DISTRIBUTION OF BACTERIOCIN PRODUCTION AMONG GROUP A HEMOLYTIC STREPTOCOCCI

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A wide distribution of bacteriocin production was found among group A streptococci isolated from different sources. Bacteriocin-producing cultures were found most frequently among streptococci isolated from people in a period of high incidence of acute streptococcal diseases. These strains were characterized by the widest spectrum of activity and by marked bacteriocin production.

The first information on bacteriocin production by hemolytic streptococci was obtained by investigations [1-6] showing the distribution of this feature among streptococci of different groups and its influence on the character of the streptococcal flora in the human pharynx in health and disease.

The object of the present investigation was to study the distribution of bacteriocin (streptocin) production among group A streptococci in various series of strains differing in their source (from patients or healthy carriers) and times of isolation.

EXPERIMENTAL METHOD

Altogether 1568 strains of group A streptococci were studied. The technique and conditions of detection of bacteriocin production were described previously [2]. The study of bacteriocin production by different assortments of strains included determination of the frequency of this phenomenon, the constancy of its detection in the same strains, and determination of the spectrum of activity of the bacteriocin-producing strains.

The method used to detect and define bacteriocin production was by cross-testing large groups of strains and studying bacteriocin production in relation to a limited assortment of sensitive indicator strains. The test of one isolated strain to one indicator strain was conventionally taken as the counting unit (one test combination of strains). Bacteriocin production, detected by the presence and size of zone of inhibition of growth of the indicator strains on solid nutrient media, was recorded by crosses: a zone of inhibition measuring 21-40 mm in diameter was assessed as +++, 11-20 mm in diameter as ++, and 9-10 mm as +.

EXPERIMENTAL RESULTS

The bacteriocin production of strains belonging to the different series is shown in Table 1. The unusually wide distribution of streptocin production (about 95%) revealed by wide cross-testing of the strains, in which 44% of the tested combinations were positive, will be noted. Closely similar mean values were obtained when strains isolated from patients in 1960 were tested. Lower indices were obtained for the activity of strains isolated from patients and from healthy carriers in 1965-1966. The highest percentage of bacteriocin-producing strains (about 100%) and of positive combinations (over 50%) was found among strains isolated in 1967, regardless of the source from which they were obtained. All strains of series obtained in a period of high incidence of acute streptococcal diseases and a high carrier rate (1967) were thus bacterio-

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TABLE 1. Distribution of Bacteriocin Production among Group A Hemolytic Streptococci

Source from which strains were isolated	Years of isolation of strains	Number of strains tested	Number of bacteriocin-producing strains		Number of combinations of strains tested	Number of positive combinations of strains	
			abs.	%		abs.	%
Patients with scarlet fever	1960	96	94	97.9	9216	4144	44.9
" " " "	1965	150	95	63.3	4375	306	6.9
Patients with chronic tonsillitis.	1966	80	68	85.0	944	208	22.0
Healthy carriers.	1966	116	102	87.9	1660	492	29.6
Patients with scarlet fever	1967*	725	722	99.6	10,885	6266	57.6
Healthy carriers.	1967*	401	401	100.0	6015	3077	51.2
Total		1568	1482	94.5	33,095	14,493	43.8

*Period of high incidence of acute streptococcal diseases and of carriers.

TABLE 2. Spectrum of Activity of Bacteriocinogenic Strains of Different Series

Source from which strains were isolated	Years of isolation of strains	Number of bacteriocinogenic strains (in %) inhibiting growth of the following number of indicator strains				
		1-3	4-6	7-9	10-12	13-15
Patients with scarlet fever.	1960	35.9	49.4	14.7	–	–
" " " "	1965	88.9	11.1	0	–	–
Patients with chronic tonsillitis. .	1966	90.4	9.6	0	–	–
Healthy carriers	1966	83.0	17.0	0	–	–
Patients with scarlet fever.	1967	4.8	28.8	44.8	20.8	0.8
Healthy carriers	1967	4.2	47.6	37.6	10.0	0.8

TABLE 3. Distribution of Positive Combinations in Different Series of Strains as Reflected by Size of Zones of Inhibition of Growth of Indicator Strains

Source from which strains were isolated	Years of isolation of strains	Total number of positive combinations of strains	Number of combinations (in %) with large zones of inhibition of growth of indicator
			+++ and ++
Patients with scarlet fever.	1960	4144	62.6
" " " "	1965	306	45.7
Patients with chronic tonsillitis .	1966	208	75.5
Healthy carriers	1966	492	34.1
Patients with scarlet fever.	1967	6266	94.6
Patients with chronic tonsillitis .	1967	3077	96.9

cinogenic, in contrast with the strains of the remaining groups. They were also distinguished by their wider range of activity. Streptocin production by the strains was a constant feature when multiple tests were carried out on some strains over a period of three years. Strains isolated from the same person as a rule were indistinguishable in their bacteriocinogenic properties.

Analysis of the results showed that to detect bacteriocin production in 1123 strains isolated in 1967, it was necessary to test only 16,900 combinations of cultures, i.e., 3.1% of the total number of possible combinations. However, to detect 359 streptocin producing strains in the other series, 13.3-16.5% of the possible number of combinations had to be tested. This comparison emphasizes the greater antibiotic activity of strains isolated in 1967 than of the other series of strains. Comparison of the spectra of bacteriocinogenic strains relative to a limited number of indicators also confirmed this conclusion (Table 2). Meanwhile,

strains isolated in 1967 not only possessed a broad spectrum of activity, but also were distinguished by their marked streptocin production. For example, they formed large zones of inhibition of growth of the indicator strains much more often than strains of the other series (Table 3).

The connection discovered between the bacteriocinogenic characteristics of the strains and the nature of the epidemiological situation may indicate a role of this factor in the infectious process and in the manifestation of the pathogenic properties of the agent. These problems, like bacteriocin production in different serotypes of group A streptococci, will be the subject of future research.

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