Antibiograms of Pathogenic Organisms Isolated from Clinical Material and Changes in Their Pattern

Taj B. Uppal,*
M.B., B.S., D.Bac. (London).
Khyber Medical College,
Peshawar, Pakistan

Summary

Susceptibility tests with twenty eight antibacterials on 766 strains of organisms, isolated between 1982 and 1984 showed some important findings, when compared with the results of similar tests on a series of strains isolated between 1977 and 1980.

Esch. coli was still the most common organism causing urinary tract infections, but in this study instead of Gentamicin Norfloxacin was the most effective drug.

Gentamicin no longer occupied the previous position and resistance to it of most of the isolates had increased.

Introduction

In an ideal world no antibiotic should be prescribed to a patient unless firstly the patient's disease has been shown to be associated with a bacterial infection or the patient at risk has been shown to be colonized with potentially dangerous bacteria and secondly the specimens have been taken, cultured and sensitivity tests performed, then the best antibiotic should be chosen.

In every-day life it is almost impossible to satisfy these conditions, so the clinician has to make a decision about the likely infecting organisms and then consider what antibiotic would be most effective against those organisms.

The choice of antibiotics for the immediate treatment of seriously ill patients with infections presents a considerable therapeutic problem. The delay resulting from a wrong initial choice, which is not corrected until the results

*Professor of Bacteriology, Department of Pathology, Khyber Medical College and Visiting Professor of Bacteriology, Postgraduate Medical Institute.

of bacteriological tests become available, may prove hazardous to the patient. Therapeutic choices are complicated by the steadily rising proportions of pathogens resistant to the commonly used antimicrobial agents. Therefore knowledge of the current drug resistance patterns of the common pathogenic bacteria is useful in clinical practice.

As the organisms causing different types of infections vary from place to place and from time to time, so do their sensitivities.

This paper gives an account of the types of organisms isolated from all specimens submitted to the laboratory during the period from 1982 to 1984, and general picture of the sort of infecting organisms which are prevalent and gives some indication of the antibiotics most likely to be useful in dealing with the infections which they cause.

Material and Methods

All the specimens submitted to the Bacteriology laboratory of Khyber Medical College, Peshawar were routinely cultured on Blood agar, Mac Conkey's agar and Choclate tellurite plates and were also inoculated into Cooked meat medium.

The cultures were examined after 18 hours (and, if necessary, after 36 hours) incubation at 37 degrees centigrade, for the presence of any growth.

For Blood cultures, 5 ml of blood was inoculated into 50 ml. of glucose broth. Subcultures were made onto solid media every alternate day and, if negative, were kept for 7 days.

The isolated organisms were identified by standard biochemical methods.[2,15]

Antibiotic sensitivity tests of the pathogenic organisms were carried out by paper disc diffusion method, using Wellcome nutrient agar plates. The potency of the antibiotic discs used and the method used for reading the results were as described previously (Uppal, 1972; 1976)[11,12] and as recommended by National Committee for Clinical Laboratory Standards[7], Blair[1] and Litrature[5].

Discs of all the available antibiotics were used for all the micro-organisms irrespective of their site of isolation and it was left at the discretion of the physician to decide as to which would be the best antibiotic to use, keeping in view the site of infection, toxicity of the drug and the cost of the drug.

Sensitivity test results of only those organisms are given whose total isolates were more than ten.

Results

During the 3-year period between January 1982 and December 1984, a total of 766 organisms were isolated. The number of isolates of various species or organisms are listed in Table I. Table II shows the distribution of organisms according to the site of infection.

TABLE I.

DISTRIBUTION OF ORGANISMS ISOLATED FROM DIFFERENT SPECIMENS

	Organism	Number of isolates	Percentage of total	Most common specimen	Percentage
1.	Esch. coli	438	57.18	urine	86.53
2.	Staph. aureus	81	10.57	pus from abscess or wound	51.85
3.	Pseudo. aeruginosa	62	8.09	urine	38.70
4.	Proteus vulgaris	57	7.44	urine	75.43
5.	Micrococcus	39	5.09	urine	92.30
6.	β-haemolytic Strep.	28	3.65	throat	42.85
7.	Morganella morganii	21	2.74	urine	66.66
8.	Klebsiella aerogenes	15	1.95	urine	46.66
9.	Staph. epidermidis	11	1.43	urine	81.81
10.	Providentia rettgeri	8	1.04	urine	62.50
11.	Proteus mirabilis	2	0.26	1 ear pus 1 urine	50 each
12.	Aeromonas	2	0.26	1 ear pus 1 urine	50 each
13.	Alkaligenes faecalis	1	0.13	blood	100
14.	Streptococcus pyogenes	1	0.13	urine	100
	Total	766			

Largest number of organisms were isolated from urinary tract infections: (541 isolates 70.6%) and the most common organism causing urinary tract infections was Esch. coli.

TABLE II.

SPECIMEN SOURCE DISTRIBUTION OF PATHOGENIC BACTERIA

	Organism	Urine	Blood	Ear pus	Pus wound or abscess	Throat sputum	H.V.S.	Eye	Stool	Pleural fluid, peritoneal fluid or semen.
1.	Esch. coli	380	8	3	25	9	7	1	1 (enteropathogenic)	4
2.	Staph. aureus	13	1	13	42	2	2	1	—	7
3.	Klebsiella aerogenes	7	—	1	4	3	—	—	normal flora	—
4.	Pseudomonas aeruginosa	25	—	13	12	3	1	—	2	6
5.	Proteus vulgaris	43	—	2	9	—	—	—	normal flora	3
6.	Proteus mirabilis	1	—	1	—	—	—	—	normal flora	—
7.	Morg. morganii	14	—	3	4	—	—	—	normal flora	—
8.	Provid. rettgeri	5	—	—	2	—	—	—	normal flora	—
9.	Aeromonas	1	—	1	—	—	—	—	—	—
10.	Alk. faecalis	—	1	—	—	—	—	—	normal flora	—
11.	Strep. pyogenes	1	—	—	—	—	—	—	—	—
12.	β-haem. Streptococci	6	—	1	6	12	3	—	—	—
13.	Micrococcus	36	—	—	2	—	1	—	—	—
14.	Staph. epidermidis	9	—	—	2	—	—	—	—	—

Sensitivity pattern results of seven hundred and fifty two isolates of different organisms tested and the percentage of sensitive strains to different antibiotics are given in Table III.

Esch. coli was isolated from 438 specimens. The most effective antibacterial drug was Norfloxacin. The other three drugs in order of effectiveness were Gentamicin, Pipemidic acid and Tobramycin.

There were 81 isolates of Staph. aureus, mostly from pus from abscesses and wounds. Tobramycin was the most effective drug. The other two drugs in order of effectiveness were Rifampicin and Gentamicin.

Pseudomonas aeruginosa was isolated from 62 specimens, mostly from ear infections. The most effective drug was Tobramycin, next in order were Carbenicillin and Gentamicin.

Of the two species of Proteus, Proteus vulgaris was the most common which was isolated from 57 different specimens and the most effective drug against it was Pipemidic acid, but as it is a specific drug for urinary tract infections, the effective drugs for other infections were Tobramycin and Gentamicin, both of which were equally effective.

Carbenicillin was the most effective drug against β–haemolytic Streptococci.

Discussion

Antimicrobial resistance is a problem which has plagued each new antibiotic that has been developed for clinical use. Resistance to some of the previously useful antibiotics has become so prevalent in many areas that the clinical usefulness of these drugs has been severely impaired.

When compaired with a similar study carried out previously between 1977–1980[13], several changes were found to have taken place in the number of different isolates and their antibiograms. During this period some newer antibiotics have also been introduced.

The number of infections with Esch. coli had increased and the number of isolates sensitive to Gentamicin had increased, but resistance to some of the other antibiotics (Tetracycline, Chloramphenicol, Kanamycin, Rifampicin, Carbenicillin, Co-trimoxaxole and Amoxycillin) had also increased.

There was increase in resistance of Staph. aureus isolates to most of the antibiotics especially Rifampicin and Cloxacillin.

PERCENTAGE OF STRAINS OF DIFFERENT SPECIES OF BACTERIA SENSITIVITY TO DIFFERENT ANTIMICROBIALS

TABLE III.

Organism	Numbers	Tetracycline	Tobramycin	Chloramphenicol	Erythromycin	Nitrofurantoin	Gentamicin	Kanamycin	Ledermycin	Lincomycin	Rifampicin	Oxytetracycline	Gabramycin	Cloxacillin
Esch. coli	438	4.6	81.7	23.7	1.8	47.3	86.6	18.7	2.0	0	1.3	4.8	32.1	0
Staph. aureus	81	29.7	73.8	51.8	40.9	56.6	71.0	22.8	18.75	65.0	71.2	27.1	48.7	74.0
Pseudo. aeruginosa	62	0	69.3	2.3	0	2.3	43.0	9.3	0	0	3.2	0	3.2	0
Proteus vulgaris	57	0	69.6	10.7	0	8.9	69.6	17.8	1.7	0	0	0	38.5	0
Micrococcus	39	8.1	56.7	27.0	16.2	70.2	62.1	21.6	5.4	37.8	62.1	2.7	27.0	51.2
β-haem. Streptococci	28	42.8	75.0	78.5	82.1	75.0	92.8	28.5	28.5	92.8	85.7	35.7	28.5	82.1
Morganella morganii	21	0	85.7	19.0	0	4.7	76.1	33.3	0	0	0	0	45.0	0
Klebsiella aerogens	15	14.2	78.5	28.5	0	35.7	92.8	42.8	14.2	0	0	20.0	57.1	0
Staph. epidermidis	11	18.1	63.6	63.6	18.1	63.6	63.6	18.1	9.0	45.4	54.5	9.0	36.3	63.6

CONTINUED TABLE III

Organism	Ampicillin	Penicillin	Carbenicillin	Methacycline	Cotrimoxazole	Streptomycin	Doxycycline	Clindamycin	Nalidixic acid	Amoxil	Minocycline	Pipemidic acid	Fosphomycin	Cephamandol	Norfloxacin
Esch. coli	14.7	0	17.7	1.6	11.2	6.6	2.0	0.9	53.0	15.6	5.3	83.0	42.1	56.4	87.5
Staph. aureus	13.5	7.5	32.5	20.0	27.5	6.7	27.8	41.2	7.5	12.6	42.3	47.6	48.4	66.6	—
Pseudo. aeruginosa	0	0	50.8	0	0	1.6	0	0	0	0	0	18.1	1.7	—	—
Proteus vulgaris	28.0	0	33.3	1.7	26.3	10.5	0	0	40.3	33.3	1.7	96.9	33.9	—	—
Micrococcus	12.8	5.1	33.3	7.6	10.2	2.5	12.8	46.1	12.8	12.8	41.0	45.4	24.3	—	—
β-haem. Streptococci	92.8	67.8	98.8	28.5	14.2	14.2	32.1	74.0	22.2	88.8	30.7	—	44.4	—	—
Morganella morganii	52.3	0	61.9	4.7	33.3	9.5	9.5	0	42.8	47.6	4.7	57.1	45.0	—	—
Klebsiella aerogens	14.2	0	21.4	0	14.2	21.4	14.2	0	35.7	0	0	—	—	—	—
Staph. epidermidis	0	0	27.2	18.1	9.0	0	18.1	36.3	0	0	27.2	50.0	54.5	—	—

As in other countries, almost all the organisms here also showed increase in resistance to Co-trimoxazole. This shows that the value of Co-trimoxazole is being progressively decreasing, especially when it has been registered for prophylaxis and treatment of urinary tract infections in Europe.[4]

As has also occurred in other parts of the world,[14] there was an increase in the number of resistant strains of Pseudomonas aeruginosa to Gentamicin and Carbenicillin, which was probably due to their extensive use. Consequently, Tobramycin, which was a later introduction to the market, was the best antibiotic against Pseudomonas aeruginosa. In other studies also Tobramycin has proved to be the most effective agent against certain strains resistant to Gentamicin and Carbenicillin.[3,6,10] Tobramycin has the added advantage of being less nephrotoxic than Gentamicin.[8]

Of the Tetracyclines, Minocycline was most effective against Esch. coli, Staph. aureus, Micrococcus and Staph. epidermidis; Tetracycline against β–haemolytic Streptococci and Oxytetracycline against Klebsiella aerogenes.

Since Esch. coli was the most common organism causing urinary tract infections, therefore of the Tetracyclines, Minocycline would be the drug of choice for treatment of urinary tract infections. It is also probably the only Tetracycline that can be given with safety in renal failure, making it the safest derivative for use in elderly patients.[9]

References

1. Blair, J.E., Lennette, E.H., Truant, J.B., (1970) : "Manual of Clinical Microbiology". American Society for Microbiology, Maryland, U.S.A.

2. Cowan, S.T., (1974) : "Manual for Identification of Medical Bacteria". Cambridge University Press, London.

3. Gillett, A.P., Wise, R., Geddes, A.M., (1978) : Use of Antibiotics — Infection in the Compromised host. Brit. M.J. ; 2: 335—337.

4. Huovinen, P., Mantyjarvi, R., Toivanen, P., (1982) : Trimethoprim resistance in Hospitals. Brit. M.J. ; 284: 782—784.

5. Literature ... Showa Yakuhin Kako Co. Ltd. Japan.

6. Moellering, R.C., Wennerstem, C., Kunz, L.J., Poitras, J.W., (1977) : Resistance to Gentamycin, Tobramycin and Amikacin among Clinical isolates of Bacteria. Am. J. Medicine; 62: 873—881.

7. National Committee for Clinical Laboratory Standards, (1973) : "Performance Standards for Antimicrobial discs susceptibility tests as Used in Clinical Laboratories", U.S.A.

8. Penington, C.R., Crooks, J., (1983) : Antibiotics I — New antibiotics and advances in antibiotic treatment. Brit. M.J.; 286: 1732—1734.

9. Reeves, D.S., Bint, A.J., Bullock, D.W., (1978) : Use of Antibiotics. Brit. M.J.; 276: 410—413.

10. Seale, T.W., Thirkill, H., Tarpay, M., Flux, M., Rennert, O.M., (1979) : Serotypes and antibiotic susceptibilities of Pseudomonas aeruginosa isolates from single sputa of Cystic fibrosis patients. J. Clin. Microbiol; 9:1, 72—78.

11. Uppal, T.B., (1972) : Antibiograms of common microorganisms isolated from clinical material in Peshawar region. Medicus; 43: 6, 266—283.

12. Uppal, T.B., (1976) : Antibiograms of Pathogenic organisms isolated from Clinical material and changes in their pattern. Pak. J. Med. Res.; 15: 1, 1—5.

13. Uppal, T.B., (1981) : Antibiograms of Pathogenic organisms isolated from Clinical material and changes in their pattern. Pak. J. Med. Res.; 20: 4, 110—115.

14. Waleh, N.S., Makaram, E.H., (1979) : Emergence of Gentamycin and Carbenicillin resistant Pseudomonas aeruginosa in Shiraz, Iran. Iran J. Med. Sciences; 10: 1—4, 93—109.

15. Wilson, G.S., Miles, A.A., (1975) : "Principles of Bacteriology, Virology and Immunity", 6th ed. Edward Arnold, London.