IJHSR International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

Clinical, Bacteriology Profile, and Antibiotic Sensitivity Pattern of Catheter Associated Urinary Tract Infection at Tertiary Care Hospital

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ABSTRACT

Background: Urinary tract infection attributed to the use of an indwelling urinary catheter and is one of the most common infections acquired by patients in health care facilities.
Aims& Objectives: Clinical, bacteriology profile, and antibiotic sensitivity pattern of Catheter associated Urinary tract infection (CaUTI).
Settings and Design: This was a prospective observational study conducted over a period of 1 year from April 1, 2015, to March 31, 2016.
Materials and Methods: The patients fulfilling criteria of CaUTI were included in this study. The urine sample was processed by standard microbiological procedures. Organisms were isolated and antibiotic susceptibility performed.
Statistical Analysis: SPSS trial version 14.0 software and the values of P <0.05 were considered statistically significant.
Results: A total 146 were positive for bacterial growth on culture. Incidence of CaUTI was 21.31 per thousand catheter days. The overall incidence of CaUTI was 27.70% predominated by female population. Total 93 (63.69%) females and 53 (36.30%) males had CaUTI, predominated by female gender [‘p’<0.001]. The mean age of patient with CaUTI was more than patient without-CaUTI [Females-59.76(±12.69):44.75(±16.91); Males-61.72(±9.9):58.73(±17.32)]. The mean duration of Foley catheter in situ was more in patient with CaUTI than patients without CaUTI [14(±7.9): 9.5 (±6.7)]. Of total 146 bacterial isolates in patients with CaUTI54 (36.99%) were *E. coli*, 24 (16.44%) *K. pneumoniae*, 14(9.589%) *P.aeruginosa*, 12(8.219%), *Enterococcus faecium* 9(6.164%), *A.baumanii complex*, 23(15.75%) COPS, 5(3.425%) MRSA and 5 (3.425%) *Serratiamarcescens*. Total 106 (72.60%) were gram negative bacilli (GNB) and 40(27.39%) were gram positive cocci (GPCs) [‘p’< 0.0001]. The majority of GPCs were sensitive to Linezolid, tiechoplanin, nitrofurontoin and co-timaxozole. All MRSA were sensitive to Vancomycin. *E coli* and *A. baumanii complex* were sensitive to Tigecycycline, colistin, Meropenem and Amikacin. Majority of *P.aeruginosa* were sensitive to Colistin, Tigecycline, Meropenem, Imipenem, PI-TZ, Amikacin, Ceftazidime, cefepime and cefeperazone-sulbactum. *K.pneumoniae* were best sensitive to Colistin, Tigecycline, Meropenem, Imipenem, Aminoglycosides, Ceftazidime and PI-TZ. S. marcescens were sensitive to colistin, tigecycline and gentamycin.
Conclusions: The Gram-negative organisms *E. coli*, *K.pneumoniae* and *P.aeruginosa* were the most commonly isolated than GPCs with high mortality rates. Female gender, increasing age and longer duration of catheter in situ were risk factors for CaUTI in present study.

Key words: Bacteriology, Catheter-associated UTI, gram negative bacilli, gram positive cocci

INTRODUCTION

The most notable complication associated with indwelling urinary catheters is the development of nosocomial urinary tract infections (UTIs), known as catheter-associated UTIs (CAUTIs). Catheter-associated urinary tract infection (CAUTI) is the most common nosocomial infection. Infections of the urinary tract associated with catheter use are significant due their high incidence and subsequent economic cost and sequel. [1] In CaUTI, *E. coli* remains the predominant organism and other aerobic gram-negative rods, such as *Klebsiella species, Proteus species, Acinetobacter species* and *Pseudomonas aeruginosa*, are frequently isolated. Gram-positive bacteria (e.g., Enterococci and *Staphylococcus aureus*) are also important pathogens in CaUTI. Data on etiology and resistance are generally obtained from laboratory surveys and should be understood in the context that organism identification. The available data demonstrate a increase in the resistance of GNB to commonly used antibiotics. [2] There are many gaps in our knowledge about CaUTI. This prospective study was conducted to better understanding of the organisms involved, antibiotic sensitivity and resistance pattern in CaUTI and to choose appropriate empirical antimicrobial agent. Since resistance rates vary by local geographic region, with individual patient characteristics, and over time, it is important to use current and local data when choosing a treatment regimen empirically before antibiotic sensitivity pattern become available.

MATERIALS AND METHODS

Study design: This was the prospective observational noninterventional study of Catheter associated urinary tract infection (CaUTI) cohort, conducted in medical ICUs of a tertiary care teaching hospital over a period of 1 year (April 2015–March 2016). This study was approved by the research and ethics committee. Informed consent was obtained from each patient's next of kin.

Aims and objectives: The objectives of this study were to determine the incidence bacteriology, Antibiotic sensitivity and resistance pattern of CaUTI patients.

Setting: The study was conducted in the medicine ICU of a tertiary care teaching hospital. The Departments of Microbiology and medicine were involved in this study.

Aims & Objectives: To identify microbial pathogens associated with Catheter associated urinary tract infection (CaUTI) in catheterized patients from Intensive Care Units (ICU) and to determine the susceptibility pattern of these isolates to antimicrobial agents and associated risk factors.

Definition of CaUTI: The term catheter associated urinary tract infection (CaUTI) is used to refer to individuals with symptomatic infection with catheter in situ. [1]

Clinical diagnosis: The diagnosis of symptomatic CaUTI is often a diagnosis of exclusion. Fever without localizing findings is the usual presentation of CaUTI. Localizing signs or symptoms such as catheter obstruction, acute hematuria, recent trauma, suprapubic pain, or costovertebral angle pain or tenderness are helpful to identify a urinary source of fever, but are present in only a minority of episodes of presumed symptomatic infection. If localizing genitourinary findings are not present, fever in bacteriuric patients should be attributed to urinary infection only when there are no other potential sources. When the same organism is isolated from both the urine and a simultaneous blood culture, a diagnosis of CaUTI is presumed in the absence of an alternate source for the bacteremia. [3]

Subject and sample size: During 12 months study period, a total of 527 patients who were catheterised of them only 146 patients were eligible for CaUTI in the study.

Procedure for data collection: All patients included in the study were monitored at frequent intervals for the development of CaUTI using clinical and microbiological criteria until either discharge or removal of catheter. The clinical parameters were recorded from bedside charts. The indications of Foley catheterization, antibiotic therapy, surgery, use of steroids, duration of hospitalization and demographic profile were noted.

Criteria for diagnosis of Catheter-associated UTI: The diagnosis of CaUTI was based on clinical and microbiological criteria. Signs and symptoms compatible with CaUTI include new onset or worsening of fever, rigors, altered mental status, malaise, or lethargy with no other identified cause; flank pain; costovertebral angle tenderness; acute hematuria; pelvic discomfort; and in those whose catheters have been removed, dysuria, urgent or frequent urination, or suprapubic pain or tenderness (A-III). [1] CaUTI in patients with indwelling urethral Catheter is defined by the presence of symptoms or signs compatible with UTI with no other identified source of infection The diagnosis was confirmed by performing a quantitative culture of the urine sample and observing ≥105 cfu/ml. and cultures positive. Based on these criteria, 146 of 527 were enrolled with diagnosed of CaUTI. Organisms isolated with quantitative counts <105 cfu/ml from the replacement catheter tend not to persist. [4]

Figure 1: Culture growth of various bacterial isolates causing CaUTI [Culture growth CaUTI on MacConkey Agar: *Escherichia coli,* MacConkey Agar: *Pseudomonas aeruginosa,* Nutrient Agar: *Staphylococcusaureus,* Blood Agar: *Staphylococcusaureus,* Blood Agar: *Klebsiellapneumoniae*]

*Microbiological techniques: M*icrobiologic diagnosis: Urine specimens for culture collected directly from the catheter or tubing, to maintain a closed drainage system. The organisms isolated by quantitative culture of the urine CaUTI patients were identified based on standard microbiological techniques. As per standard operating procedures, the samples were processed for routine aerobic bacterial culture and sensitivity by means of Standard loop technique where 20μL urine sample was inoculated on Blood agar plate (BAP) and Mac Conkey agar plate (MAP). After 24-48 hours of aerobic incubation at 37^0C, culture plates were looked for growth where ≥102 CFU/mL is considered as significant. The colonies obtained were identified by Standard methods. Organisms which were isolated from the urine specimens were subjected to standard identification and sensitivity testing by using VITEK-2 Compact Biomerieux. [3,5,6] *Multi-drug resistance:* MDR pathogens were defined as those resistant to three or more antimicrobial classes [beta lactum, quinolones, aminoglycosides, cephalosporins, microlides, carbapenemetc].

Exclusion criteria: All patients with clinical and signs suggestive of pre-existing UTI, catheter put out side hospitals or other source for fever on admission and evidence with alternative diagnosis other than CaUTI were excluded from the study.

Statistical analysis: Data entry and analysis were performed using SPSS for windows version SPSS 14.0 software (Trial version SPSS Inc., Chicago, Illinois, USA). Means and standard deviations were calculated for numerical variables. The Chi-square test was calculated and all P <0.05 were considered statistically significant. Odds ratio and relative risk (RR) was calculated for univariate analysis. The CaUTI rate per 1000 catheter days was calculated as total number of CaUTIs in ICUs/total number of catheter days in medical ICU × 1000.

RESULTS

A total 527 patients underwent Foley catheterisation during study period of one year duration of them 146 were positive for bacterial growth on culture. Incidence of CaUTI was 21.31 per thousand catheter days. The overall incidence of CaUTI was 27.70%. The incidence of CaUTI was significantly more in female population than male [33.096%: 21.544; 'p'=0.0031]. The mean age of patient with CaUTI was more than patient without-CaUTI [Females-59.76(±12.69):44.75(±16.91); Males-61.72(±9.9):58.73(±17.32)]. [Table 1]

Table 1: Demographic profile of patient with CaUTI

	Total	Mean age(SD)	Female	%	Mean age (SD)	Male	%	Mean age (SD)
Total Foley Catheter (n)	527	47.65 (±17.11)	281	53.32	44.75 (±16.91)	246	46.67	58.73 (±17.32)
CaUTI (n)	146	57.66 (±13.19)	93	33.09	59.76 (±12.69)	53	21.54	61.72 (±9.9)
'p'=0.0031								

The mean duration of Foley catheter in situ was more in patient with CaUTI than patients without CaUTI [Overall mean 14(±7.9): 9.5 (±6.7); Females- 13.6(±7.7): 9.9 (±7.8); Males-10.7(±8.6); 8.7(±7.3)]. [Table 2]

Table 2: Comparison of duration of catheter in situ in patient with CaUTI

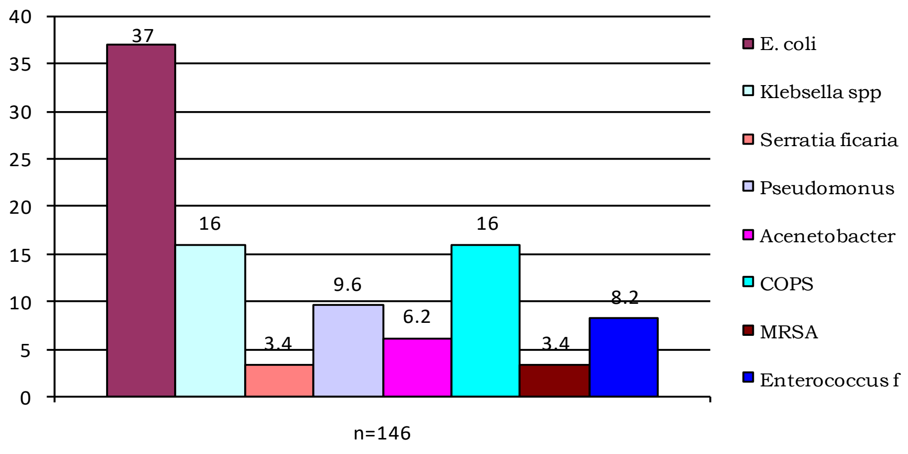
	Total	%	Mean (SD) Days	Female	%	Mean (SD)Days	Male	%	Mean (SD) Days
Total Foley Cath (n)	527	100	9.5 (6.7)	281	53.32	9.9 (7.8)	246	46.67	8.7(7.3)
CaUTI (n)	146	27.70	14(7.9)	93	17.64	13.6(7.7)	53	10.05	10.7(8.6)

Of total 146 bacterial isolates in patients with CaUTI54 (36.99%) were *E. coli*, 24 (16.44%) *K.pneumoniae*, 14(9.589%) *P.aeruginosa*, 12(8.219%), *Enterococcus faecium* 9(6.164%), *A.baumanii Complex*, 23(15.75%) *COPS*, 5(3.425%) *MRSA* and 5 (3.425%) *S.marcescens*. [Table 3]

Table 3: Distribution of isolates from CaUTI

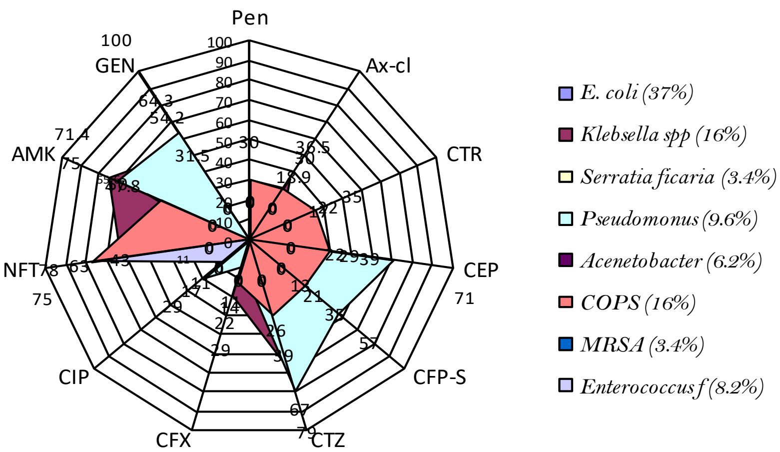
Organism	n=146	%
E. coli	54	36.9
K.pneumoniae	24	16.4
S.marcescens	5	3.42
P. aeruginosa	14	9.58
A.baumanii Complex	9	6.16
COPS	23	15.7
E.faecium	12	8.21
MRSA	5	3.42
Total GNB	106	72.60
Total GPCs	40	27.39

Total 106 (72.60%) were gram negative bacilli and 40(27.39%) were gram positive cocci, predominated by GNB ['p'< 0.0001]. Total 93 (63.69%) females and 53 (36.30%) males had CaUTI, predominated by female gender ['p'<0.001]. [Table 3 and Graph 1]

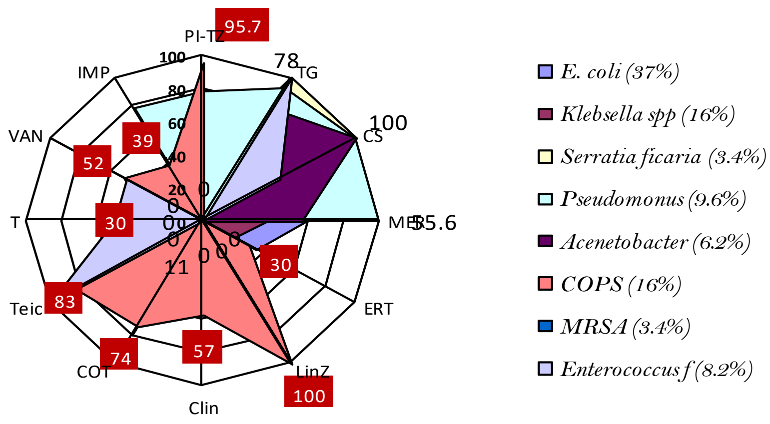


Graph 1: Incidence of Organisms in Ca UTI

E coli and *A.baumanii complex* were sensitive to Tigecycycline, colistin, Meropenem and amikacin with significant resistance to cephalosporin, Pipracillin-Tazobactum and quinolones. Majority of *P.aeruginosa* were sensitive to Colistin, Tigecyclin, Meropenem, Imipenem, Pi-TZ, Amikacin, Ceftazidime, cefepime and cefeperazone-sulbactum with moderate resistance to moderate resistance to quinolones, ceftriaxone, Amox-Clav and cefuroxime. *K.pneumoniae* were best sensitive to Colistin, Tigecycline, Meropenem, Imipenem, Aminoglycosides, Ceftazidime and PI-TZ with moderate resistance to quinolones, ceftriaxone, Cefepime, Amox-Clav and cefuroxime. *S. marcescens* were sensitive to colistin, tigecycline and gentamycin. Total 34 (32.07%) GNB were multidrug resistant ['p'= 0.40]. MDR were more prevalent in GNB than GPCs [32.07%:25%].[Table 4 and Graph 2-A & B]The majority of GPCs were sensitive to Linezolid, tiechoplanin nitrofurontoin and co-timaxozole. COPS had good sensitivity for Linezolid, Pipracillin-tazobactum, Teichoplanin Co-timaxozole and Nitrofurointoin. Enterococcus had good sensitivity pattern for Teichoplanin, Tigecyclin, Linezolid and Nitrofurointoin. All MRSA were sensitive to Vancomycin. The moderate resistance was observed for Quinolones, Aminoglycosides, Microlides and Carbapenem group with total 10 (25%) were multidrug resistant GPCs. [Table 4-B and Graph 2-A]



Graph 2-A:Antibiotic sensitivity pattern for CaUTI bacterial Isolate



Graph 2-B: Antibiotic sensitivity pattern for CaUTI bacterial Isolate

Table 4:Antibiotic sensitivity pattern for CaUTI bacterial isolate

Organism	n=146	Pen	Ax-cl	CTR	CE	CFP-S	CTZ	CFX	CIP	NFT	AMK	GEN
E. coli	54(37%)	-	7(18.9%)	12(22%)	12(22%)	7(13%)	14(26%)	6(11%)	6(11%)	23(43%)	27(50%)	17(31.5%)
K. pneumoniae	24(16%)	-	6(36.5%)	4(17%)	7(29%)	5(21%)	16(67%)	7(29%)	0(0%)	15(63%)	18(75%)	13(54.2%)
S. marcescens	05(3.4%)	-	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	5(100%)
P.aeruginosa	14(9.6%)	-	0(0%)	0(0%)	10(71%)	8(57%)	11(79%)	2(14%)	4(29%)	0(0%)	10(71.4%)	9(64.3%)
A.baumanii complex	09(6.2%)	-	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	1(11%)	5(55.6%)	0(0%)
COPS	23(16%)	7(30%)	7(30%)	8(35%)	9(39%)	8(35%)	9(39%)	5(22%)	0(0%)	18(78%)	11(47.8%)	0(0%)
MRSA	05(3.4%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
E.faecium	12(8.2%)	0 (0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	2(17%)	9(75%)	0(0%)	0(0%)
Organism	**PI-TZ**	**TG**	**CS**	**MER**	**ERT**	**LinZ**	**Clin**	**COT**	**Teic**	**T**	**VAN**	**IMP**
E. coli	19(35.2%)	54(100%)	48(89%)	32(59.3%)	19(35%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	27(50%)
K. pneumoniae	7(29.2%)	19(79%)	24(100%)	9(37.5%)	5(21%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	12(50%)
S. marcescens	0(0%)	5(100%)	5(100%)	0(0%)	0(0%)	0(0%)	0(0%)	4(80%)	0(0%)	0(0%)	0(0%)	-
P.aeruginosa	11(78.6%)	13(93%)	14100%)	14(100%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	11(79%)
A.baumanii complex	0(0%)	7(78%)	9(100%)	5(55.6%)	0(0%)	00%)	00%)	1(11%)	0(0%)	0(0%)	0(0%)	4(44%)
COPS	22(95.7%)	-	-	-	7(30%)	23(100%)	13(57%)	17(74%)	19(83%)	7(30%)	12(52%)	9(39%)
MRSA	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	5(100%)	0(0%)
E. faecium	0(0%)	12(100%)	6(50%)	0(0%)	0(0%)	12(100%)	0(0%)	0(0%)	12(100%)	6(50%)	6(50%)	0(0%)

[Pen:Penicillin, Ax-cl:Amox-Clav, CTR:Ceftriaxone, CN:Cephalexin, CFP-S:Cefoperazone + sulbactum, CTZ:Ceftazidime, CFX:Cefuroxime, CIP:Ciprofloxacin, NFT:Nitrofurontoin, AMK:Amikacin, GEN:Gentamicin, PI-TZ:Piperacillin+ Tazobactum, TG:Tigecycline, CS:Colistin, MER:Meropenem, ER:Erythromycin, LinZ: Lineolid, T:Tetracyclin, Clin: clindamycin, COT:Cotrimaxazole, Teic: techoplanin, VAN: Vancomycin, IMP: Imipenem]

In univariate analysis Age ≥60 years, duration of cateterisation>14 days, Diabetes mellitus, previous use of antibiotics, steroid used, female gender and Sr. creatinine ≥2.5 were the risk factors for CaUTI [‘p’ < 0.001].[Table 5]

Table 5: Risk factors associated with CaUTI

Variables	With CaUTI (n=146) -Risk factor present	With CaUTI (n=146) - Risk factor Absent	Without CaUTI (n=527) - Risk factor present	Without CaUTI (n=527) - Risk factor Absent
Age (≥60 years)	79	67	47	334
Cateterisation (>14 days)	96	50	48	333
Diabetes mellitus	27	119	5	376
Previous use of antibiotics	45	101	37	344
Steroid used	39	107	12	369
CKD (Sr. creatinine ≥2.5)	38	108	13	368

DISCUSSION

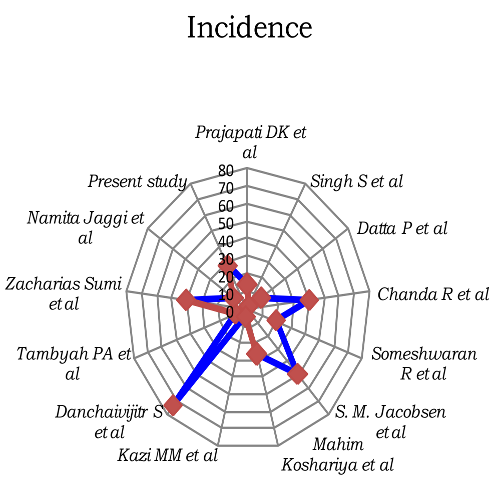
Catheter-associated urinary tract infection UTI is the most common health care associated infection worldwide and is a result of the widespread use of urinary catheterization, much of which is inappropriate, in hospitals and long term care facilities. Considerable personnel time and other costs are expended by health care institutions to reduce the rate of CaUTI. [1,7-9] Present study highlighted the burden of CaUTI in intensive care unit of tertiary care teaching hospital. We compared these findings with various study with CaUTI pertaining to demographic profile, incidence, bacteriological and clinical profile including risk factors and sensitivity resistance pattern of various bacterial isolates. The Incidence of CaUTI in present study was 21.31 per 1000 catheter days with overall incidence of CaUTI was 27.70%. Similarly variable incidence have quoted in different studies 40.57% (345/140), 1.63/1000 urinary catheter days, 10.75% 9.08/1000 catheter days,13.14/ 1000 catheter days, 4.9 per 1000 catheterized days and 27% [10-15] Danchaivijitr S *et al* in their cohort of patients in neurology and neurosurgery wards in a teaching hospital the incidence of CaUTI was 73.3%. [16] 8.60%. [17] about 30%-40% of all the nosocomial infections. [18] The average

CaUTI rate was from 10.6 to 5.6. This study presented the mean age of the patients with CaUTIs as 54.5 years and it showed an approximately equal contribution of both the sexes (52.94% in males and 47.05% in females). In present study 54(36.99%) were *E. coli*, 24 (16.44%) *K. pneumoniae*, 14(9.589%) P. aeruginosa, 12(8.219%), *E. faecium* 9(6.164%), *A.baumaniiComplex*, 23(15.75%) *COPS*, 5(3.425%) *MRSA* and 5 (3.425%) *S.marcescens*. Total 106 (72.60%) were gram negative bacilli and 40(27.39%) were gram positive cocci, predominated by GNB ['p'< 0.0001]. Similarly S. M. Jacobsen *et al* reported *E. coli* commonly isolated in CaUTIs in 50%. [19] Nicolle *et al* in their study quoted incidence of various isolates from different part of world (*E. coli* 42%-71.3%, *Klebsiellaspp*7.5%-16.7%, *Enterococcus spp* 6%-28.4%, *P. aeruginosa* 4.1%-12%). [3] HootonT M et al reported *Escherichia coli*is the most frequent species isolated, although it comprises fewer than one-third of isolates. Other *Enterobacteriaceae,* such as *Klebsiellaspecies,* *Serratiaspecies,* *Citrobacterspecies,* and *Enterobacterspecies*, nonfermenters such as *P. aeruginosa*, and gram-positive cocci, including *coagulase-negative staphylococci* and *Enterococcus species*, are also isolated. [1] Majumder M I et al quoted*E. coli*was the most frequently isolated pathogen (60%), followed by *Klebsiellaspp*.(14%). [20] *Someshwaran R. et al* reported 20% prevalence of CaUTI predominated by *E coli* (44.74%) followed by Klebsiellapneumoniae (10.53%). [21] Chanda R. V *et al Escherichia col i*and *Klebsiellaspp* were common. The other isolates included *Pseudomonas spp*. Group D *streptococci* and methicillin-resistant *Staphylococcus aureus*. Prajapati DK *et al* quoted *E. coli, Klebsiella, citrobacter* and *Acinetobacter* accounted over 90% of the isolates. Chanda R V *et al*quoted advancing age, debilitation, diabetes mellitus, duration of catheterization were the risk factors. Kazi MM *et al* most common uropathogen was *E. coli* followed by *K. pneumoniae*. *Zacharias Sumi et al* in their study the control group developed CaUTI with *Pseudomonas aeruginosa* (51%) was the commonest pathogen. [22] *DeorukhkarS C et al E. coli* followed by *P. aeruginosa* and *Enterococcus spp.* were the major bacterial isolates from CaUTI. [23] Similar to present study, *Nicolle* stated the most common infecting organism is *E coli*. Other *Enterobacteriaceae* as well as Enterococci spp, coagulase negative *Staphylococcus, Pseudomonas A*, other non-fermenters, and *Candida spp* are also frequently isolated. Antimicrobial-resistant organisms are common. The urine of patients with indwelling catheters is the one of major site of isolation of resistant gram negative organisms. *E. coli* is usually the most frequent species isolated from bacteremic CaUTI patients in acute care facilities. *Enterococcus spp* (28.4%) and *Candida spp* (19.7%) were reported to be most common at one US tertiary care academic centre. *Proteus mirabilis* is an organism of unique importance for patients with chronic indwelling catheters. The urease of P. mirabilis hydrolyzes urea several times faster than the urease produced by other organisms. This species is isolated from 80% of obstructed catheters. Other urease producing species include *P. aeruginosa, Klebsiellapneumoniae*, *Morganellamorganii*, other *Proteus species*, some *Providenciaspp* and some strains of *Staphylococcus aureus* and *coagulase negative staphylococci*. In present study majority of isolates were GNB predominated by *E coli* and no isolates of Proteus mirabilis, the probable reason for this was duration of catheter was not more than two weeks. Majumder M I *et al* reported highest sensitivity pattern was found for E. coli in urine and biofilm for imipenem (95% vs. 92%), lowest for ciprofloxacin (20% vs. 16%). Catheter biofilm resistant was found for *E.coli* in 6.95% and *Klebsiella*in 5.55%. Urine samples resistant to all tested antibiotics were only in E. coli (3.33%) cases. E.coli was the most frequent isolate which showed the higher sensitivity to carbapenems, and lowest to the quinolones. Chanda R. V *et al* High resistance was seen among *Klebsiella* isolates (nalidixic acid-86% and cefotaxime-86%). Prajapati DK *et al* quoted *E. coli, Klebsiella, citrobactor* and *acenatobactor* isolates were sensitive to amikacin, while more than 70% sensitive to ciprofloxacin, nitrofurantoin, norfloxacin and Ceftazidime. Mahim Koshariya *et al* stated that, *E. coli* were sensitive to Amikacin. The growing antibiotic resistance amongst the uropathogen isolated from CaUTI making difficult for its management. In present study total 34 (32.07%) GNB were multidrug resistant ['p'= 0.40] and 10 (25%) were MDR amongst GPCs. MDR were more prevalent in GNB than GPCs [32.07%:25%]. The moderate resistance was observed for Quinolones, Aminoglycosides, Microlides and Carbapenem group for GPCs and about 40-50% of GNB isolates were Carbapenem resistant. Similarly Brennan BM *et al* quoted Carbapenemase resistant Enterobacteriaceae (CRE) in 61% of isolates from urine cultures, and a urinary catheter was present in 48% of these patients. [24]

Table 6: Comparison of various studies with present study

Study Reference	Incidence & Isolates	Risk factors	Sensitive drugs/resistance
1. SatyenParida et al [26]		Prolonged catheterization, antibiotics, DM, elevated creatinine, Females gender	
2. Prajapati DK et al [13]	Incidence was 13.14/ 1000 catheter days. E. coli commonest, *E. coli, Klebsiella, citrobacter* and *Acinetobacter*over 90%	Long duration catheterization, female, extremes of age	80% were sensitive to amikacin, 70% sensitive to ciprofloxacin, nitrofurantoin, norfloxacin and Ceftazidime.
3. Singh S, et al [11]	CaUTI: 1.63/1000 catheter days.		
4. Datta P et al [12]	Incidence: 10.75%, 9.08/1000 catheter days.		
5. Chanda R. Vyawahare, et al [10]	(140/345)*Escherichia coli, Klebsiellaspp, Pseudomonas spp., Group D streptococci MRSA*		High resistance for Klebsiellaisolates, (nalidixic acid-86% and cefotaxime-86%).
6. Someshwaran, R. et al [21]	CaUTI was 20% (52/260). Escherichia coli 44.74% Klebsiella 10.53%	Prolonged Catheterization	
7. Sachin C. Deorukhkar et al [23]	*E. coli P. aeruginosa*and *Enterococcus spp.*		
8. Brennan BM et al [24]	*Enterobacteriaceae* (GNB)		Carbapenemase resistant Enterobacteriaceae (CRE)
9. Majumder M I et al [20]	*E. coli* and *Klebsiella*		Highest sensitivity for imipenem and lowest for ciprofloxacin.
10. S. M. Jacobsen et al [19]	E. coli (50%) and Proteus	*P. mirabilis*is the third most common cause of complicated UTI (12%)	
11. MahimKoshariya et al [14]	The incidence 27%, E. coli		Amikacin
12. Kazi MM et al [15]	4.9 per 1000 days, *E. coli, K. pneumoniae*		High resistance for *Pseudomonas* Aand *Acinetobacter*.
13. DanchaivijitrSet al [16]	CaUTI was 73.3%	prolonged catheterization	
14. Tambyah PA et al [17]	Incidence: 8.60%		
15. Zacharias Sumi et al [22]	Incidence: 40%, *Pseudomonas aeruginosa* (51%)		
16. NamitaJaggi et al [18]	10.6 to 5.6, mean age, 54.5 years equal in both genders		
17. Present study	CaUTI was 21.31 per thousand catheter days and overall incidence of 27.70%. Predominated by GNB than GPCs	Age ≥60 yrs, female gender, duration of cateterisation>14 days, DM, use of antibiotics, steroid, and Sr. creatinine ≥2.5 were the risk factors.	GNB isolates were more prevalent 1/3rd GNB isolates were MDR and 1/4th GPCs were multidrug resistant.

Kazi MM *et al* reported very high antimicrobial resistance in *Pseudomonas aeruginosa* and *Acinetobacter species*. Similar findings observed by Danchaivijitr S *et al.* [25] Multiple factors have been identified as potential risk factors for CaUTI like prolonged catheterization, use of systemic antibiotics, other active sites of infection, diabetes mellitus, and elevated creatinine. Females have much higher risk compared to males. A most important and potentially modifiable risk factor is the duration of catheterization, and hence indwelling urinary catheters need to be used for the shortest periods of time feasible. By the 30th day of catheterization, infection rates are about 100%. Antimicrobial drug therapy, while protective for short-duration catheterizations, carries the risk of selective colonization with multi-drug-resistant organisms such as Pseudomonas aeruginosa, other resistant Gram-negative bacilli, *enterococci* and yeasts. [26] In univariate analysis in present study Age ≥60 years, duration of catheterization >14 days, Diabetes mellitus, previous use of antibiotics, steroid used, female gender and Sr. creatinine ≥2.5 were the risk factors for CaUTI [‘p’ < 0.001]. High incidence of CaUTI was found in the first 2 weeks after catheterization. Risk factors for CaUTI identified were prolonged catheterization and change of the catheter. Someshwaran, R. *et al* stated prolonged catheterization was an important risk factor for CaUTI. [21]



Graph 3: Incidence of various studies with CaUTI

Infection control programs in health care facilities must be implemented and monitor strategies to limit CaUTI, including surveillance of catheter use, appropriateness of catheter indications, and complications. The prevention of CaUTI will require technical advances in catheter materials which prevent biofilm formation. Surveillance of institutional data should be reviewed by appropriate individuals and committees, and observations reported back to caregivers.

CONCLUSIONS

Catheter associated urinary tract infections (CaUTI) are major concern as one of the nosocomial infections. This study highlights the burden of CaUTI. Incidence of CaUTI was 21.31 per thousand catheter days with overall incidence of CaUTI was 27.70% predominantly affecting female gender. The GNB isolates were more prevalent with CaUTI in present study. The majority of GPCs were sensitive to Linezolid, tiechoplanin, nitrofurontoin and co-timaxozole. The moderate resistance was observed for Quinolones, Aminoglycosides, Microlides and Carbapenem group with total one fourth were multidrug resistant GPCs. *E. coli* and *A baumannii complex, P.* aeruginosa and *K. pneumoniae* were sensitive to Colistin, Tigecycline, Meropenem and Imipenem with Moderate resistance to moderate resistance to quinolones, cephalosporin and Pipracillin-Tazobactum with one third of GNB were multidrug resistant. The present study highlight burden of MDR pathogens in CaUTI. The female gender, older age, diabetes mellitus, renal failure and duration of catheter more than 14 days, previous antibiotics and steroid use were the risk factors for developing CaUTI. Knowledge of the susceptibility pattern of the local pathogens will guide for de-escalation strategy (switching from a broad-spectrum antimicrobial therapy to a narrower spectrum) depending on the microbiological data. An appropriate and judicious use of antibiotic is recommended to treat CaUTI. Knowledge of risk factors for CaUTI may be useful in implementing simple and effective preventive measures. Evidence-based protocol based strategies is suggested to reduce CaUTI, associated healthcare costs. Future studies should attempt to determine whether specific diagnostic or therapeutic strategies could reduce incidence of CAUTI. Limiting unnecessary catheterization, early discontinuation of Catheter, Alternatives to Indwelling Urethral Catheterization like In men condom catheterization and intermittent catheterization should be considered. Institutions should develop a list of appropriate indications for inserting indwelling urinary catheters and adherence to the institution-specific guidelines. Prevention of infections attributable to these devices is an important goal of health-care infection prevention programs.

***Limitations of study*:** Our results cannot be applied to other institute, as various factors and bacteriological agents causing CaUTI may vary from institution to institution. This is single center study and included patients from medical ICU, findings and interpretation of our result cannot be generalized.

ACKNOWLEDGMENT

We would like to acknowledge the staff of ICU, Medicine and Microbiology Department.

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How to cite this article: Patil HV, Patil VC. Clinical, bacteriology profile, and antibiotic sensitivity pattern of Catheter associated Urinary tract infection at tertiary care hospital. Int J Health Sci Res. 2018; 8(1):25-35.

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