THE RESTRICTION OF INFLUENZA EPIDEMICS IN SCHOOLS BY THE USE OF "LOCAL" PROPHYLACTIC VACCINES.

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In a recent communication one of us (A. I. S.) described and discussed in general terms the catarrhal complex which so frequently attacks in epidemic form aggregations of adolescents such as are found in all public schools, and which causes the loss of so many school hours. In this communication we wish to refer to a particular outbreak of this character, and the means adopted to control and limit its spread.

During the summer term of 1920 an epidemic of febrile disease of severe influenzoid type occurred at Rugby School. Out of a total of nearly 600 boys 260 were attacked, causing the loss of about 5,000 school days to the patients themselves, as well as interfering with the work, games, and social life of those who escaped. Many of the boys were seriously ill, and suffered from manifold complications such as those described in the paper already referred to.

It originated probably from one or two boys who were sent back to school in a catarrhal condition, not technically "ill," but probably carriers of the micro-organisms which caused this outbreak; and it spread rapidly, first by houses and then by forms, until most of the susceptible succumbed.

It is not our intention to describe this epidemic but rather the subsequent train of events, in the hope that certain definite points may be established as to the cause and prophylaxis of this serious infliction, which disturbs the health of our boarding schools more than any other single factor.

During the following Advent term (1920) only 40 to 50 cases, mild in type, occurred, doubtless because the immunity of the school was high, such immunity lasting probably three to six months in average cases.

As it seemed more than probable that another outbreak was to be expected in the following Lent term of 1921, a circular was sent to parents asking them to have their boys inoculated during the Christmas holidays with suitable doses of vaccine, no special brand being specified or advised. This request was complied with in the case of only 123 out of about 570 boarders; the remaining 450 came back uninoculated and susceptible. Trouble soon began, and the infection spread so rapidly that it was thought advisable to attempt to limit its incidence by inoculating all those who had not been so treated in the holidays—if they had not already succumbed. To this end nearly every boy who had not been vaccinated at home or contracted the disease was inoculated with a stock vaccine prepared from those strains of micro-organisms that had been used in the

prophylactic inoculations carried out among the New Zealand Expeditionary Force during 1918-19,² and which had the following composition:

Dose No. 1.			
Pneumococcus	...	...	50 million.
Micrococcus catarrhalis	...	...	25 "
Streptococcus	...	...	10 "
Bacillus pneumoniae	...	...	50 "
Bacillus influenzae	...	...	10 "
Staphylococcus aureus	...	...	200 "

In view of the urgency of the situation no exhaustive bacteriological examination of this epidemic was possible, but ten recent cases of the acute and subacute types, which had been admitted into the sanatorium on February 10th, 11th, and 12th, 1921, were selected for examination. The throats and nostrils were swabbed and cultures instituted upon blood agar from these swabbings. After incubation the resulting cultures showed that in four of the acute cases the *Bacillus influenzae* of Pfeiffer was the predominating organism, and it

was also present in three of the remaining six acute and subacute cases. The organisms in the remaining cases comprised *Bacillus septus*, *Micrococcus catarrhalis*, *Staphylococcus pyogenes aureus*, *Staphylococcus pyogenes albus* (haemolytic type), *Streptococcus lanceolatus* (pneumococcus), and *Streptococcus pyogenes longus*, this last-mentioned organism being represented by two distinct types, *haemolyticus* and *viridans*. All the different strains of each of the above-noted bacteria were isolated in pure culture.

From the material thus obtained a special "local" vaccine was prepared, and the vaccine was polyvalent in the sense that all the strains available of each of these organisms were utilized in the vaccine. Strains from other sources were also incorporated in the vaccine whenever necessary, so that ten strains of each species were present, this polyvalency being of special importance in our opinion in re-

spect of the influenza bacillus itself. In addition, strains of the *Bacillus pneumoniae* were included as a precautionary measure, although this organism had not been actually demonstrated in any of the Rugby cases.

The actual composition of the vaccine employed for the second dose, which was injected fourteen days after the first dose, was as follows:

Dose No. 2.			
Pneumococcus	...	...	100 million.
Micrococcus catarrhalis	...	...	75 "
Streptococcus	...	...	50 "
Pneumobacillus	...	...	100 "
Bacillus septus	...	...	100 "
Bacillus influenzae	...	...	30 "

The dosage of the various components of this prophylactic vaccine will no doubt be regarded as exceedingly small when contrasted with those recommended by the Ministry of Health in connexion with the anticatarrhal vaccine supplied by that body. It is, however, dependent upon the selection of strains and the distance from the human host of the particular cultures furnishing the antigen, in accordance with principles already laid down,³ and need not, therefore, be discussed here.

Curves showing the progress of the "influenza" epidemic, Lent Term, 1921. Black continuous line = cases admitted to sanatorium. Dotted line = cases ill in "houses."

The accompanying diagram shows the daily case incidence throughout this epidemic, under the two headings: those admitted to the sanatorium (black continuous line), and those ill in their respective boarding houses (dotted line); so that to obtain the number of cases under treatment on any given day it is necessary to add together the sum total of both groups.

The general results may be briefly summarized in tabular form, and the following statistics, showing the percentage of those who succumbed, more or less speak for themselves:

(a) Those who received both vaccines at school	...	7.3
(b) Those who were inoculated at home	...	41.0
(c) Those who were not inoculated at all	...	81.0
(d) Those who received only the initial stock vaccine at school	...	84.0

The number of individuals comprised in these four different classes totalled 565. Class (a) comprised 232 individuals, of whom 19 became infected. Class (b) comprised 123 individuals, and yielded 52 cases. Class (c) contained 160 boys, and no less than 130 cases came under treatment. Only 50 boys fell into category (d); out of these 42 succumbed. These figures show a total of 243 cases infected.

Grouping classes (a), (b), and (d) together we arrive at a total of 405 boys who received one or more inoculations, from whom the combined number of cases totalled 113—in other words, an incidence of 27.9 per cent., as opposed to 81 per cent. among the uninoculated.

By way of comment it must be recognized that Class (a) probably includes many of the naturally least susceptible cases, whereas Class (c), on the other hand, consists almost entirely of those who, being very susceptible, contracted the disease before the first inoculation was given at school. Class (d) represents the well-known fact that susceptibility to infection is temporarily increased by the first of two such inoculations, and this constitutes the "factor of danger" when preventive inoculations have to be undertaken in the presence of an epidemic. In the case of Class (b) various vaccines were used—one, two, or three doses being administered according to the varying home circumstances.

During the following summer holidays parents were again requested to have their boys inoculated before their return to school with the special "local" vaccine referred to. In some instances this was done, but in many instances the second dose was given after the boys' return to school, and again many received no prophylactic treatment. The total number of cases that occurred during the subsequent Advent term of 1921 was 21 only. Of these, 8 occurred in boys who had received prophylactic inoculations, whilst the remaining 13 occurred amongst the uninoculated.

We are indebted to W. W. Vaughan, Esq., M.V.O., Headmaster of Rugby School, for permission to record these results and figures.

REFERENCES.

¹ BRITISH MEDICAL JOURNAL, January 28th, 1922. ² *Lancet*, October 12th, 1918, and April 5th, 1919. ³ BRITISH MEDICAL JOURNAL, November 9th, 1912, and *Proc. Roy. Soc. Med.*, xii, 1919, 93-97.

ALUMINIUM THROAT SWABS.

BY

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A few years ago¹ Dr. William Murdie and the writer drew attention to an improved throat swab made from aluminium wire. Since then inquiries regarding it have come in to this laboratory from time to time, and its further extensive use by us and others have confirmed the claims made for it.

The ordinary types of swabs now in use have several serious drawbacks and disadvantages, and a more efficient kind of instrument seems to be called for. Those made of copper, iron, steel, or thin nickel wire are somewhat easily tarnished, and if left lying in a climate the least damp are very liable to become discoloured and unsuitable for use. Copper and nickel are apt to develop verdigris or a green colour from the soluble copper and nickel salts, and brown discoloration is also likely to happen with those made of iron, which develop "rust" or ferric oxide. Such swabs, after being in use or laid aside for a time, acquire an unattractive and unhygienic appearance, and are not the sort of thing to ask a patient to admit to his throat. The pledget of sterile wool is also likely to be stained, and as the soluble copper and

nickel salts are germicidal, these may more or less invalidate the bacteriological diagnosis.

By the use of the aluminium wire these and other undesirable accompaniments are obviated. It is easily moulded to shape and yet is sufficiently rigid for swabbing purposes, and it keeps bright and clean. No matter how often used, or even if kept for a considerable time, the aluminium swab never has the soiled or discoloured appearance of those made from other metals. It stands boiling well and is easy to clean and redress. Again, aluminium contains in its composition no harmful bactericidal elements.

The addition of the safety ring (see illustration) avoids the holding of the cork and gives a more complete control over the movements of the swab, thus minimizing the risk of introducing organisms other than the patient's own. In the ordinary one, as usually made, there is always the risk of the

A. Flattened and grooved end to grip wool. B. Aluminium shaft—never tarnishes. C. Ring to grip and guide the swab.

metal slipping from the cork, which is avoided by this firmer type. Aluminium being so light, the cost of the wire is very small. The best thickness to use is that known on the aluminium wire gauge as E 14 S.W.G. As there is no fear of "rusting" or "greening," the cotton-wool pledget may, if desired, be held under the running tap before swabbing the patient's throat, thus ensuring a good sample of the infected secretion, and also retarding the drying effects of transmission through the post, etc.

The throat swab is a useful item in the practitioner's armamentarium, and the aluminium wire swab holder, well made, will be found helpful in the diagnosis, prognosis, and treatment of some of the diseases met with in everyday practice. We know it is practically impossible, without a bacteriological examination, to make sure whether a patient who complains of a sore throat is suffering from diphtheria, "mixed" throat infection, Vincent's angina, follicular tonsillitis, or an infection by the *Trypanema pallidum*. Complete tests thoroughly carried out from start to finish are invaluable in speedily determining or in eliminating certain or all of these diseases and so removing the anxiety attached to an undecided clinical diagnosis. In attaining this, a hygienic, safe, clean, light, and easily handled swab is an important adjunct.

Of course, whatever kind is used, it is important to take the necessary precautions to avoid its contamination. The pledget of wool for conveying the suspected material is necessarily small, and in gently rubbing the infected surface care must be used that the wool on its introduction or withdrawal does not get soaked with saliva or other oral secretions. One has also to remember that the use of antiseptic gargles prior to use may interfere with the results to be obtained from the cultural tests when the swab reaches the laboratory. It may be further mentioned that the aluminium swab can also be made longer for special uses, as, for example, in the taking of material from uterine infections.

I am indebted to Mr. I. H. MacIver for the sketch illustrating the points described.

REFERENCE.

¹ *Caledonian Medical Journal*, April, 1913.

Memoranda:

MEDICAL, SURGICAL, OBSTETRICAL.

INFLUENZA WITH EXTREME HYPERTYREXIA.

PUBLICATION of the following case of influenza accompanied by extreme hyperpyrexia (temperature 114° F.) may be of interest, especially as some mention of it has been made in the lay press:

On January 15th I was called to see a maid who had been exposed to influenzal infection on January 9th and developed the usual symptoms of malaise, backache, headache, and slight fever, January 12th. On the morning of the 15th she felt worse, with excruciating pain in the back and a temperature of 103° at 9 o'clock. I examined her at noon. She was very pale, the skin moist but not excessively hot, the pulse of good volume, and regular, the rate 120. The heart was normal. Great tenderness was present in the left lumbar region. She had vomited several times, felt faint, and had not passed urine for nearly twenty-four hours. The abdomen was soft except for faecal masses, and there was no evidence of a distended bladder. When I took the temperature the thermometer registered 112° in the axilla. She