

## NOSOCOMIAL INFECTIONS: URINARY TRACT INFECTION IN PATIENTS WITH INDWELLING URINARY CATHETER.

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With the aim of studying the pattern of urinary tract infection in patients with indwelling urinary catheter in the University College Hospital, Ibadan, a total of 164 patients were recruited. A questionnaire was administered to each patient to provide information on demographic data, clinical diagnosis, and symptoms and signs suggestive of urinary tract infection. Catheter specimen urine from each of the patients was cultured to identify the agents of infection. Antimicrobial sensitivities of the isolates were done. It was found that 54.8% of the patients were above 50 years of age, with a male to female ratio of 2:1. Benign prostatic hyperplasia was the most common indication for catheterization. 83.5% and 16.5% had Intra-urethral and supra pubic catheterization respectively. 69.5% of these patients had urinary tract infection with 90.40%, 9.6% and 0.9% harbouring 1, 2 and 3 organisms respectively. Intake of antibiotics did not influence the incidence of urinary tract infection. The common agents of infection were *Klebsiella* spp; *Pseudomonas* spp. *Escherichia coli*, *Proteus* spp. *Staphylococcus aureus* and *Candida albicans* in order of frequency. The bacterial agents of infection were resistant to ampicillin, cotrimoxazole and nitrofurantoin commonly used for the patient with urological problem. Ceftazidime, ceftriaxone, pefloxacin and ofloxacin showed good sensitivity against the bacteria. These findings should be useful for those who manage patients with indwelling urinary catheter.

### INTRODUCTION

Urinary tract infection is an important cause of morbidity and mortality in both adult and children (1). Females are more often affected than males except at the extremes of life (2). Structural abnormalities of the urinary tract make it possible for bacteria that are usually not pathogenic to cause infection (3). Acquired abnormalities such as urinary tract calculi, prostatic hypertrophy, urethral strictures and congenital abnormalities such as double collecting system, and horseshoe kidney all interfere with the free flow of urine and create a complicated setting in which infection is more likely to occur.

Nosocomial urinary tract infections are infections occurring in hospitals and nursing homes. In hospitals where the epidemiology has been better investigated, about 80% of nosocomial urinary tract infections are associated with the use of urinary catheters (4). About 5 - 10% occurs after other genito-urinary manipulations.

The imaginative employment of catheters and drainage tubes in the urinary tract greatly facilitated urological care, however this intubation usually results in bacteriuria (5). Catheters serve as foreign bodies to which bacteria can adhere and prevent the antibacterial function of uroepithelial cell lining the urethra (6). In fact, catheterization of the urinary tract remains the most common cause of nosocomial infection in Medical practice (7).

The microbiology of UTI is predictable with *Escherichia coli*, other Enterobacteriaceae, *Staphylococcus saprophyticus* and *Enterococcus* causing more than 90% of cases. In patients with indwelling urinary catheters bacteriuria is most frequently caused by *Escherichia coli*. Other common organisms are *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Staphylococcus epidermidis*, *Enterococcus* (8), and unusual species such as *Providencia stuartii*<sup>5</sup>. The majority of these bacteria causing urinary catheter associated bacteriuria are from the patient's own colonic flora (9), and may be native

inhabitant or new immigrants, that are exogenous organisms from the hospital environment (10). The endogenous organism may migrate from the perineum to colonise the periurethral area while the exogenous organisms may directly colonize the catheter (11). Organisms may be transferred to the patient by the hands of the health worker. Many of these isolates are resistant to many antimicrobial agents.

In our locality, some workers have documented facts on the microbiology of uncomplicated UTI, but there is little fact on bacteruria and UTI in patients with indwelling urinary catheters. Hence we set out to study the bacterial agents of catheter associated bacteruria and their antimicrobial susceptibility pattern with a view of recommending antimicrobial usage in these patients.

#### **PATIENTS, MATERIALS AND METHODS.**

Patients with indwelling urinary catheters in the urological clinic and wards of the University College Hospital (UCH), Ibadan from May to December 1997 were recruited into the study. After verbal consent, a questionnaire was administered to each patient. This gave information on demographic data, clinical diagnosis, indication for, duration and site of catheterization, number and duration of antibiotics taken, and

complaints referable to urinary tract infection.

Catheter urine sample was collected aseptically into sterile disposable screw-capped universal bottle and transported to the laboratory for processing.

Using a standard loop, sample of urine was inoculated onto blood agar and Cysteine-lactose-electrolyte-deficient (CLED) medium. After overnight incubation aerobically at 37°C, organisms were identified to species level by using standard bacteriological techniques (12). The antimicrobial sensitivities were determined by using Stoke's disc diffusion technique (13).

#### **RESULTS**

The most prevalent age group with indwelling urinary catheter was 61 -70, being 25.0% of all the patients studied. This was closely followed up by age group 51 -60. Considering all the patients 54.8% were above 50 years of age. The male to female ratio is 2:1.(Table 1)

Of the 164 patients with indwelling catheter, 83 or 50.6% were patients with primary urological problems.

Benign Prostatic Hyperplasia was the most common indication for catheterization. This is followed by Urethral Structure and General Surgical Emergencies.

Urethral catheterization was used in 83.5% of cases while 16.5% of the patients had suprapubic catheterization. (Table 2).

**Table 1: Age and Sex Distribution of patients studied.**

<b>Age Range (Years)</b>	<b>Males</b>	<b>Females</b>	<b>Total</b>	<b>%</b>
11- 20	3	3	6	3.7
21 - 30	11	7	18	11.0
31 - 40	12	10	22	13.4
41 - 50	13	9	22	13.4
51 - 60	18	7	25	15.2
61 - 70	32	9	41	25.0
71 - 80	14	8	22	13.4
81 - 90	5	1	6	3.7
>90	1	1	2	1.2
Total	109	55	164	100

**Table 2: Diagnosis of patients studied and site of catheterization**

Diagnosis	Frequency	%	Site of Catheterisation	
			Urethral	Suprapubic
BPH	40	24.5	38	2
Ca Prostate	17	10.4	15	2
Urethral stricture	21	12.8	3	18
Paraplegia	11	6.7	11	0
Ca Bladder	5	3.1	5	0
RTA	10	6.1	10	0
CVA	14	8.6	14	0
Septicaemia	2	1.2	2	0
Burns	2	1.2	2	0
Renal Failure	5	3.1	5	0
Gen. Surg. Emm.	20	12.3	18	2
Diabetes Crisis	9	5.5	9	0
VVF	2	1.2	1	1
Epilepsy	2	1.2	2	0
Rupture of urethra	2	1.2	0	2
Senile Dementia	2	1.2	2	0
Total	164	100	137	27
%			83.5	16.5

**KEY:** BPH= Benign Prostatic hyperplasia  
RTA= Road Traffic Accident  
Gen. Surg. Emm. = General Surgical Emergencies  
CVA = Cerebrovascular Accident  
VVF = Vesico - vaginal fistula

Of the 164 patients, 84 or 51.2% were on antibiotics either prophylactically or therapeutically, 72(43.9%) had one type of antibiotics 10(6.1%), and 2(1.2%) had a combination of two or three antibiotics respectively, while 80 (48.8%) had none. Considering patients with antibiotics, 26(30.95%) had no organism in urine; 58 had bacteriuria. Of these, 51 (87.93%), 6(10.34%), and 1(1.72%) had 1, 2, and 3 organisms respectively. Of the 80 patients without antibiotics, 25(31.25%) had no organism in urine 55(68.75%) had bacterium. Of these,

50(90.9%) had one organism while 5 (9.1%) had two. (Table III). There is no significant difference between the group with antibiotic and those without antibiotics (p value = 0.85497196). Of these patients, 122 (73.4%) had no complaints referable to UTI during the period of catheterization 37 (27.0%) of patients with urethral catheter and 5 (18.5%) of those with suprapubic catheter showed features of urinary tract infection. 7 (5.1%) and 4 (2.9%) of patients with urethral catheter had frank discharge and pain around catheter respectively. 3.7% of the patients had suprapubic pain. (Table 4).

**TABLE 3: ANTIBIOTIC INTAKE AND FREQUENCY OF ISOLATION OF ORGANISMS FROM URINE.**

PRESENCE OF ISOLATES	INTAKE OF ANTIBIOTICS		
	YES	NIL	TOTAL
NO ISOLATE PRESENT	26	25	51
ISOLATES PRESENT	58	55	113
TOTAL	84	80	164

P>0.5

**TABLE 4: Complaints referable to UTI and site of Catheterization.**

Site	Discharge	Pain around catheter	Suprapubic pain	Fever	Others	No Complaints	Total	%
Urethral	7	4	5	13	8	100	137	83.5
Suprapubic	0	0	1	2	2	22	27	16.5
Total	7	4	6	15	10	122	164	100
%	4.3	2.4	3.7	9.1	6.1	73.4	100	

Of these patients, 50 (30.5%) had no organisms in their urine, while 114 (69.5%) had significant bacteriuria. Of these, 103 (90.4%) had one organism, while 11 (9.6%) were polymicrobial with 10 (8.8%) and 1 (0.9%) having combination of two and three agents respectively.

Table 5 shows the agents of infection in the patients.

A total of 126 organisms were isolated from the urine of these patients. *Klebsiella* species was the most common organism being 36.5% of the isolates. This is followed by *Pseudomonas* spp. (25.1%), *Escherichia coli* (23.0%), *Proteus* spp. (10.3%), *Staphylococcus aureus* (4%) and *Candida albicans* (3.2%).

Table 6 shows that majority of the isolates were from patients with primary urological problems.

Table 7 shows the susceptibility pattern of the isolates to the antibiotics used. All the isolates were susceptible to the fluoroquinolones (ofloxacin and pefloxacin). Most of the isolates were susceptible to Ceftriaxone and Ceftaxidime. The commonly used antibiotics, Ampicillin, Cotrimoxazole, Nitrofurantoin and Nalidixic acid showed low effectiveness. All isolates were resistant to Ampicillin and Cotrimoxazole. Gentamicin which was commonly used against *Pseudomonas aeruginosa*, showed unacceptably reduced effectiveness (33.3%). Ofloxacin and Pefloxacin showed effectiveness against all the isolates.

**TABLE 5: ISOLATES FROM URINE SPECIMENS OF THE PATIENTS**

Isolates	Frequency 1 <sup>st</sup> Isolates	Frequency 2 <sup>nd</sup> Isolate	Frequency 3 <sup>rd</sup> Isolate	Total	%
<i>Klebsiella</i> spp.	42	2		46	36.5
<i>Pseudomonas aeruginosa</i>	17	2		19	15.1
<i>Pseudomonas</i> spp.	11	1	1	13	10.3
<i>Escherichia coli</i>	28	2		29	23.0
<i>Proteus mirabilis</i>	7	2		9	7.1
<i>Proteus</i> spp.	4			4	3.2
<i>Staphylococcus aureus</i>	4	1		5	4.0
<i>Candida albicans</i>	1			1	0.8
Total	114	10	1	126	100



## DISCUSSION

Urinary tract instrumentation and catheterization are necessary in the care of many patients who are hospitalized or reside on extended care facilities with problems in their urinary system which result to urine retention or incontinence. Unfortunately, urinary tract instrumentation and catheterization can lead to significant morbidity and mortality (14).

The age distribution of patients with indwelling urinary catheter showed 61-70 years age group were more prone to catheter associated bacteriuria. This is because the elderly are more prone to acquired structural abnormalities and neurogenic bladder secondary to stroke or autonomic neuropathy of diabetes than the young people.

In this study, catheter associated bacteriuria was found to be commoner in males than females. Obstruction caused by BPH, Ca Prostate, and Urethral structure is peculiar to the males.

In this centre 51.2% of patients with indwelling urinary catheter were on antibiotics either prophylactically or therapeutically, with 16.7% of them having varying numbers of combination of antibiotics. However the use of antibiotics did not influence the incidence of UTI in patients with indwelling urinary catheter since no significant difference was found between the group that was on antibiotics and that was not ( $P>0.5$ ).

It is inferred that a lot of wastage of fund goes into the purchase of antibiotics for prophylactic uses for patients with indwelling urinary catheter. Therefore efforts should be geared towards standard catheter care rather than the use of antibiotics unless when indicated for therapeutic purposes.

In this study, Gram negative organisms predominated accounting for 96.0% of all isolates. This is in consonance with the reports of Akinkugbe *et al* (2) and of Ekweozor and Onyemenem in uncomplicated UTI in the same centre (15). The agents were Klebsiella species, *Escherichia coli*, *Pseudomonas aeruginosa*, Proteus species. *Staphylococcus aureus* was the only Gram-positive cocci found. Other such as *Enterococcus faecalis* and *Staphylococcus saprophyticus* were not encountered. These organisms are more associated with uncomplicated UTI. The presence of *Staphylococcus aureus* is important as it is commonly associated with Nosocomial infections (6,17), the setting under which these patients were taken care of.

Most of the isolates were multiresistant antibiotics commonly used as prophylaxis or treatment in these patient were virtually inactive. These are Ampicillin, Cotrimoxazole Nitrofuradantion and Gentamicin. These drugs were given routinely after change of Catheters thereby potentiating the emergence of resistant strain over time. Onyemenem and Ekweozor recommended Gentamicin administration to patients severely infected with *Pseudomonas*, *Klebsiella* or *Enterobacter* (15). The low effectiveness of Gentamicin in this study as well as that reported by Oni *et al* (18) counteracts this advise.

This low effectiveness may be due the fact that Cations (eg.  $Ca^{2+}$  and  $Mg^{2+}$ ) present in urine inhibit the activity of Gentamicin and the development of resistance in hospital environment (19) or that the drug is gradually included among the antibiotics prone to abuse.

Most of the Gram-negative bacilli especially *Klebsiella* species and *Pseudomonas* species are intrinsically resistant to most antibiotics, a situation which favours their continued existence in hospital environment (16). This fact greatly contributes to the high incidence of these agents in this category of patients. There is acceptable levels of

sensitivity of the bacteria to Ofloxacin, Pefloxacin, Ceftazidime and Ceftriazone.

A lot of caution is required in the use of these new generation antibiotics. This is because there is emergence of resistance to the quinolones as reported in - vitro tests in our environment(18).

Emergence of resistance to the quinolones has also been reported in patients with complicated urinary infection with *Pseudomonas aeruginosa* (20).

These findings should be useful for those who have to manage patients with catheter associated bacteriuria with limited or without laboratory facilities especially in cases where there have been poor clinical response to therapy inspite of adequate use of commonly prescribed antimicrobials”.

The association between bacteriuria and subsequent pyelonephritis is well documented in both clinical and laboratory settings. The role of indwelling catheters as risk factors associated with pyelonephritis is also well accepted (21).

Since urinary catheterization is associated with significant morbidity and even mortality the indication for catheterization must be sound and aseptic techniques used. A closed drainage system is required with administration of oral or system antimicrobial agents as at when due should reduce infection.

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