AN INVESTIGATION OF DIPHTHERIA CARRIERS

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Routine swabbing of young domestic contacts of diphtheria cases has been followed in this borough for many years. As the disease remained of sporadic incidence until 1928, the few contact carriers were easily dealt with by isolation in the borough isolation hospital. In 1928, however, not only did diphtheria increase in prevalence, but so also did the ratio of carriers, these conditions enduring to the latter end of 1930, when there was simultaneous prevalence of both scarlet fever and diphtheria. The following table shows the number of cases of diphtheria notified from 1927 to April, 1931, and the number of contacts dealt with.

	Diphtheria Cases Notified	Contacts Dealt With	Contacts with Positive Swabs
1927	63	72	3
1928	173	167	19
1929	269	275	29
1930	205	212	23
1931 (to April 1st) ...	22	38	2

In addition, nine contacts were found to be suffering from clinical diphtheria of the fauces at the time of inspection and swabbing, and many other cases of multiple infection in the family were dealt with by the practitioner in attendance. With the progress of the epidemic, one became familiar with the appearance of the nose likely to harbour diphtheria bacilli, and inspections of school children in infected classes yielded many other supposed carriers. The children deemed to be carriers were supervised by their own doctors or at the school clinic. Some 53 children, made up of 33 contacts (22 throat and 11 nasal carriers), 19 nasal carriers found in school, and 1 contact with diphtheria bacilli in both throat and nose, were treated at the school clinic. All of these at first yielded practically pure cultures of Klebs-Loeffler bacilli, and were excluded from school under daily supervision until negative swabs were obtained. I have little doubt that nearly all these carriers harboured virulent bacilli, as they were intimate contacts of diphtheria cases.

TREATMENT OF CARRIERS AND RESULTS

Treatment of these children did not impose any arduous duties on the school staff. Throat carriers had their tonsils painted daily with tinct. iodi mitis, and nasal carriers had the anterior nares swabbed with hydrogen peroxide to remove crusts, white precipitate ointment then being applied to the site. Wooden applicators were extremely useful in performing this toilet. These measures were as effective as any of the various antiseptics tried simultaneously in dealing with convalescent carriers in the borough hospital. Antitoxin had no effect on the carrier condition in my experience, although used in three cases. The conditions observed locally were interesting. Throat carriers seldom had normal fauces, and the duration of infectivity varied directly with the unhealthy state of the tonsillar tissue. Nasal carriers practically always had a sore or small excoriation of one or both nostrils, frequently with an acrid nasal discharge; in one instance there was a septic enlargement of the glands in

the neck. They often yielded positive swabs long after the local condition became normal. In most instances positive swabs were obtained for about three weeks only, but a few continued to harbour diphtheria bacilli for periods of two to three months. Three chronic throat carriers (not included above) of the convalescent type came under notice, and here tonsillectomy effected a cure.

At the school clinic isolation of the carriers was maintained as far as possible by giving them a waiting room apart from the other children. Only two fresh cases of diphtheria occurred in association with these carriers after detection. One was a domestic infection of faucial diphtheria derived from a nasal carrier detected in school. The other was in a boy who attended the school clinic for three days with a minor ailment, and contracted diphtheria on the fourth day. Virulence tests were performed only in ten instances, as laboratory animals were not kept in the small laboratory of the public health department. Such tests were carried out in a public health laboratory elsewhere, and, where isolation of the bacillus was possible, one never had a negative result. This isolation was facilitated by sending primary cultures inoculated within an hour of taking the swab and incubated overnight. There was evidence, in two cases where this was not done, that the bacilli in the swab failed to survive a postal journey.

REMARKS ON IMMUNITY

There seem to be two kinds of possible immunity to diphtheria. One might be styled anti-bacterial immunity and the other antitoxic immunity. The latter by no means confers the first, and the first seems to me to depend on phagocytosis, and to be evanescent. Antitoxin proved of little help to the carrier, nor did an attack of diphtheria a year or two before protect against the carrier state—as observed in two instances in this series. Further, it may be stated that antitoxin given prophylactically does not give passive immunity to the carrier state. Despite every precaution, on three occasions during the period of the epidemic, the scarlet fever wards, when filled to capacity, were infected by cases of diphtheria complicating scarlet fever. Passive immunity methods were thereupon freely used, and certainly prevented the appearance of clinical diphtheria. Yet the carrier condition spread through the throats and noses of the immunized children without any symptoms beyond a few "sore noses." Two of these cases proved very persistent carriers of virulent diphtheria bacilli, and yielded pure cultures for three months. Clinical diphtheria occurred among other members of the household in one or two instances where these carriers were discharged from the scarlet fever ward before detection.

CONCLUSION

Many scoff at the procedure of swabbing diphtheria contacts. The discovery of clinical diphtheria among them is sufficient warranty for the continuance of the practice, however cumbersome it may be. A further merit is that many valuable days of school attendance are saved by allowing contacts with negative swabs to return to school at once. Attendance at a centre such as the school clinic solves the problem of what to do with the carriers, and maintains touch with infectious individuals and their families. I would suggest, however, that a routine virulence test be carried out on diphtheria bacilli persisting longer than four weeks in contact carriers. Finally, it is evident that further research is required into the immunology of the diphtheria bacillus as opposed to its toxin.

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