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Prevalence of Proteus mirabilis and Pseudomonas aeruginosa among female patients with suspected urinary tract infections attending Muhammad Abdullahi Wase specialist hospital, Kano, Nigeria.

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----------ABSTRACT----------
This study was carried out to determine the distribution of uro-pathogens Pseudomonas aeruginosa and Proteus mirabilis and their antimicrobial susceptibility pattern from female patients attending Muhammad Abdullahi Wase Specialist Hospital, Kano, Nigeria, with suspected urinary tract infection. Between July to October, 2012 mid-stream urine samples from 200 patients suspected of urinary tract infection were collected for routine culture and antibiotic susceptibility testing and were processed using standard laboratory methods. Out of the 200 samples, 39% (78) were positives while 61% (122) were negatives. Gram negative bacteria were the predominant isolates. Among them Escherichia coli was the most frequent isolate (33.3%), then Pseudomonas aeruginosa (26.9%), Proteus mirabilis(21.7%), Klebsiella species (8.97%), and Proteus vulgaris (8.97%).The infections caused by Proteus mirabilis and Pseudomonas aeruginosa were more prevalent in adult females especially at the age ≥18.The antimicrobial susceptibility test shows, streptomycin, ciprofloxacin, pefloxicin and tarivid to be effective in the treatment of urinary tract infection against Pseudomonas aeruginosa and Proteus mirabilis but were resistant to augmentin. Proper awareness on personal hygiene, routine sample culture and antibiotic sensitivity profiling would play a significant role in reducing the incidence of urinary tract infection.

KEY WORDS: *Incidence, Proteus mirabilis, Pseudomonas aeruginosa, urinary tract, uro-pathogen.*

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I. INTRODUCTION

A Urinary Tract Infection (UTI) is a condition where one or more structures in the urinary tract become infected after bacteria overcome the structures strong natural defenses. Despite these defenses, urinary tract infections are most common of all infections and can occur at any time in the lifespan of an individual *[1]*. Almost 95% of cases of urinary tract infections are caused by bacteria that typically multiply at the opening of the urethra and travel up to the bladder (known as ascending route)**.**These infections are much more common in adults than children, about 1-2% of children of school-age girls and 5% of women do get urinary tract infections but is rare in males [2, 3, 4]. Infections are much more common in girls than boys. This reason is not well understood [3]. Bacterial infections of the urinary system are usually caused by microbes that enter the system from external sources. About 900,000 cases are of nosocomial origin and probably 90% of these are associated with urinary catheters [2].An infection of the urinary tract occur more frequently in women than men [5] because the female urethra is short (about 1.5 inches, compared with 8 inches in the male) and is adjacent to the genital and intestinal tracts [6]. Because of the proximity of the anus to the urinary opening, intestinal bacteria predominate in the urinary tract infections. Most infections of the urinary tract are caused by *Escherichia coli,* mostly strains that have become adapted to colonizing these organs. Also common are infections caused by *Proteus, Klebsiella* and *Enterococcus*. Infections by *Pseudomonas aeruginosa* because of their natural resistance to antibiotics are especially troublesome [2].Clinical researches have indicated the presence of numerous cases of antibiotic resistance to common antibiotics by uro-pathogens in both developed and developing countries [5, 7, 8]. Resistances to newer and more potent antimicrobials are no exceptions, making therapeutic options very limited to certain antimicrobial agents[9,10].The aim of this study was to determine the distribution of uro-pathogens *Pseudomonas aeruginosa* and *Proteus mirabilis and* their antimicrobial susceptibility pattern from female patients attending Muhammad Abdullahi Wase Specialist Hospital, Kano with suspected urinary tract infection.

II. MATERIALS AND METHODS

2.1 Study Area

The study was carried out at the in-patients and out- patients departments of Muhammad Abdullahi Wase specialist hospital, Kano, Nigeria.Kano is the capital of Kano State in northern Nigeria, in the Sahelian geographic region south of the Sahara. Its metropolitan population makes it the second largest city in Nigeria. The principal inhabitants of the city are the Hausa people. As in most parts of northern Nigeria, the Hausa language is widely spoken in Kano. Kano is largely Muslim. The region features savanna vegetation and a hot, semi-arid climate.

2.2 Sample Collection

Two hundred (200) urine samples from both out-patients and in-patients were collected using sterile universal bottles. Patients were instructed on how to collect sample (mid-stream or clean catch). Appearance of the urine was noted, e.g. amber, turbid, bloody or cloudy).

2.3 Identification of Bacterial Isolates.

The identification of the bacterial isolates was done using standard microbiological techniques comprising of studying the colony characters, staining reactions and biochemical tests.

2.3.1 Culture

A standard wire loop that delivered 0.01 ml of urine was used. The specimens were cultured immediately on Cysteine- Lactose Electrolyte Deficient (CLED) agar and then incubated overnight at 37^{o}C for 18 -24 hours aerobically.

2.3.2Macroscopic examination

The macroscopic examination was based on the colonial appearance. Gram stain procedure was carried out on the isolates and identified based on the staining reaction exhibited by the organisms and their appearance under the microscope [11].

2.3.3Estimation of Bacterial Numbers

This was done according to the method of [11]. A standard wire loop which was able to hold 0.01 ml of the sample was used. A bacteria count was based on the fact that single colony represent one organism. A count of $\geq 10^5$ was regarded as positive for urinary tract infection (significant bacterial growth for estimation).

2.3.4Biochemical Reactions

The following biochemical tests were carried: Catalase test, Coagulase test, Indole production test, oxidase test, citrate utilization test, Urease production test, lactose fermentation test and motility test to identify the organisms isolated.

2.4Antibacterial susceptibility test (diffusion sensitivity test)

Antibiotic Susceptibility test of different isolates were performed according to Kirby –Bauer disc diffusion techniques as described in [11] using the following antibiotics: Augmentin, gentamycin, pefloxicin, tarivid, streptomycin, septrin, chloramphenicol, sparfloxacin, ciprofloxacin and amoxicillin.

III. RESULTS

A total of 200 urine samples from patients suspected of urinary tract infection were screened for the study. Out of which39% (78) were positives for culture of uro-pathogens while 61% (122) were negatives. Five types of pathogens were isolated as shown in table 1. The overall result shows *Escherichia coli* has the highest isolation rate (33.3%), followed by *Pseudomonas aeruginosa* (26.9%), Proteus mirabilis 21.7%,*Proteus vulgaris* and *Klebsiella species* has (8.97%) each as in Table 1. The incidence/prevalence of *Proteus mirabilis* and *Pseudomonas aeruginosa* with respect to the age groups of the patients was found to be more in females in the age group ≥18 as shown in Table 2.*Proteus mirabilis* showed a remarkable resistance to augmentin (100%reisitance),and highly sensitive to streptomycin and ciprofloxacin (100%), sparfloxacin (94. 1%), pefloxicin (88.2%), tarivid (76.4%), gentamycin and chloramphenicol (70.5%) and amoxicillin (64.7%) as shown in table 3. Pefloxicin and tarivid with (100%) each, followed by gentamycin (95.2%), streptomycin (90.4%), ciprofloxacin (85.7%, sparfloxacin (80.9%), chloramphenicol (71.4%),were the most effective antibiotics against *Pseudomonas aeruginosa* with septrin (38.0% susceptible) showing resistance while Augmentin (100% resistance) shows maximum resistance as shown in Table 4.

Table 1: Species distribution of uro-pathogens among subjects examined

Uro-pathogen	Number positive	Percentage (%)
Escherichia coli	26	33.3
Pseudomonas aeruginosa	21	26.9
Proteus mirabilis	17	21.7
Proteus vulgaris	7	8.97
Klebsiella species	7	8.97
Total	78	100

Table 2: Prevalence of *Proteus mirabilis* and *Pseudomonas aeruginosa* according to age groups of patients

Age group (years)	*Proteus* Positive	*Mirabilis* Negative	*Pseudomonas* Positive	*aeruginosa* Negative
Children (0-12)	4	19	5	18
Adolescence (13-17)	2	21	5	20
Adult (18-above)	11	143	11	140
Total 17		183	21	178

Table 3: Antibiotic susceptibility pattern of *Proteus mirabilis* to selected antibiotics

Antibiotic	Sensitive		Resistant	
	N	%	N	%
Augmentin	0	0	17	100
Gentamycin	12	70.5	5	29.4
Pefloxicin	15	88.2	2	11.7
Tarivid	13	76.4	4	23.5
Streptomycin	17	100	0	0
Septrin	7	41.1	1058.8	
Chloramphenicol	12	70.5	5	29.4
Sparfloxacin	16	94.1	1	5.8
Ciprofloxacin	17	100	0	0
Amoxicillin	11	64.7	6	35.2

Table 4: Antibiotic susceptibility pattern of *Pseudomonas aeruginosa* to selected antibiotics

Antibiotic	Sensitive		Resistant	
	N	%	N	%
Augmentin	0	0	21	100
Gentamycin	20	95.2	1	4.7
Pefloxicin	21	100	0	0
Tarivid	21	100	0	0
Streptomycin	19	90.4	2	9.5
Septrin	83	8.0	13	61.9
Chloramphenicol	15	71.4	6	28.5
Sparfloxacin	17	80.9	5	23.8
Ciprofloxacin	18	85.7	3	14.2
Amoxicillin	13	61.9	8	38.0

IV. DISCUSSION

Antimicrobial resistance is a global problem. It is now accepted as a major public health issue and has significant implication on health and patient care. Resistance to antimicrobial drugs is associated with high morbidity and mortality, high health-care cost and prolonged hospitalization. The problem of antimicrobial resistance is more troublesome to developing countries.Microorganisms and their resistance patterns vary from one country to another, from one state to another and even from hospital to hospital. It is interesting to note that only few investigators have reported the antibiotic susceptibility pattern of *Pseudomonas aeruginosa* and *Proteus mirabilis* in this hospital, therefore this study evaluates the susceptibility pattern for P*seudomonas aeruginosa* and *Proteus mirabilis* using ten antibiotics.

Many studies have shown the incidences of bacterial urinary tract infections with *E. coli* as the predominant isolate [5, 6, 10, 12,].The prevalence of UTI in the population studied was 39%.This figure is higher than the prevalence rate of 25.6% recorded by [13] at the Jos university teaching hospital, Nigeria and 22% by [14] in Ibadan, Nigeria and it is lower than the 60% recorded by[8] at the Dalhatu Araf specialist hospital Lafia, Nigeria but agrees with [15] who recorded 38.6% in Lagos, Nigeria.

In this study the prevalence was highest in the age group ≥ 18. This finding correlates with the reports of earlier workers which include [4, 5, 16]. Also from the results of this study the most frequent etiologic agents isolated in patients with UTI was *Escherichia coli* which account for about 33.3%, *P. aeruginosa* (26.9%), *P mirabilis* (21.7%). This finding is similar to other reports from Nigeria which indicates gram negative bacteria, particularly *E. coli*, as most commonest pathogen isolated followed by *P. aeruginosa* and *P mirabilis*[8, 17].Other organisms isolated include *Proteus vulgaris* and Klebsiella species with (8.97%) each respectively, this also agrees with previous findings of [5, 10, 12].

Recurrence is commonly the consequence of UTI because of emergence and spread of antibiotic resistant strains of the uro-pathogens. Recurrence of UTI under treatment has been reported [18]. In this study; the antimicrobial susceptibility pattern of *P. mirabilis* shows the highest percentage of resistance to Augmentin (100%) followed by Septrin (58.8%) and highly susceptible to Ciprofloxacin, Sparfloxacin and Streptomycin. Pseudomonas *aeruginosa* showed high sensitivity to pefloxicin and tarivid (100% susceptible), gentamycin (95.2%), Streptomycin (90.4%) and Ciprofloxacin (85.7%) but resistant to Augmentin (100%) and Septrin (61.9%).

V. CONCLUSION

From the overall samples collected and processed, the prevalence of both organisms *Proteus mirabilis* and *Pseudomonas aeruginosa* was found to be higher on adults females (age 18-above) . The reasons might be attributed to the short urethra (about 1.5 inches) and is adjacent to the genital and intestinal tract. Five different uro-pathogens were identified among them *Escherichia coli, Pseudomonas aeruginosa* and *Proteus mirabilis* were dominant pathogens. The resistance pattern observed in this study calls for judicious measures, proper awareness programme on personal hygiene, routine sample culture and antibiotic sensitivity profiling for control of this infection and emergence of resistant strains. In this present study, streptomycin, ciprofloxacin, pefloxicin and tarivid were found to be effective in the treatment of urinary tract infection. Lastly, medical practitioners should routinely put the drugs that appeared potent and efficacious into use during prescription so as to reduce the infection to minimal level.

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