Original article

Indwelling catheter associated urinary tract infection

C. M. Poudel, G. Baniya, B. M. Pokhrel

Department of Internal Medicine and Department of Microbiology, TUTH

Correspondence to: Dr. Chandra Mani Poudel, Department of Internal Medicine, TUTH

e-mail: Chandra_poudel@yahoo.com

Background: The objective of the study is determined the microbiological profile and the resistance pattern of the strains causing Foley's Catheter Associated Urinary Tract Infection.

Materials and methods: It was a prospective study conducted in catheterized patients admitted in medical ward in Tribhuvan University Teaching Hospital (TUTH). A total of 100 adult patients above 16 years in whom an indwelling Foley's catheter inserted for short to intermediate term purpose were taken in the study. Quantitative culture of urine sample was done at the time of catheterization and was repeated on 3rd-5th day, 7th day, 10th day, 14th day and then every weekly until catheter removal or patient develops bacteriuria or until discharge of the patient at Microbiology Department Laboratory TUTH. Three ml of urine specimen were obtained aseptically and were sent to laboratory within 1 hour of collection. Antibiotic sensitivity test was done by Disk-Diffusion Technique.

Results: The most common organism causing CAUTI was found to be *E.Coli* in 40% of cases, followed by *Klebsiella, Enterococcus, Streptococcus faecalis, Pseudomonas, Staphylococcus aureus, Acinetobacter sp.and multiple bacteria.* Ninety percent of *E. coli* isolates tested were found to be resistant to Amphicillin, Ciprofloxacin and Cephalexin, 86% were resistant to Cotrimoxazole, Coamoxiclav, 68% to Gentamycin, 41% to Ceftazidime, 36.4% to Amikacin, 22% to Nitrofurantoin, 9% to Piperacillin and non of them were resistant to Imepenem.

Conclusion: *E. coli* was the most common organism causing CAUTI. *E. coli* was found to be resistant to most of the antibiotics. The organism was not resistent to Imepenem.

Introduction

CAUTI is a nosocomial type of infection. In the United States, such infection occurs in about 5% of patients admitted in acute-care hospitals.[1] About 80% of nosocomial UTI are associated with the use of urethral catheters.[2] Fifteen to twenty five percent of patients in US general hospitals may have a catheter inserted sometime during their hospital stay.[3] Although, at times, the catheter is indispensable for therapy and there are definite indications for its use, it is often overused in most institutions. The initial indication for the placement of catheter was found to be unjustified in 21% of cases while the continued catheterization was unjustified in 47% of the cases studied in one of the US hospitals.[4] Factors associated with an increased risk of CAUTI include female sex, prolonged catheterization, severe underlying illness, disconnection of catheter and drainage tube, other faulty catheter care, and lack of systemic antibiotic therapy.[5] Despite closed sterile drainage system and aseptic insertion of the catheter, which significantly reduces the incidence of CAUTI, 1% to 48% of hospitalized patients with indwelling catheters still acquire the infection.[3] The incidence of bacteriuria rises from 0.5 to 1% for a single "in-and-out" catheterization to 10 to 30% for catheters in place for up to 4 days and up to 95% for catheters in place for 30 days or more.[6] The incidence of bacteriuria in catheterized patients is directly related to the duration of catheterization; the daily rate of acquiring

bacteriuria is approximately 3% to 10%.[7]

E.coli, Proteus, Pseudomonas, Klebsella, Serratia, Staphylococcus, Enterococci and Candida spp. are the common causes of this infection. Many infecting strains display markedly greater antibiotics resistance than organisms that cause community-acquired Urinary tract infection (UTI).[5]

Diagnosis of CAUTI is based on clinical features, pyuria on routine urine examination and bacteriuria. But most patients with CAUTI are asymptomatic.[8] Pyuria (defined as a urine specimen with_>10 white blood cells [WBCs]/mm^3 or _>3 WBCs per high-power field of uncentrifuged urine [9]. Pyuria is present with asymptomatic bacteriuria in 30%–75% of bacteriuric patients with short-term catheters in place,and 50%–100% of individuals with long-term indwelling catheters in place[10,11]. There is no relation between the level of pyuria and infection in patient with catheter since the presence of catheter invariably induces pyuria without the presence of infection.[12] Direct microscopic bacteriuria, on gram-stained uncentrifused urine is found in >90% of specimens whose infections are associated with colony counts of at least 10^5cfu/ml, and this finding is very specific. Direct microscopic bacteriuria is usually not seen with colony counts of 10^2-10^4cfu/ml.[5] Since direct microscopic bacteriuria and pyuria is not a reliable method to detect CAUTI, quantitative urine culture is done to detect CAUTI. The criterion of $>10^3$ cfu/ml of urine was used in this study instead of the standard $>10^5$cfu/ml to define significant bacteriuria. It is based on the findings and recommendations of some investigators that for complicated UTI such as the catheterized patients, levels below 10^5cfu/ml can already represent true infection.[13,14,15,16,3,17,18] A single catheterized urine specimen with the bacterial species isolated in a quantitative count of 10^2 cfu/mL identifies bacteriuria in women or men.[19]

Most clinicians use a clean-voided specimen showing $>10^5$ cfu/ml as the criterion for "significant" bacteriuria (i.e., true infection) for noncatheterized patients. However, once any microorganisms are identified in urine from a patient's indwelling catheter, unless suppressive antimicrobial- drug therapy is being given or started, progression to concentrations $>10^5$ cfu/ml occurs predictably and rapidly, usually within 72 hours. Thus, most authorities consider concentrations $>10^2$ or 10^3 cfu/ml, in urine collected with a needle from the sampling port of the catheter, to be indicative of true CAUTI. This concentration can be reproducibly detected in the laboratory, and this definition is useful for therapeutic decisions and epidemiologic research. [20,21]

CAUTI is also a common complication of Foley's catheterization. Exact magnitude of the problem is not known. No such study has been conducted previously.

The objective of the study is to determine organisms responsible and antibiotics resistance pattern of the strains causing foley's CAUTI.

Materials and methods

It is a prospective study conducted in medical ward in TUTH. The study was undergone in patients catheterized and admitted in different part of Medical wards – Male medical ward, Female medical ward, Annex II medical ward, Neuroward, and Medical Intermediate coronary Care Unit (ICCU).

A total of 100 adult patients above 16 years both males and females in whom an indwelling Foley catheter inserted for 3-4 weeks were taken in the study. Strict aseptic technique was applied at the time of catheterization and maintenance of closed drainage system was strictly followed through. The Patients who were undergone catheterization in different part of Medical wards of TUTH, Katmandu in the period span of 15th March 2006 to 14th March 2007 were enrolled.

Urine specimens were obtained by aseptically aspirating the clamped and disinfected Foley's catheter with a sterile syringe 24-gauge needle. The samples were taken to laboratory within 1 hour of collection. Approximately 3ml of urine was taken as a sample.

Quantitative culture and antibiotic resistant pattern of grown organism of urine sample was done at the time of catheterization to rule out prior presence of UTI. The tests were repeated on 3rd-5th day, 7th day, 10th day, 14th day and then every weekly until catheter removal or patient develops bacteruria or until discharge of the patient. Colony count $>10^3$ cfu/ml was considered as significant. Standard loop was used for inoculating urine in culture medium. Mac-Conkey agar and blood agar were used as culture medium. Antibiotic sensitivity testing was done by Kirby-Bauer disk diffusion technique. The tests were done at the Microbiology department laboratory, TUTH.

Those patients, whose catheter were removed or who were discharged/expired before 3rd day of catheterization or those who were confirmed to have UTI before catheterization or those who violet closed catheter drainage system were excluded from the study.

The culture plates were incubated at ambient temperature of 35-37^{0}c overnight and examined. The final reading was done at 18 hrs. Positive culture plates were undergone antibiotics sensitivity testing. Negative plates were

discarded. If scanty colonies were observed, the incubation continued up to 48 hrs.

Daily examination of the patients were done to look for urinary tract infection-Blood pressure, pulse rate, temperature, suprapubic tenderness, meatal inflammation renal angle tenderness and catheter blockage. Catheter care in the form of daily meatal care by betadine or soap water and maintenance of closed drainage were frequently monitored.

The patients were followed till they developed bacteruria or discharged, expired or catheter removed. The date of catheter removal and duration of catheterization was noted.

Finally, data were collected, tabulated and statistically analyzed. Risk factors determination employed the univariate analysis for each individual variable for which Chi-square test was utilized to detect the level of significance. Stratification of one risk factor against another was done by using logistic regression analysis. SPSS version 12 for windows was utilized to analyze the data. P-value was calculated and value <0.05 was considered significant.

Results

Bacteriological profile

Out of 54 patients who acquired UTI 22 were due to E Coli which accounts for 40% of total positive culture. Other organisms are listed in the table 1. *E.Coli* came out to be the most common organism causing CAUTI followed by other gram negative bacteria and gram positive bacteria.

Table 1: Bacteriological profile

Bacteria grown on culture	Urine culture Positive	% of total culture positive
E.Coli	22	40.74
Klebsiella	6	11.11
Enterococcus	6	11.11
Streptococcus faecalis	6	11.11
Pseudomonas	6	11.11
Staphylococcus aureus	4	7.4
Acinetobacter sp.	2	3.7
Multiple bacteria	2	3.7

Antibiotics resistance pattern

The resistance pattern of *E.coli* isolates with different antibiotics is summarized in the figure 1. Ninety percent of *E coli* isolates tested were found to be resistant to Amphicillin, Ciprofloxacin and Cephalexin, 86 % were resistant to Cotrimoxazole, Amoxi-clavilunic acid, 68% to Gentamycin, 41% to Ceftazidime, 36.4% to Amikacin, 22% to Nitrofurantoin, 9% to Piperacillin and non of them were resistant to imepenem.

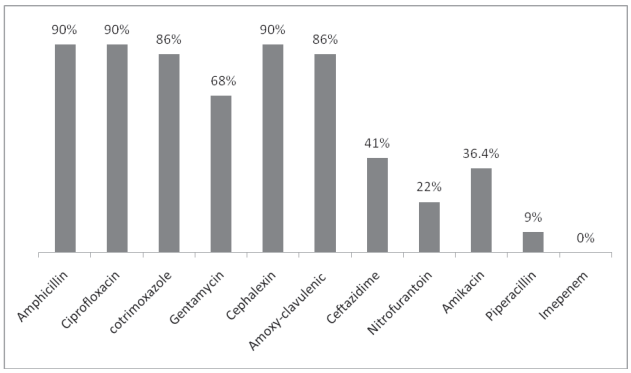

Fig. 1: Antibiotics resistant pattern of E.coli isolates.

Discussion

The result of the microbiologic profile in this study is similar to most reported studies, *E. coli* still being the most common pathogen (40.74% of cases), followed by *Klebsiella, Enterococcus, Streptococcus faecalis, Pseudomonas, Staphylococcus aureus, Acinetobacter sp.and Multiple bacteria.* In comparison to the infecting organisms in uncomplicated or community acquired urinary tract infection, there is a relatively higher isolation of gram-positive organisms such as *staphylococcus, Streptococcus faecalis* and *Enterococcus species.*[2, 3,4]In both the European and non European studies the most common organism isolated was *E.Coli*, both in CAUTI and Non-Catheter Associated Urinary Tract Infection (NCAUTI).[22] As compared to other studies[2, 3,22] *Candida species* were not isolated in this study.

In a study conducted by M. Sharifi in Qazvin University of Medical Sciences, Qazvin, Iran the majority of organisms belonged to *K. pneumonia* (60%), *E. cloacae* (25%), *E. coli* (7.5%), *P. mirabilis* (5%) and *P. aeroginosa* (2.5%).[23]But the organisms grown in our study differs from this study though the pattern is almost similar. *E.coli* was in third rank in this study while it was the most common in our study. CAUTIs comprise perhaps the largest institutional reservoir of nosocomial antibiotic-resistant pathogens, the most important of which are multidrug-resistant *Enterobacteriacae* other than *Escherichia coli,* such as *Klebsiella, Enterobacter, Proteus,* and *Citrobacter; Pseudomonas aeruginosa; enterococci a*nd *staphylococci; and Candida* spp,[20] however, the organisms causing UTI in our study differs from this study.

Ninety percent of *E coli* isolates tested were found to be resistant to Amphicillin, Ciprofloxacin and Cephalexin; 86 % were resistant to Cotrimoxazole, Coamoxiclav while resistance to Amikacin (36.4%), Nitrofurantoin (22%), Piperacillin (9%) and Imepenem is found to be less. In a study conducted in Philippines, Eighty-eight percent of the *E. coli* isolates tested were resistant to Ampicillin; 37.5 resistant to Cotrimoxazole; and 32% resistant to Nitrofurantoin. Increasing resistance was also noted with Gentamicin and Co-amoxiclav at 28% and 25%, respectively. Similarly 12% of the isolates were resistant to norfloxacin and ciprofloxacin.[3] Comparison revealed similar resistance pattern of *E.Coli* to antibiotics.

Conclusion

The most common organism causing CAUTI is found to be *E.Coli* in 40.74% of cases, followed by *Klebsiella, Enterococcus, Streptococcus faecalis, Pseudomonas, Staphylococcus aureus, Acinetobacter sp.and Multiple bacteria.* Ninety percent of *E coli* isolates were found to be resistant to Amphicillin, Ciprofloxacin and Cephalexin, 86 % were resistant to Cotrimoxazole, Coamoxiclav, 68% to Gentamycin, 41% to ceftazidime, 36.4% to amikacin, 22% to Nitrofurantoin, 9% to Piperacillin and non of them were resistant to Imepenem.

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