

**MICROBIAL FLORA AND RISK FACTORS ASSOCIATED WITH CATHETER ASSOCIATED URINARY TRACT INFECTIONS**G. N. Ravi Prakash<sup>1</sup>, K. Swarna Latha<sup>2</sup>, A. Renuka<sup>3</sup>, G. Swarna Latha<sup>4</sup>**HOW TO CITE THIS ARTICLE:**

G. N. Ravi Prakash, K. Swarna Latha, A. Renuka, G. Swarna Latha. "Microbial Flora and Risk Factors Associated with Catheter Associated Urinary Tract Infections". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 37, May 07; Page: 6355-6360, DOI: 10.14260/jemds/2015/924

**ABSTRACT: INTRODUCTION:** Catheter associated Urinary Tract Infection (UTI) represent the most common type of nosocomial infection and is a major health concern due to its complications and frequent recurrence. Among the nosocomial infections UTI contributes a major part. About 80% of nosocomial UTI are associated with using indwelling urinary catheters and most of them are asymptomatic. Only 5% of them develops symptomatic UTI which leads to development of complications like bacteremia & pyelonephritis. **MATERIALS AND METHODS:** In the present study a random collection of 100 urine samples from different clinical "groups" like surgery, urology, AMCU, Obstetrics & Gynecology patients with indwelling urinary catheter of different durations of catheter stay. Organisms isolated in culture, biochemical characterization, and antibiotic susceptibility was done. **RESULTS:** Among the samples tested 41/100 (41%) showed culture positivity. within them surgery patients were 40.90% (18/41) , Urology accounted for, 71.42% (20/28), in AMCU patients 20% (2/10), with more than 3 days of duration of catheter stay and in Obs & Gyn department showed 0 culture positivity. The predominant organism isolated is pseudomonas aeruginosa (34.2%), followed by Escherichia coli (22%), enterococci (12.19%), Klebsiella (12.19%) and Candida 19.5%. Among GNB 90% showed ESBL production, 10%  $\beta$ -lactam inhibitors resistance, 90% quinolones resistant, 50% resistant to amikacin, 100% to gentamycin was observed. **CONCLUSION:** Incidence of bacteriuria in patients with indwelling urinary catheters is 41%. Onset of bacteriuria is as early as on 3<sup>rd</sup> day of catheterization, and gradually increases with duration of stay, technique of insertion and daily catheter care done. Pseudomonas aeruginosa and Escherichia coli are common organisms isolated. Use of prophylactic antibiotics without doing culture, and antibiotic susceptibility testing leads to development of drug resistant organisms. So, active surveillance of infection is the most effective method to control the CA UTI s.

**KEYWORDS:** Urinary tract infection, indwelling urinary catheters, bactereuria, pseudomonas aeruginosa, E. coli.

**INTRODUCTION:** Hospital associated infections are wide spread. They are an important cause of morbidity and mortality. They will become even more important as a public health problem.<sup>(1)</sup> Urinary Tract Infection is the most common Hospital associated infection; about 80% of infections are associated with the use of indwelling catheters.<sup>(1)</sup> Catheter associated UTI's are commonly asymptomatic, only few of them develop symptomatic UTI; which in turn leads to development of complications like pyelonephritis and bacteremias which are associated with less morbidity, but occasionally lead to death.<sup>(1)</sup> The bacteria responsible arise from the gut flora, either from normal environment or acquired in hospital.<sup>(1)</sup> The hospital environment plays an important role in determining the organism involved in UTI 's. The introduction of a foreign body into the urinary tract especially one that remains in place for some time (e.g., urinary catheterization and cystoscopy)

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carries a substantial risk of infection particularly if obstruction is present.<sup>(2)</sup> As many as 20% of all hospitalized patients who receive short term catheterization develop an UTI.<sup>(2)</sup> Ascending route is the most common route of infection. For UTI s to occur by the ascending pathway, the enteric gram negative bacteria and other organisms that originate in the gastrointestinal tract must be able to colonize the vaginal cavity and the periurethral area.<sup>(2)</sup> Once this organisms gains access to the bladder, they may multiply and then pass up to the ureters and kidney. The pathogenesis of CAUTI is not fully understood.<sup>(2)</sup>

**AIMS AND OBJECTIVES:** I) To study microbial flora and risk factors associated in patients with catheter associated UTI's, and, II) To identify the Urinary Tract Infections in patients with indwelling urinary catheter of more than 3 days of duration with closed drainage system in different categories of patients like Surgery, Urology, AMCU, Obs & Gyn patients. III) To study the antibiotic susceptibility pattern of bacterial flora.

**MATERIALS AND METHODS:** THE present study was conducted with a random collection of urine samples in patients admitted in GGH, KURNOOL in different wards like General Surgery, Urology AMCU & Obs & Gyn, among post-operative patients with indwelling urinary catheters during 2013 - 2014. The following were included in the study: duration of catheter stay, technique of insertion and adoption of closed drainage system, were observed.

A total of 100 samples collected from these patients 76 includes test group, from General surgery and urology AMCU with more than 3 days of duration of catheter stay were included; remaining 24 includes control group with less than 3 days of duration of catheter stay, with all the patients having closed drainage system and, all in whom, aseptic precautions had been followed before insertion of catheter.

The methods of sample collection are different from the routine method of MSU collection. The samples aseptically collected by aspirating the urine through the soft rubber outlet tube of Foleys catheter tube by blocking the collecting tube with 5 ml of disposable syringe.<sup>(3)</sup>

The samples were collected with different durations of catheter stay, they were categorized as follows in Table 1.

Duration of catheter stay ( in days )	Surgery	Urology	AMCU	Obs & Gyn	Total
1-2	5	3	-	24	24
3-4	20	6	6	-	32
5-10	13	10	4	-	26
11-20	6	3	-	-	11
21-30	-	6	-	-	6

Table 1

All samples are transported immediately to the laboratory after collection and processed by conventional methods. They are tested by direct microscopic examination by wet film and gram staining method for bacteria and pus cells. Isolation of microorganism was done by inoculating the samples in suitable culture media i.e., Mac Conkey's agar and blood agar and incubated them

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aerobically at 37°C overnight. For sample inoculation semi quantitative culture method followed with a nichrome loop calibrated to contain 0.005 ml fluid was used. Organisms isolated in culture, biochemical characterization, and antibiotic susceptibility was done on Muller Hinton agar as per NCCLS guidelines and the various resistance patterns to antibiotics were observed.

**RESULTS:** The culture showing  $>10^5$  CFUs was taken as significant bacteriuria. Among the total 100 samples, 41 samples showed culture positivity with a 41% culture positive rate. Biochemical characterization and antibiotic susceptibility tests were done. The samples are categorized among the patients attending the various departments as follows: General Surgery-44, Urology-28, AMCU-10, Obs & Gyn-18 (ref-Table 2).

Category of patients	Total	Positive rate
General surgery	44	18 (40.90%)
urology	28	20 (71.42%)
AMCU	10	2 (20%)
Obs & Gyn	18	0 (0%)
Total	100	41 (41%)

**Table 2: Positivity of samples in different categories showing bacteriurea**

Among them the individual isolates were as follows- *Pseudomonas aeruginosa*-15(36.58%), *Escherichia coli*-9(22%), *Enterococci*-5(12.19%), *Klebsiella*-6(14.63%), and, *Candida* - 6(14.63%). (Table 2).

Among the samples collected from General Surgery patients - 18/44 samples were culture positive with 40.90% of incidence of bacteriuria. Among them, the individual isolates were as follows: *Pseudomonas aeruginosa* isolated in 5 samples with prevalence of (11.36%), *Escherichia coli* in 4 (9.09%); *Enterococci*- 3(6.82%), *Klebsiella* -1 (2.27%), *Candida* 5(11.36%) (Table3).

Among the samples collected from urology patients; 20/28 samples were culture positive with 71.42% of bacteriuria. Among them the individual isolates were as follows: *Pseudomonas aeruginosa* 9(32.14%) *Escherichia coli* 5(17.85%); *Enterococci* 1 (3.57%), *Klebsiella* 5(17.85%) ref - (Table 3).

Among AMCU out of 10 samples 2 showed culture positivity with 20% prevalence; among them 1(10%) was *pseudomonas* and 1 *Candida* sp (10%) were isolated. In Obs & Gyn - among 18 samples, all were negative for culture with 0% positive rate ref - (Table 3).

Organism	Total	General Surg	Urology	AMCU
<i>Pseudomonas aeruginosa</i>	15 (36.58%)	5 (11.36 %)	9 (32.14%)	1 (10%)
<i>Escherichia coli</i>	9 (22%)	4 (9.09 %)	5 (17.85%)	0
<i>enterococci</i>	5 (12.19%)	3 (6.82 %)	1 (3.57%)	-
<i>Klebsiella</i>	6 (14.63%)	1 (2.27%)	5 (17.85%)	-
<i>Candida</i>	6 (14.63%)	5 (11.36 %)	-	1 (10%)

**Table 3: Common organisms isolated**

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**Culture positive rate versus different durations of catheter stay as follows in table 4:**

Duration in days	Total positive	Surgery	urology	AMCU
1-2	0 (0%)	0%	0%	0%
3-4	6 (18.75%)	3 (9.37%)	3 (9.37%)	-
5-10	16 (61.53%)	6 (23.07%)	9 (34.61%)	1 (3.84%)
11-20	8 (72.72%)	5 (45.45%)	2 (18.18%)	1 (9.09%)
>21 days	6 (100%)	-	6 (100%)	-

**Table 4: Duration of catheter stay and positivity**

**Antibiotic Susceptibility Test:** The bacterial isolates tested with  $\beta$ -lactam drugs,  $\beta$ -lactam inhibitors, quinolones and amino glycosides Among the GNB isolates, 90% were showing ESBL resistance with cefataxime and 10% were showing resistance to  $\beta$ -lactam inhibitors with cefaperazone and tazobactam, 90% were showing quinolones resistance when tested with norfloxacin and levofloxacin. 50% were resistant to amikacin, and all were resistant to gentamycin. All pseudomonas are sensitive to piperacillin & tazobactam.

**DISCUSSION:** CAUTI is one of the most common causes of hospital associated infection; the risk factors which predisposed to CAUTI were not properly understood.<sup>(4)</sup> Risk of acquiring a urinary tract infection in patients with indwelling urinary catheters following hospital stay depends on the technique of insertion of catheter and duration of catheterization, the quality of catheter care and host susceptibility.<sup>(4,5,6)</sup> Adoption of closed method of urinary drainage has markedly reduced the risk of acquiring catheter associated infection, but the risk is still substantial. Error in maintaining sterile closed drainage were common and predisposed patients to infection.<sup>(4,5,6)</sup> Host factors which appear to increase the risk of acquiring CAUTI include, surgical operation and underlying medical illness.<sup>(5,6)</sup> A study conducted by Henry F, Alavaren et al in 1993 at Philippine general hospital medical centre, Manila showed the result as 21% -Pseudomonas aeruginosa, 18.2% Escherichia coli, 11.3% acinetobacter, 9.1% Klebsiella, 4.5% Staphylococcus saprophyticus, 2.3% Coagulase Positive staphylococci.<sup>(7)</sup> Our present study -showing 41% of bacteriuria, and microorganisms isolated are almost correlating with above study, with little higher incidence. Increased Incidence of bacteriuria occurs more than 3 days duration of catheter stay, from 25% to almost 100 % after 3weeks of duration of catheter stay. It is certain that soon after hospitalization, patient becomes colonized with bacteremia endemic to the institution, and often gram negative aerobic and facultative bacilli carry resistance markers. These bacteria colonize the patient's skin, gastrointestinal tract, and mucous membranes including the anterior urethra.<sup>(2)</sup> With insertion of catheter, the bacteria may be pushed along the urethra into the bladder or with an indwelling catheter, may migrate along the tract between the catheter and the urethral mucosa, gaining access to the bladder. It is estimated that approximately 10% to 30% of catheterized patient will develop bacteriuria.<sup>(8,9,2)</sup>

CAUTI is generally assumed to be benign.<sup>(9)</sup> Such infection in otherwise healthy patients is often asymptomatic and is likely to resolve spontaneously with the removal of the catheter.<sup>(9)</sup> Occasionally, infection persists and leads to such complications as prostatitis, epididymitis, cystitis, pyelonephritis and gram negative bacteremia, particularly in high risk patients. The last complication is serious, since it is associated with a significant mortality but fortunately occur in less than 1%

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catheterized patients.<sup>(9,4)</sup> Microorganisms that inhabit the meatus or distal urethra can be introduced directly into the bladder when the catheter is inserted.<sup>(8)</sup> Generally, however, low rates of infection have been reported after single brief catheterization, suggesting that microorganism introduced by this method are usually removed from healthy individuals by voiding or by antibacterial mechanisms of bladder mucosa.<sup>(5,9)</sup> With indwelling catheters, infecting microorganism can migrate to the bladder along the outside of catheter in the periurethral mucosal sheath or along the internal lumen of the catheter after the collection bag or catheter drainage tube junction has been contaminated.<sup>(5,9)</sup> If sterile closed drainage can be maintained extra luminal migration of microorganisms in the peri urethral space becomes a relatively more important pathway of entry into bladder.<sup>(8,9)</sup>

**CONCLUSION:** Incidence of bacteriuria in patients with indwelling urinary catheters is 41%. Onset of bacteriuria is as early as on 3<sup>rd</sup> day of catheterization and gradually increase with duration of stay, technique of insertion and daily catheter care done.<sup>(7)</sup> *Pseudomonas aeruginosa* and *Escherichia coli* are common organisms isolated. Use of prophylactic antibiotics without doing culture and antibiotic susceptibility testing leads to development of drug resistant organisms. So, active surveillance of infection is the most effective method to control the CAUTI s & bacteriurias.

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### **FINANCIAL OR OTHER**

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Date of Submission: 30/03/2015.  
Date of Peer Review: 31/03/2015.  
Date of Acceptance: 28/04/2015.  
Date of Publishing: 05/05/2015.