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Original Research Article

Prevalence of microorganisms causing catheter associated urinary tract infections (CAUTI) among catheterised patients admitted in a tertiary care hospital

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ABSTRACT

Background: Catheter-associated urinary tract infection (CAUTI) is an important cause of morbidity and mortality in Indian subjects, affecting all age groups. Bacteriuria orcandiduria is almost inevitable in nearly half of the patients who require an indwelling urinary catheter for more than 5 days. The objective of this study was to find the prevalence of CAUTI infection and to determine their antibiotic profile
Methods: The present cross-sectional study included 50 patients admitted to medicine and surgery wards in our hospital. The urine from catheter is collected from each patient and subjected to culture and antibiotic susceptibility testing.
Results: The prevalence of catheter associated urinary tract infection in our hospital is about 20% and asymptomatic bacterial colonization is 50% which is nearequal to Danchaivijitr S et al study. The common pathogens found in this study are *Escherichia coli* (22%), *Klebsiella* (18%), *Enterobacter* (8%), *Staph. aureus* (6%) which include MRSA (4%), *Pseudomonas* (6%), *Enterococcus* (4%), *Candida sps.* (4%) *Andproteus* (2%).
Conclusions: CAUTI has low prevalence 20% and asymptomatic colonisation 50% in our hospital with common pathogen being *Escherichia coli.* It is one of the important notable pathogen causing nosocomial infection among admitted patients. The patients present mainly as asymptomatic bacterial colonisation and risk of CAUTI increases with longer duration of catheterisation. All patients those who had catheter for more than 6 days, aged 60 and above, should be checked for UTI symptoms. And their urine should be cultured regularly in order to diagnose and prevent CAUTI and its complications which are very dangerous and difficult to treat.

Keywords: Asymptomatic colonisation, CAUTI, UTI

INTRODUCTION

Catheter-associated urinary tract infection (CAUTI) is an important cause of morbidity and mortality in Indian subjects, affecting all age groups.[1] Bacteriuria or candiduria is almost inevitable in nearly half of the patients who require an indwelling urinary catheter for more than 5 days.[2,3] Asymptomatic bacteriuria constitutes a major pool of the antibiotic-resistant strains of pathogens in any hospital, with critical care units (CCUs)

accounting for the majority of them.[4,5] Nearly 25% of hospital patients will undergo urinary catheterization during their hospitalization and the challenges of CAUTI prevention in these patients can be difficult to overcome.[6] Although necessary in many acute care situations, inappropriate catheter use occurs in up to half of catheterized patients, the duration of catheterization remains the most significant factor in predicting CAUTI and each day of catheterization increases the risk of CAUTI by 3% to 10%.[7-9] Left undiagnosed and untreated, CAUTI increases the risk for complications and ultimately decreases the efficiency of health care delivery. Timely intervention is required to prevent complications such as cystitis, peri-uretheral abscess, prostatitis, epididymitis and acute or chronic pyelonephritis, bacteremia and urosepsis.[2,10]

Approximately 3% of all patients with a catheter develop bacteremia, which is serious and possibly life threatening complications.[9] Nearly about 18% of patients with urinary tract related bacteremia have hospital acquired UTI and death from urosepsis is more likely in patients with CAUTI than in community acquired.[11] This present study is undertaken to find out the prevalence of bacterial and fungal pathogens as a cause of CAUTI and antibiotic sensitivity pattern of bacterial isolates from the catheterized patients who are admitted in intensive care units and urology wards which guides for the effective management of such cases.

METHODS

Cross sectional study was design. The population of this study was 50 patients involve and duration of this study was August 2016 to September 2016.

Inclusion criteria

- Adult patients who are on continuous catheterization admitted in Intensive care units and urology wards regardless of associated signs and symptoms
- Duration of catheterization should be minimum 6 days.

Exclusion criteria

- Patients who already have sub-acute/chronic Urinary tract infections prior to admission
- Duration of catheterization less than 6 days
- Patients who has not given consent.

Collection and processing of samples

Clinical history of the patients comprising of signs and symptoms such as pain in flanks/perineal regions, fever, catheter obstruction if any are obtained from the patients. After obtaining proper consent, about 10 ml of Urine sample is aspirated from indwelling catheter near the urethral site under aseptic precautions from all the admitted patients (50). Processing of urine samples is carried out within 15 minutes of collection without any delay. Urine samples are centrifuged and the deposits are used for wet mount preparations which are subsequently examined microscopically for the presence of RBCs, Pus cells, bacteria and yeast cells.

Some portion of the centrifuged deposit is subjected for cultureof bacteria using Mac Conkey Agar and CLED agar media. A loopful of sample is inoculated into these media and the plates are kept for aerobic incubation at the temperature of 37^0C for overnight. On next day, the plates are examined under reflected light for the presence of lactose fermenting and Non-lactose fermenting colonies and the semi quantitative analysis of urine also determined based on the number of colonies grown. The colonies are picked up from the plates tested for biochemical reactions for the species level identification of bacteria. Antibiotic sensitivity of the isolates is carried out according to standard CLSI guidelines. About 4-5 colonies of similar types are picked up and inoculated on Muller Hinton agar for putting up antibiotic sensitivity testing. Zone of inhibition around the antibiotic discs are measured in mm and compared with standard sensitive and resistant pattern of isolates with CLSI guidelines.

First line antibiotics such as Ampicillin, Amikacin, Cotrimoxazole, Nitrofurantoin, ciprofloxacin/norfloxacin and Cefotaxime, Erythromycin, oxacillin and second line of Antibiotics such as Imipenem, Amoxyclav, Piperacillin, Tazobactam and Cefoperazonesulbactam are the panel of antibiotics subjected in this method.

Some portion of centrifuged deposit is utilized for the cultivation of fungal organisms using Sabouraud's Dextrose agar. Inoculated media are incubated for 48 hours at 37° C. The grown colonies are identified as Candida based on their morphology by Gram staining method. Germ tube test is also done to confirm the albicans group.

RESULTS

The present study was carried out from August 2016 to September 2016 in Department of Microbiology, Medicine and Surgery in our hospital. A total of 50 patients admitted in medicine and surgery wards were included in our study. The selection of population is shown in Table 1.

50 urine samples were collected and processed, out of which 30% (n=15/50) showed no growth. Remaining were identified as *Escherichia coli* 22%, *Klebsiellasps* 18%, *Enterobacter* 8% (n=4), *Staphylococcus aureus* 6% whichincludes MRSA 4%, *Pseudomonasaeruginosa* 6%, *Enterococcus* 4%, *Candidasps* 4% and *Proteus* 2% Figure 1 shows the overall percentage of growth obtained from culture with *E-coli* being highest followed by *Klebsiella*. Of these only 10 patients had urinary symptoms which is about 20% as shown in Table 2.

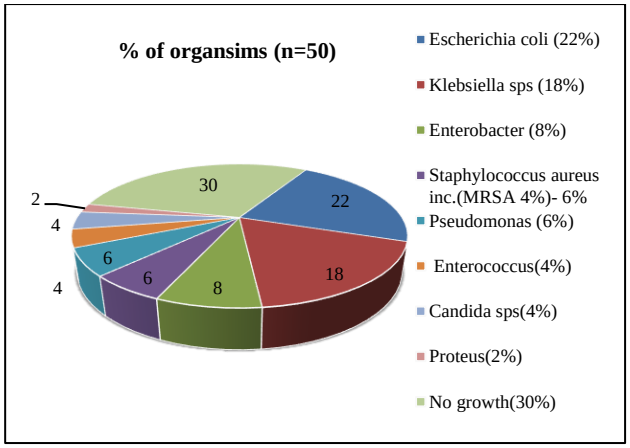

Figure 1: The overall percentage of growth obtained from culture with *E coli* being highest followed by *Klebsiella*.

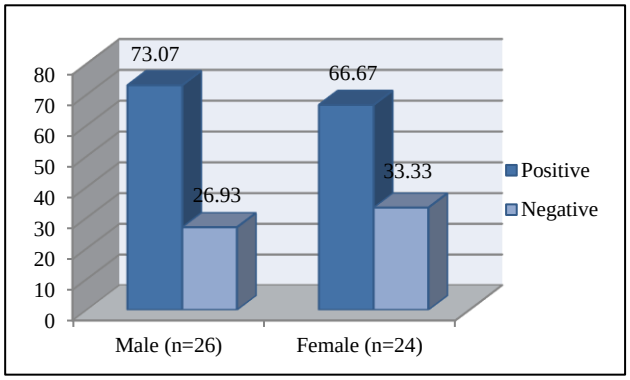

Figure 2: Male female ratio of growth.

Out of 26 males included in the study, 19 were positive for growth which is about 73.07%, while out of 24 females, 16 were positive for growth which is 66.67%. This shows males are affected more as shown in above Figure 2. In males, no. of organisms involved are higher including MRSA which reported in 2 cases and Escherichia coli being commonest among both sexes as shown in Table 2. Out of 29 patients who are aged 60 and above, 24 were positive for growth (82.75%) as shown in Table 3.

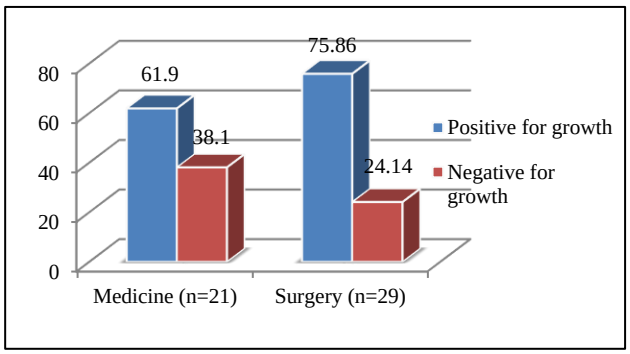

Figure 3: Highest incidence in surgery ward compared to medicine ward.

Table 1: Distribution of patients.

Distribution of patients	Percentage
Ward	
Medicine (21)	42%
Surgery (24)	58%
Duration of catheter	
6-9 days (35)	70%
10 and above (15)	30%
Sex	
Male (26)	52%
Female (24)	48%
Age	
20-39 (5)	10%
40-59 (16)	32%
60 and above (29)	58%

Table 2: Percentage of CAUTI in total 50 patients.

CAUTI	10 (20%)
Asymptomatic bacterial colonization	25 (50%)
No growth	15 (30%)

Table 3: Sex wise distribution of growth.

Sex	Growth	Frequency	Percentage
Male	*Escherichia coli*	4	15.4
	Klebsiella	5	19.2
	Staphylococcus aureus (inc.MRSA)	3	11.5
	Enterobacter	1	3.8
	Enterococcus	2	7.7
	Pseudomonas	2	7.7
	Proteus	1	3.8
	Candida	1	3.8
	No growth	7	26.9
	Total	26	100.0
Female	*Escherichia coli*	7	29.2
	Klebsiella	4	16.7
	Enterobacter	3	12.5
	Pseudomonas	1	4.2
	Candida	1	4.2
	No growth	8	33.3
	Total	24	100.0

In medicine, ward 21 urine samples were collected, of which 13 were positive for organism (61.90%) while in surgery out of 29 samples, 22 were positive for organism (75.86%) as shown in Figure 3. Further, MRSA isolates are obtained from 2 samples collected from medicine ward which is shown in Table 4.

Among 35 patients who were catheterized for 6 to 9 days, 21 were yielded organisms (60%), while among 15 patients who were catheterized 10 and above days, 14 yielded organisms (93.33 %) which are shown in Figure 4. Among 35 patients who were positive for culture

25(71%) were free from UTI symptoms like flank pain, fever and suprapubic tenderness. Remaining 10 patients (29%) had symptoms as shown in Figure 5. CAUTI is common among elders as shown in the Table 5. Figure 6 shows antibiotic sensitivity pattern of *Klebsiella* with 100% sensitive to nitrofurantoin and 77.78% resistant to nalidixic acid and Figure 7 shows antibiotic sensitivity pattern of *E-Coli* with 100 % resistant to cefuroxime and norfloxacin.

Table 4: Ward wise distribution of growth.

Ward	Growth	Frequency	Percentage
Medicine	*Escherichia coli*	4	19.0
	Klebsiella	2	9.5
	Enterobacter	2	9.5
	Pseudomonas	2	9.5
	Candida	1	4.8
	Nil	8	38.1
	MRSA	2	9.5
	Total	21	100.0
Surgery	*Escherichia coli*	7	24.1
	Klebsiella	7	24.1
	Staphylococcus aureus	1	3.4
	Enterobacter	2	6.9
	Enterococcus	2	6.9
	Pseudomonas	1	3.4
	Proteus	1	3.4
	Candida	1	3.4
	No growth	7	24.1
	Total	29	100.0

Table 5: Age wise data of CAUTI (n=10).

Age	Percentage
20 - 40	0 (0%)
40 - 60	3 (30%)
60 and above	7 (70%)

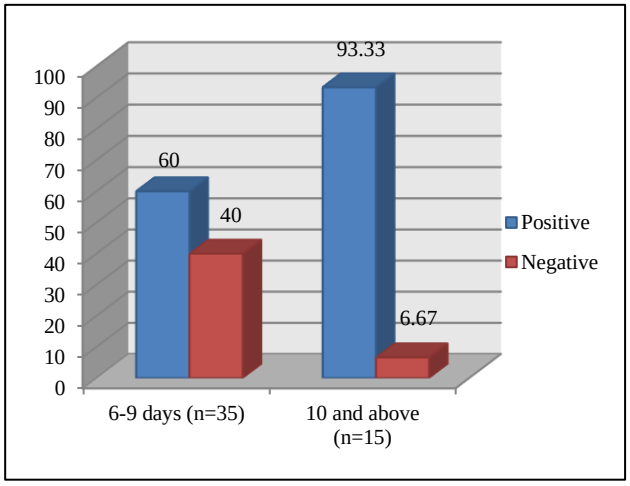

Figure 4: Relation between duration of catheter in days and organisms isolated.

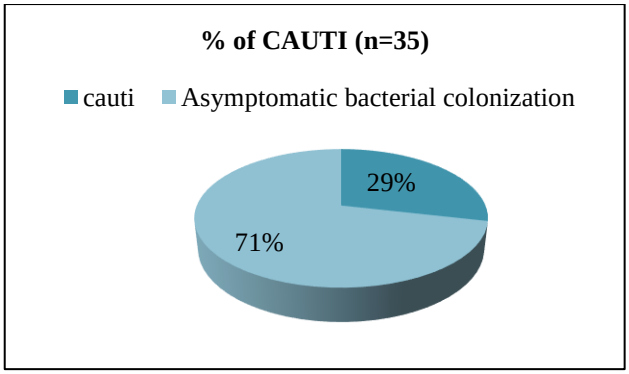

Figure 5: 71% of patients are asymptomatic.

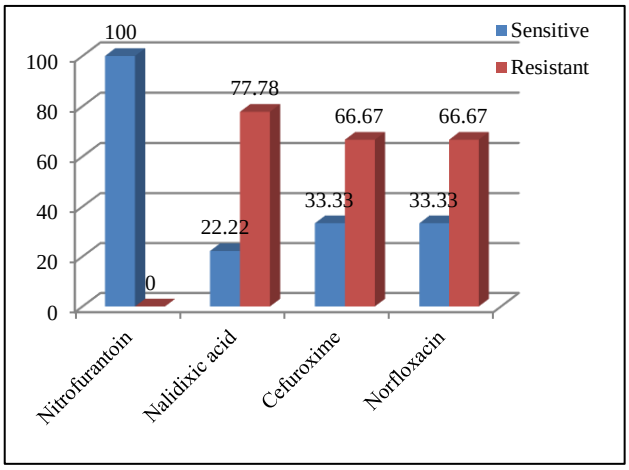

Figure 6: Antibiotic sensitivity pattern of *Klebsiella* with 100% sensitive to nitrofurantoin and 77.78% resistant to nalidixic acid.

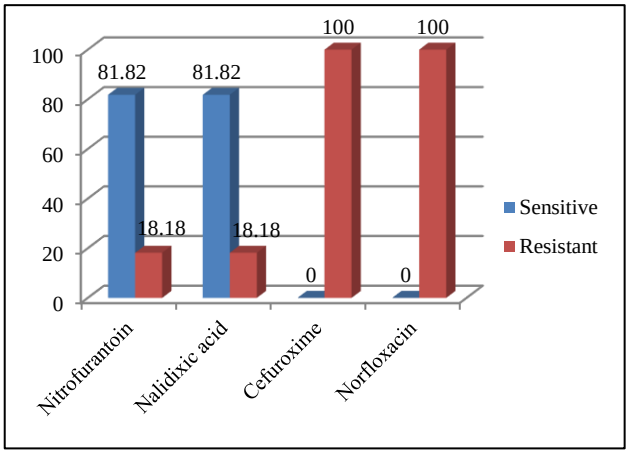

Figure 7: Antibiotic sensitivity pattern of *E Coli* with 100% resistant to cefuroxime and norfloxacin.

DISCUSSION

The prevalence of catheter associated urinary tract infection in our hospital is about 20% and asymptomatic bacterial colonization is 50% which is near equal to Danchaivijitr S et al study.[12] The common pathogens

found in this study are *Escherichia coli* (22%), *Klebsiella* (18%), *Enterobacter* (8%), *Staph. aureus* (6%) which include MRSA (4%), *Pseudomonas* (6%), *Enterococcus* (4%), *Candida sps* (4%) and *Proteus* (2%). This finding is similar to the study conducted by NHSN which also shown the *Escherichia coli* (21%) to be the common pathogen.[13] This data strongly proves that CAUTI is one of the important nosocomial infections.

Rise in increasing of CAUTI in critical care units is mainly because of not adopting meticulous aseptic precaution during catheter insertion, infrequent change of catheter and improper catheter care.[14] Male are affected more (73.07%) than females (66.67%) because many are affected by benign prostatic hypertrophy which contrary to other studies which shows females are affected more may due to lesser sample size in our study.[14,15] No. of patients positive for culture in the surgery ward is higher (75.86%) compared to those in medicine ward (61.90%). Elderly patient is affected higher by CAUTI and asymptomatic bacterial colonization (82.75%) compared to young which indicates increasing age is a risk factor.

Further 60% of patients with catheter 6 to 9 days, while 93.33% of patients with catheter above 10 days had organisms in their urine which clearly shows risk of developing CAUTI and asymptomatic bacterialcolonizationincreases with days of catheterization. So that unnecessary catheterization should be avoided wherever possible short term catheterizations must be done.

In study conducted by Tambyah PA and Maki DG shows 90% of patients positive for culture were asymptomatic.[16] Similarly, in our study also 71% of patients are asymptomatic. Targets are asymptomatic but have high potential more complications than the non-catheterized patients which necessitate repeated urine sample analysis. Our study has shown sensitive pattern of *E-Coli* to nitrofurantoin is about 81.82% and high level resistance noticed with drugs such as cefuroxime and norfloxacin, which are similar to that of Tandogdu et alstudy.[17] MRSA had been isolated from 2 samples. Surprisingly no ESBL, VRE isolates were reported.

CONCLUSION

CAUTI has low prevalence 20% and asymptomatic colonization 50% in our hospital with common pathogen being *Escherichia coli*. It is one of the important notable pathogen causing nosocomial infection among admitted patients. The patients present mainly as asymptomatic bacterial colonization and risk of CAUTI increases with longer duration of catheterizations. All patients those who had catheter for more than 6 days, aged 60 and above, should be checked for UTI symptoms. And their urine should be cultured regularly in order to diagnose and prevent CAUTI and its complications which are very dangerous and difficult to treat.

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REFERENCES

1. Jaggi N, Sissodia P. 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. J Clin Diagn Res. 2012;6:1372-6.
2. Kunin CM. Care of the urinary catheter. In: Urinary Tract Infections: Detection, prevention and management. 5th ed. Philadelphia, Pa: Lippincott Williams and Wilkins; 1997:227-79.
3. Stamm WE. Catheter-associated urinary tract infections: Epidemiology, pathogenesis and prevention. Am J Med. 1991;91Suppl 3B:65-71S.
4. Silver SA, Baillie L, Simor AE. Positive urine cultures: A major cause of inappropriate antimicrobial use in hospitals. Can J Infect Dis Med Microbiol. 2009;20:107-11.
5. Leone M, Perrin AS, Granier I, Visintini P, Blasco V, Antonini F, et al. A randomized trial of catheter change and short course of antibiotics for asymptomatic bacteriuria in catheterized ICU patients. Intensive Care Med. 2007;33:726-9.
6. Saint S. Clinical and economic consequences of nosocomial catheter-related bacteriuria. Am J Infect Cont. 2000;28(1):68-75.
7. Gokula RR, Hickner JA, Smith MA. Inappropriate use of urinary catheters in elderly patients at a midwestern community teaching hospital. Am J Infect Cont. 2004;32(4):196-9.
8. Beaujean DJ, Blok HE, Vandenbroucke-Grauls CM, Weersink AJ, Raymakers JA, Verhoef J. Surveillance of nosocomial infections in geriatric patients. J Hospital Infect. 1997;36(4):275-84.
9. Saint S, Lipsky BA, Goold SD. Indwelling urinary catheters: a one-pointrestraint? Ann Intern Med. 2002;137(2):125-7.
10. Smith J. Indwelling catheter management: From habit-based to evidence-based practice. Ostomy Wound Management. 2003;49:34-45.
11. Kang CI, Chung DR, Son JS, Ko KS, Peck KR, Song JH, et al. Korean network for study of infectious diseases. Clinical significance of nosocomial acquisition in urinary tract-related bacteremia caused by gram-negative bacilli. Am J Infect Cont. 2011;39(2):135-40.
12. Danchaivijitr S, Dhiraputra C, Cherdrungsi R, Jintanothaitavorn D, Srihapol N. Catheter-associated

urinary tract infection. J Med Assoc Thai. 2002;88(Suppl 10):S26-30.
13. Hidron AI, Edwards JR, Patel J. NHSN annual update: antimicrobial-resistant pathogens associated with healthcare-associated infections: annual summary of data reported to the national healthcare safety network at the centers for disease control and prevention, 2006-2007. Infect Control Hosp Epidemiol. 2008;29(11):996-1011.
14. Greene L, Marx J, Oriola S. Guide to the elimination of catheter-associated urinary tract infections (CAUTIs). The Association for Professionals in Infection Control and Epidemiology (APIC) Washington, DC; 2008.
15. Nicolle LE. Catheter-related urinary tract infection. Drugs and Aging. 2005;22(8):627.
16. Tambyah PA, Maki DG. Catheter-associated urinary tract infection is rarely symptomatic: a prospective study of 1,497 catheterized patients. Arch Intern Med. 2000;160:678-82.
17. Tandogdu Z, Wagenlehner FM. Global epidemiology of urinary tract infections. Curr Opin Infect Dis. 2016;29(1):73-9.

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