Antibiotic Sensitivity of Bacterial Pathogens in Urinary Tract Infections at Muhimbili National Hospital, Dar es Salaam, Tanzania

G. RIMOY*[1], M. JUSTIN-TEMU[2] AND M. MNDOLWA [3]

[1]*Department of Pharmacology, School of Medicine, Muhimbili University College of Health Sciences, P.O. Box 65010, Dar es Salaam, Tanzania.*
[2]*Department of Pharmaceutics, School of Pharmacy, Muhimbili University College of Health Sciences, P.O. Box 65013, Dar es Salaam, Tanzania.*
[3]*Muhimbili National Hospital, P.O. Box 65000, Dar es Salaam, Tanzania.*

Prevalence and sensitivity trends of urinary tract bacterial isolates were determined through a cross sectional retrospective study at Muhimbili National Hospital in Dar es Salaam. Four hundred specimens from 274 inpatients and 126 outpatients were studied and anti microbial sensitivity test was done by the disc diffusion technique. The results showed that among the isolated organisms the commonest were *E. coli* 44.75 %, *Klebsiella* spp. 33.00 %. *Proteus* spp. 10.50 %, *Staphylococcus aureus* 3.75 %, *Streptococcus* spp 3.75 %, mixed Coliforms 2.50 % and *Pseudomonas* spp 1.75 %. Of the total isolates 92.5 % were Gram negatives. Sensitivity tests against twelve antibiotics showed that resistance was common. Effectiveness of co-amoxiclav, cotrimoxazole, tetracycline, ampicillin and kanamycin was below 50.0 %. Their resistance rates were 53.9 %, 87.2 %, 85.7 %, 81.3 % and 53.9 % respectively. Gentamicin was tested in over 58 % of the common infective agents while ciprofloxacin was tested in over 71 % of all the isolates. It was observed that there was very high resistance to the commonly used antibiotics. The sensitivity rates for ciprofloxacin and gentamicin were found to be above 90 %. Therefore, these two antibiotics may be used for empirical therapy of urinary tract infections when culture and sensitivity tests are unavailable. Strict control on the use of antibiotics and appropriate measures against over the counter availability and self-medication is recommended.

Key words: Antibiotic, UTI, Bacterial Sensitivity.

INTRODUCTION

Most urinary tract infections **(**UTIs) are caused by microorganisms that gain entry into the bladder by ascending through the urethra and are more common in women than in men [1]. Majority of UTIs are caused by coliform bacteria and resistance to antibacterial agents often leads to recurrence [2]. However, previous data from Uganda and Kenya suggest that Gram positive organisms may be common causes of bacteria in those two countries [3,4] UTIs are frequent causes of morbidity in patients as well as the most common cause of nosocomial infections [5-7].

In addition to having knowledge of the common bacterial pathogens, it is useful for medical practitioners to know the pattern of sensitivity to antibiotics. Routine sensitivity tests are not easily available in most parts of Tanzania. Empirical therapy must be guided by up to date information on antibiotic sensitivities. The present study was undertaken to determine the prevalence of urinary pathogens and sensitivity patterns of isolates from patients attending Muhimbili National Hospital (MNH) in Dar es Salaam, Tanzania.

MATERIALS AND METHODS

A total of 400 specimens of midstream urine were cultured. The organisms were isolated from in and out patient specimens submitted to MNH microbiology laboratory between June 2003 and July 2004. The specimens were delivered to the laboratory soon after collection.

Procedures developed by Finegold and Martin [8] and Cheesborough [9] were followed to isolate and identify the bacteria. Urine samples were

*Author to whom the correspondence may be addressed.

cultured by the streak plate method using the standard 4 mm internal diameter platinum wire loop. Blood agar (Oxoid) and MacConkey's agar (Oxoid) plates were inoculated and incubated at 37 ^{o}C aerobically for 24 hours. Cultures with colony counts above 100,000 per ml were considered significant bacteriuria. Identification of Gram negative enteric rods was with the help of biochemical tests, which routinely included triple sugar iron agar, indole, Simon's citrate agar, lysine decarboxylase, urease as well as motility. Sensitivity tests were done on Mueller-Hinton agar using the commercial disc diffusion technique of Banner *et al.* [10].

RESULTS

From the 400 urine specimens, 7 urinary pathogens were isolated. *Escherichia coli* was the most frequent isolate (44.75 %) followed by *Klebsiella* spp (33.00 %), *Proteus* spp (10.50 %), *Staphylococcus aureus* (3.75 %), *Streptococcus* spp (3.75 %), mixed coliforms (2.50 %) and *Pseudomonas* spp (1.75 %). Gram negative bacteria accounted for 370 (92.5 %) and Gram positive bacteria for 30 (7.5 %) of the isolates (Table 1).

Table 1: Common bacterial isolates in UTI patients at MNH.

Organism	Number of specimens	Percentage occurrence
Escherichia coli	179	44.75
Klebsiella spp	132	33.00
Proteus spp	42	10.50
Staphylococcus aureus	15	3.75
Streptococcus spp	15	3.75
Mixed coliforms	10	2.50
Pseudomonas spp	7	1.75
Total	**400**	**100**

Demographic characteristics showed that out of the 400 patients with isolates, 149 (37.25 %) were male while 251 (62.75 %) were females. The age group profile of the UTI patients studied showed that highest isolates were in the age group of 50 years and above (68 %) followed by the age group of under fives.

Resistance to ampicillin was more than 80.0 % with an intermediate sensitivity of 3.9 %. The overall resistance to co-amoxiclav, cotrimoxazole and tetracycline was 53.2 %, 87.2 % and 85.7 % respectively. The sensitivity patterns of ciprofloxacin and gentamicin towards Gram negative bacteria were 92.0 % and 90.0 % respectively. These drugs were not tested on Gram positive organisms (Table 2).

The resistance rate of co-amoxiclav was more than 50.0 % with an intermediate sensitivity 6.8 %. Overall resistance rate for ampicillin, cotrimoxazole tetracycline and nalidixic acid were 81.2 %, 87.2 %, 85.7 % and 28.2 % respectively. Ampicillin, tetracycline and co-trimoxazole displayed the highest resistant rates of above 80.0 %. However, erythromycin was exclusively used for Gram positives with sensitivity rate of 60.0 %. The medicines shown in Table 3 were tested in less than 100 patients due lack of sensitivity discs; For the Gram positive organisms (Table 3), cefuroxime, nitrofurantoin, and ceftriaxone had sensitivities of more than 80.0 % while amikacin and erythromycin had intermediate sensitivities of 78.3 % and 60.0 % respectively. Kanamycin had a low sensitivity (46.0 %).

DISCUSSION

From the results, there is a higher prevalence of UTI in female than in male patients in agreement with other findings [11, 16]. As suggested by Willet and Radojick [6], this could be attributed to the shorter and wider female urethra compared to the male one, as well as its proximity to the anus. The highest isolation rate was found in the ≥50 years age group followed by the <5 years age group. This can be explained by the fact that these groups are generally more susceptible to infections.

E. coli was the most frequent isolate (44.75 %), a finding which agrees with reports in the literature [5, 6, 12, 13, 16]. The second most common isolate was *Klebsiella* spp (33.00 %). This is a higher value compared to what has been reported from this area of East Africa [3, 4]. *Staphylococcus aureus* ranked fourth in isolation rate (3.75 %). This figure is lower compared to the figures of 9.7 % and 18.0 % reported in Ethiopia [13, 16] and 8 % in Nigeria [12]. Other reports show that Gram positive organisms are common causes of urinary tract infections [3, 4, 6] while in this study this was not the case. The other common isolates were *Streptococcus* spp, mixed coliforms and *Pseudomonas* spp with low isolation rates.

Table 2: The overall antibiotic sensitivity patterns of the bacterial isolates

PATTERN	ANTIBIOTICS						
	GEN	**CIP**	**CAC**	**SXT**	**NAA**	**TTC**	**AMP**
Sensitive	195	215	130	18	59	25	30
	89.9 %	91.9 %	40.0 %	7.7 %	69.4 %	13.2 %	14.8 %
Intermediate	7	-	22	12	2	2	8
	3.2 %	-	6.8 %	5.1 %	2.6 %	1.1 %	3.9 %
Resistance	15	19	173	205	24	162	165
	6.9 %	8.1 %	53.2 %	87.2 %	28.2 %	85.7 %	81.3 %

GEN = Gentamicin, CIP = Ciprofloxacin, CAC = Co-amoxiclav, SXT = Cotrimoxazole, NAA = Nalidixic Acid, TTC = Tetracycline and AMP = Ampicillin

Table 3: Sensitivity and Resistance Pattern of Gram Positive Isolates

	NFT	**CFT**	**CXM**	**AMK**	**KNM**	**ERY**
Sensitivity (%)	86.5	85.2	93.0	78.3	46.2	60.0
Resistance (%)	13.5	14.8	7.0	21.7	53.8	40.0

NFT = Nitrofurantoin, CFT = Ceftriaxone, CXM = Cefuroxime, AMK = Amikacin, KNM = Kanamycin and ERY = Erythromycin

Overall, the resistance was unusually high to the antibiotics commonly used in the hospital settings. Extensive and uncontrolled use of antibiotics in developing countries has aggravated the development of resistant strains [10-13]. In Dar es Salaam, many antibiotics are available over the counter for self-medication thus resulting in their indiscriminate use. These problems coupled with the increased chance of cross infection among inpatients are known to account for the existing resistant bacterial strains. This may explain the high resistance rates observed for cotrimoxazole, tetracycline, ampicillin, kanamycin and co-amoxiclav.

Sensitivity patterns for ciprofloxacin and gentamicin were the highest. Ciprofloxacin was introduced for use in the study area recently relative to the time of study. The lower numbers of bacteria resistant to ciprofloxacin may be explained by the fact that the known mechanisms of resistance have not been involved in these organisms. Mechanisms of resistance to antibiotics include decreased intracellular accumulation of the drug via production of efflux pumps or changes in porin structure (in Gram negative bacteria). Efflux mechanisms are responsible for resistance in strains of S. *aureus* and *S. pneumonia* [1,15,17].

The drugs tested in less than 100 isolates such as nitrofurantoin, ceftriaxone, cefuroxime and amikacin were shown to be very sensitive (>80.0 %). Erythromycin was used exclusively in testing of Gram positive organisms and thus it was tested on a few specimens. In other studies, these drugs were tested against Gram positive organisms and showed high sensitivities [14]. The high prevalence of resistance to common and affordable drugs is disturbing and unfortunate because it leaves the medical practitioner with a limited choice of inexpensive medicines. Therefore there is a need for antibiotic usage to be controlled and measures taken to reduce self-medication and prescription by unqualified personnel.

CONCLUSION

Resistance to commonly used antibiotics was found to be very high in MNH. Sensitivity rates for ciprofloxacin and gentamicin were above 90 %. Therefore these drugs can be used for empirical therapy of UTI when culture and sensitivity testing are not available. Strict control

of the use and misuse of antibiotics and appropriate measures against over the counter availability and self-medication is recommended. Regular antibiotic sensitivity evaluation is also recommended.

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