Nasopharyngeal Carriage of Pneumococci in Children with Sick Cell Disease

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Nasopharyngeal carriage of *Streptococcus pneumoniae* was studied in children with sickle cell disease. The incidence of nasopharyngeal isolation was 17.8%. Groups 23 and 6 and type 14 predominated.

The incidence of nasopharyngeal (NP) carriage of *Streptococcus pneumoniae* in normal children varies widely from rates of 6 to 55% (3, 4, 6). Carriage rates vary according to such factors as age, the presence or absence of chronic or intercurrent acute respiratory disease, season, and the site of cultural surveys, such as institutions or home settings. It is assumed that children with sickle cell disease (SCD) have the same carriage rate as normal children; however, carriage has not been specifically studied in this group of children. Therefore, studies were performed to define the NP carriage rate of pneumococci during a single year in children with SCD who were enrolled in a study of pneumococcal vaccine.

Patients. A total of 73 children with SCD were enrolled in a pneumococcal vaccine study from 1 January 1978 to 31 December 1978. There were 18 children (24.7%) from 1 month to 4 years old, 20 children (27.4%) from 5 to 9 years old, and 35 children (47.9%) from 10 to 20 years old. A total of 71 black children admitted to the Los Angeles County/University of Southern California Medical Center Pediatric Pavilion for elective surgery or diagnostic studies served as a comparison group and were selected for study at the time of admission to the hospital. There were 32 children (45.1%) from 1 month to 4 years old, 13 children (18.3%) from 5 to 9 years old, and 26 children (36.6%) from 10 to 17 years old. All SCD and normal children were well and afebrile at the time of acquisition of an NP culture. Cultures were obtained from normal children in the comparison group only at the time of admission to the hospital. NP cultures were obtained from the SCD children on the day of enrollment into the vaccine study (e.g., day of immunization) and thereafter at the time of follow-up venipunctures for serology, which were routinely scheduled at approximately 30 days and 6 months post-immunization.

NP cultures. NP cultures were obtained from the posterior pharyngeal wall with a flexible

calcium alginate swab (Calgiswab; Inolex Corp., Glenwood, Ill.). Cultures were immediately inoculated onto a medium containing 5% defibrinated sheep blood in Columbia Agar Base (BBL Microbiology Systems, Cockeysville, Md.) and gentamicin in a final concentration of 5.0 µg/ml (2). Pneumococci were identified by typical colonial morphology, alpha-hemolytic pattern, and disk susceptibility to optochin; at least three pneumococcal colonies from each child were typed by the quellung reaction with specific rabbit antisera (Statens Seruminstitut, Copenhagen, Denmark) (1). Isolated strains were not subtyped.

A total of 73 cultures were obtained from SCD children on the day of immunization, and an additional 165 cultures were obtained at follow-up visits. Of these 165 cultures, 94 were obtained from children who had been enrolled in the vaccine study; of these 94 cultures, 57 were in the early post-immunization period (21 to 35 days) and 37 were in the late post-immunization period (72 to 180 days). A total of 71 additional cultures were obtained randomly from SCD children not initially cultured at the time of immunization or from those children who did not enroll in the vaccine study. The number of cultures obtained among SCD and comparison group children during the year are shown in Table 1. From 238 (18.1%) SCD children 43 positive cultures were obtained.

Of 73 children with SCD initially enrolled in the vaccine study, 13 (17.8%) had positive NP cultures at the time of immunization. All 13 pneumococcal isolates obtained from these SCD children were of serotypes or groups contained in the vaccine (Table 2). Among the 71 subjects in the comparison group, 12 (17.1%) had positive cultures. In contrast, however, to cultures obtained from children with SCD, only 7 of these 12 pneumococcal isolates were of "vaccine serotypes or groups". Positive NP cultures for pneumococci were obtained more frequently from young children in both normal and SCD chil-

TABLE 1. Monthly incidence of positive NP cultures for *S. pneumoniae* in well SCD and normal children

Children	Mo ^a	No. cultured	No. positive	% Positive ^b
SCD	1-3	53	12	22.6
	4-6	81	17	21.0
	7-9	56	7	12.5
	10-12	48	7	14.6
Normal	1-3	21	3	14.2
	4-6	16	5	31.0
	7-9	16	1	6.3
	10-12	18	3	16.6

^a 1-3, January to March; 4-6, April to June; 7-9, July to September; 10-12, October to December.

^b The mean % positive was 18.1% for SCD children and 16.9% for normal children.

TABLE 2. Serotypes of *S. pneumoniae* isolated from the nasopharynx of 70 normal children and 73 SCD children at the time of pneumococcal immunization, January to December 1978

Children	Pneumococcal serotype or group	No. isolated ^a
SCD	3 ^b	2
	6 ^b	3
	14 ^b	3
	9 ^b	1
	19 ^b	1
Normal	23 ^b	3
	6 ^b	2
	9 ^b	1
	11	1
	14 ^b	2
	15	2
	17	1
	19 ^b	1
	23 ^b	1
	35	1

^a The total number of isolates was 13 out of 73 (17.8%) for SCD children and 12 out of 70 (17.1%) for normal children.

^b Vaccine serotype or group.

dren, and seasonal variation was similar in both groups. Isolation rates were 32, 9.1, and 2.7% in age groups ≤ 4 years, 5 to 9 years, and ≥ 10 years, respectively. Isolation rates of 29, 31, and 28% occurred in March, April, and December, respectively, compared to low rates of 11, 6, and 9% in August, September, and October, respectively.

Isolation rates post-immunization. A total of 57 NP cultures were obtained in the early post-immunization period (21 to 35 days) from immunized children with SCD; 11 (19.3%) of these 57 cultures were positive. Of 13 children with positive cultures at the time of immunization, 6 remained positive at follow-up with the

same serotype (2 with group 23 strains, 1 with a group 6 strain, 1 with a group 9 strain, 1 with a type 14 strain, and 1 with a group 19 strain; in a seventh child, a nontypable pneumococcal strain was cultured, although he had been colonized with a type 14 strain at the time of immunization). Four children, initially culture negative, returned at 21 to 35 days post-immunization with a newly acquired NP vaccine serotype or group of pneumococci (three with a group 6 strain and one with a group 19 strain). Of 37 SCD children cultured in the late post-immunization period (72 to 180 days), 5 (13.5%) had positive cultures. Included in this group were three children with post-immunization cultures persistently positive with a pneumococcal group 23, 19, or 6 strain, respectively; one child converted from a group 6 strain to a group 18 strain, and another child acquired a type 14 strain in the post-immunization period.

Prior observations on isolations of NP pneumococci from children have documented widely varying rates, depending on age, institutional living, family clustering, and time of year (3, 4, 5). NP pneumococcal isolation rates observed in our studies of 17.1% in normal children and of 18.1% in SCD children are in accordance with prior studies. The predominant serotypes or groups (i.e., 3, 6, 14, 19, 23) isolated from our patients are similar to those of previous studies in both normal (3, 4) and SCD children (7, 8). During the 12 consecutive months sampled, group 6 strains and type 14 strains each accounted for 20% of the isolates, and group 19 and 23 strains accounted for an additional 24%. Of all strains isolated pre- and post-immunization from children with SCD, all but 1 of the 43 isolates were of serotypes or groups contained in the tetradevalent pneumococcal vaccine. Of 12 isolates from normal children, only 7 were of vaccine serotypes or groups, but this may be the result of the smaller size of the sample studied. We conclude, therefore, that the rate of isolation of pneumococci from the nasopharynx of normal and SCD children and the serotypes or groups isolated are similar.

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