



Incidence and Antimicrobial Susceptibility Pattern of Urinary Pathogens Among Patients Attending Sir Yahaya Memorial Hospital Birnin Kebbi, Kebbi State Nigeria

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ABSTRACT

This study investigated the incidence and antibiotic susceptibility pattern of *urinary pathogens* commonly isolated from patients suspected of UTI at Sir Yahaya Memorial Hospital Birnin Kebbi, Kebbi State Nigeria. Two hundred urine samples from patients suspected with urinary tract infection were collected, the causative organisms were isolated on CLED and blood agar and identified using macroscopy, microscopy and biochemical test and their antimicrobial susceptibility patterns were profiled using Kirby Bauer method. The overall incidence of UTI was found to be 31.5% (63/200). *Staphylococcus aureus* 31/200 (15.5%), *Klebsiella* spp 20/200 (10%) and *Proteus* spp 12/200 (6%). *Staphylococcus aureus*, showed high percentage of susceptibility to the antibiotics viz; ampicillin (58.0%), amoxicillin (88%), cotrimoxazole (93.5%) and pefloxacin (96.8%), resistant to ceftazidime and gentamicin (83.9%), and ofloxacin and streptomycin (100%). *Klebsiella* spp was susceptible to amoxicillin (95%) and (100%) to ciprofloxacin but resistant to the seven remaining antibiotics. *Proteus* spp showed (100%) resistance to ampicillin, ciprofloxacin, cotrimoxazole and streptomycin, but susceptible to amoxicillin, ofloxacin, and pefloxacin (50%). In conclusion, the three isolated uropathogens were susceptible to amoxicillin (> 80%), resistant to streptomycin, ofloxacin and gentamicin (<10%). Thus, routine surveillance and regular monitoring is required to establish reliable information about susceptibility pattern of urinary pathogens for optimal empirical therapy of patients with UTI.

Keywords: Multi antibiotic resistance, Prevalence, Urinary tract infections, Kebbi State

INTRODUCTION

Urinary tract Infection (UTI) is one of the most common microbial infection encountered in general practices (Flores-Mireles *et al.*, 2015; Iwuafor *et al.*, 2016; Cortes-Penfield *et al.*, 2017). Both young and adults have a history of at least one episode of UTI in their lifetime (Dibua *et al.*, 2014; Khan *et al.*, 2017). Community acquired infection is caused by *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Staphylococcus saprophyticus* or *Enterococcus faecalis*, while the hospital acquired infection were caused by *Escherichia coli*, *Pseudomonas aeruginosa*, *Proteus* sp, *Enterobacter* sp., *Serratia* sp. or *Enterococcus* (Hanna-Wakim *et al.* 2015; Bernabé *et al.* 2017; Khan *et al.*, 2017). The incidence of both community acquired and nosocomial UTI among patients rises annually. A significant number of patients who develop UTI will have recurrent urinary tract infections due to antimicrobial resistance (Sievert *et al.*, 2013; Flores-Mireles *et al.*, 2015).

The prevalence of UTI and subsequent increasing antimicrobial resistance can vary according to geographical and regional location (Mordi *et al.*, 2016; Oli *et al.*, 2015). In Nigeria, the prevalence of community-acquired and nosocomial UTIs conducted in a hospital among 12458 urine samples were 12.3% and 9.3%, respectively (Iregbu and Nwajiobi-Princewill, 2013). In a related study conducted in Ile-Ife, Nigeria, the incidence of UTIs among children and adolescence was reported to be 11.9%, of which 22.4% were females while 4.6% were males ((Flores-Mireles *et al.*, 2015; Iwuafor *et al.*, 2016). Factors such as gender, age, urinary catheter, genitourinary tract abnormalities, pregnancy, infants, elderly, and hospitalization status were attributed to high risk for

recurrent UTIs (Hidron *et al.*, 2008; Iregbu and Nwajiobi-Princewill, 2013; Oli *et al.*, 2015). In addition, lack of hygiene, compliance to dose and duration of the prescribed antibiotic, unjustified prescription written by doctors; and easy access to over the counter medication makes the management of UTI a challenging task (Khan *et al.*, 2017; Odoki *et al.*, 2019).

Multi antibiotic resistant bacteria have been reported in Kebbi State (WHO, 2014). However, no documented literature on uropathogens and their antibiotic susceptibility pattern among patients attending various hospitals in the State. This study thus, was undertaken to find out the incidence and antibiotic susceptibility pattern of isolates obtain from urine of patients attending Sir Yahaya Memorial Hospital Birnin Kebbi (SYM) Kebbi State. Knowledge of the uropathogens and their antimicrobial resistance profiles may assist in administering the appropriate antimicrobial treatment.

MATERIALS AND METHODS

Study Population

The study was conducted for a period of 10 months from January 2018 to October 2018 among UTI patients attending SYM Birnin Kebbi, in Kebbi State, Northwest Region of Nigeria. The study included 200 patients with suspected cases of urinary tract infection. Information on patient's age and gender was obtained from the Laboratory Information System. Ethical clearance was obtained prior to data collection from the Kebbi State Ministry of Health Ethics and Research Committee, Gwangwaji Secretariat, Birnin Kebbi, Nigeria. The study subjects were enrolled

after verbal informed consent was obtained. In case of minors, consents were sought from the parent or guardian.

Sample Collection and Processing

Clean urine samples were collected in sterile urine collection tubes. The urine samples were examined macroscopically and microscopically. Thereafter, 10 µl of urine was inoculated using calibrated loops by a surface streak procedure onto both CLED and blood agar, and incubated at 37°C for 24 hours. A specimen was considered positive for UTI if a single organism was observed after 24 hours of incubation and negative after further incubation for 48 hours. UTI isolates obtained on the two media were identified following standard microscopic and biochemical procedures, namely indole, citrate, oxidase, H₂S production, lysine decarboxylase, lactose fermentation, urea hydrolysis, gas production, catalase, coagulase, manitol fermentation (Clarck and Cowan, 2009).

Susceptibility Testing

The antimicrobial susceptibility of the isolates to nine commonly prescribed antibiotics was determined using the Kirby-Bauer disk diffusion method (Bauer *et al.*, 1978). A lawn of test pathogen (18 hours culture) from the nutrient agar was transferred into 5mls of sterile peptone broth. The suspension was adjusted to equal 0.5 McFarland turbidity standard. Subsequently, 3-4 drops of inoculum was spread across an entire surface of Mueller Hinton agar plate. The plates were allowed to dry. Then, antibiotic discs were gently and firmly placed on the agar plates, which were then left at room temperature for 1 hour to allow diffusion of the

antibiotics into the agar medium. The plates were then incubated at 37°C for 24 hours. After overnight incubation, growth inhibition was shown as a circular zone of no growth around the disc. The zones of growth inhibition around each of the antibiotic disks are measured to the nearest millimeter. The diameter of the zone is related to the susceptibility of the isolate and to the diffusion rate of the drug through the agar medium. The zone diameters of each antibiotic are interpreted using the criteria published by Clinical and Laboratory Standards Institute (CLSI) guidelines. The antibiotics used were Ampicillin (AM, 10 g), Amoxicillin (AX, 30 g), Ceftazidime (CAZ, 30 g), Ciprofloxacin (CIP, 5 g), Cotrimoxazole (COT, 30 g), Gentamicin (GEN, 10 g), Ofloxacin (OF, 5 g), Pefloxacin (PEF, 10 g), and Streptomycin (S, 10 g). Data were entered and analyzed using Excel 2013. Discrete variables were expressed as percentages.

RESULT

Out of the 200 urine samples, 105 samples had positive bacterial growth (52.5%), while 95 (47.5%) samples yielded no growth (Table 1). The highest growth was recorded in female patients 66 (33.0%) compared to males 33 (19.5%). Female patients within the age group of 0-15 and 16-30 years had the highest bacterial growth 31 (15.5%) and 20 (10.0%) respectively. The highest bacterial growth recorded in male patients was observed within the age group 0-15 years 15 (7.5%). Male patients within the age group of 31-45 years had the lowest bacterial growth 4 (2.0%), (Table 1).

Table 1. Frequency of bacteria isolated from UTI suspected patients at SYMH Birnin Kebbi

Age distribution	No Positive (n=105)		No Negative (n=95)	
	Male	Female	Male	Female
0 - 15	15(7.5)	31(15.5)	9(4.5)	10(5.0)
16 -30	11(5.5)	20(10.0)	10(5.0)	19(9.5)
31 - 45	4(2.0)	7(3.5)	10(5.0)	23(11.5)
46 - 60	9(4.5)	8(4.0)	6(3.0)	8(4.0)
Total	39(19.5)	66 (33)	35(17.5)	60 (30)

The most frequently isolated uropathogens out of three was *Staphylococcus aureus* 31 (15.5%), followed by *Klebsiella* spp 20 (10.0%) and *Proteus* spp 12 (6.0%) (Table 2). Twenty one of the *Staphylococcus aureus* (10.5%) were isolated from male patients, and 12 (6.0%) of the isolates were from patients between the ages of 16 – 30 years and 17 (8.5%) were outpatients. Eleven of the *Klebsiella* spp

(5.5%) were from female patients, and 8 (4.0%) were obtained from patients aged 16 -30 years. Nine of the *Proteus* spp (4.5%) was isolated from male patients, 4 (2.0%) from patients aged 16 – 60 years and 7 (3.5%) of the isolates were from outpatients (Table 2).

Table 2: Age-related incidence of bacterial isolates amongst study subjects

Distribution	<i>Staphylococcus aureus</i> n=31(15.5%)	<i>Klebsiella</i> spp n=20 (10%)	<i>Proteus</i> spp n=12(6%)
Male	21(10.5)	9(4.5)	9(4.5)
Female	10(5.0)	11(5.5)	3(1.5)
0 - 15	7(3.5)	5(2.5)	2(1.0)
16 -30	12(6.0)	8(4.0)	3(1.5)
31 - 45	7(3.5)	3(1.5)	4(2.0)
46 - 60	5(2.5)	4(2.0)	3(1.5)
Out patients	17(8.5)	1(0.5)	7(3.5)
Inpatients	14(7.0)	19(9.5)	5(2.5)

The three uropathogens isolated from patients with UTIs showed high levels of susceptibility to commonly prescribed antimicrobial drugs. Figure 1, shows percentage distribution of uropathogens susceptible to more than one of the nine commonly prescribed antibiotic at SYMH. From figure 1 below, 10 (32.3%) of *Staphylococcus aureus* were susceptible to more than 2 antibiotics, 20 (64.5%)

susceptible to more than 5 antibiotics and 1 (3.2%) was susceptible to more than 7 antibiotics. *Klebsiella* spp 18 (90.0%) were susceptible to more than two antibiotics, 2 (10.0%) susceptible to more than 4 antibiotics. *Proteus* spp 10 (83.3%) and 2 (16.7%) were susceptible to more 2 and 5 antibiotics respectively, (Figure 1). None of the *Klebsiella* and *proteus* spp were susceptible to more than 6 antibiotics.

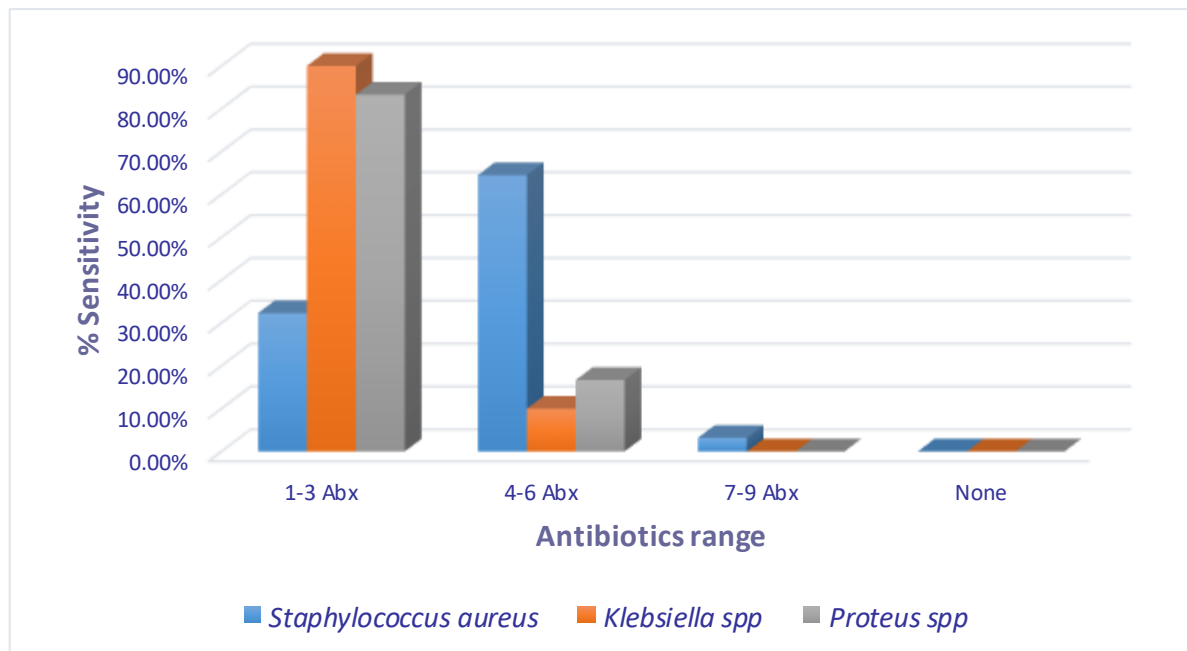


Figure 1: Number (%) of uropathogens susceptible to more than one of the test antibiotic

Table 3 shows the antibiotic susceptibility pattern of the uropathogen isolated. *Staphylococcus aureus* showed (58.0%) susceptibility to ampicillin, (88%) of the isolates were susceptible to amoxicillin, (93.5%) to cotrimoxazole and (96.8%) to pefloxacin. The organism was resistant to ceftazidime, gentamicin, ofloxacin and streptomycin. *Klebsiella* spp, which is the second most dominant uropathogen isolated, is (95%) susceptible to amoxicillin and (100%) to ciprofloxacin but resistant to the seven remaining antibiotics, (Table 3). *Proteus* spp showed

(100%) resistance to ampicillin, ciprofloxacin, cotrimoxazole and streptomycin, but susceptible to amoxicillin, ofloxacin, and pefloxacin (50%). An average of 80% of the three isolated uropathogens was susceptible to amoxicillin and more than 90% were resistant to streptomycin, ofloxacin and gentamicin (Table 3).

Table 3: Susceptibility pattern of uropathogens isolated in urine culture at SYMH Birnin Kebbi from January – October 2018

Antibiotics	<i>Staphylococcus aureus</i> (n=31)		<i>Klebsiella spp</i> (n=20)		<i>Proteus spp</i> (n=12)	
	Susceptible	Resistant	Susceptible	Resistant	Susceptible	Resistant
Ampicillin	18(58)	13(42)	0(0)	20(100)	0(0)	12(100)
Amoxicillin	27(88)	4(12)	19(95)	1(5)	6(50)	6(50)
Ceftazidime	5(16.1)	26(83.9)	4(20)	16(80)	1(8.3)	11(91.7)
Ciprofloxacin	1(3.2)	30(96.8)	20(100)	0(0)	0(0)	12(100)
Cotrimoxazole	29(93.5)	2(6.5)	0(0)	20(100)	0(0)	12(100)
Gentamicin	5(16.1)	26(83.9)	4(20)	16(80)	5(41.7)	7(59.3)
Ofloxacin	0(0)	31(100)	4(20)	16(80)	6(50)	6(50)
Pefloxacin	30(96.8)	1(3.2)	5(25)	15(75)	6(50)	6(50)
Streptomycin	0(0)	31(100)	2(10)	18(90)	0(0)	12(100)

DISCUSSION

Urinary tract infection caused by bacteria is one of the most common clinical cases that outpatients and inpatients seek treatment at SYMH Birnin Kebbi. Effective management of these patients depends on the identification of the causative agents and administering an effective antibiotic regimen. In this study, the isolation rate of uropathogens at Sir Yahaya Memorial Hospital Birnin Kebbi between the months of January 2018 to October 2018 from urine sample was 31.5%. This is comparatively lower than reports from previous studies in Okada community of Edo State (39.7%) (Henry Oladeinde *et al.*, 2011), at Specialist Hospital Yola (67.2%) (Abubakar, 2009), Dalhatu Araf Specialist Hospital, Lafia, Nasarawa (60%) (Durowade *et al.*, 2009), and among pregnant women in Ebonyi State (77.9%) (Onoh *et al.*, 2013). The lower rate of isolation might have been due to sample size variation. However, this finding is in line with studies done at National Hospital in Abuja (13.1%) (Iregbu and Nwajiobi-Princewill, 2013), among antenatal patients in Nnewi (18.2%) (Oli *et al.*, 2010) and amongst pregnant women in Amassoma, Southern Nigeria (25.3%) (Lawani *et al.*, 2015).

The bacterial growth yields from urine samples were markedly different between males and females (male = 33.0% and female = 66.0%), and differ among age groups. This agrees with previous reports which shows that uropathogens were more frequent in females than males, because of close proximity of the female urethra to the gastrointestinal outlet making it easier for uropathogens to colonize this area (Iregbu and Nwajiobi-Princewill, 2013; Cortes-Penfield *et al.*, 2017; Odoki *et al.*, 2019). The most frequent and dominant uropathogens isolated from urine samples in both outpatients and inpatients of both sexes was *Staphylococcus aureus*, which made up 50 % of all the cases. This findings agrees with previous reports undertaken on asymptomatic subjects in an urban settlement in Benin City of Nigeria and on pregnant women in Oyo and Ebonyi State and on febrile children in Nasarawa State (Musa-Aisien *et al.*, 2003; Okonko *et al.*, 2009; Chukwudozie Onuoha, 2014). The very high rate of *Staphylococcus aureus* recorded in this study likely represent poor handling of the samples (Nicole, 2002; Foxman, 2003).

Klebsiella spp is the second most dominant uropathogen isolated in the study. The specie has the ability to spread rapidly in the hospital environment and cause nosocomial infection and outbreaks (Khan *et al.*, 2017; Odoki *et al.*

2019;) because the reservoirs for transmission of *Klebsiella spp* are the gastrointestinal tract and the hands of hospital personnel (Podschun and Ullmann, 1998; Hanna-Wakim *et al.*, 2015). The findings corroborate previous results as reported in two primary health care centers in Oshogbo, Osun State (Olawale *et al.*, 2011), among pregnant women in Ondo State (Onoh *et al.*, 2013), and among symptomatic patients attending tertiary hospitals in Abuja and Maiduguri in Borno State (Iregbu and Nwajiobi-Princewill, 2013; Anejo-okopi *et al.* 2015). *Proteus spp* were the least uropathogens isolated in this study. The *proteus spp* are very important uropathogens because of their ability to cause infections and are resistant to many antibiotics (Aiyegoro *et al.* 2007; Akingbade *et al.* 2014; Dibua *et al.* 2014; Bernabé *et al.* 2017). These findings agrees with previous studies (Kehinde *et al.* 2012; Mava *et al.* 2012; Iregbu and Nwajiobi-Princewill 2013; Chukwudozie Onuoha, 2014; Flores-Mireles *et al.* 2015).

This study revealed that a higher rate of susceptibility to the commonly prescribed antibiotic agent. The susceptibility profile indicates that the amoxicillin and cotrimoxazole was the most active antibacterial agent followed by the ciprofloxacin. This result is in agreement with recommendations by Hsueh *et al.* (2011); Iregbu and Nwajiobi-Princewill (2013); Olorunmola *et al.* (2013); Bernabé *et al.* (2017). These antibiotics could be considered as alternative options in the empirical treatment of UTIs. Streptomycin, ofloxacin and ceftazidime showed very poor activity. This may be due to long-term use of these drugs over the years without prescription (Flores-Mireles *et al.* 2015; Khan *et al.* 2017; Odoki *et al.* 2019). This implies that these antibiotics cannot be used as empirical therapy for urinary tract infection particularly in the study area. The variations in susceptibility of the three uropathogens to different antibiotics commonly prescribed may be due to the indiscriminate prescription of antibiotics (Hidron *et al.* 2008; Olorunmola *et al.* 2013; Sievert *et al.* 2013; Akingbade *et al.* 2014; Bernabé *et al.* 2017).

In conclusion, the most predominant uropathogen isolated in this study was *Staphylococcus aureus* followed by *Klebsiella spp* then *Proteus spp*. The overall incidence of UTI among patients attending Sir Yahaya Memorial Hospital Birnin Kebbi in Kebbi State was 31.5%. All the three uropathogens isolated were susceptible to amoxicillin (> 80%) and resistant to streptomycin, ofloxacin and

gentamicin (<10%). Therefore, there is need for routine surveillance and regular monitoring of susceptibility pattern of urinary pathogens among UTI patients attending Sir Yahaya Memorial Hospital Birnin Kebbi for optimal empirical therapy.

Author's contribution:

MBD, BA, AYB and ASK, conceived the study and participated in its design and coordination. MBD and ASK performed sample collection and analysis. MBD, BA, AYZ and ASK analyzed the results. MBD and ASK drafted the manuscript.

Conflict of interest:

All authors have no competing interests.

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