IN VITRO SENSITIVITY OF MICROCOCCUS PYOGENES TO THE COMMONLY USED ANTIBIOTICS*

APPLICATION OF THESE TESTS TO THE TREATMENT OF BACTERIAL OCULAR INFECTION

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A VAST amount of work has been done in the application of *in vitro* sensitivity tests for the determination of resistance of bacterial strains to various antibiotics. It is now generally agreed that in many cases these tests are indispensable weapons in the armamentarium of the clinician. Two procedures may be employed:

- (1) disk method,
- (2) tube dilution method.

The former was used in this study in order to obtain quick results to aid the physician in his choice of therapy. It must be remembered that the disk method is a qualitative measure of resistance rather than a quantitative measure. However, Collins (1954) has made a comparative study of these two methods and found a good correlation between them (91·3 per cent.).

Since *Micrococcus pyogenes* (*Staphylococcus*) is usually the most frequently encountered organism in cases of conjunctivitis (Suie, 1955), it was felt that a report concerning the antibiotic sensitivity of these strains would be of interest.

Methods and Material

One hundred and fifteen isolations of *M. pyogenes* were made from cases of primary and secondary conjunctivitis by the following procedure:

Under strict aseptic technique cultures were taken from the lower cul-de-sac of patients with external ocular infections. The cotton swabs were placed immediately into thio-glycollate broth (without indicator) and incubated at 37°C. At the first evidence of growth (usually within 24 hrs) pure isolations were made on rabbit blood brain-heart infusion plates. Subsequently, the organisms were streaked heavily on other plates containing the same media. The antibiotic† and furacin disks‡ were placed approximately 2 cm. apart. The concentrations tested are shown in the Table.

Readings for zones of inhibition were made at 6 and 24 hrs. The presence or absence of a zone of inhibition determined the sensitivity. The variation in the number of strains tested with various antibiotics was due to the availability of the disk at the time of testing. Coagulase tests were made on each strain by the method previously described (Suie and Taylor, 1955).

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‡Eaton Laboratories, Norwich, New York.

Findings

The Table shows the results obtained in this series of cases. Of the antibiotics tested, bacitracin (20 μ g.) demonstrated the greatest activity against *M. pyogenes* and Polymyxin B the least. Furacin inhibited the growth of all the organisms tested. The relatively low activity recorded for erythromycin is undoubtedly due to the low concentrations used.

Organisms which were coagulase positive did not differ significantly in their antibiotic response from those which were negative.

TABLE
ANTIBIOTIC SENSITIVITY OF *M. PYOGENES* ISOLATED FROM CASES
OF PRIMARY AND SECONDARY CONJUNCTIVITIS

Drug	Dosage	No. of Strains		
		Tested	Susceptible	Percentage Susceptible
Aureomycin (μ g.)	60	106	81	76.4
	30	105	73	69.5
	10	108	71	65.7
Bacitracin (units)	20	106	92	86.8
	10	105	87	82.9
	2	107	28	26.2
Chloramphenicol (μ g.)	60	106	77	72.6
	30	105	72	68.6
	10	108	40	37.0
Dihydrostreptomycin (μ g.)	100	82	52	63.4
	10	81	33	40.1
	1	81	6	7.4
Penicillin (units)	10	107	67	62.6
	1	106	51	48.1
	0.5	106	37	34.9
Polymyxin B (μ g.)	30	106	8	7.5
	10	105	2	1.9
	5	107	4	3.7
Terramycin (μ g.)	60	106	72	67.9
	30	106	63	59.4
	10	107	49	45.8
Neomycin (μ g.)	60	88	57	64.8
	30	87	30	34.5
	10	87	23	26.4
Tetracycline (μ g.)	60	87	68	78.2
	30	87	58	66.7
	10	87	43	49.5
Erythromycin (μ g.)	10	99	56	56.3
	1	99	50	50.5
Furacin (mg.)	10	100	100	100

Discussion

How important are sensitivity determinations in the care of bacterial ocular infections? Will the arbitrary use of a "broad spectrum" antibiotic permit the physician to discard these expensive time-consuming tests? What is the best antibiotic to use if such determinations are not feasible?

The answers to these questions are somewhat modified by the severity of the ocular infection. Specifically, since an acute catarrhal conjunctivitis has a self-limiting and benign course, no great harm will be done by the arbitrary prescription of an antibiotic to which the organism is resistant. On the other hand, a corneal or intra-ocular infection will almost invariably lead to severe damage unless promptly and vigorously treated with the appropriate antibiotic.

The Table suggests certain conclusions regarding antibiotic therapy. It charts the sensitivities of *Micrococcus pyogenes* (Staphylococcus) isolated from 115 cases of ocular infection using the disk method. (Variations in the number of organisms tested by a given antibiotic were due to uncertain availability of all antibiotic discs at the time of testing).

It is immediately apparent that, even in infections caused by the same organism, there is a considerable difference in antibiotic sensitivity between different strains. Arbitrary prescription of a "broad spectrum" antibiotic would have been ineffective against at least one-fourth of this series of staphylococci; penicillin and dihydrostreptomycin would have been ineffective against at least 50 per cent.; 100 per cent. of this series were sensitive to furacin, and over 80 per cent to bacitracin.

If, therefore, one seeks the best drug for arbitrary prescription in acute conjunctivitis, good reasons exist for choosing medications the use of which is limited to topical application (such as furacin, bacitracin, sulphacetamide):

(1) The organisms are more likely to be susceptible—presumably because of the low level of usage of these drugs.

(2) If drug allergy should develop (and the index of allergy is very low for these medications) it will not preclude the use of systemic antibiotics in the event of subsequent serious infection.

(3) If resistant bacterial mutants are produced, future disease caused by these strains may still be susceptible to the systemic antibiotics.

Since variations exist not only in strain but also in type of organism, it is impossible to predict the best therapy without sensitivity testing. Such tests are mandatory in cases of serious ocular infections (keratitis, cellulitis, endophthalmitis). Pending the results of sensitivity determinations, these patients should immediately be placed on "shot-gun" therapy, such as furacin and polymyxin topically and penicillin parenterally. Because of the seriousness of such disease and the confusing differential diagnosis, such cases should be promptly referred to the ophthalmologist.

Summary

(1) Sensitivity determinations are tabulated for staphylococci isolated from 115 cases of ocular infection.

(2) Since acute catarrhal conjunctivitis is a relatively benign disease, it may safely be treated without such determinations. Recommended drugs are furacin 1 per cent., bacitracin, 500 u./ml.; or sulphacetamide 30 per cent.—to be used every 1 or 2 hours while awake. It must be remembered that acute catarrhal conjunctivitis is self-limiting, and that failure to respond within 3 or 4 days means misdiagnosis.

(3) The serious ocular infections demand prompt therapy with combined antibiotics, bacterial culture and sensitivity determinations, and reference to an ophthalmologist.

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