

The sensitivity of Staphylococci to antibiotics

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STAPHYLOCOCCI, more than other types of micro-organisms, have been able to develop protective antibiotic resistance (Mitsuhashi, 1967). As a result, many strains, particularly those found in hospitals, are now resistant to the commonly used antibiotics.

Staphylococci often produce characteristic lesions which can be recognised clinically, and supporting evidence may be obtained by Gram staining material from the lesions. However, the sensitivities of the causative organisms cannot be known for 24 hours or longer, so initial treatment must be based on a knowledge of the pattern of sensitivities of the organisms in the locality.

In this paper, we give the results of *in vitro* tests of antibiotic sensitivities to staphylococci isolated in the Department of Bacteriology, University of Malaya, during 1971.

Methods

Collection of data

The data from the University Hospital were taken from the day books in the Department of Bacteriology. The 1969 series was part of a larger study of antibiotic sensitivities. The 1971 in-patient series were isolations made during October, No-

vember and December, 1971. The out-patient series were organisms isolated from July to December, 1971. All staphylococci isolated, with the exception of those cultured from urine, were included. The organisms isolated from urine were excluded because the antibiotic discs used to test urinary organisms differed in strength from the other discs.

The data from the School Health Service were obtained from nose and throat swabs taken from schoolchildren at schools in Petaling Jaya, as part of a study into the frequency of pathogenic organisms in this group of children.

Laboratory methods

Specimens were taken on sterile cotton-tipped swabs which were cultured on 5% human blood agar plates and incubated at 37°C, both aerobically and anaerobically. Colonies, which morphologically resembled staphylococci, were Gram stained and a slide coagulase test was performed. Antibiotic sensitivities were tested on all coagulase positive cultures. The colonies were suspended in 2 ml. of sterile broth which was incubated for 2 to 3 hours. A petri dish containing diagnostic sensitivity testing agar (DST — Oxoid) was flooded with the broth, any excess pipetted off and the plate allowed to

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dry. Filter paper discs impregnated with antibiotic (Mast Laboratories) were then placed firmly on the agar and the plate incubated at 37°C overnight. Antibiotic sensitivity of a standard strain of known staphylococcus of known sensitivity (Oxford staphylococcus) was also done at the same time as a control. The concentration of antibiotic in each disc was:—

Penicillin G	4 units
Methicillin	5 microgrammes
Cephaloridine	5 microgrammes
Chloramphenicol	25 microgrammes
Streptomycin	10 microgrammes
Tetracycline	25 microgrammes
Kanamycin	30 microgrammes
Trimethoprin-sulpha	25 microgrammes
Gentamycin	10 microgrammes

The density of the growth and the size of the zone of inhibition of the organisms under test was compared with that of the standard control, and the results reported as follows:

Zone of inhibition around test organism compared with standard organism	Report	Significance
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greater than $\frac{1}{4}$	Sensitive	Sensitive
between $\frac{1}{2}$ and $\frac{3}{4}$	Moderately sensitive	May be partly resistant, a higher dose of antibiotics may be needed
less than $\frac{1}{2}$	Resistant	Resistant

In the results which follow, sensitive organisms were classed as sensitive, while moderately sensitive and resistant organisms were classed together as resistant.

Results

The sensitivities of the staphylococci to various antibiotics are shown in Table 1.

From this table, it can be seen that:—

- The percentage of staphylococci resistant to penicillin varies among the groups. The resistance is highest among the 1971 in-patient series; the percentage resistant is significantly less among the 1971 out-patient series (X^2 5.57 with 1 d.f. $0.2 > p > 0.1$) and is lower again in the Petaling Jaya school-children (X^2 25.50 with 1 d.f. $p < 0.001$). There has been no significant change in the

Table 1:
Antibiotic Sensitivities of Staphylococci

Antibiotic	University Hospital 1969 Inpatients & Outpatients			University Hospital 1971 Inpatients			University Hospital 1971 Outpatients			Petaling Jaya School Health Service 1969		
	Sens.	Resist.	% Resist.	Sens.	Resist.	% Resist.	Sens.	Resist.	% Resist.	Sens.	Resist.	% Resist.
Penicillin	199	193	62	62	133	68	54	66	55	122	38	24
Methicillin	303	13	4	142	4	3	110	1	1	**	*	*
Chloramphenicol	159	33	17	165	27	14	105	17	14	149	11	7
Streptomycin	180	136	43	98	54	35	98	14	12	91	69	43
Tetracycline	94	135	59	103	89	46	69	55	44	123	37	23
Kanamycin	103	8	7	*	*	*	*	*	*	61	0	0
Cephaloridine	312	3	1	*	*	*	*	*	*	160	0	0
Sulpha-trimethoprim	*	*	*	189	4	2	*	*	*	*	*	*
Gentamycin	*	*	*	185	6	3	*	*	*	*	*	*

*Data not available.

Table 2
Resistance of Staphylococci, 1967 and 1971

Antibiotic	In-patients		Out-patients	
	Soo-Hoo & Chai Univ. Hospital 1967 % Resistant	Present Series Univ. Hospital 1971 % Resistant	Soo-Hoo & Chai Univ. Hospital 1967 % Resistant	Present Series Univ. Hospital 1971 % Resistant
Penicillin	37	68	61	55
Streptomycin	5	35	14	12
Tetracycline	37	46	54	44
Methicillin	5	3	6	1

percentage of resistant organisms among in-patients from 1969 to 1971. (X^2 2.10 with 1 d.f. $p > 0.2$).

- Less than 5% of the staphylococci isolated in the hospital were resistant to methicillin, and this percentage has not changed from 1969 to 1971.
- Resistance to chloramphenicol is about 15% in hospital patients, but is only 7% in the schoolchildren in Petaling Jaya.
- The resistance of staphylococci among in-patients has remained constant from 1969 to 1971 (X^2 2.40 with 1 d.f. $p > 0.2$). Among the out-patients, resistance to streptomycin is much lower, but the schoolchildren showed a surprisingly high percentage of resistant organisms.
- Analysis shows that only 66% of the staphylococcal infections found in hospital would be sensitive to the penicillin-streptomycin combination which is used particularly in wound infections.
- Resistance to tetracycline has decreased within the hospital from 1969 to 1971 (X^2 6.66 with 1 d.f. $p < 0.01$) and is less common among schoolchildren.
- No recent data for the resistance to kanamycin and cephaloridine are available for hospital patients, but the low level of resistance in the 1969 series and also among the schoolchildren suggests that most organisms are sensitive.
- In the 1971 in-patient series, only 2% of the staphylococci were resistant to sulphathiazole-thioprim mixture (Bactrim, Roche, Septrin,

B.W.) and only 3% were resistant to gentamycin.

Discussion

Our findings show that there has been little change in the antibiotic resistance of staphylococci since 1967 when Soo-Hoo and Chai collected material from the University Hospital (Soo-Hoo & Chai, 1969). A comparison between the two sets of data is shown in Table 2.

(Table 2 here)

The only significant changes have been in the increasing resistance to penicillin G and streptomycin among hospital in-patients.

In vitro tests should be used as a guide to antibiotic therapy, but clinical factors may modify the choice of antibiotic (Ericsson & Anderson, 1967). From the results of the *in vitro* tests reported here, the following antibiotics may be suitable for use in staphylococcal infections. The drug actually chosen will depend on the severity of the infection, the route of administration and the risks of anaphylaxis and toxicity.

Recommended antibiotics for staphylococcal infection

Oral administration

Sulphamethoxazole-Trimethoprim combination
Methicillin derivatives
Chloramphenicol

Parenteral administration

Methicillin
Cephaloridine
Chloramphenicol

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Reserve antibiotics

Kanamycin
Gentamycin

Summary

The *in vitro* sensitivities of staphylococci isolated in the University Hospital and among school-children in Petaling Jaya have been analysed.

References

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There have been few changes in the last four years. Suggestions are made for the use of antibiotics in staphylococcal infections.

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