Antibiotics Susceptibility Pattern of Uropathogenic Bacterial Isolates from Community- and Hospital- Acquired Urinary Tract Infections in a Nigerian Tertiary Hospital

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Citation

S NWADIOHA, E NWOKEDI, G JOMBO, E KASHIBU, O ALAO. *Antibiotics Susceptibility Pattern of Uropathogenic Bacterial Isolates from Community- and Hospital- Acquired Urinary Tract Infections in a Nigerian Tertiary Hospital*. The Internet Journal of Infectious Diseases. 2009 Volume 8 Number 1.

Abstract

The study was designed to determine common bacterial aetiology of community and hospital –acquired urinary tract infection and their antibiotic sensitivity pattern. Reports of urine culture and sensitivity were retrospectively studied from September 2007 to September 2008 in the laboratory of Medical Microbiology and Parasitology Department of Aminu Kano Teaching Hospital, Kano. Results were analysed using SPSS 11.0 statistical software while p- values <0.05 were considered significant. A total of 3500 urine samples were processed .The overall prevalence of urinary tract infection was 26.0% (n=910); community –acquired urinary tract infection was 14.9%(n=520) and hospital-acquired urinary tract infection was 11.1%(n=390). p<.05. Escherichia coli predominated across the two groups (community- acquired =70.0%, hospital- acquired =25.6%) followed by Klebsiella species (community –acquired =25.4%, hospital acquired =15.2%), Proteus mirabilis(community- acquired =4.0%, 17.9%). Staphylococcus aureus(community-acquired =1.9%, hospital- acquired =6.0%). The least was Pseudomonas aeruginosa(community –acquired=0.0%, hospital-acquired =6.2%). Most isolates were resistant to Cotrimoxazole, Tetracyclines, Ampicillin, Erythromycin, Nalidixic acid and Chloramphenicol while Ciprofloxacin, Ceftriaxone and Ceftazidime showed very high activity against most of the isolates. Floroquinolones and third generation cephalosporins should be recommended choice of first line drugs for treatment of urinary tract infection where susceptibility testing is unavailable.

INTRODUCTION

Urinary tract infection (UTI) is the most common health care -associated group of bacterial infection affecting humans in Africa [1]. Most of them are as a result of urinary catheter induced infection, which comprises about 85% of nosocomial UTI [2].

A prevalent study done in Nguru, northern Nigeria[3], of microorganisms in community –acquired (CA) versus hospital –acquired (HA) UTIs was as follows , E.coli (CA=19.9%, HA =11.5%), Klebsiella species (CA=12.8%, HA=8.9%), S.aureus (CA=4.7%, HA=2.7%), Streptococcus fecalis (CA=1.4%, HA=4.3%), Pseudomonas aeruginosa (CA=1.7%, HA=3.7%), Proteus mirabilis (CA=1.7%, HA=3.0%), Salmonella species(CA=2.4%, HA=0.0%). A similar study was carried out in India [4], which recorded a predominant rate (50.0%) of E.coli among CA UTI, resistant to Cotrimoxazole and Aminopenicillins. Another study done in Sagamu, western Nigeria among pregnant women and non pregnant women recorded 26.6% and 5.6% prevalence respectively of significant bacteriuria [5]. Thus UTI is a disease too common to be ignored in modern day medical practice since it is encountered at virtually all levels of health care provision in Africa and beyond [6].

The present study was therefore carried out to determine the spectrum of bacterial isolates and their antibiotic susceptibility in community versus hospital –acquired UTI in Aminu Kano Teaching Hospital, Kano. The findings underscore the impact of UTI in the locality and the choice of empirical treatment.

MATERIALS AND METHODS

STUDY AREA

The study was carried out in Kano, an ancient city situated in north- western part of Nigeria. It is densely populated and known for commercial activities, with a historic background of ground -nut pyramid. The city hosts a teaching hospital named Aminu Kano Teaching Hospital(AKTH) which serves as a referral centre for the state and neigbouring states

like Kaduna, Katsina, Jigawa, Yobe.

PROCEDURE

A retrospective study that reviewed the report of urine microscopy , culture and sensitivity from September 2007 to September 2008 was carried out in Microbiology and Parasitology laboratory of the Aminu Kano Teaching Hospital. The urine samples were collected from out-patient departments and from the wards in the hospital. The samples were grouped into two categories on the basis of community –acquired UTI and hospital acquired UTI.

COMMUNITY –ACQUIRED UTI group, included the following; (1) Out –patients with UTI who visited out-patient clinics. (2) In –patients who had UTI at the time of admission. (3) In-patients who developed UTI less than 24 hours of admission without initial diagnosis of UTI.

HOSPITAL -ACQUIRED UTI group, included the following; (1) In-patients who had been on admission for more than 24 hours but UTI was not diagnosed at the time of admission. (2) Out-patients whose history of UTI was traced from the hospital.

Majority of the samples were midstream urine specimens, and others included catheterized urine samples and supra-pubic aspirates, collected in sterile universal bottles (about 15 ml) and processed immediately or stored at 4 °C within 4 hours. Urine samples were examined macroscopically and microscopically. Uncentrifuged urine was examined under x40 objective for pus cells, red blood cells, casts and crystals and other important features and later centrifuged at 1500 rpm and sediments examined for parasites. The uncentrifuged urine samples were inoculated with a calibrated loop delivering 0.001 ml of urine onto Cystine Lactose Electrolyte Deficient (CLED) agar and Blood agar plates. The culture plates were incubated aerobically at 36 °C for 18 to 24 hours. A number of more than 100 colonies per ml of urine were considered significant. A significant bacteriuria count was taken as any count equal to, or in excess of 10^5 per milliliter of urine. The colonies were identified by standard biochemical tests and antibiotic sensitivity of the organisms was performed by Kirby-Bauer diffusion technique in accordance with NCCLS criteria [7] . Control strains used were E. coli NCTC 10418, Pseudomonas aeruginosa NCTC 10662 and Staphylococcus aureus NCTC 6571. The results were analyzed using SPSS 11.0 statistical software; chi-square(X^2) was used to compare association between proportions and P-values <0.05 was considered significant at 95.0% confidence level. Ethical approval was given by the ethics committee of the Aminu Kano Teaching Hospital.

RESULTS

Urine samples belonging to three thousand and five UTI patients were collected and processed between September 2006 to September 2007, in Medical Microbiology and Parasitology laboratory of Aminu Kano Teaching Hospital. Three thousand subjects were managed for community-acquired UTI, while only 500 subjects were managed for hospital acquired UTI .Only nine hundred and ten(26.0%) urine samples yielded uropathogenic bacterial isolates from the patients of UTI in Aminu Kano Teaching Hospital, Kano. Five hundred and twenty bacterial uropathogens were isolated from 3000 urine samples collected from community –acquired UTI patients, whereas, 390(78.0%) isolated from 500 urine samples collected from hospital –acquired UTI patients. These associations were found to be statistically significant.($p<0.05$). (Table I).

E.coli predominated across the two groups (CA=70.0%, HA=25.6%), followed by Klebsiella species (CA=25.4%, HA=15.2%), Proteus mirabilis (CA=4.0%, HA=17.9%), Proteus vulgaris (CA=2.9%, HA=2.8%), Staphylococcus aureus (CA=4.4%, HA=6.0%), Enterococcus species (CA=1.9%, HA=4.7%), Coagulase negative staphylococcus (CA=1.6%, HA=1.4%), Pseudomonas aeruginosa (CA=0.0%, HA=6.2%) (Table II).

E.coli, Klebsiella species, Proteus mirabilis, Proteus vulgaris, Enterococcus species, Staphylococcus aureus and Coagulase Negative Staphylococcocci from the CA UTI group of patients were averagely below 50% sensitive to the antibiotics; Ampicillin, Tetracyclines and Cotrimoxazole. Antibiotics such as Chloramphenicol, Erythromycin, Cloxacillin, Nalidixic acid and Nitrofurantoin showed average activity of about 50% on these organisms. On the other hand, antibiotics such as Augmentin, Gentamycin, Ceftazidime, Ceftriaxone and Ciprofloxacin recorded higher activity of about 70% and above on these organisms (Table III).

The sensitivity pattern of bacterial isolates ; E. coli, Klebsiella species, Proteus mirabilis, Proteus vulgaris, Staphylococcus aereus, Coagulase Negative Staphylococci and Enterococci from the HA UTI group of patients was considerably lower for the majority of the antibiotics as compared to isolates from the CA UTI group. They far

below 50% sensitive to the following antibiotics; Ampicillin, Cotrimoxazole, Gentamycin,Nalidixic acid, Tetrcyclines, Tetracyclines, Chloramphenicol, Erythromycin nd Cloxacillin. This difference was found to be statistically significant (P<0.05). (Table III and IV). However, Ceftriaxone, Ceftazidime and Ciprofloxacin recorded a relative high level of activity (average of 70% and above) to the organisms. Pseudomonas aeruginosa was still very sensitive to Ceftazidime and Ciprofloxacin(Table IV).

Figure 1

Table I. Distribution of urine samples and bacterial isolates among the community versus hospital- acquired UTI groups of patients in Aminu Kano Teaching Hospital, Kano, from September 2006 to September 2007

*UTI	Urine Samples of the Patients	Bacterial Isolates from Urine Samples	Percentage
CA	3000	520	17
HA	500	390	78

*UTI – Urinary Tract Infection, HA – Hospital Acquired, CA – Community Acquired

X^2 =18.00 df=1 p<0.05

Figure 2

Table II. Bacterial aetiology of UTI among study population in Aminu Kano Teaching Hospital, 2007 -2008

ISOLATES	*CA UTI Group of Patients No.(%)	HA UTI Group of Patients No.(%)	Total No.(%)
Escherichia coli	364(70.0)	100(25.6)	464(51.0)
Proteus mirabilis	21(4.0)	70(17.9)	91(10.0)
Proteus vulgaris	15(2.9)	50(12.8)	65(7.1)
Klebsiella spp.	79(15.2)	99(25.4)	178(19.6)
Enterococcus spp.	9(1.9)	18(4.7)	27(3.0)
Staphylococcus aureus	23(4.4)	23(6.0)	46(5.1)
Coagulase-Negative-Staphylococci	9(1.6)	6(1.4)	15(1.6)
Pseudomonas aeruginosa	-	24(6.2)	24(2.6)
TOTAL	520(57%)	390(43%)	910

*CA- Community Acquired , HA- Hospital Acquired , UTI- Urinary Tract Infection

Figure 3

Table III. Bacterial isolates and antibiotic sensitivity pattern amongcommunity -acquired UTI group of patients in Aminu Kano Teaching Hospital 2007 -2008

ANTIBIOTICS	BACTERIAL ISOLATES						
	*E. coli 364 (%)	P. mirabilis 21 (%)	P. vulgaris 15 (%)	Klebsiella spp 79 (%)	Enterococci 9 (%)	S. aureus 23 (%)	CNS. 9 (%)
AMPICILLIN	130(49.2	39(48.2)	27(49.1))	39(49.4)	8(50.0)	9(56.3)	5(55.6)
AUGMENTIN	-	43(53.1)	29(52.7)	42(53.2)	-	-	-
CO-TRIMOXAZOLE	120(45.5	39(48.2)	25(45.5)	0(0.0))	-	-	-
CEFTAZIDIME	-	-	-	70(88.6)	-	-	-
CEFTRIAXONE	258(97.7)	78(96.3)	54(98.2)	-	14(87.5)	13(81.3)	9(100)
CIPROFLOXACIN	260(98.5)	78(96.30)	52(94.5)	75(94.9)	12(75.0)	13(81.3)	9(100)
GENTAMYCIN	185(72.2)	53(73.1)	38(70.9)	55(70.0)	10(62.5)	10(62.5)	5(55.6)
NITROFURANTOIN	184(69.7)	50(61.7)	29(52.7)	40(50.6)	-	-	-
NALIDIXIC ACID	140(53.0)	43(53.1)	28(50.9)	40(50.6)	-	-	-
TETRACYCLINE	100(37.9)	38(46.9)	25(45.5)	39(49.4)	0(0.0)	6(37.5)	-
CHLORAMPHENICOL	-	-	-	-	7(43.8)	9(56.3)	4(44.4)
ERYTHROMYCIN	-	-	-	-	8(50.0)	9(56.3)	5(55.6)
CLOXACILLIN	-	-	-	-	8(50.0)	10(62.5)	6(66.7)

**E. coli – Escherichia coli, P. mirabilis – Proteus mirabilis, P. vulgaris – Proteus vulgaris, S. aureus –Staphylococcus aureus,* CNS *– Coagulase Negative Staphylococci,* spp -species

Figure 4

Table IV. Bacterial isolates and antibiotic sensitivity pattern among the hospital –acquired UTI group of patients in Aminu Kano Teaching Hospital, 2007 – 2008

ANTIBIOTICS	BACTERIAL ISOLATES							
	*E.coli 100 (%)	P. mirabilis 70 (%)	P. vulgaris 50 (%)	Klebsiella spp. 99 (%)	P. aeruginosa 24 (%)	S. aureus 23 (%)	CNS. 64 (%)	Enterococci 18 (%)
AMPICILLIN	64(35.4)	14(18.3)	4(40.0)	41(40.6)	0(0.0)	14(46.6)	2(33.3)	4(44.4)
AUGMENTIN	82(45.3)	13(44.8)	4(40.0)	50(49.5)	8(33.3)	-	-	4(44.4)
CO-TRIMOXAZOLE	68(37.6)	12(41.4)	4(40.0)	41(40.5)	-	-	-	-
CEFTAZIDIME	-	-	-	78(77.2)	22(91.7)	-	-	-
CEFTRIAXONE	147(81.4)	24(82.8)	8(80.0)	-	-	-	5(83.3)	8(88.9)
CIPROFLOXACIN	155(85.6)	24(82.8)	7(70.0)	79(78.2)	18(75.0)	25(83.3)	5(83.3)	8(88.9)
GENTAMYCIN	88(48.3)	16(55.2)	4(40.0)	48(47.5)	12(50.0)	-	-	5(55.6)
NITROFURANTOIN	95(52.5)	16(55.2)	5(50.0)	50(49.5)	9(37.5)	-	-	-
NALIDIXIC ACID	79(43.6)	13(44.8)	4(40.0)	50(49.5)	4(16.7)	-	-	-
TETRACYCLINE	69(38.1)	-	-	30(29.7)	4(16.7)	13(43.3)	2(33.3)	0(0.0)
CHLORAMPHENICOL	-	-	-	-	-	15(50.0)	2(33.3)	0(0.0.0)
ERYTHROMYCIN	-	-	-	-	-	14(46.7)	3(50.0)	0(0.0)
CLOXACILLIN	-	-	-	-	-	17(56.7)	4(66.7)	3(33.3)

**E. coli – Escherichia coli, P. mirabilis – Proteus mirabilis, P. vulgaris – Proteus vulgaris, S. aureus –Staphylococcus aureus, CNS – Coagulase Negative Staphylococci, spp -species*

DISCUSSION

The present study was set out to determine the bacterial isolates of community versus hospital- acquired urinary tract infection and their antibiotic susceptibility pattern in Aminu Kano Teaching Hospital, Kano Nigeria. A total of three thousand and five hundred urine samples were collected and processed at the hospital from September 2006 to September 2007; comprising 3,000 urine samples from a group of patients with community -acquired urinary tract infection and 500 urine samples from another group with hospital –acquired urinary tract infection. The overall prevalence of UTI was 26.0% (n=910). The prevalence of community-acquired UTI was found to be 14.9% (n=520) and that of hospital –acquired UTI was 11.1% (n=390).This finding agrees well with a similar finding in Nguru, north eastern Nigeria of 17,3% overall prevalence of UTI, with 10.5% and 6.8% prevalences for community versus hospital-acquired UTI [3] . Urethral catheter induced infection coupled with compromised host immunity promote hospital-acquired UTI [3].

The commonest bacterial organisms in the study were Escherichia coli(51.0%), Klebsiella species (19.6%) and

Proteus mirabilis(10.0%). The least number of bacterial isolates was Pseudomonas aeruginosa(2.6%) isolated only from hospital-cuired UTI urine sample. Gram-positive bacterial organisms encountered in the study were Staphylococcus aureus (5.1%), Enterococci(3.0%) and Coagulase Negative Staphylococci(1.6%). These findings are partly similar to those of Jombo etal [3], in north eastern Nigeria and Onyemelukwe etal [7], in eastern Nigeria,but slightly different in the sense that Pseudomonas aeruginosa was isolated only among the hospital -acquired UTI group in the present study. P. aeruginosa is noted to thrive well in disinfectants/soaps used in preparation for urethral catheterization. In all, Gram –negatives were more prevalent than Gram-positive bacteria, similar to reports from other Nigerian centres [8, 9].

The degree of resistance to routine antibiotics, by bacterial isolates from hospital-acquired UTI group was significantly higher than that shown by community -acquired UTI group. Such routine antibiotics included Ampicillin, Tetracyclines, Cotrimoxazole, Erythromycin and Chloramphenicol. However, a high sensitivity about 80.0% and above was generally recorded with

Ceftriaxone, Ceftazidime and Ciprofloxacin. The antibiotic sensitivity profile in this study goes a long way to describe the degree of abuse and misuse of common routine antibiotics in our society. In addition, continued exposure of bacteria to routine antibiotics used in the hospital consequently leads to development of resistant strains [10] .

A limitation in the study was differentiating urine samples of patients who were on admission for more than 24 hours from those who were less. In view of this, all urine samples from patients who were on admission for which UTI was not a diagnosis prior to admission were grouped under Hospital –acquired UTI group. The authors are also aware that nosocomial infections can be acquired at the out-patient clinic as well.

We recommend that antibiotic sensitivity reports be obtained before initiation of most antibiotics. The benefits of antibiotics prophylaxis should be thoroughly weighed against the impending resistance to be encountered in the long run .This policy will not only encourage proper treatment of patients with UTI , but would discourage the indiscriminate use of antibiotics and prevent further development of resistant strains among bacteria.

In conclusion, the present study has therefore, shown that the hospital –acquired UTI group of patients has a higher rate of infection. We also observed that the hospital –acquired UTI has a higher risk of antibiotic resistance than the community –acquired UTI. Lastly, floroquinolones(e.g ciprofloxacin) and the third generation cephalosporins(e.g Ceftriaxone, Ceftazidime) should be a reliable choice of antibiotics for empirical treatment of UTI in this locality.

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