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Bacterial agents of urinary tract infections and their current antibiotics sensitivity pattern among patients attending Aminu Kano Teaching Hospital (AKTH) Kano, Nigeria

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ABSTRACT: Bacterial species isolated from mid-stream samples of 400 patients from both the outpatient and in-patients department of Aminu Kano Teaching Hospital, Kano with the history of urinary tract infection were investigated between January to May, 2004. Bacterial agents isolated in this study were *Escherichia coli* (42%) and *Proteus* (32%). Observations from the study have shown that the occurrence of bacteriuria was 12.5% of the total sample screened. *E. coli* was the most predominant organism isolated and its more common in females than males at the ratio of 17.9% - 19.9%. While *Proteus* sp (32%), *Klebsiella* sp (12%) and *Pseudomonas* sp (4%) with less in females of the total organisms isolated. The antimicrobial susceptibility test showed that *E. coli* was sensitive to Nalidixic acid (19.2%), Nitrofurantoin (18.0%), Ceftazidime (12.3%), Ofloxacin (10.3%), Cefroxime (10.0%) and Gentamycin (5.2%). Therefore, the infections caused *E. coli* were more prevalent in females than in males especially at the age ≤ 9 .

Keywords: Bacterial agents, urinary tract infections, antibiotics, sensitivity.

Introduction

A urinary tract infection (UTI) is inferred when there is presence of $\leq 10^5$ cfu of the particular organism per ml of midstream urine sample (Minnuberge *et al.*, 1986). Urinary tract infections represent the commonest genitourinary disease in children and are the second commonest infection which affects them (McHardy *et al.*, 1973). Urinary tract infections in children are particularly important because their occurrence may be associated with some congenital abnormality of the UTI or error in management, if not corrected, these may lead to recurrent infections causing damage to the UTI (Weinberg, 1995).

Microbiologically, urinary tract infections exist when pathogenic microorganisms are detected in the urinary tract (Cannon *et al.*, 1986). The infection is considered significant and requires treatment when more than 10^5 microorganisms per millimeter of urine are present in a properly collected specimen (Minnuberge *et al.*, 1986).

A urinary tract infection is a condition when one or more structures in the urinary tract becomes infected after bacteria overcome the structures (Sigel *et al.*, 1980). When bacteria is present and there are no symptoms, its called bacteriuria (Savage *et al.*, 1973).

UTI is defined as a significant bacteriuria in the presence of symptoms. The bacteria most often seen in UTIs are of faecal origin. The organisms are subset of the organisms found in faeces. Strict anaerobic bacteria rarely cause UTIs (Hoton *et al.*, 1991). An infection occurs when microorganisms usually bacteria from the digestive tract cling to the opening of the urethra and begin to multiply. Most infections arise from one type of bacteria, *E. coli* which normally live in colon (Jodal, 1987).

In most cases, bacteria first begin growing first begin growing in the urethra. An infection limited to the urethra is called urethritis (Stamm *et al.*, 1987) from there bacteria often move into bladder, causing a bladder infection (cystitis) (Correirre, 1988). If the infection is not treated promptly bacteria may then go into the ureters to infect the kidneys pyelonephritis (Brenner, 1988). Microorganisms called *Chlamydia* and *Mycoplasma* may also cause UTIs in both men and women (Hoton, 1991), but these infections tend to remain limited to the urethra and reproductive system. Unlike *E. coli*, *Chlamydia* and *Mycoplasma* may be sexually transmitted and infections require treatment of both partners (Ronald and Nicole, 1992).

Fever, vomiting, abdominal pains, weight loss, urethral discharge, frequent micturation, painful micturation, pressure in the lower pelvis, urination (painful), frequent need to urinate (frequency), urgent need to urinate (urgency), need to urinate at night, abnormal urine (haematuria), foul or strong urine odour, sexual intercourse painful pain flank pain, fatigue, chills, mental change or confusion (in elderly people its only sign of possible UTIs) (Gillenwater *et al.*, 1987).

It is on the recommendation of the WHO (1991) that current status of bacterial aetiological agents related to infectious diseases as well as their trends of antibacterial sensitivities are studied. This is with the aim of giving a useful data that can help the clinicians and public health policy makers towards effective control and prevention of such diseases.

Materials and Methods

Sample Collection

Four hundred (400) 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). The patients comprises of the elderly, children and adults male and females. Appearance of the urine was noted, e.g. amber, turbid, bloody or cloudy).

Identification of Bacterial Isolates

Culture

A standard wire loop that delivered 0.02 ml of urine was used. The specimens were cultured immediately on blood agar and CLED (cystine Lactose Electrolyte Deficient) and MacConkey agar and then incubated overnight at 37°C.

Macroscopic examination

The macroscopic examination was based on the colonial appearance. Crishank and Edward (1967) describe the following: size, shape, colour, pigmentation, edge, consistency, odour, haemolysis, opacity, etc.

Microscopic examination

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 (Cheesbrough, 1984).

Estimation of Bacterial Numbers

This was done according to the method of Cheesbrough (1984). A standard wire loop which was able to hold 0.02 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 significant bacterial for estimation.

Biochemical 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.

Antibacterial susceptibility test

Diffusion sensitivity test

Commercially prepared antibiotic disks with appropriate concentration of antimicrobials were placed on the agar inoculated with the test organism. The zones of inhibition produced after overnight incubation was measured and recorded (Cheesbrough, 1984).

Results

Four hundred patients from both the out-patient and in-patient departments of Aminu Kano Teaching Hospital, Kano with the history of urinary tract infection were studied (Table 1).

Table 1 shows that female took the largest share of 54% while the males took 46%. This result is contrary to the work of Stanfield (1968), but similar to the work of Topley and Wilson (1978).

This study has shown that the occurrence of bacteriuria was 12.5% of the total sample screened (Table 5). This figure is lower than that obtained by Bashir (1994) whose study revealed that urinary tract infections has 22.5% incidence in the patients attending Jos University Teaching Hospital (JUTH). The high incidence of bacterial urinary tract infection in this study in children with 24% of the total isolates (both infants and children). This work is similar to the work done by Goldsmith (1990) at children's hospital, Bradford.

The main pathogen or bacterial agents isolated in this study were *E. coli* and *Proteus* 32% (Table 3). This contradicts the work of Stammie *et al.* (1987) whose work showed that the main pathogens isolated were *E. coli* and *Klebsiella* at microbiology laboratory of Madrid area. And it is in line with the work done by Kadri (2003) at the microbiology laboratory of government medical college, Kashmi whose study showed that the organisms were *E. coli* and *Proteus*.

Most of the infections in this study arise from one type of bacteria; *E. coli* with 42% of the total isolates in colon. The high occurrence of bacteriuria in this study may be due to the fact that it's a hospital based study. According to Brunfult (1992) *E. coli* causes a wide variety of clinical infections it causes about 80% of the acute urinary tract infection. While in chronic cases is less than that.

Topley and Wilson (1987) also stated that *E. coli* is the most prevalent organism of urinary tract infections. *E. coli* being the common organism isolated and its more common in females than in males at the ratio of 17.9% - 19.9%. This study is similar with the work of Topley and Wilson (1987) with the result that *E. coli* is the most common in the age group (<9years) with 14.0% of the total isolates. And the occurrence is more in females than males with 28% and 14% respectively. Nalidixic acid and cefuroxime was the most sensitive drug against this organism, therefore it is the drug of choice.

Proteus took 32% of the organisms isolated and the occurrence is more in males than in females with 22% and 10% respectively. This work is similar to work done by Stamm *et al.* (1982); Hoton and Thomas (1991). This may be because *Proteus* spp is a more common inhabitant of the preputial sac than of vulva or that *Proteus* spp with its active motility and swimming ability can in comparison with other organisms more readily transverse the longer urethra in boys (Shown *et al.*, 1991).

Klebsiella spp took 12% of the total organisms isolated with equal share of 6% for both male and female, which contradicts the work of Stanfield (1966) who stated that *Klebsiella* spp is more common in males than in females. Ceftazidime, gentamycin and ofloxacin are the drugs of choice against this organism.

Staphylococcus aureus gave 8.0% of the total organisms isolated. And both male and female have 4% each, which is also contrary to the work of Bashir (1994) who stated that *Staphylococcus aureus* is more common in females with 11.1% than in males with 2.2% of the total *S. aureus* isolated among patients

attending JUTH. This may be as a result of taming antibiotics since *S. aureus* cause mainly secondary infections. Ceftazidime and amoxicillin are drugs of choice against the organisms.

Pseudomonas spp occurred only in females with 4.0% of the total organisms isolated. According to Ogbonana (1990), *Pseudomonas* sp has been found in urinary tract infection following catheterization. It occurred once in the age group (20 – 29) and (30 – 39) respectively. Ceftazidime and amoxicillin are drugs of choice against this organism.

Citrobacter sp occurred once being 2.0% of the total isolated organisms. It only occurred in female of age range <9. When found it causes infection (Lindberg *et al.*, 1978). Ofloxacin and cefuroxime are the drugs of choice.

The sensitivity and resistance ratio of bacterial agent of urinary tract infection revealed that the most common bacteria of UTI were sensitive to ceftazidime, ofloxacin, nalidixic acid and cefuroxime and a result comparable to those reported by others. However, these bacteria were resistant to cotrimoxazole, tetracycline, augmentin and amoxicillin. This result is similar to the work of Kadri and Orestein (1999) at microbiology laboratory of government medical college, Kashmir (India) and that of Ashok and Abbas (2003) whose work was done at children's hospital Pakistan Institute of Medical Science reported that the commonest bacteria were sensitive to cefuroxime, ofloxacin, nalidixic acid, nitrofurantoin and resistant to cotrimoxazole, amoxicillin and chloramphenicol.

Table 1: The study population according to sex.

Sex	No. of patients	Percentage (%)
Males	208	57.3
Females	192	42.7
Total	400	100

Table 2: the study population according to age.

Age group	No. of patients examined	Percentage (%)
<9	114	28.5
10-19	62	15.5
20-29	56	14
30-39	36	9.0
40-49	30	7.5
50-59	14	3.5
60-69	22	5.5
70-79	20	5.0
80-89	2	0.5
Adult age not specified	44	11.0
Total	400	100

Table 3: The bacterial isolates.

Isolate	No. of patients examined	Percentage (%)
<i>E. coli</i>	21	42
<i>Proteus</i>	16	32
<i>Klebsiella</i>	6	12
<i>Staphylococcus</i>	4	8
<i>Pseudomonas</i>	2	4
<i>Citrobacter</i>	1	2
Total	50	100

Table 4: Culture result.

Organisms isolated	No. of occurrence	Percentage (%)
Number of bacterial significant growth	50	12.5
No significant bacterial growth	112	28
No bacterial growth	206	51.8
No. of yeast cells	30	7.5
Contaminant	2	0.5
Total	400	100

Table 5: Bacterial isolates in relation to age of the patients.

Age group	<i>E. coli</i> (%)	<i>Proteus</i> (%)	<i>Klebsiella</i> (%)	<i>Staph.</i> (%)	<i>Pseudomonas</i> (%)	<i>Citrobacter</i> (%)
<9	7 (14)	1 (2)	3 (6)	-	-	1 (2)
10-19	4 (8)	-	1 (2)	2 (4)	-	-
20-29	1 (2)	4 (8)	-	1 (2)	-	-
30-39	1 (2)	3 (6)	-	-	1 (2)	-
40-49	2 (4)	1 (2)	1 (2)	-	1 (2)	-
50-59	2 (4)	-	-	-	-	-
60-69	-	2 (4)	1 (2)	-	-	-
70-79	1 (2)	-	-	-	-	-
80-89	-	2 (4)	-	-	-	-
Adult age not specified	3 (6)	3 (6)	-	1 (2)	-	-
Total	21(42)	16(32)	6(12)	4(8)	2(4)	1(2)

Key: numbers in parenthesis () are percentages

Conclusions

The present study revealed that the most common organisms implicated in the diagnosed UTI cases at Aminu Kano Teaching Hospital (AKTH), Kano between Jan. – May, 2004 were *E. coli*, *Proteus*, *Klebsiella*, *Staphyococcus aureus* and *Pseudomonas*. The agents were common in female than in male. The most active antibacterial agents was shown to be ceftazidime while tetracycline, amoxicillin, augmentin and ampicillin appeared inactive. It is therefore, recommended that, clinicians should always pay attention to research results while attempting to give an effective prescription.

Recommendations

Preventive measures such as good personal hygiene, wearing cotton underwear, avoiding wearing of tight clothes, avoiding using prolonged activities that can aggravate bladder infections such as bicycle, horse back, riding motorcycle and traveling. Recognizing and treating urinary tract infections (UTIs) is important because untreated UTI could lead to serious kidney problems that could threaten the life of people. In this study, its advisable to sue ceftazidime and ofloxacin for the treatment of UTI.

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