Original Research Article

Bacteriological Profile in the Catheter Associated Urinary Tract Infection (CAUTI) Patients in a Tertiary Care Hospital of Uttarakhand, India

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Abstract

Introduction: UTIs are the most common type of healthcare-associated infection (HAI). Among UTIs acquired in the hospital, approximately 75% are associated with a urinary catheter. According to the CDC, Catheter associated urinary tract infections (CAUTIs) are defined as an UTI developing in a patient after 48 hours of implantation of an indwelling urinary catheter. **Materials and Methods:** The present study was a cross sectional study**,** conducted over a period of one year.A total of 468 subjects (patients) were included in this study.Before enrolling patients into study, an informed written consent from each patient was taken.Taking all aseptic precautions and following CDC guidelines, Urine samples of catheterized patients received and sent for bacterial culture and sensitivity in the Microbiology section of Central laboratory (an ISO 15189:2012 certified, NABL accredited Laboratory) of SMIH, Patel Nagar, Dehradun. Out of 468 patients, only 100 were culture positive and were processed and reported as per the standard methods. **Results:** In our study we found that Escherichia coli (53%) were the predominant bacteria isolated, followed by Klebsiella Pneumoniae (16%). Minimum (1%) isolation was seen for Enterococcus casseliflavus.Maximum number of cases were from age-group of 71-80 years (18%) followed by 61-70 years (16%) and least number of cases from age-group of 1-10 years & 91-100 years (1%) each. The prevalence of CAUTI was more in females (53%) than in males (47%). **Conclusion:** Based on this study, we conclude that Catheter associated urinary tract infections (CAUTI) are one of the most common nosocomial infections. Escherichia coli are found to be the most common causative organism followed by Klebsiella Pneumoniae, responsible for CAUTI in a tertiary care hospital of north India. Advanced age and female sex are more vulnerable group to get CAUTI. To avoid device associated infections, it is required to establish a standard guideline for the indwelling urinary catheter management.

Keywords: CAUTI, UTI, CLED Media, HAI, E. coli.

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Introduction

A urinary tract infection (UTI) is an infection involving any part of the urinary system, including urethra, bladder, ureters, and kidney. Urinary tract infection (UTI) is one of the most common infections and accounts for more than 150 million cases worldwide[1].

Urinary tract infections (UTIs) are one of the most important causes of morbidity among hospital acquired infections affecting persons of all ages, including young women, children, and the elders[2].

UTIs are the most common type of healthcare-associated infection (HAI). Among UTIs acquired in the hospital, approximately 75% are associated with a urinary catheter. Between 15-25% of hospitalized patients receive urinary catheters during their hospital stay. The most important risk factor for developing a catheter associated UTI (CAUTI) is prolonged use of the urinary catheter[3].

According to the CDC, Catheter associated urinary tract infections (CAUTIs) are defined as UTI where an indwelling urinary catheter was in place for more than two consecutive days in an inpatient location on the date of event, with day of device placement being Day one, and an indwelling urinary catheter was in place on the date of event or the day before. If an indwelling urinary catheter was in place for more than two consecutive days in an inpatient location and then removed, the date of event for the CAUTI must be the day of device discontinuation or the next day for the UTI[4].Surgical-site infections (SSIs) were identified to be the most common hospital acquired infections (HAI) (23.94%), followed by hospital-acquired pneumonia (HAP) (18.31%), urinary tract infection (UTI) (16.9%), catheter-related bloodstream infection (BSI) (16.9%), ventilator-associated pneumonia (VAP) (9.85%), septicemia (8.45%) and others (5.65%)[5].The risk of developing urinary tract infections increases significantly with the use of indwelling devices such as catheters and urethral stents[6].The susceptibility of an individual to CAUTI is mediated by several risk factors, including older age, female gender, diabetes, and impaired immunity. However, the most important risk factor is the use of an indwelling catheter and the duration of catheterization[1].Indwelling urinary catheters are standard medical devices utilized to relieve urinary retention and urinary incontinence. Due to their frequent and unnecessary use, many patients are placed at risk of complications like Catheter-Associated UTI (CAUTI) which has got considerable economic impact. In most of the cases, the underlying cause of CAUTI is formation of a pathogenic biofilm on the surface of the indwelling urinary catheter[7].In patients, Catheter associated UTI (CAUTI) can lead to many complications such as prostatitis, epididymitis, and orchitis in males, and cystitis, pyelonephritis, gram-negative bacteremia, endocarditis, vertebral osteomyelitis, septic arthritis, endophthalmitis, and meningitis in patients[8].Aim of this study was to isolate bacteria from catheterized inpatients with presumed urinary tract infections and to find out their prevalence.

Materials and methods

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After taking clearance from Institutional Ethical committee, aone-year Cross – sectional study, from 1stOctober 2015 to 30th September 2016 was carried out in the Department of Microbiology & Immunology, at Shri Guru Ram Rai Institute of Medical and Health Sciences (SGRRIM&HS) & Shri Mahant Indiresh Hospital, Dehradun, Uttarakhand (India).

Inclusion Criteria

Catheterized inpatients with catheterization of greater than 48 hours duration and with clinical suspicion of Urinary tract infections were included in this study.

Exclusion Criteria

Non – catheterized patients with UTIsandPolymicrobial growth were excluded from this study.

Selection of Subjects

Over a period of one year, from 1stOctober 2015 to 30thSeptember 2016, a total of 468 urine samples from catheterized inpatients were collected, following CDC guidelines. Cases from all age group and of both sexes admitted in SGRRIM&HS were included in this study.

Study Tools

Before enrolling patients into this study, nature of study was explained to the patients and an informed written consent from each patient was taken. A structured patient pro-forma was prepared. Patients were evaluated according to predetermined protocol and history was taken regarding various socio-demographic factors as name of the patient, age, sex, occupation, residence. Relevant medical history was taken for the study purpose.

Study Protocol

Urine samples of catheterized patients from various wards & ICUs were received for bacterial culture in the Microbiology section of Central laboratory (an ISO 15189:2012 certified, NABL accredited Laboratory) of SMIH, Patel Nagar, Dehradun, Uttarakhand, India. All samples were collected taking all aseptic precautions, followed by their processing and reporting as per the standard methods.

Sample Collection

Under aseptic conditions, catheter specimens of urine were obtained by clamping off above the port, to allow collection of freshly voided urine. The wall of the tubing was then vigorously cleaned with 70% ethanol.Now urine was aspirated via sterile syringe and hence the integrity of closed drainage system was maintained.Urine which had been standing in the catheter drainage bag was not used.

Sample Transport

As urine is an excellent medium for growth of bacteria, urine was immediately transported to laboratory in sterile Uricol (HiMedia) for processing.

Media and Analyzer Used

Microscope, CLED media with bromothymol blue and VITEC – 2.

Processing of Urine Samples

Under aseptic conditions, urine samples were immediately cultured by semi-quantitative technique onto CLED with Bromothymol blue (Cysteine Lactose Electrolyte Deficient) medium by using disposable calibrated loop, holding 5µl of uncentrifuged urine. It was then incubated overnight at 37°C. If no growth was detected, it was reported as negative cultures. If growth was present, the total number of colonies per ml was counted.A colony count of 10^3- 10^5 CFU/ml was taken significant for processing.Presence of three or more types of colonies was reported as mixed growth.

Identification of Organisms

All the suspected colonies were subjected to gram staining for initial identification of organism according to their gram reaction and morphology. The isolates were identified as lactose fermenter and non-lactose fermenter on the basis of colony morphology on CLED media.Pure isolated organisms were further processed for identification by Vitek 2 automated system.

Data Management and Statistical Analysis

Data was entered and analyzed on Microsoft Excel and interpreted by descriptive methods in terms of frequency distribution in percentages, proportions, rates ratios etc. Nonparametric tests i.e., chi square was applied to ascertain significance of association.

Results

The current study was carried out at SGRRIM & HS, Patel Nagar, Dehradun, Uttarakhand, India. Out of total 468 urine samples from catheterized patients, 100 were found culture positive.

In our study, maximum number of cases were found in age-group 71-80 years (18%) followed by age-group 41-50 years and 61-70 years (16%) each. Lowest numbers of cases were in age-group 1-10 years and 91-100 years (1%) each.

Considering all sexes, out of total 100 cases found culture positive, 53% cases were Female and 47% cases were Male and with a Male: Female ratio of 0.8:1.

In our study, only 11% of catheterized patients had symptoms of UTI whereas 89% of cases were asymptomatic.

Table 1 shows maximum number of cases (50%) were obtained from Intensive Care Units (SICU, MICU, HDU) while least number of cases obtained was from the Department of Orthopaedics (2%).

Table 2 shows that Escherichia coli (53%) were the predominant bacteria isolated, followed by Klebsiella Pneumoniae (16%). Minimum (1%) isolation was seen for Enterococcus casseliflavus

Table 3 shows that the positivity was more in the groups with duration of catheterization of less than 4 days followed by 4-7 days. None of the cases in this study were catheterized for more than 7 days.

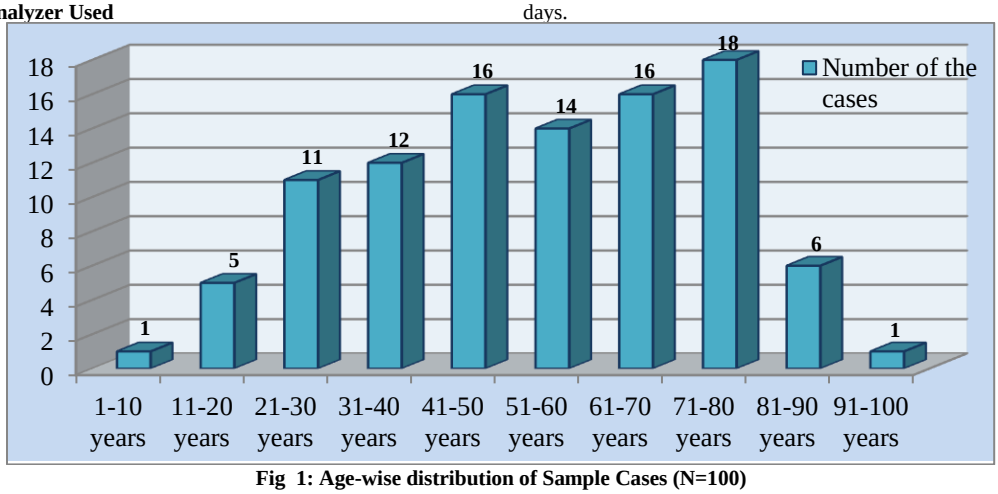

Fig 1: Age-wise distribution of Sample Cases (N=100)

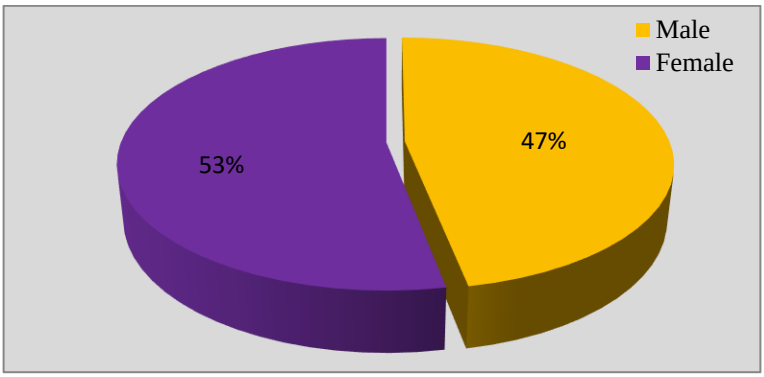

Fig 2: Gender-wise distribution of Culture Positive Cases (N=100)

Table 1: Ward-wise distribution of Culture Positive cases(n=100)

Wards	Number of Cases	Percentage of Cases
SICU	27	27%
MICU	9	9%
HDU	14	14%
Medicine ward	4	4%
Surgery ward	10	10%
Obstetrics ward	3	3%
Gynecology ward	7	7%
Orthopedics ward	2	2%
Nephrology ward	7	7%
Neurology ward	13	13%
CCU ward	4	4%
Total	100	100%

Table 2: Spectrum of organisms isolated from catheterized patients (n=100)

Organism isolated	Number of cases	Percentage of Cases
Escherichia coli	53	53%
Klebsiella pneumoniae	16	16%
Pseudomonas aeroginosa	9	9%
Enterococcus faecium	9	9%
Enterococcus faecalis	3	3%
Enterococcus casseliflavus	1	1%
Proteus mirabilis	3	3%
Enterobacter aerogenes	2	2%
Enterobacter cloacae	2	2%
Acinetobacter baumannii	2	2%
Total	**100**	**100%**

Table 3: Duration of Catheterization and Positivity percentage(n=100)

Duration of catheterization	Number of cases	Percentage of cases
<4 days	64	64%
4-7 days	36	36%
>7 days	0	0
Total	**100**	**100%**

Discussion

In the present study, we foundthat maximum numbers of cases were found in age-group 71-80 years (18%) followed by age-group 41-50 years and 61-70 years (16%) each. Lowest numbers of cases were in age-group 1-10 years and 91-100 years (1%) each. This is in concurrence with a study by Niveditha S. et al wherein UTIs in catheterized patients were found to be more common in elderly patients (aged > 60 years)[9]. Taiwo S.S. and Aderounmu A.O.A. have also reported the age group of 61-70 years as the most vulnerable group[10]. Our findings also agree with another study by Oni etal wherein 61-70 years was the most affected[11]. Advanced age predisposes to catheter associated UTI. This is because the elderly are more prone to acquired structural abnormalities and neurogenic bladder secondary to stroke or autonomic neuropathy of diabetes than the young people[11]. Thus presence of co-morbidities in the elderly increases the risks of catheter associated UTIs.

In this study we also found that out of total 100 cases found culture positive, 53% cases were Female and 47% cases were Male and with a Male: Female ratio of 0.8:1. In a study by Abdullah N.M.A.*et al*, the frequency of UTI was also greater in women as compared to men as 66% of the patients were females and 34% were males principally owing to anatomic and physical factors[12]. Similar results were shown by kashefet al[13]. Our study is also in concurrence with a study by Syed M.A., Devanand P.et al[14]. This may be explained by the fact that females are more prone to develop UTIs, probably due to their anatomical &physiological changes like short urethra, its

proximity to anus, dilatation of the urethra and stasis of urine during pregnancy[15].

Our study also showed that isolation of *Escherichia coli* (53%) were the predominant bacteria isolated, followed by *Klebsiella Pneumoniae* (16%). Minimum (1%) isolation was seen for *Enterococcus casseliflavus*. NiveditaS.et al in their study have also reported *Escherichia coli* to be the most commonly isolated (70%) followed by *Klebsiella Pneumoniae* (16%).[9]Ramesh A. et al in their study also reported the *Escherichia coli* to be the most commonly isolated (37.5%) followed by *Candida Spp* (25%)[16]. However Abdallah N.M.A.etal have reported 30% isolation of *Escherichia coli*followed by *Enterococcus* (17%)[12].Many of these pathogens are part of the patient's endogenous bowel flora but some may have been acquired by cross-contamination from other patients or hospital personnel or by exposure to contaminated solutions or non-sterile equipment. *Escherichia coli*are responsible for more than 80% of all the UTIs and it causes both symptomatic UTIs and Asymptomatic Bacteriuria (ABU). The ability of the Uropathogenic*E. coli* (UPEC) to cause symptomatic UTIs is associated with the expression of a variety of virulence factors, which include adhesins (e.g., type 1 and P fimbriae) and toxins (e.g., haemolysin)[17].

Conclusion

Based on this study, we conclude that Catheter associated urinary tract infections (CAUTI) are one of the most common nosocomial infections. Escherichia coliare found to be the most common causative organism followed by Klebsiella Pneumoniae,responsible for CAUTI in a tertiary care hospital of north India. Advanced age specially age group 61-70 and 71-80 are more vulnerable to get Catheter associated Urinary tract infections (CAUTI) due to multiple factors like comorbidities, difficulty in maintain proper hygiene etc. Female as compared to males are more susceptible to get infected (CAUTI) due to multiple factors like short urethra, its proximity to anus, dilatation of the urethra and stasis of urine during pregnancy.

To avoid device associated infections, it is required to establish a standard guideline for the indwelling urinary catheter management. There is a need to establish standard guidelines on the care of catheters for all the units in the hospital, with a view to prevent the nosocomial infections, which are associated with the devices in the patients. Further, to validate the results of this study, more such large-scale prospective studies are required.

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