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Phage Types of *Staphylococcus aureus* Received at the Quebec Public Health Laboratory from 1976 to 1983

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Phage typing of 13,579 clinical and environmental strains of *Staphylococcus aureus* received at the Quebec Public Health Laboratory between 1976 and 1983 was routinely performed to assess the distribution of lytic groups. Strains susceptible to phages 94, 95, and 96 predominated and accounted for 25% of the specimens. The distribution of strains in lytic groups varied with time and specimen source.

Between 1976 and 1983, the Quebec Public Health Laboratory systematically phage typed 13,579 clinical and environmental isolates of *Staphylococcus aureus*. This study reports the distribution among lytic groups of all of the strains tested. Variations in distribution in relation to some clinical sources and time periods are also presented.

The strains came from different regions of the province, with a majority of them from the city of Montreal. Less than 10% of the strains were multiple isolates from single patients. All of the strains were confirmed to be *S. aureus* based on their cultural characteristics and the production of a free coagulase (9).

Typing was performed with the 23 phages of the international system: group I, phages 29, 52, 52A, 79, and 80; group II, phages 3A, 3C, 55, and 71; group III, phages 6, 42E, 47, 53, 54, 75, 77, 83A, 84, and 85; and group M (miscellaneous), phages 81, 94, 95, and 96. The methodology described by Blair and Williams (2) was used in accordance with the recommendations of the International Subcommittee for the Phage Typing of *S. aureus* (4, 7). *S. aureus* strains which were susceptible to phages from two or more of the above-mentioned lytic groups were assigned to the "mixed-group" phage patterns. Strains that could not be typed at 100 times the routine test dilution (100 RTD) were considered nontypeable.

The distribution of the 13,579 strains among the different lytic groups is shown in Table 1. Of the 3,555 strains belonging to group M, 94% were typed by phages 94, 95, and 96; the remaining 6% were typed by phage 81. The next group in importance (the nontypeable group) accounted for 24.5% of the strains. Groups I and III and mixed-group phage patterns presented similar proportions (12 to 15%), while only 8% of the strains were susceptible to group II phages. In the mixed group, combinations involving only lytic groups I, III, or M were most frequent (11.9%), while group II was involved in five combinations accounting for 1.8% of the strains.

Our proportion of strains belonging to lytic group III was statistically comparable (8) to that reported by Zierdt et al. (11); however, we encountered three times as many strains belonging to lytic group I. However, the close proportion of group II in both studies was statistically different (8). Comparisons with group M are not possible, since Zierdt et al. did not use phages 94 and 96 before 1976. Furthermore, the distribution in lytic groups obtained here (Table 1) closely correlated with that reported by Meadows (5) in an independent 10-year study performed in a Quebec hospital ($r = 0.96$, $P = 0.002$) (3). The distribution of the strains according to their recovery site is given in Table 2. Strains isolated from the nose and throat were predominant.

The distribution of strains by lytic groups according to various recovery sites, which were chosen on the basis of large numbers or clinical importance, is illustrated in Fig. 1. Group M predominated except at the skin-lesion site, where the lytic group II prevailed. Our finding that most strains isolated from skin-lesion sites belong to group II is interesting because of the common association made between these strains and staphylococcal infections accompanied by cutaneous manifestations (1, 6). A larger proportion of nontypeable strains (30.5%) was encountered in isolates from the nose-throat site than from the other sources.

The distributions of strains among the different lytic groups and according to selected sources were compared using a normalized sample, and their correlation coefficients (r) were calculated (3). There was a high degree of correlation between the distribution from the blood culture and pus-wounds sources and the total number of strains ($r \geq 0.9$), with a statistical significance ($P \leq 0.01$). The distribution of strains recovered from the nose-throat site correlated well with the distribution of strains isolated from the pus-wounds site ($r = 0.91$, $P = 0.01$) and with that of the total

TABLE 1. Distribution of *S. aureus* strains in lytic groups

Lytic groups	No. of strains	% Distribution[a]
I	2,034	15.0
II	1,092	8.0
III	1,710	12.6
M	3,555	26.2
Mixed:		
I + M	581	4.3
I + III	377	2.8
III + M	374	2.8
I + III + M	282	2.0
I + II + III + M	114	0.8
I + II	54	0.4
II + III	36	0.3
I + II + III	18	0.1
I + II + M	15	0.1
II + M	11	0.1
Nontypeable	3,326	24.5

[a] The total percent distribution for mixed-type strains was 13.7%.

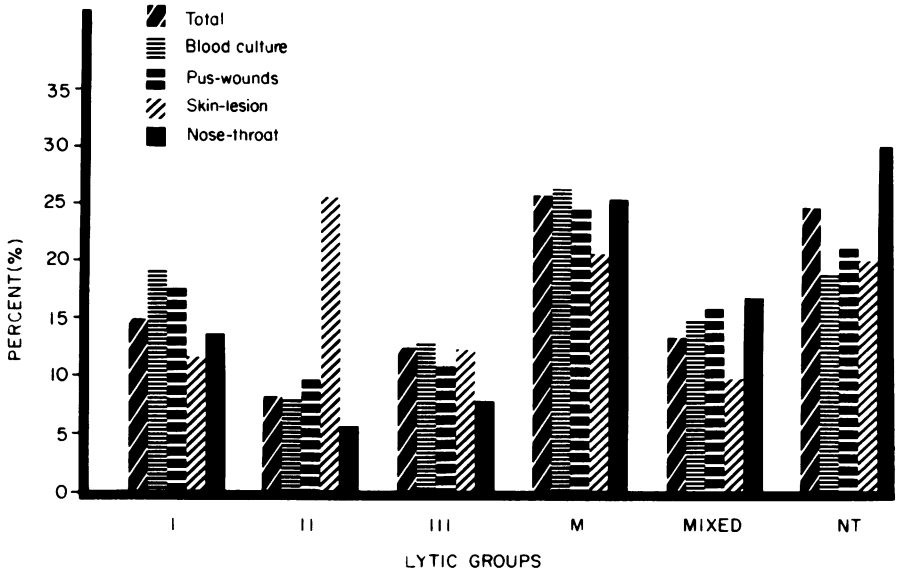

FIG. 1. Distribution of *S. aureus* strains among lytic groups for selected sources. NT, nontypeable.

number of strains ($r = 0.9$, $P = 0.006$). No statistically significant correlations between the distribution of strains from noses and throats and those from blood cultures or between strains isolated from skin and lesions and strains from other sources were found ($P > 0.05$).

The yearly proportion of group III strains, calculated by the least-squares method (10), remained stable over the 7-year study. Among the changes in trends, we noticed an important increase (13 to 39%) in the number of mixed-group strains and an important decrease in the number of nontypeable strains (33 to 8%). Increases in the mixed-group phage patterns have already been reported (5, 11). The decrease in nontypeable strains could be related to a marked decrease in the number of nose and throat samples from which such strains were most frequently obtained, particularly during the last 2 years of the study.

At the Quebec Public Health Laboratory, 25% of the *S. aureus* strains studied from 1976 to 1983 were susceptible to phages 94, 95, and 96, with respect to both the total number of strains and the majority of sources; these strains were probably endemic during this period. In addition, our distribution of *S. aureus* strains among lytic groups varied with time and in relation to the specimen sources.

TABLE 2. Distribution of 13,579 *S. aureus* strains by source

Origin	No. of strains	% Distribution
Human		
Nose-throat	4,752	35.0
Pus-wounds	1,688	12.4
Sputum	925	6.8
Umbilical	791	5.8
Eye-ear	648	4.8
Skin-lesion	458	3.4
Blood culture	328	2.4
Urine	146	1.1
Others	903	6.7
Unknown	2,138	15.7
Nonhuman		
Food	385	2.8
Environment	417	3.1

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