter hygiene and SOPs should be emphasized and its regular practice should be implemented. With proper training and knowledge the rates of CAUTIs can be controlled significantly.

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