



Original Research Article

Catheter Associated Urinary Tract Infection (CAUTI)– Incidence and Microbiological Evaluation in a Tertiary Care Hospital in Kota Region, an ICU Based Study

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Abstract

Background: Catheter-associated urinary tract infections (CAUTIs) are the most common nosocomial infection affecting all age groups and are a leading cause of morbidity and mortality in hospitalized patients. The etiological agents are often multidrug resistant.

Objectives: 1. To find the incidence of CAUTI in intensive care unit (ICU) patients. 2. To identify etiological agents responsible for CAUTI. 3. To determine antimicrobial susceptibility pattern for bacterial agents obtained.

Methods: Urine samples from 210 clinically suspected cases of CAUTI were obtained from patients with urinary catheters admitted in ICUs. Urine samples were subjected to wet mount, culture and sensitivity testing. Responsible pathogens and their antimicrobial susceptibility pattern were obtained based on CSLI standards.

Results: The incidence of CAUTI in the present study was 16%. Higher incidence of CAUTI (55%) was found in male sex as compared to females (45%). Incidence of CAUTI was found higher as the days of catheterisation increased. Most predominant etiological agents responsible for CAUTI were *E.coli* (69.69%) followed by *klebsiella* species (15.15%). 25% isolates among *Enterobacteriaceae* were ESBL producing. Uropathogens isolated from CAUTI are more resistant to antimicrobials.

Conclusions & Prevention: It is must to implement following strategy for reducing the risk of infection due to indwelling catheters: 1. reducing the duration of catheterization 2. early removal of catheters, 3. aseptic insertion 4. maintenance of a closed urinary drainage system. 5 Strict infection control measures.

Introduction

The term “catheter fever” was used for the first time in 1883^[1] and it has been 50 years since Beeson, et al., recognized the potential harms arising from urethral catheterization and penned an editorial to the American Journal of Medicine

titled “The case against the catheter”^[2]. Urinary tract infections (UTIs) are the most common type of nosocomial infections encountered in healthcare facilities accounting for 30-40% of nosocomial infections.^[3,4] 80% of nosocomial UTI are associated with an indwelling urinary

catheter ie catheter-associated infections (CAUTIs). 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%.^[6,7] 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-urethral abscess, prostatitis, epididymitis and acute or chronic pyelonephritis, bacteremia and urosepsis.^[8]

Nearly 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.^[5,9] 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

A present study was a prospective study, conducted at Microbiology department, New Hospital Medical College, Kota, Rajasthan for a period of 6 months (January 2019 to June 2019) after ethical permission (Number F3()/acad-2/2019/1706). The study population was 210 ICU inpatients catheterized by indwelling urinary catheter. Urinary catheter care bundle was implemented among all catheterized patients as per healthcare infection control practices advisory committee guidelines^[5]

Inclusion criteria- Patient must meet 1, 2 and 3 below

1. Patient had an indwelling urinary catheter that had been inserted after admission & is in place for > 2 days after admission, either: Still present on the date of event or removed the day before the date of event.
2. Patient has at least one of the following signs or symptoms: •fever (>38.0°C)

•suprapubic tenderness •cost vertebral angle pain or tenderness •urinary urgency •urinary frequency •dysuria

3. Patients who has given consent

Exclusion Criteria

1. Patients who already have sub-acute/chronic Urinary tract infections prior to admission
2. Patients who has not given consent.

Collection and Processing of Samples

Clinical history comprising of signs and symptoms such as fever, suprapubic tenderness, costovertebral angle tenderness or any other related to UTI is obtained from the patients. After obtaining proper consent, about 10 ml of Urine sample is aspirated from indwelling catheter near the urethral site/ sampling port, under aseptic precautions which was transported to the microbiology laboratory for immediate processing.

Processing of specimens in laboratory: The urine samples were subjected to direct wet mount and culture using semi-quantitative standard loop technique.^[10] Inoculation was done on MacConkey agar and blood agar. 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 $\geq 10^5$ was taken significant. Discrete bacterial isolates thus obtained were subjected to Gram staining, hanging drop preparation, other necessary tests including biochemical tests for further identification. The species identification of bacterial and fungal isolates was done based on standard laboratory procedures^[11]. Kirby-Bauer disc diffusion method was adopted for antimicrobial susceptibility testing using appropriate antimicrobial discs as per CLSI guidelines.^[12]

Results

A total 210 urine sample from catheterized patients were obtained. Of the total 210 patients 121 (57%) were male and 89 (42%) were female patients. Coming to microscopic examination, out

of 210 urine samples, 33 samples showed the evidence of pus cells and or micro-organisms. Following the culture ,170 (81%) was sterile and 33(16%) samples showed growth of which 31 were bacterial and 2 showed fungal growth. 7 samples have shown insignificant growth on culture.

Off the 31 bacterial isolates, most common isolate was *E. coli* in 23 (74%) cases, followed by *Klebsiella* species in 5 (17%) cases. Other Gram-negative bacteria such as, *Acinetobacter* were found in 2(6%) cases & among gram positive bacteria, *Enterococcus* spp. was seen in 1 (3%) cases. The 2fungal isolates obtained were *Candida albicans*. (Table 1)

Table 1: spectrum of isolates obtained in CAUTI

S.No	Organism	No of isolates
1	<i>E.coli</i>	23
2	<i>Klebsiella Sp.</i>	5
3	<i>Acinetobactor</i>	2
4	<i>Enterococcus</i>	1
5	<i>Candida albicans</i>	2
Total		33

Table 2 shows that the incidence of UTI was significantly higher as the days of catheterization increased.

Table 2

No of days of catheterisation	Presence of UTI
2-4	4
5-7	8
7-14	21
Total	33

In our study, males (55%) have more incidence of CAUTI as compared to females (45%).

Age distribution in CAUTI confirmed cases is shown in figure 1

Figure 1

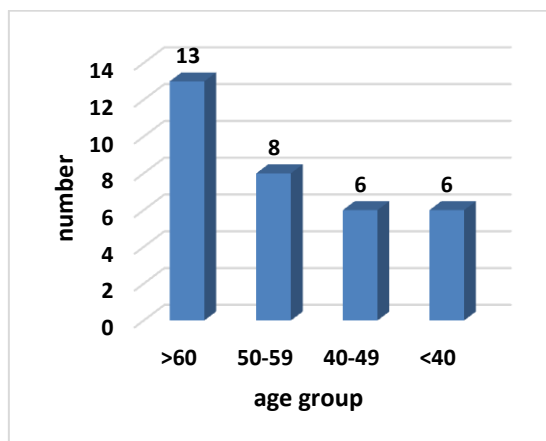


Table 3: Antimicrobial susceptibility pattern of Enterobacteriaceae

Antimicrobial drug	Sensitive	Intermediately sensitive	Resistant
Ampicillin/sulbactam	6	4	18
Amoxicillin/clavulanic acid	9	2	17
Azithromycin	5	-	23
Cefoperazone/sulbactam	13	-	15
Ceftazidime	20	1	7
Ceftazidime/Clavulinic acid	28	-	-
Colistin	25	1	2
Cotrimoxazole	8	1	19
Gentamicin	15	1	12
Imipenam	13		15
Netilmicin	18	1	9
Nitrofurintoin	20	4	4
Norfloxacin	5		23
Piperacillin/Tazobactam	10		18

Table 3 shows high level of resistance of to commonly used drugs for UTI such as norfloxacin (82%), azithromycin (81%), ceftazidime (68%), cotrimoxazole (68%) and piperacillin-tazobactam (64%). Among Enterobacteriaceae 25% isolates were extended spectrum β lactamase producers. Colistin was preserved as a reserve drug.

Table 4: Antimicrobial susceptibility pattern of nonfermenting bacteria (acenetobactor)

Antimicrobial drug	Sensitive	Intermediately sensitive	Resistant
Ampicillin/sulbactam	1		1
Cefepime	1		1
Cefotaxime			2
Colistin	1	1	
Ceftazidime/tazobactam	1		
Ciprofloxacin			2
Cotrimoxazole	1		
Gentamicin	1		1
Meropenem	1	1	
Norfloxacin	1		1
Nitrofurantoin			2
Piperacillin/Tazobactam	2		

Antimicrobial pattern of acinetobactoris shows that most effective antibiotic was piperacillin/tazobactam (100% sensitive) and least effective antibiotic agents were cefotaxime, nitrofurantoin & ciprofloxacin.

Table 5: Antimicrobial susceptibility pattern of *Enterococcus* species

Antimicrobial drug	Sensitive	Intermediately sensitive	Resistant
Ampicillin	-	-	1
Ciprofloxacin	-	-	1
Doxycycline	-	-	1
Fosfomycin	-	-	1
Gentamicin	-	-	1
Levofloxacin	1	-	-
Linezolid	1	-	-
Nitrofurantoin	1	-	-
Vancomycin	1	-	-

Enterococcus species isolate was sensitive to linezolid, vancomycin, levofloxacin and nitrofurantoin. Vancomycin was preserved as a reserve drug.

Discussion

CAUTI is the common HAI among ICU patients. Several risk factors are associated with the development of CAUTI which include prolonged intra urinary catheter dwell time, lengthy hospital stay, female gender, neurological issues and comorbid conditions in critical care patients.^[13]

Overall 16% incidence of CAUTI was found in present study. Study by Kakaria BA et al in Maharashtra, 2018 has found overall incidence of UTI 31% in catheterized patients.^[14] Vinoth M et al., found that incidence of CAUTI was 20% in their study.^[15]

Incidence of CAUTI in our study was found comparatively less than other studies. Possible reason for that may be strict adherence to hand hygiene among staff and doctors, proper implementation of catheter care bundle, increased attention to avoid unnecessary urinary catheterization, wherever possible short term catheterizations was done, use of gowns and gloves by health care workers & proper environmental decontamination by effective disinfectants.

As advancing age is one of the predisposing host factors for development of CAUTI, the largest age group included in our study is > 60 years of age (40%) while 24% of the patients were between 50 - 60 years of age (Fig. 1).

Usually female gender is another significant risk factor in many studies. The increased risk among women is probably due to anatomic makeup (ie short length urethra, approximation of urethral and anal opening) causing an easier access of the perineal flora to the bladder along the catheter^[13] However, in our study males were predominantly affected. This might be due to multiple factors. A higher number of male samples are received as compared to female samples. Also most of the cases in our study are of advanced age and male are prone to obstructive urinary lesion especially from benign prostate hypertrophy, Ca prostate and stricture associated with advanced age.

In the present study, among total CAUTI patients, 12% of patients were catheterised for 2-4 days duration, 24% have catheter from 5 to 7 days and 64% have catheterisation from 1 to 2 weeks. This clearly shows risk of developing CAUTI increases with days of catheterization. This is similar to the study done by Sangamithra et al (2017)^[16] and Vinoth M et al., (2017).^[15] So, unnecessary catheterization should be avoided wherever possible short term catheterizations must be done.

In present study *E. coli* (69%) was found the most common isolate among all microorganisms isolated. Kakaria et al (40%), Sanghmitra et al (36%) also found *E. coli* as most isolated organism^[14,16]. After *E. coli*, *klebsiella* species (16%) was second most common isolate. Study by kakaria et al also shows *klebsiella* as second most common uropathogen with isolation rate 18% [18%].

Both commensal and uropathogenic *E. coli* (UPEC) strains colonize the large intestines of humans but UPEC strains primarily causes UTI. The reason for *E. coli* being the most common isolate in CAUTI is presence of several virulence factors like mannose-resistant hemagglutinins, P fimbriae, adhesins, biofilm formation, hemolysin, K antigens, and aerobactin^[17].

The high resistance rate among the isolates observed in our study may be part due to the design of our study as it involve patients from

ICUs. These patients generally undergo various empiric antimicrobial treatment and are, therefore, prone to develop infections by multidrug resistant pathogens.

Conclusion & Prevention

CAUTI has low prevalence 16% in our hospital with most common pathogen being *Escherichia coli*. The risk of CAUTI increases with advancing age, longer duration of catheterizations. Prevention is the main step against CAUTI. Emphasis should be made on appropriate use and early removal of catheters, aseptic insertion, the maintenance of a closed urinary drainage system. Hand washing should be done immediately before and after manipulation of catheter site or apparatus. The catheter should be inspected frequently to ensure there is no obstruction to flow of urine. Usage of antimicrobial agents in suspected cases of CAUTI may be withheld in ICUs till microbiology reports are made available unless absolute need for empirical therapy is required in order to avoid emergence of resistant strains. Hospital-wide surveillance program and appropriate catheter care protocols should be developed and implemented from evidence based protocol. Emphasis should always be given on good catheter management rather than use of prophylaxis to reduce incidence of CAUTI

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