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Original Research Article

A Study of Risk factors, Occurrence and aetiology of Catheter Associated Urinary Tract Infections (CAUTI) and Antibiotic Sensitivity Pattern from confirmed cases of CAUTI in a Tertiary care Hospital

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Abstract

Introduction: The urethral catheter is one of the most vulnerable of medical devices, having been used for urine retention on an intermittent or indwelling basis for centuries. Insertion of a catheter may carry urethral organisms into the bladder. Even with meticulous attention to maintenance of the closed system, the space between the external catheter and the urethral mucosa offers opportunity for bacterial entry directly into the bladder and are eliminated efficiently; most bacterial strains that enter the catheterized urinary tract are able to multiply to high concentrations within a day. The duration of catheterization is the most important risk factor for the development of catheter-associated bacteriuria. the present study was done to assess the risk factors, occurrence and aetiology of catheter associated urinary tract infections (CAUTI) in ICU of Dr D.Y Medical College, Hospital and Research centre, by various microbiological techniques and to determine the susceptibility pattern of isolates to commonly used antimicrobial agents for prophylaxis and empiric therapy of CAUTI in patients on indwelling catheter. ***Results***: majority of the patients (17.3%) were in the age group of 61-70years followed by 41-50 years (16.2%), 51-60 years (16%), 21-30 (14.9%), 31-40 years (14.5%), 71-80 years (11.1%), 11-20 years (7.1%) and 81-90years (2.9%). The mean age of the patients was 49.21 ± 19.04 years. 62.5% patients were male and 37.5% were female. There was male preponderance and the M:F ratio was 1.67:1. It was observed that significantly higher number of patients (6.1%) patients had the indwelling catheter for 8-14 days. There was significant association of days of catheterization and CAUTI as per Chi-square test ($p<0.05$). The logistic regression analysis showed that days of catheterization were independently associated with CAUTI. ***Conclusion:*** The urinary tract of catheterized patients is highly susceptible to severe infection. This infection is associated varied microbiological aetiology. Antibiotic sensitivity pattern of the pathogen involved is also low. This along with existing underlying condition of comorbidities increases hospitalization, medication, morbidity and also adds to the financial burden. Therefore, it is imperative to carry out microbiological testing to determine aetiology and ascertain effective antibiotics. Emphasis should also be made on reducing the duration of catheterization in order to reduce the incidence of catheter-related UTI. Hospital-wide surveillance program and appropriate catheter care protocols should be developed and implemented from evidence-based protocol.

Keywords: Risk factors, Occurrence, aetiology, Urinary, Tract Infections.

INTRODUCTION

Catheter-associated urinary tract infection (CAUTI) is an important cause of morbidity and mortality in Indian affecting all age groups [1]. Bacteriuria or candidemia is almost inevitable in nearly half of the patients who require an indwelling urinary catheter for more than 5 days [2, 3]. The urethral catheter is one of the most venerable of medical devices, having been used for urine retention on an intermittent or indwelling basis for centuries. Insertion of a catheter may carry urethral organisms into the bladder. Even with meticulous attention to maintenance of the closed system, the space between the external catheter and the urethral mucosa offers opportunity for bacterial entry directly into the bladder and are eliminated efficiently; most bacterial strains that enter the catheterized urinary tract are able to multiply to high concentrations within a day [4]. The duration of

catheterization is the most important risk factor for the development of catheter-associated bacteriuria [5].

Short-term catheterization:- Between 15 and 25% of patients in general hospitals may have a catheter in place sometime during their stay. In short term catheterization, common bacteriuric species such as Escherichia coli are isolated. Other common organisms are Pseudomonas aeruginosa, Klebsiella pneumoniae, Proteus mirabilis, Staphylococcus epidermidis, Enterococci, and Candida species. Most bacteriuria in short-term catheterization is of single organisms.

Long-term catheterization:- The two most frequent indications for long term catheterization are urinary incontinence and bladder outlet obstruction. Complications of long-term catheter-associated bacteriuria fall into two categories. The first includes symptomatic UTIs such as seen with short-term catheterization, i.e. fever, bacteraemia, and acute pyelonephritis [6-9]. Some of these episodes may end in death. The second group is more often associated with long-term catheterization: obstruction, urinary tract stones, local per urinary infections, chronic pyelonephritis [10] and with prolonged use, bladder cancer. Several microbial agents have been found to be responsible for CAUTI Escherichia coli, Pseudomonas aeruginosa, Acinetobacter, Proteus, Klebsiella, Enterobacter, Staphylococcus aureus, Enterococcus faecalis, Candida and Enterococcus. CAUTI have been associated with a threefold increased risk of mortality in hospitals including ICUs because of inappropriate use of antimicrobial agents leading to the spread of antimicrobial resistance and emergence of multidrug resistant uropathogens [4, 11]. The presence of a biofilm plays a central role in the pathogenesis of CAUTI [12]. CAUTIs are a cause for concern because catheter-associated bacteriuria comprises a huge reservoir of resistant pathogens in the hospital environment.[13] Hence the present study was done to assess the risk factors, occurrence and aetiology of catheter associated urinary tract infections (CAUTI) in ICU of Dr. D.Y Medical College, Hospital and Research centre, by various microbiological techniques and to determine the susceptibility pattern of isolates to commonly used antimicrobial agents for prophylaxis and empiric therapy of CAUTI in patients on indwelling catheter.

MATERIAL AND METHODS

A hospital based prospective study was conducted with 475 patients to analyze risk factors, occurrence and aetiology of catheter associated urinary tract infections (CAUTI) in critical care units.

Type of Study

A hospital based prospective study Population:- All patients with urinary catheter of more than 48 hrs duration in SICU and MICU for the above period. Place of study: Department of Microbiology Dr. D. Y. Patil Medical College. Hospital and Research Centre Pimpri, Pune.

Sample Size: 475 Patients

Inclusion criteria

SICU/MICU patients with urinary catheter inserted >48hrs.

Exclusion criteria

SICU/MICU patients with urinary catheter inserted <48hrs 2) Pregnant women.

METHODOLOGY

Patients admitted in SICU/MICU with indwelling urinary catheter for more than 48 hrs duration at Dr. Dy.patil medical college, hospital and research centre, pune were enrolled in the study. After explaining about the study informed consent were taken in prescribed consent form. The patients detailed history, signs and symptoms were recorded and details were entered in prescribed proforma. Urinary catheter days of SICU and MICU were recorded.

Laboratory diagnosis

Specimen collection: Prior to catheter change or removal from each patient, urine sample were collected aseptically using a sterile needle and syringe from the distal edge of catheter tube into the sterile universal container and transported. Microbiology: The samples were processed by the routine standard laboratory procedure. This included microscopy, culture, identification and antibiotic susceptibility testing.

Urine Microscopy

Urine Microscopy was performed on centrifuged catheter urine specimen. Sediment was used for wet mount and gram stain preparation. Motility of the bacteria is seen by hanging drop preparation to identify and differentiate motile bacteria from non-motile bacteria.

Urine culture and Identification: Cultures were set up on cysteine Lactose electrolyte deficient agar (CLED) for isolating all kind of urinary pathogen Isolates suggestive of Yeast were sub-cultured on Sabourauds dextrose agar (SDA). Semi quantitative method of urine culture was followed and a sterile calibrated wire loop was used to deliver a loopful (0.01ml) of urine onto each culture media. All the culture plates were incubated at 37 ^{0}C aerobically for 18-24 hrs and in all the culture positive plates, isolates were identified by their colony morphology, gram stain and characterized biochemically by biochemical reactions like (Indole, Methyl red, Urease, citrate, TSI, H2s, gas production, Catalase Coagulase and Oxidase test for respective bacteria). Further identification of yeast and yeast like isolates were done by demonstration of germ tube sporulation on cornmeal

agar, sugar fermentation and assimilation CHROME agar as required.

Antimicrobial susceptibility testing

It was done by Kirby-Bauer Disk diffusion method on Muller- Hinton agar, According to CLSI guidelines diameters of various antibiotic discs are measured and compared with standard zone size interpretation chart to label them as sensitive or resistant. Extended spectrum Beta lactamases (ESBLs) were detected by combined disk diffusion method Metallo- Beta lactamases (MBLs) were detected by combined disk diffusion method. Methicillin resistant Staphylococcus aureus (MRSA) were detected by disk diffusion method using Oxacillin and Cefoxitin antibiotic disks. Analysis of risk factors, aetiology and antibiotic resistance were carried out by suitable tests.

Incidence of CAUTI of SICU/MICU were calculated by following formula:-
CAUTI rate of a ward = NO: of CAUTI x 1000 / Urinary catheter days

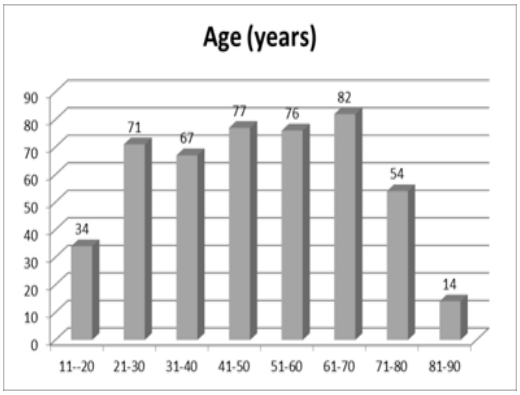
STATISTICAL ANALYSIS

Quantitative data is presented with the help of Mean and Standard deviation. Comparison among the study groups is done with the help of unpaired "t" test as per results of normality test. Qualitative data is presented with the help of frequency and percentage table. Association among the study groups is assessed with the help of Fisher test, student "t" test and Chi-Square test. "p" value less than 0.05 is taken as significant.

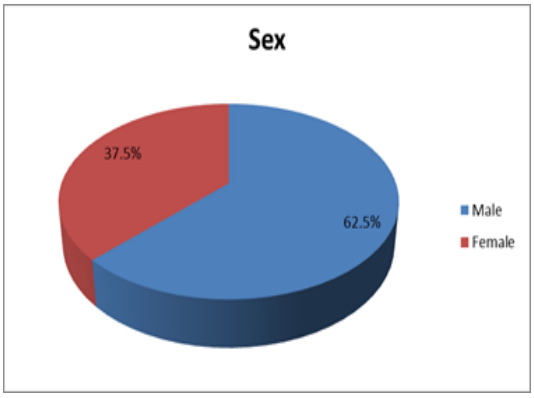
OBSERVATIONS AND RESULTS

A hospital based prospective study was conducted with 475 patients to analyze risk factors, occurrence and aetiology of catheter associated urinary tract infections (CAUTI) in critical care units.

Age In the present study:- Majority of the patients (17.3%) were in the age group of 6170years followed by 41-50 years (16.2%), 51-60 years (16%),21-30 (14.9%), 31-40 years (14.5%), 71-80 years (11.1%), 11-20 years (7.1%) and 81-90years (2.9%). The mean age of the patients was 49.21 ± 19.04 years. 62.5% patients were male and 37.5% were female. There was male preponderance and the M: F ratio was 1.67:1.

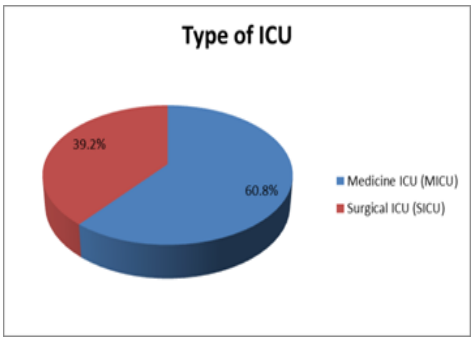


GRAPH-1



PIE CHART -1

Body Weight:- Majority of the patients (56.2%) weighed in the range of 61-70 kgs while 187 (39.4%) and 21 (4.4%) patients weighed in the range of 71-80 kgs and 51-60 kgs respectively. The mean body weight of patients was 69.72 ± 4.24 kgs. 289 (60.8%) patients were from Medicine ICU (MICU) while 186 (39.2%) patients were from Surgical ICU (SICU). Majority of the patients (53.4%) had the indwelling catheter for 8-14 days followed by 15-21 days (25.3%), 1-7 days (17.3%) and >22 days (4%).



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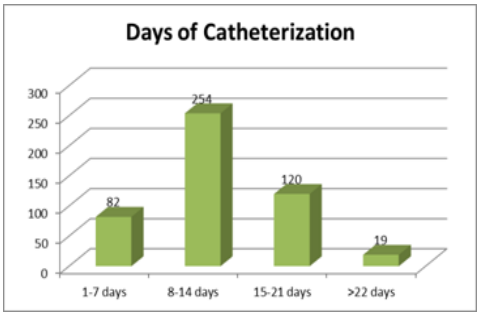
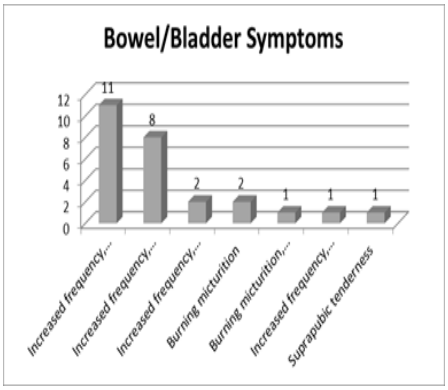
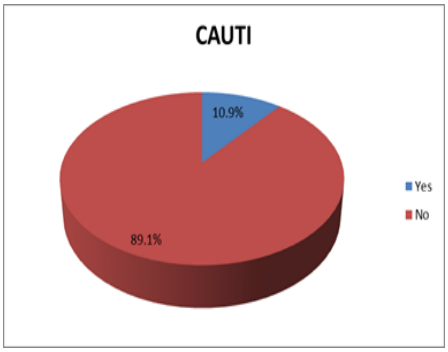


GRAPH-2

Bowel/Bladder Symptoms:- The most common symptom was increased frequency, urgency and burning (2.2%) followed by increased frequency, burning micturition(1.6%), increased frequency, urgency(0.4%), burning micturition (0.4%), burning micturition, fever (0.2%), increased frequency, burning, dysuria (0.2%) and suprapubic tenderness (0.2%). 83 (17.5%) patients had TLC of 4000-11000 cell/mm^{3}while 392 (82.5%) patients had TLC >11000cell/mm^3. Leukocytosis was seen in 82.5% patients. It was observed in our study that 52 (10.9%) patients had Catheter Associated Urinary Tract Infections (CAUTI).



GRAPH-3



PIE CHART-3

Culture Findings:- It showed bacterial isolates in 22 (42.3%) of the patients and the most common bacterial isolate was E.coli(28%) followed by Enterococcus spp (18%), Klebsiella pneumoniae (18%), Proteus mirabilis (9%), Pseudomonas aeruginosa (9%), Acinetobacter spp(4.5%), Citrobacterkoseri (4.5%), Methicillin-resistant Staphylococcus aureus[MRSA] (4.5%) and Methicillin-sensitive Staphylococcus aureus [MSSA] (4.5%).

Age, Sex and CAUTI in patients:- Majority of patients with CAUTI were in the age group of 61-70 years (2.5%) followed by 41-50 years (2.1%). There was no significant association of age and CAUTI as per Chi-square test ($p>0.05$). 29 (6.1%) and 23 (4.8%) male and female patients respectively had CAUTI. There was no significant association of sex and CAUTI as per Chi-square test ($p>0.05$).

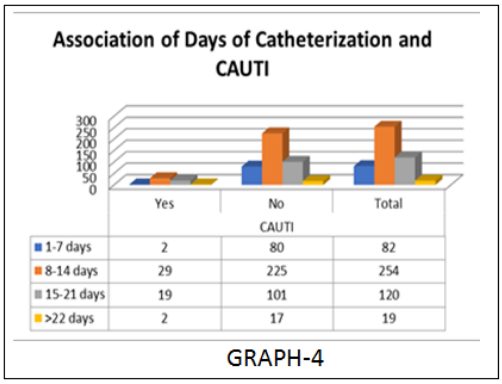
Type of ICU and CAUTI in patients:- 27 (5.6%) and 25 (5.3%) patients were from Medicine ICU (MICU) and Surgical ICU (SICU) respectively had CAUTI. There was no significant association of type of ICU and CAUTI as per Chi-square test ($p>0.05$).

Days of Catheterization and CAUTI in patients:- It was observed that significantly higher number of patients (6.1%) had the indwelling catheter for 8-14 days. There was significant association of days of catheterization and CAUTI as per Chi-square test ($p<0.05$).

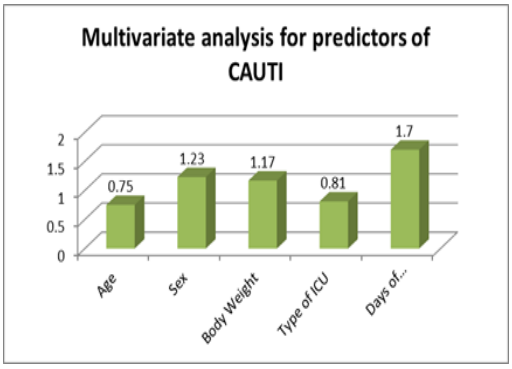
Total Leukocyte Count (TLC) and CAUTI in patients:- 10 (2.1%) and 42 (8.8%) patients with CAUTI had TLC of 4000-11000 cell/mm^{3}and >11000cell/mm^{3}respectively. There was no significant association of Total Leukocyte Count (TLC) and CAUTI as per Chi-square test ($p>0.05$).

Antibiotic sensitivity pattern of bacterial isolates:- It is observed that E.coli was sensitive to Amikacin, Gentamicin, Imipenem, Nitrofurantoin and Ceftazidime + Tazobactam while Enterococcus spp was sensitive to Ampicillin, Linezolid and Vancomycin. Klebsiella pneumoniae was sensitive to Gentamicin, Imipenem, Ceftazidime + Tazobactam and Ceftazidime + Clavulinic acid while Proteus mirabilis and Pseudomonas aeruginosa were sensitive to Amikacin and Colistin respectively. Acinetobacter spp was sensitive to Imipenem, Colistin, Tigicycline and Ofloxacin while Citrobacterkoseri was sensitive to Ampicillin, Cefoxitin, Cotrimoxazole, Gentamicin, Imipenem, and Nalidixic acid, Norfloxacin, Nitrofurantoin and Ceftazidime + Tazobactam. MRSA was sensitive to Cotrimoxazole, Linezolid, and Nalidixic acid, Vancomycin and Nitrofurantoin while MSSA was sensitive to Amikacin, Ampicillin, Ciprofloxacin, Clindamycin, Cotrimoxazole, Gentamicin, Linezolid, Oxacillin, Vancomycin and Nitrofurantoin.

Predictors of CAUTI:- The logistic regression analysis showed that days of catheterization were independently associated with CAUTI.



GRAPH-4



GRAPH-5

DISCUSSION

Urinary catheter is inserted in more than 5 million patients in Emergency critical care hospital settings and extended care facilities. Therefore, these are at increased risk for CAUTI and its related sequelae. Worldwide per urethral catheter is identified as single most important predisposing factor for UTI. Catheter may serve as portal of entry for the pathogen if not aseptically inserted [14, 15]. In healthy patients, catheter associated colonization is usually asymptomatic, which resolves spontaneously after the removal of the catheter. In susceptible patients colonization persists and leads to infection. The complication of which could be such as prostatitis, epididymitis, cystitis, pyelonephritis and septicaemia due to Gram-negative bacteraemia particularly in high risk patients [16]. In the present study a total of 475 urine samples both from MICU and SICU were taken into account. In the present majority of patients (17.3%) were in age group of 61-70 years followed by 41-50 years (16.2%), 51-60 years (16%), 21-30 years (14.9%), 31-40 years (14.5%), 71-80 years (11.1%), 11-20 years (7.1%) and 81-90 years (2.9%). The mean age of patients in our study was 49.21±19.04 years. Similar results found in other studies by Verma S *et al.* [17], prospective study conducted on 163 patients found most of the subjects in their study were in the age group between 16 and 95 years (mean 54.21± 8.62 years),with 46 patients being older than 65 years. Datta P et al[18] also showed similar results in 117 patients with age group > 60 years and 562 patients with age group < 60 years. In our study there was no significant association of age and CAUTI as per Chi-square test (p>0.05).In the current analysis Males were 297 and females 178. There was a male preponderance with M:F ratio as 1.67:1. Similar results of more male preponderance were also seen in other studies like Verma S *et al*.[17] showing 102 males and 61 females. Datta P *et al*.[18] also a prospective study ascertaining the epidemiology and risk factors of health care associated infections from intensive care units with 369 males and 310 female patients. Vyawahare CR *et al*. 19, prospective study assessing the incidence of UTI in 395 catheterized patients with males 200 (58%) and females 145 (42%). Col Singh S *et al*. [20], hospital based observational study which also evaluated the prevalence of HAI in ICU settings showing 138 (67.4%) as males and 66 (32.35%) females. There was no significant association of sex and CAUTI as per Chi –square test (p>0.05). In the present study majority of patients (56.2%)were in the range 61-70 kgs, while 187 (39.4%) and 21 (9.4%) were in the weight range of 71-80 kgs and 51-60 kgs respectively, which was in accordance with other similar studies by Datta P *et al*.[18], Verma S *et al*.[17], Vyawahare CR *et al*.[19] and Col Singh S *et al*.[20] The present study showed 289 (60.8%) patients from Medicine ICU (MICU) while 186 were from surgical ICU (SICU). Similar observations were also noted in other studies conducted by various authors like study of Vyawahare CR *et al*.[19] who found out a total of 345 urine sample from catheterized patients, 271 (79%) samples were from medicine ICU and 74 (21%) were from surgical ICU. There was no significant association of type of ICU and CAUTI as per Chi-square test (p>0.05). In this study it was observed that majority of patients (53.4%) had the indwelling catheter for 8-14 days followed by 15-21 days (25.3%), 1-7 days (17.3%) and > 22 days (4%). This was comparable to the studies conducted by Datta P *et al*.[18] and Verma S *et al*. [17]. In a prospective study by Datta P *et al*.[18]. Out of 679 patients having an indwelling urinary catheter, total number of Foley's catheterization days were 8039 which is in accordance with our study with Foley's catheterization days as 8064. In one more study by Col Singh S *et al*.[20] hospital based observational study evaluating the prevalence of HAI in ICU reported linear trend was found to be 71.29, p value <0.001,odds ratio 1 for stay less than 5 days, 9.87 for stay between 5 and 10 days and 42.8 for stay beyond 10 days, thus proving that there is a highly significant risk of developing HAI as length of stay in ICU increased. There was a significant association of days of catheterization and CAUTI as per Chi-square test (p<0.05) The most common symptom in the study was increased frequency, urgency and burning micturition (2.2%), followed by increased frequency, burning micturition (1.6%), increased frequency, urgency (0.4%), burning micturition, fever (0.2%) and suprapubic tenderness also (0.2%). Similar results were seen in study conducted by Verma S *et al.*[17] Associated symptom in the study was diabetes which was seen in maximum patients. Datta P *et al*.[18] prospective, observational study ascertaining the epidemiology and risk factors of health–care associated infections in Intensive Care Units (ICU) also reported presence of diabetes having a significance with health care associated infections. In the present study it was observed that 83 (17.5%) patients had TLC of 4000-11000 cells /mm^3. Leukocytosis was seen in 82.5% of CAUTI patients. One study by Hooton TM *et al*. [21] also showed in his study leukocytosis of >14000 cells/mm^3 in 13% of their CAUTI patients. There was no significant association of Total leukocyte count (TLC) and CAUTI as per Chi-square test (p<0.05). In the present study bacterial growth was reported in 22 (42.3%). Among the bacterial isolates the most common organism isolated was E.coli (28%) followed by Enterococcus spp (18%), Klebsiella pneumonia (18%), Proteus mirabilis (9%), Acinetobacter spp (4.5%), Citrobacter koseri (4.5%), Methicillin resistant staphylococcus aureus (MRSA) (4.5%) and Methicillin sensitive Staphylococcus aureus (MSSA) (4.5%). These findings were consistent with the studies of Datta P *et al*. [18], Verma S *et al*. [17], Vyawahare CR *et al*.[19], Taiwo SS *et al*. [22], Karina BD *et al*. [23] and Col Singh S *et al*. [20]. Verma S *et al*. [17] prospective study reported 69.2% CAUTI were due to bacterial aetiologies and 30.8% due to yeast. Among bacterial growths Gram negative bacilli and Gram positive cocci were 50% and 19.2% accounting to CAUTI. Their

study also found similar results of E.coli being the most common isolate among CAUTI followed by Enterococcus faecalis (19.2%), Klebsiella pneumoniae (11.5%), Pseudomonas aeruginosa (7.7%), Acinetobacter baumanii (7.7%) and Citrobacter koseri (3.8%). Vyawahare CR *et al*. [19] prospective study assessing the incidence of UTI in catheterized patients reported 69 bacterial isolates. In their study also E.coli was isolated in maximum patient's 39 accounting for (57%) cases; this was in accordance with our study. In their study E.coli was followed by Klebsiella pneumoniae spp 14 accounting for (20%) cases, Pseudomonas spp 5(7%), Enterobacter spp and Citrobacter spp in 4% cases. Gram positive isolates in their study were Group –D Streptococci in 6(9%). Methicillin resistant Staphylococcus aureus in 2 (5%) CAUTI cases. In another study by Taiwo SS *et al*. [22] Klebsiella pneumoniae (36%) the most common then Pseudomonas spp 27% and E.coli 20%. It showed similar results with the present study accounting E.coli (28%). In their study E.coli was followed by Staphylococcus aureus (10%), Proteus mirabilis (3%), Candida albicans (3%) and Coagulase negative Staphylococcus (CONS) (1.6%). In one more study conducted by Karina BD *et al*. [23] E.coli was found to be the most common pathogen (27%), Klebsiellaspp (26%), Pseudomonas spp (8%). Off the Gram positive isolates in their study also Enterococcus (9%) was the most common pathogen as in our study. In the current analysis it was observed that E.coli was sensitive to amikacin, gentamicin, imipenem, nitrofurantoin and ceftazidime + tazobactam while Enterococcus spp was sensitive to ampicillin, linezolid and vancomycin. Klebsiella pneumoniae was sensitive to gentamicin, imipenem, ceftazidime + tazobactam and ceftazidime + clavulinic acid. While Proteus mirabilis and Pseudomonas aeruginosa was sensitive to amikacin and colistin respectively. Acinetobacter spp was sensitive to imipenem, colistin, tigecycline and ofloxacin while Citrobacter koseri was sensitive to ampicillin, cefoxitin, cotrimoxazole, gentamicin, imipenem, nalidixic acid, norfloxacin, nitrofurantoin and ceftazidime + tazobactam. MRSA was sensitive to cotrimoxazole, linezolid, nalidixic acid, vancomycin and nitrofurantoin. While MSSA was sensitive to amikacin, ciprofloxacin, clindamycin, cotrimoxazole, gentamicin, linezolid, oxacillin, vancomycin and nitrofurantoin [24-27]. Similar results were seen in other studies also like studies conducted by Datta P *et al*.[18], Verma S *et al*.[17], Vyawahare CR *et al*. [19] and Col Singh S *et al*.[20] Datta P *et al*.[18] prospective, observational clinical study ascertaining the epidemiology and risk factors of health care associated infections in intensive care units (ICUS) reported high degree of resistance to amoxicillin-clavulanate, 3rd generation cephalosporins, gentamicin and netilmicin. But in our study gentamicin was 66.7 % sensitive in E.coli and 75 % in Klebsiella pneumoniae, 50% sensitive in Proteus mirabilis, while in Citrobacter koseri it showed 100% sensitivity. Imipenem showed maximum sensitivity for gram negative bacilli in Datta P *et al*.[18] study. In their study only 25-40 % of Pseudomonas spp and Acinetobacter spp were sensitive to imipenem. This was in accordance with our study where Pseudomonas showed 50% sensitivity to imipenem. In our study Klebsiella pnemoniae showed a sensitivity of 75% for imipenem similar results were seen in studies by Datta P *et al*.[18] and Vyawahare CR *et al.* [19]. In Datta P *et al*. [18] study imipenem showed 55-90% sensitivity for E.coli and Klebsiella spp and in Vyawahare CR *et al*. [19] showing 95% sensitivity for imipenem. In addition with ceftazidime +tazobactam (82%) sensitivity was seen in their study which was comparable with our study showing (50-100%) ceftazidime + tazobactam sensitivity. In the present study Acinetobacter spp was sensitive to imipenem, tigecycline and ofloxacin this was in accordance with Datta P *et al*. [18] and Verma S *et al*. [17]. Verma S *et al*.[17] study 2 Acinetobacter baumani were isolated, 1 was resistant to all tested antibiotics except tigecycline. In the present study Nitrofurantoin showed 100 % sensitivity for E.coli, 50% sensitive to Citrobacter koseri and maximum resistance for klebsiella pneumoniae as they were the MDR strains even Verma S *et al*. [17] also showed in their study nitrofurantoin 44.4% resistant, cotrimoxazole 88.9% resistant, fluroquinolone 77.8% resistant. In our study also cotrimoxazole sensitivity varied both in gram–positive and gram – negative isolates between 50-75%. In this present study of ours non-fermenters showed 100% sensitivity to colistin this showed similar results with a study conducted by Verma S *et al*. [17] The prevalence of MRSA in our study was 4.5% but in other studies it varied e.g. it was 30% in Datta P *et al*.[18]. In the current study Staphylococcus aureus showed 100% sensitivity to both vancomycin and linezolid and Enterococcus spp also showed 100% sensitivity. This was quite similar to study by Datta P *et al.* [18] One thing which was not in accordance with the above study was that we did not get any strain resistant to vancomycin. In current analysis of our study CAUTI rate came out to be 6.1, similar results were also seen in other studies.

Table-1

Cauti rate	**Our study Rate**	**Study " a" by (col shivinder singh *et al.* [20] india**	**Study "b" by (duo-shuang xie *et al.* [24] china**	**Study "c" by (reinaldo salomao *et al.* [25] brazil**	**Study "d" by (victor d. Rosenthal) inicc 1998**	**Study "e" by (wilde m *et al.*) Ny**
Incidence/1000 catheter days	6.1	9	15.8	9.6	8.2	8.4

CONCLUSION

The urinary tract of catheterized patients is highly susceptible to severe infection. This infection is associated with varied microbiological aetiology. Antibiotic sensitivity pattern of the pathogen involved is also low. This along with existing underlying condition of comorbidities increases hospitalization, medication, morbidity and also adds to the financial burden. Therefore, it is imperative to carry out microbiological testing to determine aetiology and ascertain effective antibiotics. Emphasis should also be made on reducing the duration of catheterization in order to reduce the incidence of catheter-related UTI. Hospital-wide surveillance program and appropriate catheter care protocols should be developed and implemented from evidence-based protocol.

REFERENCES

1. Jaggi, N., & Sissodia, P. (2012). Multimodal supervision programme to reduce catheter associated urinary tract infections and its analysis to enable focus on labour and cost effective infection control measures in a tertiary care hospital in India. *Journal of clinical and diagnostic research: JCDR*, *6*(8), 1372.
2. Kunin, C. M. (1997). *Urinary tract infections. Detection, prevention, and management* (No. Ed. 5). Williams & Wilkins..
3. Stamm, W. E. (1991). Catheter-associated urinary tract infections: epidemiology, pathogenesis, and prevention. *The American journal of medicine*, *91*(3), S65-S71.
4. Stark, R. P., & Maki, D. G. (1984). Bacteriuria in the catheterized patient: what quantitative level of bacteriuria is relevant?. *New England Journal of Medicine*, *311*(9), 560-564.
5. Platt, R., Polk, B. F., MURDOCK, B., & Rosner, B. (1986). Risk factors for nosocomial urinary tract infection. *American journal of epidemiology*, *124*(6), 977-985.
6. Warren, J. W., Damron, D., Tenney, J. H., Hoopes, J. M., Deforge, B., & Muncie Jr, H. L. (1987). Fever, bacteremia, and death as complications of bacteriuria in women with long-term urethral catheters. *Journal of Infectious Diseases*, *155*(6), 1151-1158.
7. Muder, R. R., Brennen, C., Wagener, M. M., & Goetz, A. M. (1992). Bacteremia in a long-term-care facility: a five-year prospective study of 163 consecutive episodes. *Clinical infectious diseases*, *14*(3), 647-654.
8. Rudman, D., Hontanosas, A., Cohen, Z., & Mattson, D. E. (1988). Clinical correlates of bacteremia in a Veterans Administration extended care facility. *Journal of the American Geriatrics Society*, *36*(8), 726-732.
9. Warren, J. W., & Muncie Jr, H. L. Hall-Craggs M.(1988) J. *Infect. Dis*, *158*, 1341-1346.
10. Tribe, C. R., & Silver, J. R. (1969). *Renal failure in paraplegia*. Pitman Medical.
11. Vatopoulos, A. C., Kalapothaki, V., & Legakis, N. J. (1999). Greek Network for the Surveillance of Antimicrobial Resistance. Bacterial resistance to ciprofloxacin in Greece: results from the national electronic surveillance system. *Emerg Infect Dis*, *5*, 471-476.
12. Subramanian, P., Shanmugam, N., Sivaraman, U., Kumar, S., & Selvaraj, S. (2012). Antiobiotic resistance pattern of biofilm-forming uropathogens isolated from catheterised patients in Pondicherry, India. *The Australasian medical journal*, *5*(7), 344.
13. Hooton, T. M., Bradley, S. F., Cardenas, D. D., Colgan, R., Geerlings, S. E., Rice, J. C., ... & Nicolle, L. E. (2010). Diagnosis, prevention, and treatment of catheter-associated urinary tract infection in adults: 2009 International Clinical Practice Guidelines from the Infectious Diseases Society of America. *Clinical infectious diseases*, *50*(5), 625-663.
14. Graves, N., Tong, E., Morton, A. P., Halton, K., Curtis, M., Lairson, D., & Whitby, M. (2007). Factors associated with health care-acquired urinary tract infection. *American journal of infection control*, *35*(6), 387-392.
15. Weinstein, R. A., Lundstrom, T., & Sobel, J. (2001). Nosocomial candiduria: a review. *Clinical infectious diseases*, *32*(11), 1602-1607.
16. Kunin, C. M. (1979). *Detection, prevention, and management of urinary tract infections* (Vol. 381). Philadelphia: Lea & Febiger.
17. Verma, S., Naik, S. A., & Deepak, T. S. (2017). Etiology and risk factors of catheter associated urinary tract infections in ICU patients. *International Journal of Medical Microbiology and Tropical Diseases*, *3*(2), 65-70.
18. Datta, P., Rani, H., Chauhan, R., Gombar, S., & Chander, J. (2014). Health-care-associated infections: Risk factors and epidemiology from an intensive care unit in Northern India. *Indian journal of anaesthesia*, *58*(1), 30.
19. Vyawahare, C. R., Gandham, N. R., Misra, R. N., Jadhav, S. V., Gupta, N. S., & Angadi, K. M. (2015). Occurrence of catheter-associated urinary tract infection in critical care units. *Medical Journal of Dr. DY Patil University*, *8*(5), 585.
20. Singh, S., Chaturvedi, R., Garg, S. M., Datta, R., & Kumar, A. (2013). Incidence of healthcare associated infection in the surgical ICU of a tertiary care hospital. *Medical journal armed forces India*, *69*(2), 124-129.
21. Hooton, T. M., Bradley, S. F., Cardenas, D. D., Colgan, R., Geerlings, S. E., Rice, J. C., ... & Nicolle, L. E. (2010). Diagnosis, prevention, and treatment of catheter-associated urinary tract infection in adults: 2009 International Clinical Practice Guidelines from the Infectious Diseases

Society of America. *Clinical infectious diseases*, *50*(5), 625-663.
22. Taiwo, S. S., & Aderounmu, A. O. A. (2006). Catheter associated urinary tract infection: aetiologic agents and antimicrobial susceptibility pattern in Ladoke Akintola University Teaching Hospital, Osogbo, Nigeria. *African Journal of Biomedical Research*, *9*(3).
23. Billote-Domingo, K., Mendoza, M. T., & Torres, T. T. (1999). Catheter-related urinary tract infections: incidence, risk factors and microbiologic profile. *Phil J Microbiol Infect Dis*, *28*(4), 133-138.
24. Xie, D. S., Lai, R. P., & Nie, S. F. (2011). Surveys of catheter-associated urinary tract infection in a university hospital intensive care unit in China. *Brazilian Journal of Infectious Diseases*, *15*(3), 296-297.
25. Salomao, R., Rosenthal, V. D., Grimberg, G., Nouer, S., Blecher, S., Buchner-Ferreira, S., ... & Maretti-da-Silva, M. Â. (2008). Device-associated infection rates in intensive care units of Brazilian hospitals: findings of the International Nosocomial Infection Control Consortium. *Pan American Journal of Public Health*, *24*(3).
26. Rosenthal, V. D., Maki, D. G., & Graves, N. (2008). The International Nosocomial Infection Control Consortium (INICC): goals and objectives, description of surveillance methods, and operational activities. *American journal of infection control*, *36*(9), e1-e12.
27. Wilde, M. H., McMahon, J. M., McDonald, M. V., Tang, W., Wang, W., Brasch, J., ... & Chen, D. G. D. (2015). Self-management intervention for long-term indwelling urinary catheter users: randomized clinical trial. *Nursing research*, *64*(1), 24.