BRIEF COMMUNICATION

Common Bacterial Pathogens and their Antibiotic Sensitivity at Jimma Hospital: A Four-Year Retrospective Study.

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ABSTRACT

Background: *Since the presence of drug resistant bacteria in the natural environment is a great threat for public health, updated information on local pathogens and their sensitivity patterns is very essential for personnel who are involved in the healthcare delivery system. The aim of the present study is to provide information about the existing of microbial drug resistance in the local area.*

Method: *A retrospective analysis of the sensitivity patterns bacterial isolates from clinical specimens submitted to Jimma Regional Public Health Laboratory from February 1993 to January 1997 was performed. Data was organised using percentages and presented in tables.*

Result: *During the study period a total of 4610 specimens were submitted and 1120 suspected pathogenic bacteria were isolated. From these, 52%, 24%, 13% and 11% of the bacteria were isolated from pus and body discharge, urine, stool and blood respectively. Isolated bacteria were tested for 6 to 11 antibiotics. The most commonly isolated bacteria, in order of decreasing frequency were* S. aureus, *Proteus spp.,* E. coli *Shigella spp. and Klebsiella spp.*

Conclusion: *This study showed that most of bacteria were resistant to the commonly used drugs like ampicillin, penicillin G, co-trimoxazole, tetracycline and erythromycin, and sensitive to gentamicin, kanamycin and nalidixic acid. Even though it is difficult to generalise on the basis of laboratory results only, the results from this study suggest that these three drugs can be used in treating most from this study suggest that these three drugs can be used in treating most bacterial infections. This would be particularly useful in health set-ups where culturing and sensitivity testing is impossible, although the availability and cost effectiveness of these antibiotics is in question. Since all the studies done on this topic in different parts of Ethiopia showed the presence of multiply resistant bacteria, providing updated information on local pathogens with their sensitivity patterns is crucial in the management of infectious disease.*

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INTRODUCTION

Even though the antimicrobial resistance of bacteria is a world-wide problem, the situation in developing countries like Ethiopia is particularly serious. The reasons for this include, inappropriate use of antimicrobials and the wrong dose for an insufficient length of time; lack of laboratory facilities and trained staff; and inavailability of guidelines regarding the selection of drugs especially in rural areas. In addition, control procedures in hospitals are often inadequate resulting in the spread of infectious disease and resistant strains (1-4).

In Ethiopia, because of the absence of well-equipped bacteriological laboratories, published data on drug resistance are few. So far all studies conducted in the country on antimicrobial sensitivity patterns of common pathogens have indicated the presence of multiple antimicrobial resistance from different clinical samples. These consecutively conducted studies reveal that the majority of pathogens have become resistant for the most widely available drugs found in the country (5-12).

In a study made in 1983 in Addis Ababa, more than 85% of all types of urinary pathogens were resistant to at least one antibiotic (7). A study in Sidamo in 1989 showed a very similar result (11). In Jimma, previously published data showed that common pathogens isolated from different clinical samples, such as most members of the enterobacteriaceae (*Escherichia coli, Citrobacter spp.* and *Enterobacter spp.)* and *Staphylococci spp.* were highly resistant to ampicillin, penicillin, tetracycline and co-trimoxazole, and less resistant to gentamicin and kanamycin (12, 13).

Since the presence of drug resistant bacteria in the natural environment is a great threat for public health and because of the ever increasing numbers of resistant strains with time, updated information on local pathogens and their sensitivity patterns is very helpful for health personnel who are responsible for treating patients, deciding health priorities, allocating resources, monitoring the emergence of resistant bacteria and planning effective use of antimicrobials in the region. Therefore, the purpose of this study is to provide such information.

MATERIALS AND METHODS

Study design. The study is based on data registered between February 1993 and January 1997 from patients who submitted clinical specimens to Jimma Public Zone Health Laboratory. Specimens were collected from the patients, and bacteria were isolated and identified with the standard procedures (14) by senior laboratory technicians.

Source of data. Bacteria were isolated from urine, blood, faeces, pus and body discharges (wound, throat, urethral and vaginal) specimens by inoculation on the appropriate culture media. They were then processed for anti-microbial susceptibility test by the Kirby-Bauer agar diffusion method with discs which were the same brand. Sensitivity or resistance was recorded according to the standard method (15). Intermediate readings were very few and were considered sensitive.

Data collection and analysis. A simple format was prepared for collection of data. All the necessary information for the study was derived from the records of the Regional Public Health Laboratory. The collected data were summarised, and organised by using descriptive statistics, for which the values of different variables were first identified and then tallied.

For this study, the sensitivities of 1120 bacteria, isolated from 4610 clinical specimens, have been analysed. The antibiotics used varied according to the

type of bacteria and the availability of discs for the test. Most isolates were tested against up to 11 antibiotics.

RESULTS

During the four year study period, 4610 clinical specimens were submitted to the laboratory. From these 1011, 1334, 1406 and 855 were stool, urine, body discharge and blood respectively. A total of 1120 clinically important bacterial isolates were identified (Table 1). From these 1120 bacteria isolates, 52%, 24%, 13% and 11% were isolated from pus and body discharges, urine, stool and blood respectively. The major isolated bacteria in order of decreasing frequency were *S. aureus, Proteus spp, E. coli, Shigella* and *Klebsiella spp.* (Table 1).

Table 1. Isolated pathogens and specimen sources. Jimma Zone Public Health Laboratory. February 1993 - January 1997.

Bacterial type	Source of bacterial isolates				
	Urine	Blood	Stool	Pus & body discharge*	Total
Gram-negative					
E. coli	103 9.0)	3 (2.5)	-	33 (5.6)	139 (12.4)
Klebsiella spp	50 (18.9)	6 (5.0)	-	58 (9.8)	114 (10.2)
Proteus spp	20 (7.6)	4 (3.3)	-	165 (27.8)	189 (16.9)
Providentia spp	16 (6.1)	-	-	42 (7.1)	58 (5.2)
Pseudomonas spp	5 (1.9)	4 (3.3)	-	54 (9.1)	63 (15.6)
Citrobacter	14 (5.3)	1 (0.8)	-	29 (4.9)	44 (3.9)
Enterococcis	13 (4.9)	-	-	-	13 (1.2)
Salmonella spp	7 (2.7)	57 (47.3)	4 (2.8)	-	68 (6.1)
Shigella spp	-	-	139 (97.2)	-	139 (12.4)
N.gonorrhoea	-	-	-	31 (5.2)	31 (2.8)
Serratia	1 (0.4)	1 (0.8)	-	-	2 (0.2)
Arizona	-	2 (1.7)	-	1 (0.2)	3 (0.3)
Enterobacter	-	7 (5.8)	-	-	7 (0.6)
Gram-Positive			-		
S. aureus	26 (9.8)	10 (8.3)	-	180 (30.4)	216 (19.3)
S. saprophyticus	9 (3.4)	-	-	-	9 (0.8)
S. epidermidis	-	20 (16.7)	-	-	20 (1.8)
S. viridans	-	5 (4.2)	-	-	5 (0.4)
Total (%)	264 (24.0)	120 (11.0)	143 (13.0)	593(52.0)	1120 (100)

* Includes ear, throat, wound, urethral and vaginal discharge.

From the total isolates Gram-negative bacteria account for 78% and Gram-positive-bacteria 22%. Therefore, Gram-negative bacteria were responsible for the majority of infections. The dominant bacteria isolated from urine were *E. coli, Klebsiella* and *Staphylococci sp.* *Salmonella spp.* especially *S. typhi* accounted for about 68% of the total isolates in the blood. *Shigella spp.* were the most frequent isolates from the stool. *S. aureus, Proteus spp., Pseudomonas spp.*

and *Klebsiella spp.* were the dominant bacteria isolated from pus and body discharges.

Table 2 shows the antimicrobial susceptibility pattern of the isolated organisms. In general there was low sensitivity to ampicillin, penicillin cephalothin, tetracycline and high sensitivity to gentamicin and kanamycin, with sensitivities to other antibiotics varying according to the organism. In particular *Shigella spp.* were found to be sensitive to gentamicin, kanamycin, nalidixic acid and polymixin B, but highly resistant to tetracycline, erythromycin, ampicillin and penicillin (Table 2). *Salmonella spp.* was found to be sensitive to chloramphenicol, gentamicin, kanamycin, nalidixic acid and bactrim, and resistant to penicillin G, cephalothin and ampicillin (Table 2).

Table 2. No bacterial isolates from clinical specimens tested for different antimicrobials and their % sensitivities, Jimma Zone Public Health Lab., Feb. 1993-Jan. 1997.

Bacteria	Amp	PG	CF	Chm	GM	K	Na	Pb	SXT	Te	E	FM
E.coli	114(4)	31(3)	46(24)	25(36)	116(81)	101(49)	89(72)	15(34)	118(30)	65(11)	23(17)	27(74)
Klebsiella spp	99(3)	21(0)	26(5)	42(17)	93(74)	94(46)	72(50)	-	93(29)	40(15)	34(15)	16(63)
Proteus spp	176(7)	39(0)	76(17)	128(16)	130(65)	102(61)	77(57)	14(14)	91(34)	42(0)	35(0)	3(0)
Providentia sp	54(2)	6(0)	30(23)	49(12)	53(68)	49(57)	32(13)	9(22)	54(24)	42(7)	12(0)	4(3)*
Psuedomonas sp	58(0)	9(0)	33(0)	60(7)	51(88)	56(39)	3(30)	25(32)	51(19)	42(5)	16(0)	-
Citrobactor	42(0)	8(0)	-	38(32)	27(78)	34(38)	30(50)	10(20)	42(29)	25(8)	23(22)	-
Enterococcus	5(0)	5(20)	2(2)*	4(1*)	6(100)	4(25)	1(0*)	1(0*)	6(17)	2(0*)	-	-
Salmonella spp	47(34)	16(6)	30(13)	65(94)	51(92)	36(78)	18(72)	5(60)	55(93)	52(58)	26(8)	-
Shigella spp	116(2)	15(27)	36(25)	93(17)	119(98)	96(91)	102(73	27(70)	132(12)	90(0)	63(5)	-
N.gonorrhoea	31(36)	24(4)	12(50)	23(39)	31(77)	25(68)	11(27)	3(3*)	29(3)	30(13)	10(10)	-
Enterobactor	7(14)	-	63(0)	4(1*)	3(3*)	6(33)	-	-	6(50)	7(0)	3(0*)	-
S. aureus	191(7)	95(2)	41(51)	185(29)	193(82)	133(74)	81(35)	30(30)	196(45)	146(10)	73(51)	-
S. saprophyticus	9(0)	5(0)	2(1)	8(0)	12(67)	7(57)	3(0*)	-	12(17)	7(0)	5(80)	-
S. epidermidis	15(20)	3(0)	4(1*)	18(22)	16(63)	15(40)	3(0*)	-	19(42)	12(0)	3(1*)	-
S. viridans	4(2*)	-	3(3*)	5(20)	4(3*)	3(2)	3(0*)	-	5(20)	-	-	-
Miscellaneous[1]	5(1*)	-	4(1*)	3(2*)	5(60)	5(80)	-	2(0*)	3(2*)	-	-	-

1 include Arizona and Serratia isolates
- Isolates not tested for a particular antimicrobial agent
* No of sensitive isolate [% of sensitivity not calculated for less than 5 isolates]
No. in brackets indicate % of sensitive
AMP Ampicillin; E Erythromycin; K Kanamycin; PG Penicillin G; Chm Chloramphenicol; FM Nitrofurantion; Na Nalidixic acid;
SXT Co-trimoxazole; CF Cephalothin; GM Gentamicin; Pb Polymixin-B; Te Tetracyclin

DISCUSSION

The findings of this retrospective study confirms earlier observations of widespread resistance to commonly used drugs in the region. The order of frequency and type of bacteria isolated from urine, blood, stool and body discharges are similar with other studies conducted in Addis Ababa, Sidamo and Jimma (5,7,12,13). The result of sensitivity pattern of salmonella and Shigella are similar with the study conducted in Addis Ababa in which 82-85% shigella and 75 - 79% of salmonella isolates were resistant to one or more drugs (8,16).

Even though the sensitivity pattern of *E. coli* strains to the widely and commonly used drugs is more or less the same as previous studies, the percentage of resistance has been increased in this study. In a study done by Gedebou in 1983, the sensitivity of *E. coli* to tetracycline, ampicillin and co-trimoxazole was 28%, 37% and 90%, but in this study the sensitivity to those drugs was 10.8%, 4% and 29.7% respectively (7). This shows that resistance to some antibiotics is increased through time (17). *E. coli* was found to be sensitive to gentamicin, nitrofurantoin and nalidixic acid. The sensitivity of *S. aureus* for ampicillin, tetracycline and bactrim was similar with that reported by Megersa (13). *N. gonorrhoea* was sensitive only to gentamicin and kanamycin, and resistant to the most widely used anti-microbial drugs like penicillin G, erythromycin, tetracycline, ampicillin and co-trimoxazole. The rates of resistance were higher than reported from other studies (5,13), which indicates a considerable increase in the rate of resistance through time. *Proteus spp.*, which was significantly isolated from pus, body discharge and urine, were found to be sensitive to gentamicin, kanamycin and nalidixic acid only.

In the present study, Gram negative bacilli dominates the list of pathogens although *S. aureus* is the leading isolated organism. This agrees well with the previous conducted studies (5,13). In general, 80% of bacterial isolates from different clinical samples were to be found resistant to ampicillin, penicillin G, tetracycline and erythromycin and sensitive to gentamicin, kanamycin and nalidixic acid. Hence, these three drugs can be used in health set-ups where culturing and sensitivity testing is impossible. However, increasing use of such drugs will inevitably result in the emergence of resistant strains, and therefore it will be necessary to continually monitor the situation.

In summary, as it can be seen from this and previous studies done in various places, the frequency of single as well as multiple antimicrobial resistance is increasing all the time. This reflects either scarcity of diagnostic laboratory facilities or inappropriate usage of the commonly available antimicrobial drugs. Therefore, providing updated information on local pathogens and their sensitivity pattern is a major tool in combating this nationally as well as globally alarming situation.

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REFERENCES

1. Cheesbrough M. Medical Laboratory Manual for Tropical Countries: Vol **II**, Butterworth, 1984: 196-205.
2. WHO. Antimicrobial resistant: report of scientific working group. Geneva, 23-27. WHO/BVI/PHA/ANT/82.1, 1981
3. Sam K. Kenyan antibiotic resistance. Lancet, 1997: **349** (Suppl. III): 20-29

4. WHO Bulletin. Resistance to antimicrobial agents. 1996; **74**: No 3. 335-336.

5 Lindtson B. Setegn D. Neimil M. Sensitivity patterns of bacteria isolated from patients at Sidamo regional hospital. Ethiop. Med. J. 1989; **27**:27-31.

6. Gedebou M. Tassew A. Increasing incidence of resistance of *E. coli* to antimicrobials. Ethiop. Med. J. 1983; **21**: 61-67.

7. Gebedou M. UTI Etiologic patterns and resistance. Ethiop. Med. J. 1983; **21**:3-9

8. Gedebou M. Tassew A. Shigella species from Addis Ababa: frequency of isolation and *in vitro* drug sensitivity. J. Hyg. 1982: **88**: 47-55.

9. Geyid A. Lemenh Y. The incidene of methicillin resistant *S.aureus* strains in clinical spcimens in relation to their beta-lactamase producing and multiple drug resistance properties in Addis Ababa. Ethiop Med. J. 1991: **29**:149-153.

10. Gedebou M. Tassew A. Antimicrobial Resistant and R factor of Salmonella isolates from Addis Ababa. Ethop.Med.J. 1981; **19**: 77-85.

11. Plorde JJ. Eng SC. Wright LS. Debassai A. Antimicrobial sensitivity of common bacterial pathogens isolated in Addis Ababa: a preliminary report. Ethiop: Med. J. 1970; **8**: 107-118.

12. Belete E. Antibiotic sensitivities of common bacterial pathogens in Jimma zone between Jan 1992 - Jun 1994. JIHS Student paper pp.5-10

13. Megersa D. Drug resistance: a retrospective survey in Illubabor region. Bull. JIHS. 1993; **3**:51-61.

14. Collee JG. Fraser AG. Marmion BP. Simons A. In: Mackie and McCartney's Practical Medical Microbiology. 4th ed Churchill Livingstone. 1996.

15. Bauer AW. Kirby WMM. Sherris JC Turk M. Antibiotic susceptibility testing by a standard single disc diffusion method. Am. J. Clin. Pathol. 1966; **45**: 493-496

16. G/Yohannes A. Salmonella from Ethiopia: prevalent species and their susceptibility to drugs. Ethiop. Med. J. 1985; **23**: 97-102.

17. Belihu A. Lindtsorn B. Increasing Incidence of Resistance to Antimicrobials in Sidamo. Ethiop. Med. J. 1999; **37**: 181-186.