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Retrospective studies on the prevalence of uropathogens in Sokoto metropolis

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This retrospective study was conducted at Specialist Hospital Sokoto, Sokoto State to outline the causative agents associated with urinary tract infections (UTIs) and to compare the prevalence of UTI among sexes and age groups. The cases seen between November, 2013 and October, 2014 were included in the study. Total number of patients in the study was 1,120 (589 male and 631 female). Total number of patients with positive urine culture was 525, while 638 were culture negative and 57 were neither decided (positive or negative). The rate for positive culture was 52.4% for male patients and 47.6% for female patients. Age range indicated 11.1% are ≤ 18 years of age, while 88.9% accounts for patients >18 years. The study revealed that *Escherichia coli* (26.9%) and *Staphylococcus* spp. (26.9%) were the common causative organisms, followed by *Klebsiella* spp. (16.4%), *Proteus* spp. (13.1%), *Citrobacter* spp. (6.5%) and others accounting for 10.3% (*Streptococcus* spp., 3.8%, *Enterobacter* spp., 3.4% and *Pseudomonas* spp., 3.1%). Most commonly preferred antibiotics in the study were Ciprofloxacin, Ofloxacin, Norfloxacin, Cefotaxime, Cotrimoxazole, Nalidixic acid, Nitrofurantoin, Ceftazidime, Ampicillin, Erythromycin, Tetracycline, Amoxicillin/ Clavulanic acid and Gentamicin. Cotrimoxazole displayed a high resistant rate of 84.2%, while Amoxicillin/Clavulanic acid showed a high susceptibility rate of 88.8% to all isolates. The study creates awareness on the causative agents of UTIs as well as the prevalence of UTI among sexes and age group in Sokoto Metropolis. The study also creates awareness on the susceptibility pattern of the causative agents.

Key words: Retrospective studies, prevalence, uropathogens.

INTRODUCTION

Urinary tract infections (UTIs) is one of the most common infections encountered in the population, with about 150 million estimated per year worldwide (Gupta, 2001; Jane-Franco et al., 2012; Durgesh and Tumane, 2012). Despite the widespread availability of antibiotics, UTI remains the most common bacterial infection in the human population (Durgesh and Tumane, 2012). UTI affects the overall wellbeing of individual contributing substantially to health care costs (Farah et al., 2011; Jebouri and Atala, 2012). The diagnosis of UTI is usually made based on the presence of signs and symptoms and confirmed by culture examination with significant bacteriuria supported

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by high level pyuria (Khoshbakt et al., 2013).

UTI can occur in any part of the urinary tract. In 2006, Inabo and Obanibi reported that most UTI infections are caused by retrograde ascent of bacteria from the faecal flora via the urethra to the bladder and kidney. This is most especially in the females who have a shorter and wider urethra and is more transversed by microorganisms (Inabo and Obanibi, 2006; Kolawale et al., 2009). In most cases, bacteria travel to the urethra and multiply causing kidney infection if not treated (Bean et al., 2008).

Cystitis has been used to describe a syndrome including dysuria (pain or burning sensation during urination), frequency and occasionally supra pubic tenderness. Acute pyelonephritis describes a clinical syndrome characterized by flank pain or tenderness, or both, and fever, often accompanied by dysuria, urgency and frequency (Ramesh et al., 2008).

History and physical examination may suggest one to have a UTI (Safar et al., 2008). Although, definitive diagnosis requires a clean catch urine specimen which is collected from the middle of the urinary stream, the main goal is to avoid picking up bacteria from the skin.

The empirical therapy of UTIs relies on the predictability of the agents causing UTI and the knowledge of their antimicrobial susceptibility patterns (Safar et al., 2008). An accurate and prompt diagnosis of UTI is important in shortening the disease course and for preventing the ascent of the infection to the upper urinary tract and renal failure (Safar et al., 2008). Guidelines for the approach to a patient with UTI include the requirement of identifying the causative organism by urine culture and choosing the most appropriate antibiotic through *in vitro* sensitivity tests (Priya et al., 2002). Sometimes, bacteria develop resistance to antibiotics. Therefore, urine cultures can help in selecting an effective antibiotic treatment.

Escherichia coli is the most common cause of UTI among virtually every patient group and accounts for 80 to 90% of cases of uncomplicated pyelonephritis and cystitis (Safar et al., 2008).

The study aimed at determining the prevalence of uropathogens associated with UTI and susceptibility pattern in Sokoto Metropolis and to help the clinician to choose the right empirical treatment.

MATERIALS AND METHODS

This study was carried out after getting the approval from Specialist Hospital Sokoto Research Ethic Committee. The retrospective study was undertaken over twelve (12) month period (November, 2013 to October, 2014) using the Specialist Hospital Microbiology Department record book of patient biodata and test results. For this study, demographic data collected were patient age and sex. Age range is grouped into two (≤ 18 and > 18 years) due to the method of documentation, thereby taking note of adult and ≤ 18 years of age only.

Clean catch midstream urine samples (MSU) were collected in sterile disposable containers (4-5 ml). Urine specimens were subjected to general urineexaminations using direct microscopy for white blood cell (WBC) counting. Urine samples were cultured on CLED Agar using calibrated wire loop and incubated in aerobic condition for 18 – 24 h at 37°C. Cultures without any colony at the end of 18 – 24 h incubation were discarded and sample with colony count equal or more than 10^5 cfu/ml were considered positive. Isolates were identified using standard microbiological methods including Gram staining, colonial morphology on media, H_2S production, oxidase, indole, catalase, urease and citrate utilization test (Oluremi et al., 2011). Antimicrobial susceptibility testing were performed on Mueller Hinton Agar (MHA) using disc diffusion technique (modified Kirby Baeur's) according to Clinical and Laboratory Standards Institute (CLSI) guidelines. Antibiotics mostly used are Ofloxacin (10 µg), Ciprofloxacin (5 µg), Norfloxacin (10 µg), Nitrofurantoin (300 µg), Amoxicillin/Clavulanic acid (30 µg), Gentamicin (30 µg), Nalidixic acid (30 µg), Cotrimoxazole (25 µg), Cefotaxime (30 µg). While Ceftazidime (30 µg), Ampicillin (10 µg), Erythromycin (15 µg) and Tetracycline (30 µg) are less commonly used. Antibiotic discs are all obtained from Himedia, India and sometimes from Oxoid, United Kingdom (UK). The hospital used *E. coli* ATCC 27922 for Quality Control of susceptibility test.

Data were analyzed using Microsoft Excel 2010 version. Discrete values were expressed as percentages. Statistical significant difference was considered at value of $P \leq 0.05$. All urine microscopy, culture and sensitivity (M/C/S) of male and female from General Out-Patient Department (GOPD) and other special clinics like Paediatric Out-Patient Department (POPD), Surgical Out-Patient Department (SOPD), and Medical Out-Patient Department (MOPD) were included. Records on routine medical check as well as pregnant women were excluded from the study. Records of patient on admission were excluded from the study too.

RESULTS

The total number of patients in the study was 1,120. Female patients account for a total of 631, while male patients account for 589. The total number of patients with positive urine culture was 525, while 638 were culture negative, and 57 results were neither decided (positive or negative). The rate for positive culture was 52.4% (275/525) for male patients and 47.6% (250/525) for female patients. The rate for negative culture was 45.8% (292/638) for male patients and 54.2% (346/638) for female patients. The results according to age range indicated that 11.1% (58/525) are ≤ 18 years of age, while 88.9% (467/525) accounts for patients greater than 18 years as shown in Table 1.

Analysis of the result according to percentage of UTI isolate among the pathogens revealed that *E. coli* and *Staphylococcus* spp. were the highest with 26.85% (141/525) each, followed by *Klebsiella* spp. 16.38% (86/525), then *Proteus* spp. 13.14% (69/525) and *Citrobacter* spp. 6.48% (34/525). Others in the study covers isolates which are less than 5%, and they include *Pseudomonas* spp. 3.05% (16/525), *Enterobacter* spp. 3.43% (18/525) and *Streptococcus* spp. 3.81% (20/525),which altogether accounts for 10.3% (54/525) as shown in Table 2.

E. coli and *Staphylococcus* spp. are the predominant isolated pathogens based on gender. It occured more frequently in men (51.1% each in men as compared to 48.9% in women). The prevalence of UTI due to *Proteus* spp. is higher in men than in women (62.2% in men as

Table 1. Prevalence of uropathogens associated with UTI according to patient gender and age.

Source		Sex				Age Range	
	Month	**Male**	**Female**	**CN**	**NR**	**≤ 18**	**> 18**
Urine	November	37	23	5	8	8	52
	December	28	25	4	4	4	49
	January	18	17	6	9	9	26
	February	23	33	10	7	7	49
	March	35	25	0	5	5	55
	April	17	25	5	2	2	40
	May	27	23	6	15	15	35
	June	22	12	4	1	1	33
	July	18	15	1	3	3	30
	August	19	23	3	3	3	39
	September	9	15	6	0	0	24
	October	22	14	7	1	1	35
	Total	275	250	57	58	58	467

UTI, Urinary tract infection; CN, culture negative; NR, result not recorded.

Table 2. Percentage of UTI isolate among the pathogens.

Isolate	Percentage
E. coli	
Klebsiella spp.	16.4
Staphylococcus spp.	26.8
Proteus spp.	13.1
Citrobacter spp.	6.5
Others	10.3

E. coli, Escherichia coli, UTI, urinary tract infection, others include *Streptococcus* spp., *Enterobacter* spp. and *Pseudomonas* spp.

Table 3. Distribution of bacterial isolates among sexes.

Bacterial isolate	Male	Percentage	Female	Percentage	Total
E. coli	72	51.1	69	48.9	141
Klebsiella spp.	40	46.5	46	53.5	86
Staphylococcus spp.	72	51.1	69	48.9	141
Proteus spp.	45	62.2	24	37.8	69
Citrobacter spp.	17	50	17	50	34
Others	28	51.9	26	48.1	54

compared to 37.8% in women), whereas the prevalence of UTI due to *Klebsiella* spp. is higher in women than in men (53.5% in women as compared to 46.5% in men). In UTI due to *Citrobacter* spp., both sexes have equal prevalence (50%) each, whereas the prevalence in others (*Pseudomonas* spp., *Streptococcus* spp. and *Enterobacter* spp.) were higher in men (51.9%) than in women (48.1%) as revealed in Table 3.

Percentages of resistance of all isolates to the antimicrobial agents were Cotrimoxazole (84.2%), Nalidixic acid (75.2%), Norfloxacin (66.8%), Cefotaxime (52.2%), Ciprofloxacin (51.2%), Ofloxacin (44%), Nitrofurantoin

Table 4. Percentage of resistance to the antimicrobial agents among 525 UTIs isolates.

Antimicrobial agents	Percentage of isolates	
	Susceptible	Resistant
Ciprofloxacin	256/48.8	269/51.2
Norfloxacin	171/32.6	354/67.4
Gentamicin	340/64.8	185/35.2
Nalidixic acid	130/24.8	395/75.2
Cotrimoxazole	83/15.8	442/84.2
Nitrofurantoin	335/63.8	190/36.2
Amoxicillin/Clavulanic acid	466/88.8	59/11.2
Cefotaxime	251/47.8	274/52.2
Ofloxacin	294/56	231/44

(36.2%), Gentamicin (35.2%) and Amoxicillin/Clavulanic acid (11.2%), while percentages of susceptibility of all isolates to the antimicrobial agents were Amoxicillin/ Clavulanic acid (88.8%), Gentamicin (64.8%), Nitrofurantoin (63.8%), Ofloxacin (56%), Ciprofloxacin (48.8%), Cefotaxime (47.8%), Norfloxacin (32.6%), Nalidixic acid (24.8%) and Cotrimoxazole (15.8%). The percentage of pathogen resistance varied between 84.2 and 11.2% to the antimicrobial agents, while susceptible of pathogen varied between 88.8 and 15.8% as shown in Table 4.

DISCUSSION

From the bio data and results of M/C/S examined in Specialist Hospital Sokoto, sensitivity results were not properly documented. Although, almost all the antibiotics used displayed sensitivity or resistant to one isolate or the other. Based on the records, Amoxicillin/ Clavulanicacid, Gentamicin and Nitrofurantoin show high level of activity against most isolates as compared to commonly use antimicrobial agents like Cotrimoxazole, Nalidixic acid and Norfloxacin. The high rate of resistance to Cotrimoxazole, Nalidixic acid and Norfloxacinacid may be due to these agents which are the most commonly prescribed, cheaper and easily available in the hospital and community pharmacies. Data obtained in this study show that the bacteria causing UTIs are still susceptible to antibiotics commonly used in the hospital and community pharmacies.

Several reports have indicated that females are more prone to have UTIs than males during youth and adulthood (Yabaya et al., 2012, Khoshbakt et al., 2013), because the urethra is shorter and more readily transversed by microorganisms. Data obtained in this study shows that males have a higher prevalence of UTI than females. This might be connected to orientation of the people where they hardly discuss issues that have to do with sexual organs and sexual activity. Environment, culture and attitude may play a major role to that effect. Another reason may also be exclusion of pregnant women and also a higher number of men than women with culture positivein the study.

E. coli and *Staphylococcus* spp. were the most prevalent cause of UTI in this study. This is in line with most studies, according to Khoshbakt et al. (2013), that *E. coli* is the most prevalent causative organism of UTI in all age groups and both sexes. *Staphylococcus aureus* is a facultative anaerobic Gram-positive coccal bacterium. Management mistakes or sample collection mistakes may account for the high prevalence of *Staphylococcus* spp. in the study. This might be due to the fact that *Staphylococcus* is a commensal of peri-anal and vaginal region. Therefore, emphasis on personal hygiene most especially in females may be important in reducing the incidence of UTI. Although, *S. aureus* is relatively infrequent urinary tract isolate in the general population (Omar et al., 2014). In specific patient populations, however, *S. au*reus can be important primary urinary pathogen (Muder et al., 2006) for example methicillin resistant *Staphylococcus aureus* (MRSA). UTI occur in both endemic and epidemic fashion among patients undergoing urologic surgical procedures.

The results indicate a lower UTI rate in patient ≤ 18 years of age. This might be possible, because UTI symptoms according to Safar et al. (2008) are not a reliable indicator of infection and in children below 2 years of age are non-specific.

Conclusion and recommendation

In conclusion, *E. coli* and *Staphylococcus* spp. were the most prevalent cause of UTI in this study. *E. coli, Proteus* spp., *Staphylococcus* spp. and others (*Pseudomonas* spp., *Streptococcus* spp. and *Enterobacter* spp.) occurred more in male patients than female patients according to the study. *Klebsiell*a spp. occurred more in female than male patients, while *Citrobacte*r spp. has equal prevalence in both sexes in the study. The study creates awareness about the causative organisms of UTI and the prevalence among sex and age groups in Sokoto Metropolis.

A guideline for the approach to UTI should include the requirement of identifying the causative organism through urine culture and choosing the appropriate antibiotic through *in vitro* sensititvity tests. Also, the study of susceptibility pattern is very important for the development of empiric treatment guideline for urinary tract infections.

Conflict of interests

The author(s) did not declare any conflict of interest.

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