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URINARY BACTERIAL ISOLATES AND THEIR ANTIBIOTIC SENSITIVITY PATTERNS AT UNIVERSITY OF ILORIN TEAHING HOSPITAL, ILORIN, NIGERIA.

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Abstract

This study was carried out to determine the prevalent bacterial agents of Urinary Tract Infections (UTI) and their antibiotics sensitivity patterns in Ilorin, Nigeria. Midstream urines of 10,119 patients who are suspected of UTI were screened for significant bacteriuria. Sensitivity of isolates to selected second and third generation cephalosporins, quinolones and aminoglicosides was carried out using agar diffusion method. 534 (5.28%) of the urine specimens were positive for bacterial growth. Gram negatives bacteria accounted for the majority of the isolates (85.6%), all being members of the Enterobacteriaceae except Pseudomonas aeruginosa which accounted for 7.12% of all isolates. The overall predominant isolate was Escherichia coli (34.08%). Other isolates included Klebsiella pneumoniae (32.21%), Staphylococcus aureus (10.67%), Enterobacter spp.(10.49%), Enterococcus faeclis (3.18%), Proteus spp (1.69%) and Staphylococcus epidermidis (0.56%). Increased incidence of UTI due to gram positive bacteria was recorded. The predominant cause of community acquired UTI was Escherichia coli while Klebsiella pneumonae was the most common agent of UTI among in-patients. Most isolates were sensitive to fluoroquinolones (ofloxacin and ciprofloxacin) and the third generation cephalosporins (ceftriaxone and ceftazidime). The second generation cephalosporin, cefuroxime showed poor activity against Enterococcus faecalis (41.18%), Staphylococcus aureus (40.35%), Staphylococcus

epidermidis (33.00%) and Pseudomonas aeruginosa (18.42%). Majority of the isolates were resistant to nitrofurantoin and gentamycin. A combination of a third generation cephalosporin and fluoroquinolones where not contraindicated, is recommended for the empiric treatment of UTI before sensitivity results are available.

Keywords: Urinary tract infection, bacteriuria, antibiotic sensitivity.

Introduction

A urinary tract infection (UTI) is a serious health problem world over being a major cause of morbidity and mortality amongst the affected patients whose number is said to run into millions yearly (Blumberg, *et al*., 1997). The true incidence of UTI however is not yet known in Nigeria (Adedoyin, *et al*., 2003). In a study in Ibadan, a value of 21.7% was arrived at among all patients, independent of age or sex (Ekweozor and Onyemenem, 1996). While 21.4% was obtained among peadiatric patients with febrile illness in Ilorin (Adedoyin, et al., 2003). Other studies, among pregnant women in Nigeria reported 26% (Aboderin, et al., 2004) and 69.5% in patients carrying indwelling urinary catheters (Oni et al., 2003).

Infections of urinary tract often arise as a complication of catheterization and other forms of urinary tact instrumentations, bactereamia / septicaemia, obstructive uropathy and diabetes mellitus (warren, 2001; Carapeti, et al., 1996 and Walter, 2001). The incidence of UTI is also said to be high among geriatric population, patients with urinary incontinence/urogenic bladder and sexually active young women among others(Walter, 2001 and John, 1996).

The un-holy alliance between UTI and nosocomial infections today is a source of concern to health care providers in any hospital setting with UTI being responsible for about 80% of all hospital acquired infections (Sharify, 2004). This situation is further worsened by the current spread of multi-drug (antibiotics) resistant strains of various bacterial pathogens throughout the world (Onile, 1997).

Even though members of Enterobacteriacae have been proven to be the regular and commonest cause of UTI (Warren, 2001 and Walter, 2001), The predominant and specific bacterial agents, and their antibiotic sensitivity varies from one locality to another, and over time in any particular place. Of recent, uncommon microorganisms, gram positive cocci especially, and *Staphylococcus saprophyticus* in particular, which hitherto had played minimal roles in UTI were being more frequently encountered (Ekweozor and Onyemenem, 1996).

In view of these, regular bacterial and antibiotic susceptibility surveillance of urinary samples are a necessity. This will provide timely detection of any deviation from what is already known and enable health care service providers avoid complications and offer effective and efficient medical care to patients. The present work therefore is aimed at determining the prevalent bacterial agents of UTI and their antibiotic sensitivity patterns at the University of Ilorin Teaching Hospital (UITH), Ilorin, Nigeria.

Materials and Methods

Samples collection

This study was carried out in the Department of Medical Microbiology, UITH, Ilorin, Nigeria between June, 2002 and May 2004.

All urine samples (10, 119) submitted for Microscopy Culture and Sensitivity were analysed microbiologically using MacConkey, CLED and Blood agar. The plates were incubated at 37°C for 18-24hrs, samples with bacterial count equal to 10^5cfu/ml or greater is considered significant bacteriuria (CDC, 2003) and hence positive for UTI. All isolates were fully characterised biochemicaly and serologically where found necessary (Monica, 1991).

Request forms sent along with samples were used to determine the age, sex and ward/ hospital unit of the patients been analysed.

Antibiotic sensitivity test.

Antibiotic sensitivity testing was performed using the modified method of Kirby Bauer (1996) and Johnson et al., (1995). Pure colonies of the isolated organisms were suspended in sterile normal saline inside bijou bottles and the turbidity of the suspension adjusted to 0.5 McFarland's standard. A sterile cotton swab was dipped into the suspension and squeezed against the side of the bottle. The swab was then used to inoculate diagnostic sensitivity test agar before the application of single antibiotic discs and subsequent incubation at 37°C aerobically for 24hours.

Zone diameters of inhibition around each disc were measured using a calibrated ruler and interpreted according to National Committee for Clinical Laboratory Standards (NCCLS, 1990). *Escherichia coli* NCTC 10418, *Staphylococcus aureus* NCTC 6571 and *Pseudomonas* ATCC 27853 were used as control strains as appropriate. The antibiotic discs used were Ofloxacin (10µg), Ceftazidime (30µg), Gentamycin (10µg), Erythromycim (5µg), Ciprofloxacin (5µg), Azithromycin (10µg), Cefuroxime (30µg), Ceftriaxone (30µg), Perfloxacin (5µg), and Nitrofurantoin (200µg).

Results

Out of 10,119 of samples examined 534 were bacteriologically significant, giving a rate of 5.28%. Of this, 236(44.2%) were from males and 298(55.8%) were from females resulting in a male to female ratio of 1:1.3

The age and sex distribution of the patients with significant bacteriuria is as presented in Figure 1. Women ages 31-40 years were mostly affected, while men were more affected at age 61-70 years.

Table 1 shows the ward/ hospital unit distributions of the significant bacteriuria patients. Majority of the patients with significant bacteriuria were from Adult Medical Wards, 179 (33.52%) followed by those from the General Out-patient Department, 105 (19.66%) and the least from Paediatrics ward, 5 (9.36%).

The gram negatives bacteria accounted for 457(85.6%) of the isolates, with *Pseudomonas aeruginosa* giving 38 (7.12%) of this number.The overall predominant isolate among the gram negative bacteria was *Escherichia coli* 182 (34.08%). The predominant cause of community acquired UTI was *Escherichia coli 182(*43.08) while Staphylococcus *aureus* was the predominant gram-positive isolates found 57 (10.67%), Table 2.

The antibiotic sensitivity patterns of the isolates were as summarized in Tables 3 and 4. All the isolates were generally sensitive to quinolones (ciprofloxacin, ofloxacin) and the third generation cephalosporins (ceftazidime and ceftriazone). The second generation cephalosporin, cefuroxime showed poor activity against *Staphylococcus aureus* (40.35%), *Staphylococcus epidermidis* (33.00%), *Enterococcus faecalis* (41.18%) and *Pseudomonas aeruginosa* (18.42%). *Klebsiella pneumoniae, Escherichia coli, Enterobacter* sp. and *Enterococcus faecalis* were resistant to gentamycin with each showing 46.51%, 45.05%, 32%, and 23.53% percentage sensitivity respectively. All gram negative isolates and *Enterococcus feacalis* were resistant to nitrofurantoin.

Discussion

The 5.23% prevalent rate of significant bacteriuria among all urine samples screened in this study is far lower than that reported in a study from Ibadan where 21.7% was obtained (Ekweozor,1996). This may have to do with increase in level of awareness of hospitals especially tertiary health care service providers on dangers of inappropriate handling of catheter in catheterized patients.

The male to female ratio of patients with positive urine culture was 1: 1.3. This finding corroborates the works of Adedoyin, et al., (2003) and Ekweozor, (1996). Females were more affected in this study and they

accounted for 298 (55.81%) of patients with significant bacteriuria. This has been explained to be related to the anatomic and hormonal differences between males and females which tend to favour UTI in females (Walter, 2001). In this study we observed that females between ages of 30-50 were mostly affected with significant bacteriuria meaning that these groups of patients are likely to suffer Urinary Tract Infection. The reason for vulnerability of this group is due to the fact that, female hormones are at maximal level of production during the reproductive years and by decreasing motility of the urino-genital tract, causes stasis which predisposes women more to UTI (Ekweozor, 1996, Walter, 2001 and John, 1995). Males, in this study, were mostly affected at old age (>50 years). This may be related to other medical problems prevalent during this period that may warrant hospitalization and urinary catheterization (Walter, 2001 and John, 1996).

Most cultures with significant bacteriuria came from the Adult Medical Units (33.52%) of the hospital, this may be due to the fact that the unit is where debilitated patients, often on urinary catheters are being treated. The high rate of UTI among patients attending the General Out-patient Unit (19.66%) of the hospital can not be explained. However, the 18.16% and 15.36% recorded with patients in Accident & Emergency Unit and Surgery Unit respectively may be related to the regular use of urinary catheters in these areas. The same reason goes for Obstetrics and Gynaecology wards where 9.36% rate was obtained. Very few significant bacteriuria cultures were obtained at Neonatal Intensive Care Unit (0.56%) and Peadiatric ward (0.98%). This attest to the fact that the incidence of UTI is generally low among neonates, infants and children (Walter, 2001), this may be related to the difficulty associated with proper specimen collection in peadiatrics and as such, the reduce request for urine cultures in this age bracket.

In this study gram- negative organisms, account for majority of the isolates (85.58) this agreed with earlier finding of Walter (1996) and Joseph (2003). *Escherichia coli* and *Klebsiella pneumonae* were respectively predominant agents of community acquired UTI and UTI among hospitalized patients (Table 2), this work is in conformity with the report of Kweozor (1996) report. However, the overall commonest isolate was *Escherichia coli* (34.08%) as against *Klebsiella spp.* reported in Ibadan.

A considerable increase in the level of UTI due to gram positive bacteria was recorded in this study (Table 2) this is far higher than what was reported by Ekweozor,(1996). Majority of the gram positive agent of UTI in this study were *Staphylococcus aureus* as against the Ibadan study where coagulase negative staphylococcal agents were the predominant gram positive isolates.

All the isolates obtained in this study were sensitive to quinolones (ciprofloxacin, ofloxacin) and the third generation cephalosporins (ceftazidime and ceftriazone). This may be due to the fact that these drugs were relatively new in the Nigerian market and also expensive, this reduce level of abuse by the consumers and therefore reduce resistance to them. The second generation cephalosporin, cefuroxime however showed poor activity against *Staphylococcus aureus* (40.35%), *Staphylococcus epidermidis* (33.00%), *Enterococcus faecalis* (41.18%) and *Pseudomonas aeruginosa* (18.42%). Though these isolates are among the highly resistant bacteria known today, cefuroxime is one of the most used cephalosporin at our centre and its earlier usage in Nigeria may be responsible for its reduced antibacterial activity. *Klebsiella pneumoniae, Escherichia coli, Enterobacter* sp. and *Enterococcus faecalis*, were resistant to gentamycin with 46.51%, 45.05%, 32%, and 23.53% percentage sensitivity respectively. All gram negative isolates and *Enterococcus feacalis*, were equally resistant to nitrofurantoin. The degree of resistance noted against gentamycin and nitrofurantoin may have to do with pressure exerted by the prolonged usage and probably ready abuse of these drugs in this country.

In conclusion, current prevalent rate of UTI University of Ilorin Teaching Hospital as found in this study is 5.28%. The predominant causative organisms of UTI in our environment are gram negative bacteria and most isolates are sensitive to floroquinolones (ciprofloxacin and ofloxacin) and the third generation cephalosporins (ceftazidime and ceftriazone). Therefore a combination of a third generation cephalosporin and fluoroquinolones, where not contraindicated as in children below the age of 12 years, is recommended for the empiric treatment of patients with UTI before sensitivity results are available. A higher index of suspicion is required to detect cases of peadiatric UTI and a six month to yearly review of sensitivity profile of clinical isolates is advocated.

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TABLE 1: Ward Distribution of Patients with Significant Bacteriuria.

Ward/ hospital unit	No of patients	Percentage
EPU	13	2.44
NICU	3	0.56
ADULT MEDICAL	179	33.52
SURGERY	82	15.36
PEADIATRICS	5	0.94
O&G	50	9.36
GOPD	105	19.66
A&E	97	18.16
TOTAL	534	100

KEY
EPU: Emergency paeditric unit
NICU: Neonatal intensive care unit
O&G: Obstetrics and gynaecology
GOPD: General out-patient Department
A&E: Accidents and emergency

Table 2 Distribution of Bacterial Agents Causing UTI In both out and in-patients in UITH Ilorin

Bacterial agents	Out-patients no	In-patients no	Total no	(%)
Klebsiella pneumoniae	66	106	172	(32.68)
Escherichia coli	103	79	182	(43.08)
Enterobacter species	0	56	56	(10.49)
Pseudomonas aeruginosa	14	24	38	(7.12)
Proteus species	3	6	9	(1.69)
Staphylococcus aureus	46	11	57	(10.67)
Enterococcus faecalis	13	4	17	(3.18)
Staphylococcus epidermidis	0	3	3	(0.56)
Total	245	289	534	(100.0)

KEY
no: number of isolates
%: percentage of isolates represented.

Table 3: Susceptibility pattern of gram- negative urinary bacterial Isolates.

Antibiotics	*Klebsiella pneumoniae* n=172		*Escherichia coli* n=182		*Enterobacter species* n=56		*Proteus species* n=9		*Pseudomonas aeruginosa* n=38	
	x	(%)	x	(%)	x	(%)	x	(%)	x	(%)
Ceftaxidime	134	(77.91)	131	(71.98)	34	(61.00)	8	88.89)	38	(100.0)
Cefuroxime	102	(59.30)	109	(59.89)	48	(86.00)	5	55.56)	7	(18.42)
Ceftriazone	157	(91.28)	154	(84.62)	56	(100.0)	9	100.0)	33	(86.84)
Ciprofloxacin	123	(71.51)	116	(63.74)	42	(75.00)	9	100.0)	29	(76.32)
Ofloxacin	119	(69.19)	118	(64.84)	45	(80.00)	7	77.78)	31	(81.58)
Perfloxacin	83	(48.26)	109	(59.89)	56	(100.0)	6	66.67)	26	(68.42)
Azithromycin	132	(76.74)	133	(73.08)	37	(66.07)	9	(100.0)	20	(53.63)
Gentamycin	80	(46.51)	82	(45.05)	18	(32.00)	6	(66.67)	24	(63.16)
Nitrofurantoin	68	(34.88)	79	(43.41)	23	(41.00)	0	(00.00)	16	(42.11)

KEY

n: number of isolates
x: number of isolates sensitive
%: percentage of isolates sensitive

Table 4: Susceptibility pattern of gram- positive urinary bacterial Isolates.

Antibiotics	*Staphylococcus aureus* n=57		*Staphylococcus epidermidis* n=3		*Enterococcus faecalis* n=17	
	X	(%)	X	(%)	X	(%)
Ceftaxidime	39	(68.42)	2	(67.00)	13	(76.47)
Cefuroxime	23	(40.35)	1	(33.00)	7	(41.18)
Ceftriazone	57	(100.0)	3	(100.0)	14	(82.35)
Ciprofloxacin	49	(85.96)	3	(100.0)	17	(100.0)
Ofloxacin	51	(89.47)	3	(100.0)	16	(94.12)
Perfloxacin	40	(70.18)	3	(100.0)	7	(41.18)
Erythromycin	39	(68.42)	2	(67.00)	8	(47.06)
Gentamycin	48	(84.21)	3	(100.0)	4	(23.53)
Nitrofurantoin	46	(80.70)	3	(100.0)	7	(41.18)

KEY

n: number of isolates
x: number of isolates sensitive %: percentage of isolates sensitive

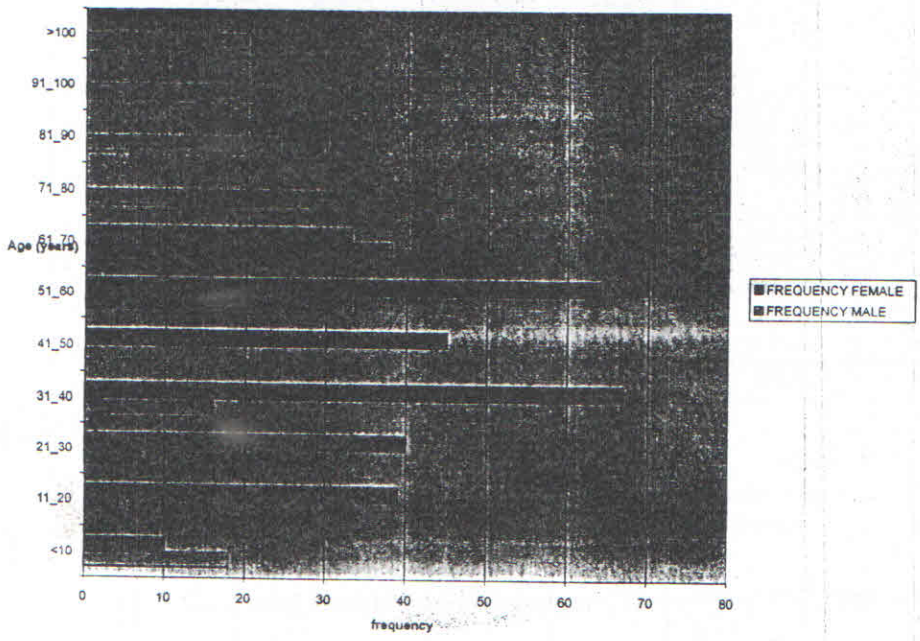

Figure 1: Age and sex distribution of patients With significant bacteriuria