ORIGINAL RESEARCH PAPER

Volume-8 | Issue-1 | January-2019 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

SURVEILLANCE OF CATHETER ASSOCIATED URINARY TRACT INFECTION IN AN ACUTE HEALTH CARE SETTING

Microbiology

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ABSTRACT

BACKGROUND: Catheter associated urinary tract infection (CAUTI) is one of the commonest healthcare-associated infection (HAI) in acute health care setting responsible for morbidity. The aim of this study was to characterize the organisms responsible for CAUTI and compare their antibiotic sensitivity profile with urinary isolates from OPD patients with urinary tract infection (UTI).

MATERIAL AND METHODS: In this study prospective surveillance of CAUTI was performed over a period of 08 months. Urinary samples were processed according to standard procedures.

RESULTS: CAUTI rate per 1000 urinary catheter days decreased from its peak of 12.75 to 2.98 during study period. Escherichia coli was the commonest isolate. Approximately 70% of the CAUTI isolates were resistant to carbapenems as compared to 30% out-patient isolates of UTI.

DISCUSSION AND CONCLUSION: Robust hospital specific infection control program and surveillance is necessary to prevent CAUTI in health care settings.

KEYWORDS

CAUTI, antibiotic resistance, healthcare associated infection, infection control

INTRODUCTION:

Catheter associated urinary tract infection (CAUTI) is one of the commonest device related healthcare-associated infection (HAI) affecting hospital stay, choice of antibiotics and also overall outcome of a patient. In our hospital setting approx 15% of total adult inpatients are catheterized, of which 80% are admitted to intensive care units (ICU). CDC estimated over 93,300 cases of catheter associated and non-catheter associated urinary tract infection in 2011 in acute healthcare settings. The prevalence of CAUTI is variable. It primarily depends on available infrastructure, knowledge, attitude and standardized practices followed by health care workers (HCW) in a hospital. An Australian multi-centric study reported point prevalence of CAUTI as 0.9% with *Staphylococcus aureus* and *Candida* species were the most common pathogens.[1] Educating health care workers (HCW) about HAI and adoption of CAUTI prevention bundles can significantly alter the rates of CAUTI in an Intensive care setting. The burden of HAI is much higher in resource limited setting. Pooled prevalence of HAI in developing countries obtained by analysis of data from 220 studies from 1995 to 2009 indicated 15·5 cases per 100 patients [95% CI: 12·6–18·9]), which is much higher than developed nations.[2] Nevertheless these infections are preventable with systematic training of HCW in infection control practices. Implementation of CAUTI prevention bundle and continuous monitoring of infection control practices can limit number of cases of CAUTI.

The spectrum of organism seen in cases of CAUTI is multi drug resistant as compared to isolates from UTI encountered in OPD settings.[3] As there is limited data available from Indian settings, the primary objective of this study was, to characterize the organisms responsible for CAUTI in an intensive care setting of a tertiary care teaching hospital. Additionally we also prospectively estimated the monthly incidence of CAUTI following schematic training and implementation of infection control practices.

MATERIAL AND METHODS:

Prospective surveillance of CAUTI was performed over a period of 08 months from May to Dec 2017 at a tertiary care hospital. CAUTI was defined by CDC criteria, wherein an individual with indwelling urinary catheter for two or more calendar days were included.[4] For OPD cases of UTI, all patients with symptoms of fever with dysuria or increase in frequency, urgency or suprapubic tenderness or costo-vertebtal angle pain were considered.[4] Urinary samples were aseptically collected from catheterized patients of ICU/acute wards as well as from non catheterized OPD patients. Samples were subjected to culture on cysteine lactose electrolyte deficient medium by conventional method. Isolation of two or less organisms with at least one of which bacterium showed a colony count of $\geq 10^5$ CFU/ml was considered pathogenic. Conventional and automated methods (VITEK 2) were used for identification and antibiotic susceptibility testing (ABST) of isolates. ABST interpretation was performed as per CLSI guidelines.[5] Catheterized patients with asymptomatic bacteremia were also included in study. Resistant pattern of CAUTI isolates from ICU were compared with out-patient isolates of UTI. Prospective surveillance of CAUTI was performed by infection control team and monthly rate of CAUTI per 1000 catheter days was determined by infection control nurse.

RESULTS:

A total of 1635 urinary samples were processed for culture between May to Dec 2017. During this period 447 organisms were isolated from UTI cases of outpatient department (OPD). Also 37 isolates from CAUTI were identified in ICU and acute wards. Of these 37 cases, 20 were male patients. The average age and length of stay in hospital at the time of infection were 40.94 years and 6.29 days respectively. *Escherichia coli* (18.9%) and *Klebsiella* spp (18.9%) were most common CAUTI isolates followed by *Enterococcus* spp (16.2%), *Pseudomonas aeruginosa* (13.5%) and *Citrobacter freundii* (13.5%). Whereas, *Escherichia coli* (46.3%) isolate was predominant in OPD case. The distribution of urinary isolates is shown in **Fig 1**. *Acinetobacter* and *Candida* sp were not isolated from OPD

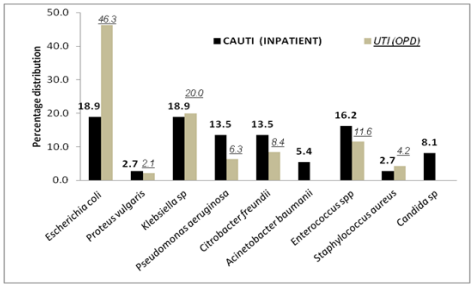


Fig 1. Distribution of urinary isolates from IN patients (CAUTI) and OPD cases of UTI.

The antibiotic sensitivity pattern of CAUTI isolates Approximately 73% of the CAUTI isolates were Gram negative bacteria (GNB) and all of them were resistant to third generation cephalosporin. The sensitivity to other antibiotics were: Gentamycin (30%), Cotrimoxazole (35%), Nitrofurantoin (50%) and Fosfomycin (65%). Only 30% of CAUTI GNB were sensitive to carbapenems as compared to 70% out-patient isolates of UTI. The sensitivity of Gram positive CAUTI isolates were: doxycyclin (72%), cotrimoxazole (57%), azithromycin (15%), ciprofloxacin (15%), ampicillin (15%). All isolates were sensitive to vancomycin, linezolid and teicoplanin.

The antibiotic sensitivity pattern of OPD isolates The antibiotic sensitivity pattern of urinary isolates from OPD is shown in Fig 2 and Fig 3. The sensitivity of both Gram negative and Gram positive isolates were higher in OPD isolates.

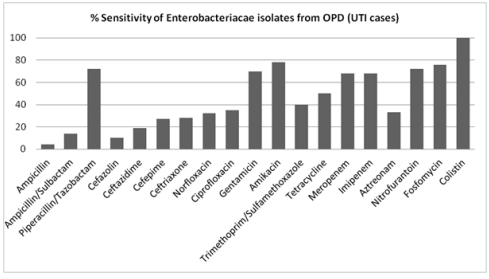


Fig 2. The antibiotic sensitivity pattern of Gram negative urinary isolates from OPD.

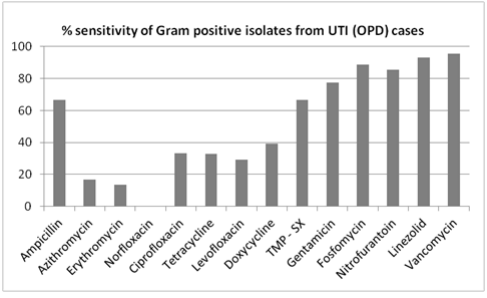


Fig 3. The antibiotic sensitivity pattern of Gram positive urinary isolates from OPD.

CAUTI rate per 1000 urinary catheter days was 12.75 in Jul, which decreased to 2.98 in Nov following strict adherence to CAUTI prevention bundle. The monthly trend of CAUTI is shown in **Fig 4.**

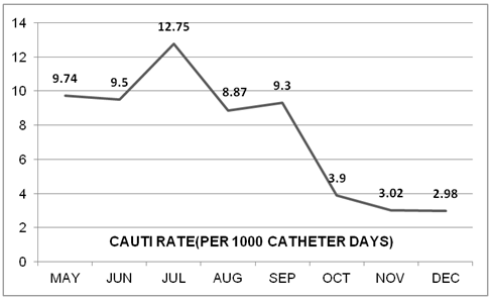


Fig 4. Surveillance of catheter associated urinary tract infection (CAUTI per 1000 catheter days)

DISCUSSION

Insertion of urinary catheter in an acute health care setting is a necessary evil. Prevention of CAUTI is not just the domain of infection control team of a hospital. Concentrated efforts are required by each individual engaged in patient care, from housekeeping staff to consultant physician or surgeon. Also involvement of health administrators is essential for training, implementation and monitoring of infection control strategies.[6] HAI prevention bundles are group of activities that needs to be performed in totality to prevent acquisition of new infection and break the chain of transmission. CAUTI prevention bundle comprises of set of activities to be carried out during and insertion and maintenance period of urinary catheter. Our hospital engaged in training and implementation of CAUTI prevention bundles as well as active surveillance of CAUTI rates. We achieved significant reduction in CAUTI rate per 1000 urinary catheter days from its peak value of 12.75 to 2.98 during the study period. Similar reduction was observed by other studies also following strict monitoring of CAUTI prevention bundles.[7,8] Although further reduction is needed, availability of desired infrastructure, training and adverse patient to doctor/nurse ratio acts as hindrances in resource limited settings.

The study showed predominance of Gram negative bacteria (GNB) in both inpatient and outpatient settings. The percentage isolation of E coli was considerably higher in OPD (46.3%) as compared to In-patient (18.9%). Similar pattern was reported by a study from southern India also.[9] Antibiotic resistance pattern was relatively higher in CAUTI isolates as compared to out-patient isolates of UTI. All GNB from CAUTI were resistant to second and third generation cephalosporins. Sensitivity to fosfomycin was fairly preserved among inpatient as well as outpatients. Previous study from similar setting has recommended fosfomycin as a viable option for multi drug resistant uropathogens.[10] Other multidrug resistant isolates like *Acinetobacter* and *Candida sp* was restricted to ICU settings. Finally except for a single isolate of *Enterococcus*, all Gram positive isolates were sensitive to vancomycin, linezolid and teicoplanin. The study does have certain limitation. As the observation period was just 8 months, the numbers of isolates responsible for CAUTI were lesser for accurate representation of sensitivity pattern.

CONCLUSION

To conclude, the study highlighted distribution and antibiotic resistance pattern in uropathogens isolated from OPD and acute health care settings. Emergence of multidrug resistance uropathogens is a cause for worry. Periodic health education, robust hospital specific infection control program and surveillance is necessary to prevent CAUTI in a health care settings.

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