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Pattern of Uropathogens and Antibiotics Susceptibility in a Tertiary Hospital in North-Western Nigeria

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Abstract

Background: A uropathogen is a microorganism capable of causing urogenital tract infection (UGI). The most common uropathogens are *Escherichia coli*, *Pseudomonas aeruginosa*, *Proteus mirabilis* and *Klebsiella pneumonia*. They lead to UGI in patients with urinary tract obstruction, indwelling catheter/stent, elderly and patients with immunosuppression. There is increasing resistance to commonly used antibiotics due to empirical misuse of antibiotics

The objective of this study is to document pattern of uropathogen and their antibiotics susceptibility in our hospital.

Materials and methods: This is a retrospective study of consecutive urological patients with features of urinary tract infection (UTI) in our hospital from June 2017 to June 2018. Data was collected using a semi-structured proforma and analysed using SPSS version 20.0 for windows. Results were reported in percentages and mean ± standard deviation.

Results: There were 126 patients with features of UTI with a mean age of 51.44 ± 23.43 years and a range of 1 to 86 years. The male to female ratio was 20**:**1. The commonest risk factors for the UTI was benign prostatic hyperplasia (32.5%). There was catheter associated urinary tract infection (CAUTI) in 68 patients (54.0%). The uropathogens isolated were *Escherichia coli* (43.7%), *Pseudomonas aeruginosa* (15.9%), *Staphylococcus aureus* (15.1%), *Proteus mirabilis* (7.9%) and *Klebsiella pneumoniae* (4.0%). The uropathogens showed good sensitivity to ciprofloxacin (17.5%), nitrofurantoin (14.3%), levofloxacin (13.5%) and ceftriaxone (7.9%). They showed resistance to amoxicillin/ clavulanate (Augmentin) (15.9%), ciprofloxacin (10.3%) and ampicillin (7.1%).

Conclusion: The most common uropathogens in our environment are *Escherichia coli*, *Pseudomonas aeruginosa, Staphylococcus aureus, Proteus mirabilis and Klebsiella pneumonia*. The uropathogens showed good sensitivity to Ciprofloxacin, Nitrofurantoin, Levofloxacin, Ceftriaxone, Gentamicin and they were resistant to Amoxicillin-clavulanate (Augmentin), Ciprofloxacin, Ampicillin, Co-trimoxazole and Ceftriaxone.

Keywords: antibiotics, pattern, sensitivity, resistance, sensitivity, urinary tract infections, uropathogen

Introduction

Urinary tract infection (UTI) is a major public health problem worldwide with 150 million cases recorded annually (1,2). It accounts for 35- 50% of total nosocomial infections (3,4) more especially in patients that are catheterized for any reason for more than 5 days (5). Before any urological intervention, UTI must be excluded or eradicated if present to avoid urosepsis, surgical site infection and failure of reconstructive procedures (6,7). Urinary tract infection is often treated empirically based on the most likely pathogen, its antibiotic susceptibility and resistance in a community or geographic location (8).

The commonest organisms implicated in urinary tract infections are *Escherichia coli, Klebsiella pneumonia, Proteus mirabilis and Pseudomonas aeruginosa* (5,11). *Staphyloccocus aureus* may be involved in urogenital infection when the organism ascends into the urinary tract by following catheterization, instrumentation or when the pathology involved skin as in Founier's gangrene (4). There is growing concern about increased resistance to the antibiotics used commonly to treat UTI such as co-amoxiclav, Co-trimoxazole, Nitrofurantoin, fluoroquinolones, 3rd generation cephalosporins (9). There is need for study to update pattern of uropathogen and antibiotic resistance periodically to guide empirical therapy for UTI (9,10).The objective of this study was to determine the pattern of uropathogens and their antibiotics susceptibility at Usmanu Danfodiyo University Teaching Hospital Sokoto, Nigeria.

Materials and methods

This is a retrospective study of consecutive patients with features of urinary tract infection (UTI) managed by Urology Unit, Department of Surgery, Usmanu Danfodiyo University Teaching Hospital, Sokoto, from June 2017 to June 2018. Data was collected using a semi-structured proforma. The data collected include biodata, clinical features, diagnosis, results of urine microscopy, culture sensitivity, antibiotics treatment and outcome. Data analysis was done using SPSS version 20.0 for windows. Results were reported as percentages and mean standard deviation.

Results

There were 126 patients with features of UTI with mean age of 51.4 ± 23.4 and a range of 1 to 81 years. There were 120 males (95.2%) and 6 females 4.8%) with a male to female ratio of 20:1.

The most common presentations of the patients were lower urinary tract symptoms (LUTS) in 94 patients (74.6%), haematuria in 21 patients (16.7%) and fever in 15 patients (11.9%). Other presentations are shown in figure 1 below. There was catheter associated urinary tract infection (CAUTI) in 68 patients (54.0%) with urinary diversion. Urethral catheter was passed in 45 patients (35.7%) and suprapubic cystostomy in 23 patients (18.3%).

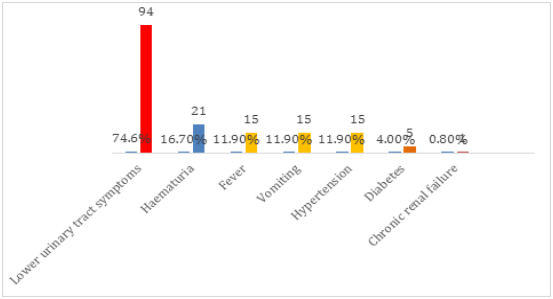

Figure 1: Presentations of patients with Urinary tract infection

The urine microscopy was positive in 116 patients (92.1%). There was pyuria ± nitrituria in 126 patients (100%). The most common diagnosis associated UTI was benign prostatic hyperplasia (BPH) in patients 41 patients (32.5%). Other patients' diagnoses/ risk factors are shown in Table 1 below. Table 1: Diagnoses of Patients with Urinary Tract Infection

Diagnosis/ Risk Factor	Number of patients	Percentage (%)
BPH	41	32.5
Urethral stricture	19	23.0
Urogenital infection ± pyonephrosis	15	11.9
Schistosomal ureteric obstruction	14	11.1
Urolithiasis	12	9.5
Renal	2	1.6
Urete ral	3	2.3
Bladder	3	2.3
Urethral	4	3.3
Prostate cancer	7	5.6
Bladder cancer	5	4.0
Vesical schistosomiasis	5	4.0
Urethral injury	1	0.8
Chronic kidney disease	1	0.8
Pelvi-ureteric junction obstruction	1	0.8
Peyronie's disease	1	0.8
Cellulitis of the lower limb	1	0.8
Posterior urethral valve	1	0.8
Varicocoele	1	0.8
hydrocoele	1	0.8
Total	126	100.0

The commonest uropathogen isolated in the patients was Escherichia coli in 55 patients

(43.5%). Other uropthogens found are shown in Table 2 below.

Table 2: Pattern of Uropathogen

Uropathogen	Number of Patients	Percentage (%)
Escherichia coli	55	43.5
Pseudomonas aeruginosa	20	15.9
Staphylococcus aureus	19	15.1
Proteus mirabilis	10	7.9
Klebsiella pneumoniae	5	4.0
Streptococcus spp	4	3.2
Candida albicans	3	2.4
Salmonella spp	1	0.8
No isolate	9	7.1
Total	**126**	**100.0**

The antibiotic with the highest sensitivity was ciprofloxacin in 22 patients (7.5%). The details of the sensitivity of other antibiotics are shown in Table 3 below.

Table 3: Susceptibility Pattern of Uropathogen

Antibiotic	Number of Patients	Sensitivity (%)
Ciprofloxacin	22	17.5
Nitrofurantoin	18	14.3
Levofloxacin	17	13.5
Ceftriaxone	10	7.9
Gentamicin	8	6.3
Cefuroxime	6	4.8
Micromox	5	4.0
Netilin	4	3.2
Augmentin	3	2.4
Moxifloxacin	2	1.6
Nalidixic acid	2	1.6
Co-trimoxazole	2	1.6
Erythromycin	1	0.8
None	17	13.5
Not available	9	7.1

The pattern of the antibiotic's resistance is shown below in Table 4. The highest resistance was to Augmentin (15.9%) and the least resistance was to urinary antiseptics, nitrofurantoin (0.8%) and nalidixic acid (1.6%).

Table 4: Resistance Pattern of Uropathogen

Antibiotic	Number of Patients	Resistance (%)
Augmentin	20	15.9
Ciprofloxacin	13	10.3
Ampicillin	9	7.1
Co-trimoxazole	6	4.8
Ceftriaxone	6	4.8
Cefuroxime	4	3.2
Gentamicin	4	3.2
Tetracycline	3	2.4
Nalidixic acid	2	1.6
Nitrofurantoin	1	0.8
None	58	46.0

Discussion

Urinary tract infection (UTI) is a major public health problem worldwide accounting for 35-50% of total nosocomial infections (2,3). It is a common problem in urological patients with urinary tract obstruction which may require urinary diversion which predisposes them more to infection when a catheter or stent is in place for more than 5 days (7). These patients developed catheter associated bacteriuria which may progress to UTI or urosepsis when antibiotics prophylaxis or treatment of CAUTI and other aspects of catheter care are not instituted at appropriate interval (3,4). Urinary tract infection is often treated empirically based on the most likely pathogen, its antibiotic susceptibility and resistance in a community (8). This require update regularly (9,10).

The mean age of 51.4 years in this study is comparable to that of 50.1 years reported by Woldemariam et al (12) in Addis Ababa, Ethiopia. There were more male patients in this study as opposed to the previous studies where there was female preponderance. But this may be due to the fact that their study involved only diabetic patients (12).

The presence of lower urinary tract symptoms, fever, hematuria vomiting, hypertension, diabetes, chronic renal failure and CAUTI in our patients is in agreement with what was reported in the literature (7). Obstruction, catheter and co-morbidity more especially diabetes creates vicious cycle for infection to thrive(7). The infection can only be controlled by breaking the cycle through the relief of obstruction, removal or change of catheter and normoglycemia.

Urine culture was negative in 8.0% of the patients which may be due to the commencement of the patients on empirical antibiotics therapy by general practitioners before taking urine sample for microscopy. There was significant pyuria and nitrituria in all the patients. This is consistent with what was reported in literature that combination of pyuria and nitrituria are diagnostic for UTI in 95-98% of the cases(7).

The most common predisposition to the infection is urinary tract obstruction from BPH, urethral stricture, urinary schistosomiasis and indwelling as reported by the previous studies (7,13,14).

The uropathogens associated with the UTI in order of frequency include *Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, Proteus mirabilis and Klebsiella pneumoniae* as reported in the literature. *Escherichia coli* is the commonest organism responsible for the UTI as reported by most studies (12,15-16). The organism accounted for 43.5% of the UTI in our study which is lower than 50.9% and 75% reported by Sule et al (17) in Kano, Nigeria and Sanjib et al (16) in Khulna, Bangladesh; but higher than 45.8% and 23.0% reported by Maduakor et al(18) in Enugu, Nigeria and Woldemariam et al(12) in Addis Ababa, Ethiopia. *Pseudomonas aeruginosa* was the second most common pathogen accounting for 15.9% as opposed to other studies in Nigeria where it accounted for the least (19,18). The organism accounted for 1.8% and 4.2% in the previous studies by Sule et al (19) and Maduakor et al(18) respectively. The high prevalence of *Pseudomonas aeruginosa* in our study may be related to the presence of nosocomial CAUTI in our patients (7,20,21). *Staphylococcus aureus, Proteus merabilis* and *Klebsiella pneumoniae* accounted for 15.1%, 7.9% and 4.0% respectively in the present study which is comparable to 15.6% and 7.3% reported by Maduakor et al (18) for *Staphylococcus aureus* and *Klebsiella pneumonia* but differs in the incidence of *Proteus mirabilis* for which they reported 11.5%. Sule et al(19) reported higher incidence of *Klebsiella pneumoniae* (23.3%) but comparable incidence of *Proteus mirabilis* (7.9%). The least reported organisms in the present study were *Salmonella spp, candida albicans and Streptococcus spp* which accounted for 0.8%, 2.4% and 3.2% respectively which is contrary to the findings by Sule et al(19) where *Pseudomonas auregenosa* (1.8%), *Proteus mirabilis* (7.0%) and *Staphylococcus saprophyticus* (9.6%) accounted for the least. The least reported organisms by Maduakor et al (18) were *Acinetobacter* (1.0%), *Enterobacter* (4.0%) and *Pseudomonas aeruginosa* (4.0%).

The most sensitive drugs were Ciprofloxacin, Nitrofurantoin and levofloxacin while the least sensitive drugs were Erythromycin (0.8%), co-trimoxazole (1.6%), Nalidixic acid (1.6%) and moxifloxacin (1.6%). These contradict what was reported by Sule et al in Kano where ofloxacin and gentamicin have the highest sensitivity while Nitrofurantoin and co-trimoxazole have the lowest sensitivity. They reported sensitivity of 81%,55%, 12%, 6.9% for ofloxacin, gentamicin and Nitrofurantoin against the uropthogenic E coli respectively. Woldemariam et al (12) reported high sensitivity to Nitrofurantoin (100.0%), Amikacin (92.3%) and Tobramycin (92.3%) by E coli.

The highest resistance is this study was to Augmentin (15.9%), ciprofloxacin (10.3%) and ampicillin (7.1%) while the lowest resistance was to Nitrofurantoin (0.8%, Nalidixic acid (1.6%)

and gentamicin (2.4%) which is comparable to what was reported by Woldemariam et al (12), in which the highest resistance was to ampicillin and Augmentin (14.3%). The study by Sule et al (19) showed highest resistance to amoxicillin (88%), augmentin (71%) and co-trimoxazole (93%) and nalidixic acid (67%).

Conclusion

Escherichia coli, Pseudomonas aeruginosa and Staphylococcus aureus were the most common organisms associated with UTI, while the least common were *Salmonella spp, candida albicans, Streptococcus spp, Klebsiella pneumonia and proteus merabilis.* The highest sensitivity was to ciprofloxacin, Nitrofurantoin and levofloxacin. There was high resistance to Augmentin, ciprofloxacin and ampicillin.

Urinary tract obstruction, co-morbidity and indwelling catheter are the most common risk factors associated with UTI in our environment.

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