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ANTIBIOTIC SENSITIVITIES OF COMMON BACTERIAL PATHOGENS IN URINARY TRACT INFECTIONS AT GONDAR HOSPITAL, ETHIOPIA
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ANTIBIOTIC SENSITIVITIES OF COMMON BACTERIAL PATHOGENS IN URINARY TRACT INFECTIONS AT GONDAR HOSPITAL, ETHIOPIA

A. F. MOGES, A. GENETU and G. MENGISTU

ABSTRACT

Objective: **To determine the prevalence and sensitivity trends of urinary bacterial isolates.**
Design: **A cross-sectional study.**
Setting: **Gondar College of Medical Sciences (GCMS) Teaching and Referral Hospital, north west Ethiopia.**
Subjects and methods: **Four hundred and twenty urine specimens from 70 in-patient and 350 out-patient cases were studied by quantitative culture method and anti-microbial sensitivity test was done by disc diffusion technique.**
Results: **One hundred and seventy two pathogenic organisms were isolated from 166 patients; the isolation rate was 39.5 %. Among the isolates *E. coli, S. aureus,* Klebsiella species, coagulase negative *Staphylococcus* species and *Citrobacter* species were common accounting for 46.0%, 18.0%, 10.0%, 8.0% and 6.0%, respectively. Of the total isolates 71.5% were Gram negatives. Sensitivity tested against ten antibiotics showed that resistance was common, and the effectiveness of tetracycline, ampicillin, co-trimoxazole, chloramphenicol and penicillin was under 50.0%. The resistance rate was 71.5%, 62.2%, and 62.2%, 54.7% and 40.8%, respectively. Polymixin B, cefoxitin, gentamycin and erythromycin controlled over 76.0% of the common infective agents. Ciprofloxacin did control 98.3% of the organisms.**
Conclusion: **Resistance was found to be very high to the commonly used antibiotics. The sensitivity rate for the recently introduced ciprofloxacin was above 98%. Therefore, this antibiotic may be used for empirical therapy of urinary tract infection (UTI) when culture and sensitivity testing is impossible. Strict control on the use of antibiotics and appropriate measures against over the counter availability and self-medication is recommended.**

INTRODUCTION

Most urinary tract infections (UTI) are initiated by organisms that gain entrance to the bladder by ascending through the urethra and they are more common in women than in men(1). Bacterial infections of the urinary tract are extremely common; some are also resistant to treatment or are likely to recur. Many different microorganisms can infect the urinary organs but by far the commonest belong to the coliform group of Gram-negative bacteria(2). However, previous data from Kampala and Nairobi suggest that Gram-positive organisms may be common causes of bacteriuria in East Africa(3,4). Urinary tract infections are by no means a new problem; they are frequent causes of morbidity in our patients, as well as the most frequent cause of nosocomial infections in many hospitals(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 the country. Empirical therapy must be guided by recent surveys of antibiotic sensitivities. This study was therefore undertaken to determine the prevalence of urinary pathogens and sensitivity patterns of isolates from patients attending Gondar College of Medical Sciences Teaching Hospital, Ethiopia.

MATERIALS AND METHODS

A total of 420 specimens of mid-stream urine were cultured. The organisms were isolated from in- and out patient specimens submitted to the Gondar College of Medical Sciences laboratory between February and October 2000. The specimens were delivered to the laboratory soon after collection. No transport media were used because of the very close distance to the wards. Out-patient specimens were taken in the laboratory.

Procedures developed by Finegold and Martin(8) and Cheesborough(9) were followed to isolate and identify the bacteria. Urine samples were cultured by the streak plate method using standard 4mm internal diameter platinum wire loop. Blood agar (Oxoid) and MacConkey agar (Oxoid) plates were inoculated and incubated at 37°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, Simmon's citrate agar, lysine decarboxylase, urease and motility.

Sensitivity tests were done on Mueller- Hinton agar using the commercial disc diffusion technique of Bauer *et al*(10) against ampicillin (10 Mcg), tetracycline (30 Mcg), chloramphenicol (30 Mcg), co-trimoxazole (25 Mcg), gentamycin (10 Mcg), ciprofloxacin (5 Mcg), cefoxitin (30 Mcg) and polymyxin B (300u). Penicillin G (10 iu) and erythromycin (15 Mcg) were added for Gram-positive organisms. For data analysis Epi info-6 and statistical tests were used whenever appropriate.

RESULTS

From 420 patient urine specimens, 172 urinary pathogens in 166 patients were isolated showing an isolation rate of 39.5%. The number of isolates was greater than the number of specimens because in six specimens two pathogenic bacteria were isolated. As shown in Table I, *Escherichia coli* was the most frequent isolate, 78 (46.0%) followed by *Staphylococcus aureus,* 31 (18.0%), *Klebsiella* spp, 18 (10.0%), Coagulase negative *Staphylococcus* spp. 14 (8.0%), *Citrobacter* spp. 10 (6.0%) and *Proteus* spp, seven (4.0%). Gram negatives accounted for 123 (71.5%) and Gram positives 49 (28.5%) of the total isolates.

Table 1

Common bacterial isolates of GCMS hospital in UTI patients

Organism	No	%
Escherichia coli	78	46.0
Staphylococcus aureus	31	18.0
Klebsiella spp.	18	10.0
Coagulase negative *Staphylococcus spp.*	14	8.0
Citrobacter spp.	10	6.0
Proteus spp.	7	4.0
Others*	14	8.0
Total	172	100

**Streptococci* (n=4), *Enterobacter* spp (n=3) *Salmonella* spp (n=3), *Serratia* spp (n=2), *Pseudomonas* species (n= 1), *Hafinia alvei* (n= 1).

Of the total specimens, 227 (54.0%) were from females. The majority of the pathogens were from females with the isolation rate of 105 (46.3 %) whereas in males it was 61 (31.6%). The highest isolation rate was in the age group 50 years and above (54.7%) followed by the age group 1-4 years (38.5%) (Table 2).

For Gram-positive organisms, erythromycin was effective in more than 75.5% (Table 3). The resistance rate for penicillin was more than 40% with the highest

Table 2

Distribution of bacteriuria by sex and age among UTI suspects

Sex	Positive (%)	Negative (%)	Total (%)
Male	61 (31.6)	132 (68.4)	193 (100)
Female	105 (46.3)	122 (53.7)	227 (100)
Total	166 (39.5)	254 (60.5)	420 (100)
Age (years)			
<4	5 (38.5)	8 (61.5)	13 (100)
5-14	3 (20.0)	12 (80.0)	15 (100)
15-49	123 (37.5)	205 (62.5)	328 (100)
50+	35 (54.7)	29 (45.3)	64 (100)
Total	166 (39.5)	254 (60.5)	420 (100)

Table 3

The overall antibiotics sensitivity pattern of UTI

Pattern	AMP	GEN	SXT	TTC	CAF	FOX	CIP	PB	ERY	PEN
Sensitive	55	130	60	38	73	135	169	138	37	23
	(32.0)	(75.6)	(34.9)	(22.1)	(42.4)	(78.5)	(98.3)	(80.2)	(75.5)	(46.5)
Intermediate	10	4	5	11	5	4	–	13	1	6
	(5.8)	(2.3)	(2.9)	(6.4)	(2.9)	(2.3)		(7.6)	(2)	(12.3)
Resistant	107	38	107	123	94	33	3	21	11	20
	(62.2)	(22.1)	(62.2)	(71.5)	(54.7)	(19.2)	(1.7)	(12.2)	(22.5)	(40.8)
Total	172	172	172	172	172	172	172	172	49	49

AMP= Ampicillin, ERY= Erythromycin, GEN= Gentamicin, PEN= Penicillin, SXT = Co-trimoxazole, TTC= Tetracycline, CAF = Chloramphenicol, FOX= Cephoxitin, CIP= Ciprofloxacin, PB= Polymyxin B
-Numbers in parentheses show percentages

intermediate sensitivity 12.3%. The overall resistance rate for tetracycline, ampicillin, co-trimoxazole and chloramphenicol was 71.5%, 62.2%, 62.2% and 54.7%, respectively.

The sensitivity rate in both Gram-negatives and Gram-positive pathogens for polymyxin B, cefoxitin and gentamycin was 80.2%, 78.5% and 75.6%, respectively. The sensitivity pattern for ciprofloxacin in Gram-negatives was 100% and in Gram positives 93.9%. There were three isolates (all of which were Gram-positives) resistant to ciprofloxacin. These organisms were *Streptococci* spp. and *Staphylococcus aureus* (n=2). The intermediate pattern was 7.6%, 6.4% and 5.8% for polymyxin B, tetracycline and ampicillin, respectively.

DISCUSSION

The isolation rate of 39.5% in this study is higher compared to previous studies in Addis Ababa(11) and Nigeria(12) but it is in agreement with a previous report from Gondar which was 36.6%(13). The higher prevalence of UTI in females than in males is in agreement with the findings of others(11) and as suggested by Willet and Radojcic(6) this could be from their shorter and wider urethra as well as its proximity to the anus.

The highest isolation rate was found in the age group above 50 years (54.7%) followed by the age group less than 4 years (38.5%). This could be explained by the fact that extreme ages are susceptible to infections. *E.coli* was the most frequent isolate (46.0%). This finding is in line with that of other studies(5,12,13). The second most common isolate was *S. aureus* (18.0%). This is a higher value than reported in this hospital, which was 9.7%(13) and 8.0 % in Nigeria(12), though, there are reports that Gram-positive organisms can be common causes of UTI in East Africa(3,4,). Since *S. aureus* is the second most common cause of nosocomial infection and there were a significant number of in-patients with a history of catheterisation specimen contamination with *S. aureus* could not be ruled out. The other common isolates were *Klebsiella* and *Citrobacter* species. These results were in agreement with those of other studies(11-13).

Overall, the resistance rate was alarmingly high to the antibiotics commonly used in the hospital. Extensive and uncontrolled use of antibiotics in developing countries has aggravated the development of antibiotic resistant strains. In Gondar, many antibiotics are available over the counter for self-medication and indiscriminate use. These problems, coupled with the increased chance of cross infection among inpatients, are known to account for circulating resistant bacterial strains. This may explain the highest resistant rates observed for tetracycline, ampicillin, co-trimoxazole and chloramphenicol.

The sensitivity pattern for ciprofloxacin is the highest, probably because it has only been introduced in the last two years for use in the study area. Ciprofloxacin resistance strains of *Entrobacteriacae* were not observed. Yet ciprofloxacin resistant Gram-positive bacteria were isolated. This was similar to the findings of Van Der Wall *et al*(14). The lower numbers of bacteria resistant to ciprofloxacin may be explained by the fact that resistance is by chromosomal mutation rather than by acquisition of plasmids(1,15).

The high prevalence of resistance to common and cheap drugs is disturbing and unfortunate because it leaves the medical practitioner with no or few choices that are inexpensive. Therefore, it is time that antibiotic usage was controlled and measures taken to curtail self-medication and prescription by unqualified personnel.

CONCLUSION

Resistance to the commonly used antibiotics was found to be very high. The sensitivity rate for the recently introduced ciprofloxacin was above 98%. Therefore, this antibiotic may 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.

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REFERENCES

1. Volk, W.A., Gebhradt, B.M., Hammarskjold, M. and Kadner, R.J. *Essentials of Medical Microbiology.* 5th ed. Lippincott- Raven. Philadelphia 1996.
2. Water, G., Harrison, B. and Kunin, G. Urinary tract infection. *New Engl. J. Med.* 1979; **301**:396.
3. Tulloch, J.A., Shaper, A.G. and King, M.H. Bacteriuria and hypertension in African diabetics in Uganda. *East Afr. Med. J.* 1966; **43**:33.
4. Phillips, I., Basson, S.S., Kasule, J. and Kakutu, D.G. Bacteriuria of pregnancy in Kampala- A preliminary survey. *East Afr. Med. J:* 1969; **46**:516-519.
5. Turck, M. and Stamm, W. Nosocomial infection of the urinary tract. *Amer. J. Med.* 1981; **70**:651-654.
6. Willet,W.C. and Radojcic, V. Urinary tract pathogens and antibiotic sensitivity Patterns in Dar es Salaam. *East Afr. Med. J.* 1976; **53**:685-92.
7. Magoha, G.A.O. Nosocomial infection of the urinary tract: Pattern of antibiotics use and drug resistance. *East Afr. Med. J.* 1997; **74**:190-193.
8. Finegold, S.M. and Martin,W.J. *Diagnostic Microbiology* 6th ed. The C.V. Mosby Company, Toronto 1982.
9. Cheesbrough, M. *Medical laboratory Manual for Tropical Countries.* V.II Tropical Health Technology, Doddington 1984.
10. Bauer A.W., Kirby, W.M.M. Sherirs, J.C. and Turck, M. Antibiotic Susceptibility Testing by standardized single disk method. *Amer. J. Clin. Pathol.* 1966; **45**:433-496.
11. Messele, G. Urinary Tract infections. Aetiologic patterns and resistance. *Ethiop. Med. J.* 1983; **21**:3-13.
12. Onifade, E.O. Nwobu, R.A.U., Bamidele, E.O. and Okanume, C.A. Pathogens and antibiotic susceptibility profiles in urinary tract. *East Afr. Med. J* 1992; **69**: 587-590.
13. Abraham, A. and Girmay, Y. Antibiotic sensitivity pattern of prevalent Bacterial pathogens in Gondar. Ethiopia. *East Afr. Med. J.* 1996; **73**:67-71.
14. Van Der Wall, E., Verkooyen, R. P., Groot, J. M., Oostinga, J., Dijk, A., Hustinx, W.N.M. and Verbrugh, H.A. Prophylactic Ciprofloxacin for catheter associated urinary tract infection. *Lancet* 1997; **339**:946-951.
15. Brooks, G.F., Butel, J. S. and Morse, S.A. Medical Microbiology. 21st ed. Appleton & Lange. Stamford, Connecticut 1998.