Original Research Article

Study of incidence and risk factors of urinary tract infection in catheterised patients admitted at tertiary care

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ABSTRACT

Background: Catheter-associated urinary tract infections (CAUTIs) are the most common nosocomial infection and a leading cause of morbidity and mortality in hospitalized patients. The aim of this study was to determine the incidence and risk factors of urinary tract infection in catheterised patients in a tertiary care hospital.

Methods: Total of 200 patients above 16 years in whom an indwelling Foley's catheter inserted were taken in the study. A urine specimen was obtained aseptically and culture done on nutrient agar, sheep blood agar and MacConkey agar plates. After incubation of 24 hours, colony count done for organisms showing growth and colony count ≥105 was taken significant.

Results: The incidence of CAUTI in the present study was 31%. Higher incidence of CAUTI (56.46%) was found in female sex as compared to males (43.54%). Incidence of CAUTI was found higher in first weeks (54.83%). Incidence among diabetes patients is found more (63.33%). Most common isolate found was *E. coli* (38.71%) among all uropathogens. Uropathogens isolated from CAUTI are more resistant to antimicrobials.

Conclusions: It is must to implement following strategy for reducing the risk of infection due to indwelling catheters: 1. reducing the duration of catheterization 2. Use antibacterial substance coated catheter 3. Strict infection control measures.

Keywords: CAUTI, Incidence Nosocomial

INTRODUCTION

Catheter-associated urinary tract infections (CAUTI) remain the most common nosocomial infection, accounting for more than 40% of infections reported by acute care hospitals and 34% in nursing homes.[1-3] CAUTI has been a leading cause of morbidity and mortality in hospitalized patients.[4] The normal mechanical wash-out effect of the urinary stream is interrupted when there is a urinary catheter. For this reason, micro-organisms that enter the catheterized urinary tract are able to multiply to dangerous levels in as short a time as one day.[5] Aim of this study was to determine the incidence and risk factors of urinary tract infection in catheterized patients in a tertiary care hospital.

METHODS

This study was conducted at the bacteriology laboratory, in a tertiary care hospital, SBHGMC Dhule, Maharashtra India from August 2015 to December 2016 after the permission of respective authorities. All Adult patients having indwelling catheter inserted after admission at the Medical Intensive care unit, Gynecology Ward of tertiary care Hospital were recruited for this study. Total of 200 patients above 16 years in whom an indwelling catheter inserted were taken in the study. Collection of urine

sample was done at the time of development of any symptoms like fever, suprapubic tenderness or costovertibral angle tenderness or any other related to UTI. A urine specimen was obtained by aseptically aspirating the clamped and disinfected catheter with a sterile syringe. Urine mixed well by inverting the container many times, a standard calibrated sterile chromium loop (1mm) delivered 0.001ml of uncentrifuged urine was used to inoculate a nutrient agar, sheep blood agar and MacConkey agar plates. These plates were incubated aerobically at 37°C for 18-24 hours. On the next day, colony count done for organisms showing growth and colony count ≥105 was taken significant. Microorganisms isolated were identified according to colonial morphology, gram-stain reaction and biochemical tests and after that antimicrobial susceptibility testing was done.

RESULTS

Out of 200 urine samples, 62 samples were found culture positive (≥105cfu/ml) for microorganisms and other samples were negative or normal flora.

Table 1: Ward wise positive samples.

Ward	Total samples	Positive samples
ICU	140	43 (30.71%)
Medical ward	30	10 (33.33%)
Gynecology ward	30	9 (30%)

Highest urinary tract infection rate was found in ICU ward, which is 33.33 % followed by medical wards (30.71%) and Gynecology ward (30%). Overall incidence was found as 31%. Out of 62 positive samples, 16 (25.80%) samples were from age group 16-30 years, and 25 (42.32%) samples were from age group 31-50 years, 19 (30.64%) samples from age group 51-70 years and 2 (3.07%) samples from age group more than 70 years of age. The incidence of CAUTI was higher in the first week (54.83%), followed by second week (32.26%) and third week (12.91%). In first week, 8.06% patients developed bacteriuria within 2 days while 19.35% patients developed bacteriuria between 3-4 days and 27.42 % patients developed bacteriuria between 5-7 days.

Table 2: Different organism isolated in percentage.

Organism	Total Isolates	Percentage
ICU	140	43 (30.71%)
E. coli	24	38.71%
Pseudomonas spp.	13	20.97%
Klebsiella spp.	11	17.74%
Acinetobacter	4	6.45%
Candida spp.	3	4.84%
Proteus mirabilis	5	8.06%

Out of total 62 positive samples, 27 (43.54%) were male patients and 35 (56.46%) were female. Total 30 out of

200 patients having diabetes mellitus, out of which 19 (63.33%) patients developed UTI and 11 (36.66%) patients did not develop UTI. In case of non-diabetes patients 43 (25.29%) patients developed UTI and 127 (74.70%) patients did not develop UTI.

Most common organism isolated is *Escherichia coli* (38.71%) among all isolates. After *E. coli* second most common isolate is pseudomonas species (20.97%). After that Klebsiella species (17.74%), *Proteus mirabilis* (8.06%), Acinetobacter (6.45%), Candida species (4.84%) and Enterococcus species (3.23%).

In case of enterobecteriaceae highest resistance was found to cefaclor (84.09%) and cotrimoxazole (80%) followed by polymyxin B (22.72%) and levofloxacin (13.63%). Among *Enterobacteriaceae* 79.54 % isolates were extended spectrum β lactamase producers. 40.90% isolates were found Amp c positive. In case of *E. coli* highest resistance was found to cefaclor (87.50%) and co-trimoxazole (87.50%), followed by cefotaxime (83.33%) and cefipime (70.83%). Lowest resistance was found to levofloxacin (8%) and imipenem (16.66%). Out of 24 isolates, 20 (83.33%) isolates of *E. coli* were found extended spectrum β lactamase producers. Four isolates (16.66%) of *E. coli* were found multidrug resistant.

In pseudomonas species highest resistance was found against tobramycin (92.30%) while lowest against polymyxin B (15.38%). In case of antipseudomonal cephalosporins like ceftazidime and cefaperazone, resistance was found 69.23%. All imipenem resistant isolates of pseudomonas species were found carbapenemase producers. In case of enterococcus, all isolates were found susceptible to linezolid, levofloxacin, chloramphenicol and teicoplanin and vancomycin.

DISCUSSION

In present study, incidence of urinary tract infection in ICU was found as 30.71%. In medicine and gynecology ward 33.33% and 30% respectively. Overall 31% incidence of CAUTI was found in present study. Study by Lu CC et al, Taiwan in 2000 has found overall incidence of UTI 57% in catheterized patients.[6] Danchaivijitr S et al, found that incidence of CAUTI was 73.3% in their study.[7] Billote-Domingo K et al, reported 51.4% incidence of urinary tract infection in catheterized patients in 1998.[8] Incidence of CAUTI in our study was found less than other compared studies. Possible reason for that may be increased use of systemic antimicrobials active against urinary pathogens, increased attention to avoid unnecessary medical devices and attention to hand washing among staff and doctors, use of gowns and gloves by health care workers, proper environmental decontamination by effective disinfectants.

The incidence of CAUTI was higher in the first week (54.83%), followed by second week (32.26%) and third week (12.91%). In first week, 8.06% patients developed

bacteriuria within 2 days while 19.35% patients developed bacteriuria between 3-4 days and 27.42 % patients developed bacteriuria between 5-7 days. Present study shows that maximum incidence (54.83%) of bacteriuria occurs during first week of catheterization. This finding is also comparable with the Study conducted by Billote-Domingo K et al, (58.20%) and Danchaivijitr S et al (51.35%).[7,8] In second week incidence decreased to 32.26% in present study and 30.90% in study by Billote-Domingo et al and 37.84% in study by Danchaivijitr S et al.[7,8] Out of total 62 positive samples, 27 (43.54%) were male patients and 35 (56.46%) were female This shows higher incidence of Cauti in female patients. This indicates that females are more susceptible to Cauti than male. Higher incidence of Cauti in female patients is comparable with the Study conducted by Billote-Domingo K et al and Danchaivijitr S et al.[7,8] This increased risk in women is likely to be due to easier access of the perineal flora to the bladder along the outside of the catheter as it traverses the shorter female urethra. In addition, a woman's urethra is closer to anus. This makes it easier for bacteria to spread into her urethra and cause an infection. Rosser and colleagues retrospectively reviewed 126 trauma ICU patients with sepsis and found that increased length of stay, length of catheterization, and age (more than 60 years) were independent factors associated with the development of nosocomial UTI.[9]

Total 30 out of 200 patients having diabetes mellitus, out of which 19 (63.33%) patients developed UTI and 11 (36.66%) patients did not develop UTI. In case of non-diabetes patients 43 (25.29%) patients developed UTI and 127 (74.70%) patients did not develop UTI. This indicates that diabetes is significant risk factor for catheter associated urinary tract infection. A Nested case-control study in a multicenter cohort conducted by Christophe C et al, also found that diabetes is a risk factor for CAUTI.[10] Billote-Domingo K et al, noted that out of 32 patients having diabetes mellitus 24 (75%) patient developed urinary tract infection as compared to 86 (47.25%) out of 182 non diabetes patients.[8]

In present study *E. coli* (38.71%) was found the most common isolate among all microorganisms isolated. Laupland K et al, in 2000 found *E. coli* 23%, Johnsen TEB et al, found *E. coli* 31%, Billote-Domingo K et al, found *E. coli* 22.30% and Danchaivijitr S et al, has found *E. coli* 15.10%.[7,8,11,12] After *E. coli, Pseudomonas* (20.97%) was second most common isolate. Study by Laupland K et al and Johnsen TEB et al, also shows *Pseudomonas* as second most common uropathogen with isolation rate 10% and 13% respectively.[11,12] Isolation rate of *Enterococcus*, 3.26% of present study is comparable with study of Billote-Domingo K et al, and Danchaivijitr S et al, showing isolation rate of 7.40% and 12.60% respectively.[7,8]

Uropathogens isolated from CAUTI are more resistant to antimicrobials compared with community acquired ones.[13-15] Eradication of these micro-organisms in the presence of urethral catheter is difficult and is often impossible due to antimicrobial resistance and the presence of biofilm on the inner surface of the catheter.[4,14,16] Resistance to antimicrobial agents has been noted since the first use of these agents and is an increasing world-wide problem.[17]

In present study, 87.5% isolates of *E. coli* were resistant to cefaclor and 83.33% isolates were found resistant to cefotaxime. This higher resistance to cephalosporins is comparable with study done by Hasan AS et al, found 95.2% and 71.4% resistance to cefaclor and cefotaxime respectively.[18] There was more resistance found to co-trimoxazole in present study (87.5%) which is comparable with Study done by Johansena TEB et al (88%).[12]

Pseudomonas was 2nd most common isolate in present study. In present study pseudomonas was found 69.23% resistant to both ceftazidime and cefaperazone. Study conducted by Wazait HD et al, in 2001 reported 0.90% and by Patel MH et al, in 2010 reported 34% resistant to ceftazidime.[18,19] This shows that resistance among pseudomonas species has increased more over last 10 years. Highest resistance was found to aminoglycosides (tobramycin) 92.30%. Study by Billote-Domingo K et al, in 1998 reported 75% pseudomonas isolates were resistant to tobramycin.[8] Lower resistance was found to polymyxin B (15.38%) and imipenem (23.07). 30.76% isolates of pseudomonas were found multi drug resistant. Sharma J et al, in 2010 reported 71.7% multi drug resistant pseudomonas in urinary tract infection.[20] Related to many other studies, here much higher resistance pattern was observed. The above difference may be due to the variations in the hospital environmental conditions.[21,22]

CONCLUSION

This study identified three risk factors associated with CAUTI: female gender, diabetes mellitus and duration of catheterization. Since the first two are unalterable host factors, emphasis should be made on reducing the duration of catheterization. Another possible strategy for reducing the risk of infection due to indwelling (i.e. urethral or suprapubic) catheters is to use catheters coated with an antibacterial substance.

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