

CATHETER ASSOCIATED URINARY TRACT INFECTION (CAUTI) INDUCED NOSOCOMIAL INFECTION WITH REFERENCE TO INCIDENCE, DURATION AND ORGANISM IN A TERTIARY CARE TEACHING HOSPITAL

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Abstract

Objective: Background: Indwelling urinary-catheter induced urinary tract infections (UTI) are an important cause of nosocomial infection. To determine the incidence of catheter associated infections and to correlate the incidence of catheter-associated infection with the duration of catheterization and to find out the most common organism responsible for catheter associated UTI in our hospital.

Materials & Methods: This prospective study was conducted in a tertiary care teaching hospital. The urine samples from 100 patients from different wards, belonging to different age-groups and with different clinical conditions were collected under all aseptic precautions. Total 4 samples from each patient were collected on day 1st, 3rd, 5th and 7th and transported in a sterile plain bulb to the microbiology laboratory for further processing. Urine samples were processed for inoculation, macroscopic examination, microscopic examination and gram staining.

Results: Total 65% catheterized patients developed UTI within 7 days of catheterization. There was an increase incidence of UTI with duration of catheterization. Only 7 (10.77%) patients were infected on day 1, whereas by 7th day 100% of patients were infected. Most commonly isolated pathogen was Escherichia coli (30.76%) followed by Pseudomonas aeruginosa (26.15%) and Klebsiella (23.07%).

Conclusion: CAUTI can be prevented if proper aseptic precautions are taken. Doctors and nurses should be trained in taking precaution necessary to prevent CAUTI. Minimizing the duration of catheterization and administration of prophylactic antibiotics can prevent infection in short-duration catheterized patients.

Key words: Urinary catheter, incidence, urinary tract infections, nosocomial infection.

INTRODUCTION

Urinary tract infection (UTI) is an important cause of nosocomial infection. Most nosocomial infections associated with urinary tract following instrumentation, usually a catheter. In hospitals and nursing homes these catheters are inserted for various clinical indications. In these conditions, the catheters have to be left in-situ

for some time. The indwelling urinary-catheter is an essential part of modern medical care. It is widely used to give temporary relief of anatomic or physiologic urinary obstruction, facilitate surgical repair of the urethra and surrounding structures, provide a dry environment for comatose and incontinent patients and permit

accurate measurement of urinary output in severely ill patients. (1) Such indwelling catheters are responsible for about 40% of all nosocomial infections. (2, 3) They are the cause of high mortality and high morbidity in these patients. UTI cause bacteremia in 2 - 4% of patients and have been associated with a case fatality rate three times as high as nonbacteremic patients. The risk factors for UTI include duration of use, female sex, absence of systemic antibiotics, and disconnection of the catheter - collecting tube junction and improper asepsis during insertion of catheter. Also they constitute the largest institutional reservoirs of nosocomial antibiotic resistant organisms. Multi-drug resistant organisms, susceptible hosts, hospital environment predispose to such infections.

Urinary tract infection in hospitalized patients is often overlooked or regarded as an unavoidable temporary and insignificant incident. UTI following instrumentation are generally assumed to be benign, but though the major part apparently is self-limiting, complications such as epididymitis, pyelonephritis & bacteraemia or endocarditis occur in a small proportion of patients.

The urinary tract is the most common identifiable source of bacteraemia due to gram-rods. To overcome this problem and to reduce the incidence of UTI in catheterized patient's one widely used technique is the use of closed drainage systems. (4) i.e. those with collecting bags fused to the distal end of the collecting tube. Another common method has been the irrigation with antimicrobial solution. The most popular solution neomycin and polymyxin were shown to be effective in open systems.

Frequent cleansing of the metal catheter junction with soap & water or with antiseptic and regular application of antimicrobial cream or ointment to this site is widely recommended. (5)

Majority of the bacteria causing catheter-associated bacteriuria are from the patients own flora and may be native inhabitants or new immigrants i.e. exogenous organisms from the hospital environment that have colonized the gut. (6)

Growth of bacteria in biofilms on the inner surface of catheters promotes encrustation and may protect bacteria from antimicrobial agents. Systemic antimicrobials, sealed tubing and catheter junctions, silver ion - coated catheters, and antiseptics in the collecting bag have all been efficacious in one or more controlled trials. (4) Further research in the areas of innovative catheter-system design, bacterial host epithelial cell interaction, and targeted antimicrobial prophylaxis seem the most likely approaches to controlling UTI in future. So this study was planned to find the incidence of catheter associated infections in our hospital to correlate the incidence of catheter-associated infection with the duration of catheterization and to study the most common organism responsible for catheter associated UTI.

MATERIALS & METHODS:

This prospective study was conducted in a tertiary care teaching hospital. After taking the permission from institutional ethical committee data was collected from 100 patients.

The urine samples from 100 patients from different wards, belonging to different age-groups and with different clinical conditions

were collected under all aseptic precautions after cleansing the proximal extraurethral part of the catheter with alcohol and puncturing with a sterile syringe and needle. In all, total 4 samples from each patient were collected on day 1st, 3rd, 5th & 7th and transported in a sterile plain bulb to the microbiology laboratory for further processing.

Urine Sample were processed for **inoculation** (Under all aseptic precautions, the samples were first of all inoculated with a calibrated platinum loop of internal diameter 4 mm (0.001 ml) on to the Blood Agar and MacConkeys Medium. Plates were then kept for overnight incubation at 37 °C. The overnight incubated plates of Blood Agar & MacConkeys Agar were examined. The number of colonies & morphology were noted. A single colony on Blood Agar plate indicating a bacteriuria of 10³ or more CFU/ml, which by definition is considered as significant bacteriuria in catheterized patients. So every single colony with distinct morphology was identified, isolated & processed for species identification using biochemical reactions as described by Kowan and Steel. Culturing on Sabouraud's dextrose agar, after demonstrating in wet preparation, identified yeasts. Also, Gram stain was done to confirm the yeast cells. Germ-tube test and Corn-meal agar inoculation, sugar assimilation & fermentation was done for species identification.), **macroscopic examination** (The urine sample was grossly observed for altered colour and turbidity), **microscopic examination** (A drop of uncentrifuged urine was examined under low and high power on the glass slide by placing a cover slip over it. Several fields were searched to identify & count the number of pus cells. More than 5 pus cells per high power field (>5/ hpf) in an uncentrifuged sample were

considered as significant. Also, RBC's, epithelial cells, casts, yeast cells, crystals & microbes were searched.), **and gram staining** (A drop of uncentrifuged urine was allowed to dry on a glass slide. The smear was Gram-stained and examined under oil immersion field. Presence of at least one organism per oil-immersion field (1 org./oef) was considered as significant.).

RESULT:

Table-1: Incidence of UTI in catheterized patients

Sex	Total no. of patients catheterized	No. of patients infected	%
Male	72	52	72.22
Female	28	13	46.42
Total	100	65	65

A total of 100 patients were studied from different wards in different age-groups that were non-ambulatory and catheterized. Of these 72 patients were male and 28 patients were female. Out of total 72 male; 52(72.22%) developed urinary tract infection. In female patients, 13(46.42%) out of 28 were infected. Total 65% catheterized patients developed UTI within 7 days of catheterization. (Table 1)

Urine was examined on Day-1, Day-3, Day-5, and Day-7 of catheterization. There was an increase incidence of UTI with duration of catheterization as shown in table 2. Only 7 (10.77%) patients were infected on day 1, whereas by 7th day 100% of patients were infected. (Table 2)

Table 2: Relationship of incidence of UTI with duration of catheterization

Day of catheterization	Male	Female	Total	%
1 st	5	2	7	10.77
3 rd	32	08	40	61.54
5 th	45	10	55	84.61
7 th	52	13	65	100

Most commonly isolated pathogen was *Escherichia coli* (30.76%) followed by *Pseudomonas aeruginosa* (26.15%) and *Klebsiella* (23.07%). Other organisms isolated were CONS (9.2%), Enterococci (7.61%), *Proteus* (6.15%) and *Candida* spp. (3.07%). (Table 3)

Out of the 100 patients studied, a total of 69 organisms were isolated ; of which 67 were bacteria and 2 isolates were *Candida*. Out of these 69 isolates, 53 (76.81%) were isolated from males and 16 (23.19%) were isolated from females. Two *Candida* were isolated from each a male and a female patient. Urine samples from 4 patients showed polymicrobial flora. Out of these 4 patients, Coagulase negative *Staphylococcus* (CONS) was isolated from 3 patients and *Candida albicans* was isolated from 1 patient. Out of these 3 CONS, one was isolated from male patient, in association with *Klebsiella* spp. in a patient of stricture urethra on 7th day of catheterization. 2 CONS were isolated from female patients. Out of these two CONS one was isolated from patient of urinary calculus in association with *Escherichia coli* on 5th day of

catheterization and the other one CONS was isolated from a patient of LSCS in association with *Escherichia coli* on 7th day of catheterization.

The *Candida albicans* was isolated from a female patient of meningitis with history of diabetes mellitus in association with *Enterococcus* sp. on 7th day of catheterization. The other isolate of *Candida albicans* was from a male patient who did not have polymicrobial flora.

DISCUSSION:

UTI has already been discussed as one of the most important cause of nosocomial infections. Indwelling catheters are responsible for 40% of nosocomial infections. CAUTI is defined as significant bacteriuria with urological signs and symptoms of infection associated with histopathological changes. However significant bacteriuria in CAUTI is defined as a concentration of $>10^2-10^3$ CFU/ml in catheterized urine sample. Bacteriuria develops in at least 10–15% hospitalized patients with indwelling urethral catheters according to Walter E. Stamm (7) and in 25% of the catheterized patients according to Maki D.G. et al. (8) However in our study very high incidence (65%) of CAUTI was found. Though most clinicians use a criteria of $>10^5$ CFU/ml as significant bacteriuria for non - catheterized patients, most authorities considered concentration of 10^2 or 10^3 CFU/ml as a criteria of CAUTI. (8) We have also applied the same criteria for our study. Aseptic precautions during introduction of catheter are an important step in reducing the incidence of catheter-associated infections.

Table 3: Organisms isolated from catheterized urinary tract patients

Sr.No	Name of organism	Number of isolates			
		Male	Female	Total	%
1	<i>Escherichia coli</i>	18	2	20	30.76
2	<i>Pseudomonas aeruginosa</i>	12	5	17	26.15
3	<i>Klebsiella pneumoniae</i>	13	2	15	23.07
4	CONS	2	4	6	9.02
5	<i>Enterococcus spp.</i>	4	1	5	7.61
6	<i>Proteus spp.</i>	3	1	4	6.15
7	<i>Candida albicans</i>	1	1	2	3.07
Total		53	16	69	

It has been found that when surgeons introduce catheter in operation theatres, there is a lesser incidence of infection than when catheters are introduced by the nursing staff. Resident doctors are supposed to introduce the catheter, but it has been observed, that sometimes due to overwork and majority of times due to negligence, the duty is passed on to the nursing staff, who may not take proper aseptic precautions increasing the incidence of CAUTI. Many of the patients were ambulatory without training them regarding the precautions to be taken as they moved about with the urinary-bag taking no precautions. We have also noticed that, the patients themselves empty the bag or with the help of relatives taking no aseptic precautions. This could be the one of the reasons of higher incidence of CAUTI in our study. Another reason may be overcrowding in the wards.

The sex wise incidence was intended to be studied. However in our study, we had more male patients than female and therefore, sex wise

incidence could not be studied. However most of the studies indicate female to male ratio as 2:1. The rate of infection in females may be more (9), because of short urethra, and sexual intercourse which facilitates the infection. (10)

Risk of CAUTI is said to increase as the duration of catheterization increases. Garibaldi et al study and other studies too have shown bacteriuria from second day onwards at a rate of 3-10% / day & reaches up to 30% within 4 days. (3,4,11) Similarly we have found an increase of almost 50% on the third day.

Most commonly isolated pathogen was *Escherichia coli*, followed by *Pseudomonas aeruginosa* and *Klebsiella*. Other organisms isolated were CONS, *Enterococci*, *Proteus* and *Candida albicans* Other studies have showed the same findings.(11,12,13) Where as one study (8) showed that multidrug resistant *Enterobacteriaceae* other than *Escherichia coli* was commonly isolated from catheterized

patients and Enterococci was usually isolated from patients on antibiotic therapy. (10) Most of the patients in our study were already on antibiotics due to preexisting clinical conditions, therefore probably, Enterococci could be isolated from almost 7.61% of the cases. Out of 65 infected patients, 4 (6.1%) of them showed polymicrobial flora. From these 4 patients, the initial isolate was *Klebsiella pneumoniae* in the male patient and *Escherichia coli* from the 3 female patients. This was followed by a second isolate from the same patient, on either the 5th or the 7th day. These isolates were CONS in 2 female patients and *Candida albicans* + *Enterococcus* in the 3rd female patient. In case of the male patient the second isolate on the 7th day of catheterization was CONS. These findings are consistent with the findings of Garibaldi et al. who had observed that, in catheterized patients the initial isolate was usually *Escherichia coli* but later on antibiotic resistant organisms like *Pseudomonas* and *Enterococci*, appeared in the urine.

CONCLUSION:

CAUTI can be prevented if proper aseptic precautions are taken. Doctors and nurses should be trained in taking precaution necessary to prevent CAUTI. Catheterization should be done only if necessary. Minimizing the duration of catheterization and administration of prophylactic antibiotics can prevent infection in short-duration catheterized patients, but will increase the number of resistant strains if administered to long term catheterized patients.

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