NOTE ON "INFLUENZA" AND PNEUMONIA: FROM A FIELD HOSPITAL.

BY

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THE New Zealand Stationary Hospital acted as the infectious disease hospital for the Second Army, British Expeditionary Force, for the seven months May to November, 1918. Bacteriological examinations were made in 116 cases of "influenza" and pneumonia and in 67 healthy controls as follows: 17 "influenza," 17 healthy controls, and 10 pneumonia in the June epidemic, and 39 "influenza," 50 healthy controls, and 50 pneumonia in November. During the later period bacterial vaccines were used for prophylaxis and treatment.

Bacteriological Examination of Influenza and Pneumonia Cases.

In the "influenza" cases 17 blood cultures taken during the first few hours of the illness having proved negative and over fifty blood smears having shown nothing definitely abnormal they were discontinued, and post-nasal swabs were taken as soon as possible after admission. Sputum was examined in cases in which specimens could be obtained. In the pneumonia cases the sputum was always examined, post-nasal swabs only occasionally, as the patients were usually too ill to be troubled, and blood cultures and agglutination tests were also carried out.

Post-mortem swabs were taken from the heart, lungs, and other organs. All specimens were examined by direct smears and by culturing on tryptic agar plates of suitable reaction containing 5 per cent. of human blood, and the same medium and technique were used during both epidemics.

CULTURES.

"Influenza" Cases.

Organisms Isolated from Blood, Sputum, or Post-nasal Swab.	June Epidemic.		November Epidemic.	
	17 Cases.	17 Healthy Controls.	39 Cases.	50 Controls.
<i>B. influenzae</i> ...	9	3	32	13
<i>Pneumococcus</i> ...	6	5	32	7
<i>Streptococcus</i> ...	9	9	26	27
<i>M. catarrhalis</i> ...	13	14	25	40

Pneumonia Cases.

Organisms Isolated from Blood, Sputum, or Post-nasal Swab.	June Epidemic. (10 Cases.)	November Epidemic. (50 Cases.)
<i>B. influenzae</i> ...	10	37
<i>Pneumococcus</i> ...	10	50
<i>Streptococcus</i> ...	9	33
<i>M. catarrhalis</i> ...	2	27

The records showing the details of the findings of these organisms from sputa, post-nasal swabs, and necropsies, both from direct smears and cultures, in 183 cases and totalling over 1,600 results, would occupy too much space for reproduction here.

The influenza bacilli were indistinguishable in direct smears or cultures from other small delicate-growing Gram-negative bacilli such as the Koch-Weeks bacillus, and they frequently showed involution forms in culture.

Agglutination tests of the patients' serums with the influenza bacilli isolated from them showed little agglutinating power either in the early or late stages of the disease, the highest titre being 1 in 20; these tests, therefore, were not persevered with.

The results are not illuminating. The influenza bacillus was usually, though not always, to be found in the cases

of "influenza" and pneumonia, but it was also frequently present in the healthy controls. It was found in a smaller percentage of cases and controls during the June epidemic than during that of November.

Streptococci were very frequently found in the post-nasal swabs and sputa, but were noticeably predominant in the cases of bronchopneumonia.

The *pneumococcus* was found in every case of pneumonia and in every specimen post mortem, and was the constant infecting organism in lobar pneumonia; it was also found in the spinal fluid of seven meningitis cases admitted as cerebro-spinal fever, none of whom developed pneumonia, but only one recovered. All the pneumococci isolated from the blood or lungs of our pneumonia cases that I have been able to type with Rockefeller serums belonged to Types I and II, some of those isolated from the sputum were Types I and II; others were inagglutinable with those serums and were classed as of Group IV.

Complications.

1. *Double Pneumonia*.—An exceptional tendency to spread to the opposite base was noted.

2. *General Peritonitis* occurred in one case, the infection spreading downwards from the diaphragm.

3. *Terminal Empyema* occurred in one case.

4. *Enterica*.—In one instance only was there any such complication, due to paratyphoid B. No ulceration of the ileum or large bowel was found at any of the autopsies.

5. *Epistaxis*.—This was a marked feature of the onset of the pneumonia, and in two cases bowel haemorrhage occurred.

Post-mortem Findings in a Series of Twenty-four Cases.

In the majority of cases the post-mortem examination showed a lobar pneumonia at one or both bases with coincident congestion of the upper lobes. Apical pneumonias were uncommon.

Morbid Anatomy of a Typical Case.

Red hepatization in a lower lobe, with patches of grey hepatization forming in the old-standing cases. A certain amount of serous effusion. The upper lobes in the first stage (congestion); in about half the autopsies pus was found in the smaller bronchioles. The heart dilated, but valves normal, with no endocarditis present. In one case only was a lobular pneumonia found.

The striking feature of the cases was the intense toxic condition of the patients, out of all proportion to the simple lobar pneumonias revealed at autopsy.

Vaccine Treatment of "Influenza" and Pneumonia Cases.

Nature of Vaccine Used.—The vaccine consisted of *Pneumococcus* and *B. influenzae* prepared from organisms isolated from the blood or lungs of the most toxic cases, six suitable strains of each being used. In the case of pneumococcus two strains of each of three types—mixed, sensitized, and unsensitized—the types being I, II, and an inagglutinable type of Group IV. In certain cases of bronchopneumonia in which a *Streptococcus haemolyticus* was present, that organism was included in the vaccine in the same strength as the pneumococcus.

Dosage.—The first dose used in each case of "influenza" was 75 million pneumococci, consisting of 25 million of each of three types of *Pneumococcus*, and 100 million *B. influenzae*, and in the case of pneumonia 25 million of the three types of *Pneumococcus* and 100 million *B. influenzae*, and this was repeated or decreased in the next dose according to its effect in the particular case, and increased in later doses if necessary. These initial doses were maintained throughout in order to preserve some continuity of dosage, it being considered better to have results from 50 or 100 cases treated with the same initial doses than to dodge about from one dose to another.

Intervals.—The temperature, pulse, respiration, and condition of lungs and heart were considered in deciding the intervals. No untoward results could be attributed to the dosage except in two cases of pneumonia in which rigors occurred during the night following.

Vaccine Results.

Total "influenza" cases during November ...	327
Cases with respiratory complications ...	132
Cases with pneumonia ...	40
Deaths ...	22

	Total Cases.	Developed Pneumonia.		Mortality per Cent. of Total Cases.
		No. of Cases	Deaths.	
I. Inoculated against pneumonia immediately after onset of "influenza."	10	0	0	0
Not inoculated immediately after onset	317	50	27=54%	8.5
II. Inoculated immediately after onset of respiratory complications (but before pneumonia)	56	10	5=50%	9
Not inoculated immediately after onset of respiratory complications	76	40	22=55%	29
III. Inoculated only after pneumonia supervened	29	29	15=52%	52
Not inoculated (pneumonia)	11	11	7=63%	63

As far as can be judged from the small number of cases, the prevention of pneumonia by vaccine inoculations was successful, whether carried out before or immediately after the onset of "influenza," though it must be remembered that we were dealing with presumably sound and healthy individuals (apart from the attacks of "influenza"), and that such uniformly satisfactory results might not be obtained with the average man and woman. It is noticeable that the mortality rate increased in proportion to the seriousness of the condition when the vaccine was first administered, that the earlier it was given the better the result, but that in the cases in which pneumonia occurred the mortality was about 50 to 60 per cent., whether vaccine was, or had been, administered or withheld. It is quite possible that better results might have been obtained under conditions in which more attention could have been paid to individual cases than is possible in a crowded field hospital, or even with a different vaccine dosage or interval; but, as far as pneumonia is concerned, our results pointed to the success of vaccine in prevention, but to a very doubtful benefit in treatment once pneumonia was established. Unfortunately, no antipneumococcus serum was available for treatment.

One cannot help drawing the conclusion that the success of this treatment depends upon the early administration of the vaccine, and that the best results may only be expected when every "influenza" case is inoculated immediately, without waiting for the more serious secondary infections to declare themselves.

Prophylactic Inoculation.

During the June epidemic so many cases of "influenza" occurred in the staff that we had thirty-five orderlies in hospital at one time. Arrangements were immediately made to inoculate those who had not contracted the disease; the inoculations, however, were not compulsory.

Although the total staff numbered 250 not another case occurred in the unit from that time. This appears at first to be evidence of effective inoculation, but the records show that only six individuals volunteered for the injection!

At the end of October the epidemic had acquired so serious a nature that the whole of the staff was inoculated. Nine officers, fourteen sisters, and ninety-one other ranks were at once inoculated with the following vaccine:

N.Z.E.F. Mixed Catarrhal Vaccine Prepared by Captain Lowe and Dr. Eyre.

	Dose 1.	Dose 2.
Pneumococcus ...	50	100 million
Streptococcus ...	10	50 "
B. influenzae ...	10	30 "
Staphylococcus aureus ...	200	500 "
M. catarrhalis ...	25	75 "
B. pneumoniae ...	50	100 "
B. septus ...	50	100 "

New Vaccine.

Meanwhile steps had been taken to prepare what was considered a more suitable vaccine.

In order that as far as possible the vaccine should provide adequate protection against the prevalent infection of the particular place and period, it was decided:

1. That the essential constituents were the *Pneumococcus*, *Streptococcus*, and *B. influenzae*.

2. That it was of fundamental importance that the pneumococci should include Types I and II, and, in the light of the experience of Major Borel of the French army, that it would be wise to add other types not included in those worked out by the Rockefeller Institute, but isolated from our fatal cases.

3. That several virulent strains of *B. influenzae* and *Streptococcus haemolyticus* isolated from our fatal cases should be included.

4. That it should be unsensitized and unheated.

5. That primary or secondary subcultures only should be used.

The vaccine was therefore prepared accordingly.

Dosage.

Fearing to use the massive dosage of Lister in case of getting very severe reaction in a staff that could not be excused duty after inoculation, and not wishing to use what was thought to be the small dosage of the N.Z.E.F. vaccine, the following scheme of dosage was drawn up and carried out:

	Dose 1.	Dose 2.
B. influenzae (12 strains) ...	500	1,000 million
Pneumococcus (3 types) ...	250	500 "
Streptococcus haemolyticus (12 strains) ...	250	500 "

Interval seven to ten days.

The total dosage is admittedly not as high as it might have been; it would have been safer to have given a third dose, but there are limits to what can be done in the way of inoculation in a busy hospital with a hard worked staff, and one must admit that all hands were "fed up" with the innumerable injections received during the last four years.

One officer, 23 sisters, and 109 other ranks were inoculated with this vaccine. There were numerous cases of moderate local reactions and malaise, but none were sufficiently severe to cause anxiety or admission to hospital, in fact no one "reported sick."

That relic of opsonic index days, the "negative phase," appears to be rather a bogey as far as prophylactic inoculations is concerned. The experience of the last four years indicates that when disease appears shortly after prophylactic inoculation it is more probably due to inappropriate vaccine or inadequate dosage than to infection during the "negative phase."

Of the 114 cases inoculated with the "N.Z.E.F. mixed catarrhal vaccine" supplied from London there were a few admitted to hospital with "influenza" or "cold," but none were seriously ill and none developed pneumonia. Of the 133 cases inoculated with the vaccine prepared in the hospital laboratory there were no cases of either "influenza," "cold," or pneumonia. Considering that during the epidemic the hospital received hundreds of cases of "influenza" or pneumonia, it seems wonderful that the staff should have escaped. The inoculations certainly appear to have afforded protection, but the numbers are small and an important factor no doubt was the excellence of the supervision, the masking of attendants, and the high standard of sanitation and hygiene; for not only did no nurse or orderly in the pneumonia ward develop pneumonia, but in the whole of the seven months that the hospital was acting as the infectious disease hospital for the Second Army not a single attendant in the Infectious Block contracted any infectious disease.

One of the difficulties experienced in recording observations during the recent epidemic is due to the nomenclature of the condition, as the name "influenza" has so long been loosely used to describe any of the various respiratory catarrhs due to *B. influenzae*, *Pneumococcus*, *M. catarrhalis*, *B. septus*, *Streptococcus*, etc. Whatever be the initial causative organism, there is no doubt that the infection quickly becomes a mixed one and that the appearance of secondary infection is concomitant with the graver symptoms. It is to be hoped that the etiology of the condition will soon be made clear, that some specific

name may be determined upon to distinguish the disease in its uncomplicated form, and so put an end to the present confusion of identities.

I have to thank the late Colonel C. H. Begg, C.M.G., D.M.S., N.Z.E.F., and Lieut.-Colonel C. H. Newton, D.S.O., O.C. the New Zealand Stationary Hospital, for permission to publish these notes.

FEBRILE ACIDOSIS IN SCARLET FEVER IN CHILDREN.

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ACETONURIA has been found by Harris in 84.8 per cent. of cases of scarlet fever in children.¹ I have examined daily the urine of seven consecutive cases with moderate attacks, estimating the acidity, the proportion of urea and ammonia-amido nitrogen, and testing for acetone and diacetic acid, with the following results:

1. Acidosis lasting from three to twelve days, reaching its maximum on the third to fifth day of disease.
2. Acetone and diacetic acid not always, though generally, present.
3. Urine not alkaline during administration of sodium bicarbonate gr. 10 to gr. 15 every four hours.
4. One return of acetone, increase in ammonia nitrogen from 1.7 per cent. to 6.3 per cent., and rise in acidity from 2 per cent. to 68 per cent. N/10 acid, after halving the dose of soda.
5. Nephritis developed later in the two patients who showed the most severe acidosis.

Clinically none of the cases suggested diphtheria, but routine nose and throat cultures, to discover carriers, gave two positive results from the nose. I consider the acidosis in these cases was due to scarlet fever, although it has been shown to occur in diphtheria.²

Finding acidosis at the start of my examinations I at once gave sodium bicarbonate. As this did good in moderate and severe cases I have made it routine for all, with satisfactory results. I ask that it shall be given for a week to ten days to all children who have scarlet fever, the dose being regulated by the reaction of the urine. Further, I am so convinced that acidosis is present in every other acute febrile complaint of children that I plead for the giving of soda to them pending the proof of this contention.

Methods.

$\text{NH}_3 + \text{NH}_2$ nitrogen = formalin (BRITISH MEDICAL JOURNAL, March 25th, 1909).

Urea = hypobromite.

Acetone = sodii nitroprusside } Depth of colour.

Diacetic acid = ferri perchlor. }

Acidity = N/10 NaOH with phenolphthalein indicator. (Neutral potassium oxalate used if urine was high coloured.)

The two following cases had nephritis; one showed it associated with acidosis on the twelfth day, starvation doing harm; both suggest the possibility that acidosis aids in determining the complication, and that early administration of soda may reduce its incidence.

CASE I.

A boy, aged 7, was admitted on the fourth day of the disease, pale and listless; pulse 120, weak; temperature, 99.2°. His condition caused some anxiety. The culture from the throat was negative, that from the nose yielded the Hoffman bacillus.

Urine: Ammonia nitrogen rose to 13.9 per cent. on the fifth day, and fell gradually to 4 per cent. on the eleventh and twelfth days. Acetone and diacetic acid were never found. Nephritis developed on the twenty-fourth day and lasted until the thirty-fourth day. The urine on the twenty-fifth day contained a trace of albumin, and hyaline and granular casts; ammonia nitrogen 1.8 per cent.; no acetone or diacetic acid.

CASE II.

A girl, aged 6, was admitted on the tenth day of disease, peeling. Temperature 97.8°, pulse 116. She was given carbohydrate diet. On the eleventh day there was no albumin, but a trace was present on the twelfth day; the temperature was then 99°, pulse 120; she had vomited. By routine treatment she was given liquor ammonii acetatis and barley water only. On the thirteenth day the child was worse; pulse 130 to 140, irregular, weaker; she was still vomiting. The urine contained a trace of albumin, and hyaline and granular casts. Acetone and diacetic acid were present. Acidity = 100 per cent. N/10 acid; ammonia nitrogen 6 per cent.

Treatment consisted of barley water, milk 1½ pints with half an ounce of sugar, and sodium bicarbonate gr. 15 every three hours. On the fourteenth day her condition was improved. Milk 3 pints with half an ounce of sugar, and sodium bicarbonate gr. 15 every four hours. She was still better on the fifteenth day: ammonia nitrogen 4.8 per cent.; acidity = 72 per cent. N/10 acid; acetone was present. Carbohydrate diet, soda continued. On the sixteenth day there was no albumin; ammonia nitrogen 2.4 per cent.; acidity = 40 per cent. N/10 acid; there was a trace of acetone. On the seventeenth day she was much improved and was taking food well. Ammonia nitrogen 2 per cent.; acidity = 8 per cent. N/10 acid; no acetone. Soda reduced to a dose every eight hours. She made an uninterrupted recovery.

I have had only two cases in adults (males aged 17 and 23). Both had increased ammonia-amido nitrogen, the younger giving 11.3 per cent. on the fourth day of illness, with acidity = 125 per cent. N/10 acid. Neither had acetone or diacetic acid. They benefited by soda, and I consider all moderate or severe adult cases should be given it.

REFERENCES.

¹ Harris, *Lancet*, 1910, vol. i, p. 1346. ² Peters, *BRITISH MEDICAL JOURNAL*, 1918, vol. i, p. 10.

NATIONAL MEDICAL TREATMENT.

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In view of the fact that health matters, including the treatment of sick persons, occupy a prominent position in the social reforms contemplated by the new Government, it is desirable that the medical profession should either have some definite views as to what future action will prove acceptable to it, or be prepared to submit a scheme, approved by the majority, for the consideration of the general public.

The views of the profession, and those of the general public as represented by the law makers, on a subject which is peculiarly technical in character, and which is trammelled to a certain extent by tradition, are likely to be divergent, and the best opportunities for reconciliation are not afforded when a scheme, which represents in the main only the views of the latter section, has been prepared and submitted as part of a settled policy.

The subject is of so involved and intricate a character that it would be impossible for any single individual outside an interested Government department, to which all sources of information are available, to prepare a detailed scheme which would meet all difficulties, or which could be regarded as more than a basis for discussion.

Up to the present the chief efforts have been directed towards the elaboration of schemes which have advocated what is known as a whole time state medical service. To the generality of the profession such a scheme is not acceptable, but the difficulties associated with a part-time service have been such as have apparently rendered it difficult for those who favour such a service to formulate general principles which could be developed into a piece of efficient administrative machinery.

Alternatives.

If alterations or additions to the present method of state treatment—and the medical benefit under the Insurance Act may reasonably be included in such a term—are decided upon, one of three courses will probably be followed, namely: (a) Additional powers and responsibilities may be tacked on to the present panel system, or (b) a whole-time service may be created, or (c) a part-time service may be established based on experience gained in panel work.

The limitation of medical benefit to insured persons alone cannot continue. Another service has been added to the many competing classes of state treatment. The Insurance Act accepts no responsibility for the treatment of persons with physical defects at ages prior to the insurance age, but this would probably be met by inclusion of dependants. If such were included the intricate