

Incidence of Urinary Tract Infections among Out-Patients Attending Clinic in University of Calabar Teaching Hospital (UCTH), Calabar, Cross River State, Nigeria.

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ABSTRACT

A survey of urinary tract infections (UTIs) among patients in the University of Calabar Teaching Hospital (UCTH) was carried out by determining the patients' total bacterial counts, distribution of significant bacteriuria according to age group (0-17, 18-34, 35-51, 52-68, and 69-85 years), incidence rate of UTI for male and female, etiological agents and their percentage occurrence according to the age groups. Results showed that 68% of the 250 patients screened did not have urinary infections, while 23.6% had urinary tract infections, 8.8% had low level of bacteriuria.

Age group 35 – 51 years had the highest incidence of bacteriuria (41.7%), followed by group 18 – 34 years (32.0%) and 0 – 17 years (15.0%). Incidence of UTI is more in females than in males. Among 30 males and 30 females in the age group 35 – 51years assessed for UTI, 17 females had bacteriuria as against 8 males. More females had bacteriuria than males in all the age groups. *Escherichia coli* (95.7%) was observed to be the commonest etiological agent, followed by *Proteus* spp (31.4%), *Staphylococcus saprophyticus* (24.3%), *Staphylococcus aureus* (20.0%), *Pseudomonas aeruginosa* (11.4%), and haemolytic *Streptococcus* (8.6%).

Statistical analysis shows that there is no significant difference on the number patients visiting UCTH, and percentage occurrence of etiological agents according to age groups at P = 0.05 while there is significant difference in the distribution of significant bacteriuria according to age groups, incidence rate of UTI by age groups

for male and female, and percentage occurrence of etiological agents in 70 patients with significant bacteriuria at P = 0.05. These findings show that the rate of incidence of UTI follow the order; 35 – 51 > 18 – 34 > 52 – 68 > 0 – 17 > 69 – 85years age groups, with females being more vulnerable than males and *Escherichia coli* as the commonest etiological agent.

(Keywords: urinary tract infections, total bacterial counts, bacteriuria, incidence rates, percentage occurrence, etiological agents)

INTRODUCTION

Urinary tract infection (UTI) is a bacterial infection that affects any part of the urinary tract. Although urine contains a variety of fluids, salts and waste products, it does not usually have bacteria (AHA, 2005). UTI has different names, depending on what part of the urinary tract is infected. An infection in the bladder is called *Cystitis* or bladder infection and it is the commonest of the urinary tract infections. If the infection is on the kidney, it is called *Pyelonephritis*. There is also urethritis for infection in the urethra (Norrby, 2007).

Urinary tract infections are caused by bacteria that enter the urethra and then the bladder. This can lead to infection, most commonly in the bladder, which may spread to the kidney (Lin and Fajardo, 2008). Sexual activities, gender, urinary catheters, genetics, diabetes, sickle cell disease, enlarged prostate, narrowed urethra, kidney stone and pregnancy includes the risk factors of urinary tract infections (Fowler, 1996; Lin and Fajardo, 2008; Foster, 2008; Nicolle, 2008). In young

active women, sex is responsible for 90% of bladder infections, with risk factor related to the frequency of sex (Nicolle, 2008). The term "Honeymoon cystitis" has been applied to this phenomenon of frequent UTI during early marriage.

Symptoms of bladder infection include cloudy or bloody urine, low fever, pain or burning with urination, pressure or cramping in the lower or middle abdomen or back and strong need to urinate often, even right after the bladder has been emptied. If the infection spreads to the kidneys, symptoms may include chills and shaking at night, fatigue, fever above 101°F, flank (side), back or groin pain, flushed, warm or reddened skin, mental changes or confusion, nausea and vomiting, and abdominal pain (Lin and Fajardo, 2008; Nicolle, 2008).

Escherichia coli are the commonest pathogen causing 60-90% of urinary infections (Cheesbrough, 2002). UTIs caused by *Pseudomonas*, *Proteus*, *Klebsiella* species and *Staphylococcus aureus* are associated with hospital-acquired infections, often following catheterization or gynecological surgery (Cheesbrough, 2002; Nicolle, 2008). *Staphylococcus saprophyticus* infections are usually found in sexually active young women (Cheesbrough, 2002). Infections of anterior urinary tract (urethritis) are mainly caused by *Neisseria gonorrhoeae* (especially in men). *Candida* urinary infection is found in diabetic patients and those with immunosuppression (Cheesbrough, 2002). *Mycobacterium tuberculosis* is usually carried in the blood to the kidney from another site of infection. Pyuria with a negative urine culture may also be found when there is infection with *Chlamydia trachomatis*, *Ureaplasma* or *N. gonorrhoeae*, or when a patient has taken antimicrobials (Cheesbrough, 2002).

Diagnosis of UTI involves urinalysis, to look for the presence of nitrite, leukocytes or leukocyte esterase or via urine microscopy to determine the presence of red blood cells, white blood cells and bacteria maybe useful (Nicolle, 2008). Urine culture showing a quantitative count greater than or equal to 10^3 colony forming unit (CFU) per ml of a typical urinary tract organism along with antibiotic sensitivity testing, is a useful guide to antibiotic choice (Nicolle, 2008).

Despite the awareness in urinary tract infection and its consequent severe health implications, the rate of incidence of UTIs among different age groups has not received adequate attention. This study is therefore aimed at examining the distribution of UTIs among different age groups and determining their etiological agent among male and female within the age groups.

MATERIALS AND METHODS

Sample Collection

Two hundred and fifty urine samples were collected over a period of 2 weeks from patients who visited the University of Calabar Teaching Hospital, Calabar, Cross River State, Nigeria (UCTH). Samples were grouped according to age in the order 0-17, 18-34, 35-51, 52-68, and 69-85years. The samples were collected into sterile universal containers and transported to the Microbiology laboratory of the Cross River University of Technology, Calabar for analysis. The samples were analyzed within 6 hours of collection.

Microscopic Analysis

Urine was examined microscopically as a wet preparation to detect pyuria (white blood cells in excess of 10 cells per microliter (10^5 MI) of urine), red cells, casts, yeast cells and motile trophozoites of *Trichomonas vaginalis*. The pus and epithelial cells were also determined following standard procedures (Cheesbrough, 2002; Woodford and George, 2011)

Bacteriological Analysis

One hundred and fifty urine specimens that had about 2.5 pus cells per high power field (2.5 pusca/hpf), epithelial cells above 10/hpf or yeast cells were cultured on MacConkey agar and Cystine Lactose Electrolyte-Deficient (CLED) agar. They were incubated at 37°C for 24- 48hrs (Cheesbrough, 2002; Woodford and George, 2011).

Biochemical Analysis and Identification of Isolates

Biochemical tests were carried out for the characterization of the isolates and identification was made following standard methods (Cheesbrough, 2002; Brooks, *et al.*, 2004; Antai, 2005; Woodford and George, 2011).

RESULTS

The total bacterial count profile of 250 midstream urine specimen was determined as shown in Table 1. Sixty eight (68.0%) of the patients were not infected, 4.0% had 10^2 - 10^3 cfu/ml, 4.4% had 10^3 - 10^4 cfu/ml, 12.0% had 10^4 - 10^5 cfu/ml, and 11.6% had greater than (\geq) 10^5 cfu/ml. Result of statistical analysis shows that there is no significant difference in the total bacterial counts of the patients at $P = 0.05$. Cheesbrough (2002) reported that bacterial counts less than 10^4 /ml is considered not significant, 10^4 - 10^5 /ml is doubtfully significant and counts equal or greater than 10^5 /ml is significant bacteriuria.

Significant bacteriuria was observed in the age groups as represented in Table 2. Age group 35-51 years had the highest percentage (41.7%) of significant bacteriuria followed by age group 18-34 years with 32.0%. Age groups 0-17, 52-68, and 69-85 years had percentage bacteriuria of 15.0%, 6.6% and 0%, respectively. There is significant difference at $P = 0.05$ on the distribution of significant bacteriuria according to age groups.

The incidence rate of UTI by age group for male and female was elucidated (Table 3). In the age group 0 – 17 years, 2 males and 1 female had significant bacteriuria out of the 20 patients

tested. Among age group 18–34 years, 14 males and 26 females had significant bacteriuria out of 125 patients tested. Eight (8) males and 17 females out of 60 patients tested had significant values in the 35 -51 years age group. On the other hand, 1 male and 1 female had significant bacteriuria out the 30 patients tested among 52 – 68 years age groups, while no significant value was observed for patients in age group 69–85 years. Statistical analysis revealed that there is significant difference on the incidence rate of UTI by age groups for male and female at $P = 0.05$.

The etiological agents of UTI among the patients were elumerated (Table 4). Out of the 70 patients that had significant bacteriuria, 95.7% of the cases presented with *Escherichia coli* as the etiological agent, 31.4% had *Proteus* spp, and 24.3% had *Staphylococcus saprophyticus* while 20.0% had *Staphylococcus aureus* as etiological agent. *Pseudomonas aeruginosa* and Haemolytic *Streptococcus* were responsible for 11.4% and 8.6% of the cases, respectively. There is significant difference at $P = 0.05$ on the etiological agents of UTI in 70 patients with significant bacteriuria.

The total percentage occurrence of the etiological agents according to age groups was determined (Table 5). *Escherichia coli* is shown to be the most common etiological agent of UTI in the sampled population. It was identified in all the age groups except 69–85 years which had no infection. The highest was observed in the age group 35–51 years (66.7%) followed by 18–34 years (20.0%). Result of statistical analysis shows that there is no significant difference at $P = 0.05$ on the percentage occurrence of etiological agent according to age groups.

Table 1: Total Bacterial Count in Urine Samples from Patients visiting UCTH.

Total count range (cfu/ml)	Number of Patients n = 250	Percentage (%)
No growth	170	68.0
10^2 - 10^3	10	4.0
10^3 - 10^4	11	4.4
10^4 - 10^5	30	12.0
$\geq 10^5$	29	11.6

* = $P < 0.05$

Table 2: Distribution of Significant Bacteriuria According to Age Group.

Age group (Years)	Number tested	Number (%) with Significant Bacteriuria		
		10 ⁴ -10 ⁵ /ml	≥ 10 ⁵ /ml	Total
0 - 17*	20	2(10.0)	1(5.0)	3(15.0)
18 - 34	125	22(17.6)	18(14.4)	40(32.0)
35 - 51	60	18(30.0)	7(11.7)	25(41.7)
52 - 68	30	1(3.3)	1(3.3)	2(6.6)
69 - 85	15	0(0)	0(0)	0(0)
Total	250	43(17.2)	27(10.8)	70(95.3)

* = P > 0.05

Table 3: Incidence Rate of UTI by Age Groups for Male and Female.

Age group tested	Number		Male		Female		Male		Female	
	Male	Female	10 ⁴ -10 ⁵ /ml	≥10 ⁵ /ml	10 ⁴ -10 ⁵ /ml	≥10 ⁵ /ml	Total	Total	Total	Total
0 - 17	20	8	12	2	0	0	1	2	1	1
18 - 34	125	75	50	8	14	6	12	14	26	26
35 - 51	60	30	30	5	13	3	4	8	17	17
52 - 68	30	10	20	1	0	0	1	1	1	1
69 - 85	15	5	10	0	0	0	0	0	0	0
Total	250	128	122	16	27	9	18	25	45	45

* = P < 0.05

Table 4: Etiological Agents of UTI in Patients with Significant Bacteriuria.

Etiological agents	10 ⁴ -10 ⁵ /ml	≥10 ⁵ /ml	Total	% occurrence
<i>Escherichia coli</i>	20	47	67	95.7
<i>Proteus spp</i>	12	10	22	31.4
<i>Staphylococcus saprophyticus</i>	8	9	17	24.3
<i>Staphylococcus aureus</i>	7	7	14	20.0
<i>Pseudomonas aeruginosa</i>	4	4	8	11.4
<i>Haemolytic streptococcus</i>	3	3	6	8.6

* = P < 0.05

Table 5: Incidence Rate of Etiological Agents According to Age Group.

Age group	Number Tested	Number (%) with Significant Bacteriuria						% Occurrence
		<i>E. coli</i>	<i>Proteus spp.</i>	<i>Staphylococcus saprophyticus.</i>	<i>S. aureus</i>	<i>Pseudomonas aereuginosa</i>	<i>Haemolytic streptococcus</i>	
0 - 17*	20	1(5.0)	0(0)	0(0)	0(0)	0(0)	0(0)	5
18 - 34	12	25(20.0)	12(9.6)	3(2.4)	11(8.8)	10(8.0)	5(4.0)	52.8
35 - 51	6	40(66.7)	7(11.7)	5(8.3)	6(10.0)	4(6.7)	1(1.7)	105
52 - 68	30	1(3.3)	3(10.0)	0(0)	0(0)	0(0)	0(0)	13.3
69 - 85	15	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0

* = P > 0.05

DISCUSSION

The total bacterial counts show that 68% of the patients were not infected. Cheesbrough (2002) reported that bacterial counts less than 10^4 /ml is considered not significant, 10^4 - 10^5 /ml is doubtful significant and counts equal or greater than 10^5 /ml is significant bacteriuria. Hence, bacterial counts of 8.4% (4.4% and 4.0%) of the patients could be said to be non-significant while 23.6% (12.0% and 11.6%) were significant.

The distribution of significant bacteriuria revealed that age group 35–51 years had the highest percentage of 41.7%. This is followed by group 18 - 34 yrs with 32.0%. This result agrees with the findings of Lin and Fajardo (2008) and Nicolle (2008) that sexual activities is a risk factor of UTI. Age groups 35 -51 years and 18 – 34 years fall into the sexually active class. Woodford and George (2011) reported that urinary tract symptoms are frequently lacking in the elderly. The presentations may be vague with incontinence, a change in mental status, or fatigue as the only symptoms (Lane and Takhar, 2011). While some present to a health care provider with sepsis, an infection of the blood, as the first symptoms (Salvatore *et al.*, 2011). Diagnosis can be complicated by the fact that many elderly people have preexisting incontinence or dementia (Woodford and George, 2011).

The incidence rate of UTI by age group for male and female shows that female are more vulnerable than male. The study revealed that among 30 males and 30 females in the age group 35 – 51 years assessed for UTI, 17 females had significant bacteriuria as against 8 males. This result was confirmed when out of 75 males and 50 females screened for UTI, 26 females as against 14 males had significant bacteriuria. This corroborates the finding of Dielubanza and Schaeffer (2011) that women are more prone to UTI than men, because, in female, the urethra is much shorter and closer to the anus. As a women's estrogen levels decrease with menopause, her risk of urinary tract infections increases due to the loss of protective vaginal flora (Dielubanza and Schaeffer, 2011).

Escherichia coli were found to be the major causative agent of UTI, with 95.7% occurrence. It is followed by *Proteus* spp. (31.4%), and *Staphylococcus saprophyticus* (24.3%). Cheesbrough (2002) reported that *Escherichia coli* are the commonest urinary pathogen, causing

60 – 90% of infections. *Escherichia coli* are the cause of 80–85% of urinary tract infections, with *Staphylococcus saprophyticus* being the cause in 5–10% (Nicolle, 2008). Rarely, they may be due to viral or fungal infections (Amdekar *et al.*, 2011). Other bacterial causes include: *Klebsiella*, *Proteus*, *Pseudomonas*, and *Enterobacter*. These are uncommon and typically related to abnormalities of the urinary system or urinary catheterization (Salvatore *et al.*, 2011). Urinary tract infections due to *Staphylococcus aureus* typically occurs secondary to blood born infections (Lane and Takhar, 2011). During Cystitis, uropathogenic *E. coli* subvert innate defenses by invading superficial umbrella cells and rapidly increasing in numbers to form intracellular communities (Justice, *et al.*, 2006). Some strains of *E. coli* are more invasive, for example, capsulated strains are able to resist phagocytosis, other strains are more adhesive (Cheesbrough, 2002).

The examination of incidence rate of the etiological agents confirms the findings that *E. coli* is the commonest urinary pathogen. Result shows that it had the highest percentage of occurrence (66.7%) in the 34 – 51 years and 20% in the 18 – 34 years. It is followed by *Proteus* spp. with 11.7% in the 35 – 51 years and 9.6% in the 18 – 34 years.

This study indicates that incidence of urinary tract infections according to age, follow the order; 35 – 51 > 18 – 34 > 52 – 68 > 0 – 17 > 69 – 85 years, with females being more vulnerable than males and *Escherichia coli* as the major etiological agent.

CONCLUSION

The research revealed that the age group; 35-51 years has the highest incidence of significant bacteriuria, followed by 18-34 years age group. Females were found to be more vulnerable to bacteriuria than the males. *Escherichia coli* are the commonest etiological agent of urinary tract infections among patients in the University of Calabar teaching hospital.

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