

Identification and antibiogram of gram positive cocci from catheter associated urinary tract infection (CAUTI) in intensive care units of a tertiary care hospital

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Abstract

Introduction: The study was conducted to know about the Gram positive cocci causing urinary tract infections in catheterized patients in intensive care units and to study their antimicrobial sensitivity pattern.

Materials and Methods: A sample size of 100 catheterised patients in Intensive care units were included in a period of 1 year from December 2012 to November 2013 to assess the urinary tract infections caused by indwelling catheter.

Result: Of 100 cases, 11 showed catheter associated urinary tract infections. Out of them 10 were *Enterococcus* spp, and 1 was Coagulase negative staphylococci. Isolates were multi drug resistant and showed sensitivity to Vancomycin, Linezolid, Teicoplanin.

Conclusion: Infections were more with male sex, prolonged catheterization, old age and diabetes. High incidence of CAUTI was found in the first 2 weeks of catheterization. It was noted by antimicrobial susceptibility, that most of the urinary isolates are resistant to the commonly used antibiotics.

Keywords: Intensive care units (ICU), Urinary tract infections (UTI), Catheter associated (CA), Multi drug resistant (MDR).

Introduction

Catheter associated urinary tract infection is a leading cause of morbidity and mortality in hospitalized patients. When left in place for too long or used inappropriately, it is a hazard to the very patient that it is designed to protect.^{21,18}

CAUTI is defined by the presence of symptoms or signs compatible with UTI with no other identified source of infection along with $\geq 10^3$ colony forming units (cfu/ml) of ≥ 1 bacterial species in a single catheter urine specimen or in a mid stream voided urine specimen from a patient whose urethral, suprapubic or condom catheter has been removed within the previous 48 hours.¹²

Patients in the Intensive care units are at high risk of device associated infection due to underlying conditions and impaired host defenses, surgery and invasive medical procedures.⁸ Indwelling urinary and central venous catheters are used commonly in the care of critically ill patients. Though important clinical benefits are provided by both types of devices, they are also the leading causes of nosocomial infection in the intensive care units.¹⁷

UTI's are the third most common type of infection which occurs in ICU'S after pneumonia and lower respiratory tract infections and comprises 8% to 21% of all nosocomial infections. Because patients in ICU's require frequent and careful monitoring of intake and output and many of them use urinary catheter, the risk of UTI is significantly higher than in other patient populations.⁶ Approximately 97% of UTI's in the ICU are associated with an indwelling urinary catheter.

CA-UTI are caused by a variety of pathogens, which includes Gram positive organisms like *Enterococcus* spp, *CONS*, *Staphylococcus aureus*.

Up to 25% of patients who require a urinary catheter ≥ 7 days develop Nosocomial bacteriuria with a daily risk of 5%.¹⁸ Bacteriuria develops at an average rate of 3% to 10% per day of catheterization.⁴ Microorganisms are from

patient's endogenous bowel, or from other patients, hospital personnel by cross-contamination, non-sterile equipment.¹⁴

CAUTIs are a cause of concern because catheter-associated bacteriuria comprises a huge reservoir of resistant pathogens in the hospital environment.³ The epidemiology, frequency, microbiological spectrum and antimicrobial resistance patterns of microorganisms causing Device-Associated Infections vary among institutions and can change yearly. Multidrug resistant pathogen infection are on the rise, which further complicates the management of these infections.⁸ Documented phenomena include the emergence of beta lactam and vancomycin resistance of *Enterococci* and *Coagulase Negative Staphylococci*.⁴

In healthy patients CA-UTI is often asymptomatic and is likely to resolve spontaneously with removal of the catheter. Occasionally may lead to complications and bacteremia.¹⁴ CA-UTI is the second most common cause of nosocomial blood stream infection.¹⁶

The vast majority of nosocomial UTI's occur in patients whose urinary tracts are currently or recently catheterized. The development of CA-bacteriuria depends on duration of catheterization, colonization, improper care of catheter, underlying illness, older age, diabetes.^{11,18}

Patients in the intensive care unit are at a higher risk of device-associated infection.⁸ CAUTIs comprises a huge reservoir of resistant pathogens in the hospital environment.²

Most episodes of bacteriuria in short term catheterized patients are caused by single organisms, mostly *Enterococci* and coagulase negative staphylococci. *Enterococcus* spp cause most of the infections.

Enterococcal species are among the predominant organisms responsible for causing CAUTI's. Fifteen to thirty percent of CAUTI's are caused by the *Enterococcus* species, especially *Enterococcus faecalis* and *Enterococcus faecium* and is therefore now considered as the third leading cause of

hospital-acquired UTIs. During CAUTIs, *E.faecalis* due to presence of a foreign body produce biofilms and results in persistent urinary tract infections. Biofilm formation by many enterococcal isolates and increasing resistance to antibiotics, including vancomycin pose significant challenges in treating enterococcal infections.^{10,5}

The risk of UTI increase with duration of catheterization and the Acute Nosocomial UTI is usually asymptomatic.⁷

Although recommendations have been made to treat CAUTI's only when they are symptomatic (fever, rigors, pain, haematuria, dysuria), symptoms have not been clearly defined and unrelated to CAUTI, the presence of an indwelling urinary catheter alone can cause dysuria or urgency.²⁰

Materials and Methods

100 in-patients of Intensive care units were included in the study. Study was done from December 2012 to November 2013 in Microbiology department at Sree Gokulam Medical College and Research Foundation.

The sample included admitted Patients with indwelling catheter of either sex and above 19 years of age of all intensive care units of Sree Gokulam Medical College and Research Foundation. The samples of Patients with confirmed urinary tract infection before catheterization, patients whose lab culture reported as mixed flora, Urinary catheter tips Urine from catheter bags were excluded.

Urine samples were collected aseptically within 2 hours of catheterisation for baseline urine cultures and microscopic examination. Thereafter samples were analysed on 3rd day, 5th day, 7th day until Catheter is removed or, Significant bacteriuria occurred on two consecutive cultures or patient is discharged, whichever comes early. Minimum three samples were collected from each individual. Urine samples were collected by aspirating urine from the Foley's catheter with sterile syringe with gauge 26 needle after disinfecting the catheter with 70% alcohol.

The samples were transported to the Microbiology laboratory immediately. If there was a delay of >2 hours, sample was refrigerated at 4°C.⁹ Wet film microscopy and urine cultures were done.⁸

A colony count of $\geq 10^3$ CFU/ml was considered positive. Standard procedures, biochemical tests and antimicrobial susceptibility test (by Kirby-Bauer disc diffusion technique) were followed for identification of isolates.

The antibiotic discs used were from Himedia and the discs used were Ampicillin (10µg) Amoxycylav (20/30µg), Cephalaxin (30µg), Cotrimoxazole (1.24/23.75µg) Nitrofurantoin (300µg), Tetracycline (30µg), Linezolid (30µg), Teicoplanin (30µg), Vancomycin (30µg), Novobiocin (30µg). The antibiotic susceptibility was interpreted as sensitive, intermediate or resistant by comparing the observed zone of inhibition of the test organisms to the required zone size for the Standard strains as per CLSI Guidelines.

Results

The results obtained are as follows:

Table 1: Number of samples obtained from the various Intensive care unit (ICU)

Intensive care units	Number of Samples
Medical Intensive care unit	56
Surgical Intensive care unit	24
Neuro surgical Intensive care unit	12
Post operative Intensive care unit	7
Cardiac care unit	1
Total	100

Out of 100 samples collected, 56 samples were collected from Medical Intensive care unit, 24 from Surgical Intensive care unit, 12 from Neuro surgical Intensive care unit, 7 from Post operative Intensive care unit and 1 from Cardiac care unit respectively.

Table 2: Association between the duration of catheterization and catheter- associated urinary tract infection

Duration of Catheterization	Total no: of patients catheterized	Growth seen
1 week	43	1(2.3%)
2 week	36	4(11.1%)
3 week	15	3(20%)
4 week	4	2(50%)
More than 4 weeks	2	1(50%)

Pearson Chi Square value: 32.47, p value< 0.001

Total number of patients catheterized for one week were 43, and the growth observed among this 43 was 1(2.3%), Total number of patients who were catheterized upto two weeks was 36, among the 36 growth observed was 4 (11.1%). Out of the 15 patients catheterized for upto 3 weeks growth observed was 3 (20%)., and 4 patients catheterized for 4 weeks and 2 patients catheterized for more than 4 weeks, half of them developed Catheter associated Urinary tract infection, that is 2 and 1 respectively.

Table 3: Catheter-associated urinary tract infections in the various Intensive care unit

Intensive care unit	Culture Positive [%]
Medical Intensive care unit	5(45.5%)
Surgical Intensive care unit	3(27%)
Neuro surgical Intensive care unit	2(18%)
Post operative Intensive care unit	1(9%)
Cardiac care unit	0(0%)
Total	11

Out of the 11 culture positive samples, 5 (45.5%) were from Medical Intensive care unit, 3 (27%) were from Surgical Intensive care unit, 2 (18%) were from Neuro surgical Intensive Care unit, 1 (9%) was from Post operative Intensive care unit. The highest percentage of growth was found in Medical Intensive care unit.

Table 4: Sex wise distribution of positive cultures

Sex	Culture negative	Culture positive
	No: (%)	No: (%)
Males	37 (28.9)	8 (17.7)
Females	52 (49.1)	3 (5.5)

Pearson Chi Square value: 4.209, $p < 0.05$

Out of 45 samples collected from males 8(17.7%) were culture positive. Out of the 55 samples collected from females 3(5.5%) were culture positive.

Table 5: Gram positive organisms isolated

Gram positive organisms	Number
<i>Enterococcus faecalis</i>	7 (63.6%)
<i>Enterococcus faecium</i>	3 (27.3%)
Coagulase negative <i>Staphylococcus</i>	1 (9.1%)
Total	11

Out of the 11 Gram positive cocci isolated, 7(63.6%) were *Enterococcus faecalis*, 3(27.3%) were *Enterococcus faecium*, and 1 Coagulase negative *Staphylococcus* was isolated (9.1%).

Table 6: Sensitivity pattern of Enterococcus species

Drugs	<i>E.faecalis</i> (n=7)		<i>E.faecium</i> (n=3)	
	S	R	S	R
Ampicillin	1(14.3%)	6(85.7%)	1(33.3%)	2(66.7%)
Amoxy Clav	1(14.3%)	6(85.7%)	1(33.3%)	2(66.7%)
Cephalexin	-	7(100%)	-	3(100%)
Nitrofurantoin	2(28.6%)	5(71.4%)	-	3(100%)
Cotrimoxazole	0(0%)	7(100%)	-	3(100%)
Tetracycline	4(57.1%)	3(42.9%)	2(66.7%)	-
Linezolid	7(100%)	-	3(100%)	-
Vancomycin	7(100%)	-	3(100%)	-
Teicoplanin	7(100%)	-	3(100%)	-

Both *E.faecalis* and *E. faecium* showed 100% resistance to Cephalexin and Cotrimoxazole. *E.faecalis* showed 57.1% and *E. Faecium* showed 66.7% sensitive to Tetracycline. Low percentage of sensitivity was shown by *E.faecalis* as well as *E.Faecium* to Ampicillin (14.3% and 33.3% respectively). All *E.faecium* was resistant to Nitrofurantoin whereas *E faecalis* (71.4%) was resistant to Nitrofurantoin.

Both *E.faecalis* and *E. faecium* showed complete sensitivity to Vancomycin, Teicoplanin and Linezolid.

Discussion

Urinary tract infections (UTIs) as a nosocomial infection, has a prevalence of 1% to 10%.^{9,22} Catheter-associated urinary tract infections is common and accounts for bacteremia in 2 to 4% of patients and has a case fatality three times higher than nonbacteriuric patients.²³ Among catheterized patients the reported incidence of CAUTI ranges from as low as 5% to as high as 73%.⁴ In the present study, out of 100 cases studied, 11% developed CAUTI and high incidence of CAUTI was found in the first two weeks of catheterization. This result is comparable with Danchaiwijitr et al¹⁵ study which showed a incidence 73.3% of CAUTI with high incidence in the first two weeks of catheterization. Prolonged catheterization was identified as a risk factor in the present study also and there was no CAUTI induced bacteremia.¹⁵

In our study *Enterococcus spp.* (10 in numbers – 90.9%) were predominant. 7(70%) were *Enterococcus faecalis* and 3 (30%) were *Enterococcus faecium*. Studies done by Ho Lee et al⁶ who evaluated 1,315 patients at medical and surgical ICUs, out of which 61 people developed CAUTI and *Enterococcus spp.* was seen in 30.6% patients.⁶ Similarly in a prospective study in a medical intensive care unit including 137 consecutive catheterised patients by Tissot et al¹⁹ 17% of the pathogens that caused CAUTI was *Enterococcus spp.*

Only 1 Coagulase negative staphylococcus was isolated in our study, whereas a study done by Thombare et al¹ isolated 6.06% of CONS responsible for causing CAUTI. The CONS isolated in our study showed sensitivity to Nitrofurantoin, Cephalexin, Amoxycillin-Clavulanic acid, Clindamycin, Vancomycin, Linezolid, Teicoplanin and Rifamycin, a zone of more than 25 mm was observed to Cefoxitin, hence it was not Methicillin resistant CONS. In the study by Thombare et al⁴ sensitivity to the drugs were Ampicillin (25%), Gentamicin (50%), Cefoxitin (100%), Vancomycin (100%), and Nitrofurantoin (50%).

Conclusion

All health care associated UTI are caused by instrumentation of the urinary tract. The incidence was more in males and risk factors identified were prolonged catheterisation, old age and diabetes mellitus. High incidence of CAUTI was found in the first 2 weeks of catheterisation.

Longer duration of catheterization increases the chances of CAUTI. The antibiogram pattern gives a clue that most of the isolates are resistant to the commonly used antibiotics. Hospital acquired CAUTI is often due to multi drug resistant strains which require higher antibiotics and these strains may spread to other patients.

Conflict of Interest: None.

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