

Thirteen instances are recorded. In these the total number of leucocytes varied between 6,000 and 11,000 per cubic millimetre, and the distribution was within normal limits.

Evidence of the Production of Antibodies to the Haemophilic Bacilli Isolated.

It is common experience that an attack of influenza leaves little or no immunity. Indeed, it is the opinion of many physicians that one attack may predispose to another. Since, however, cases recover, some useful reaction on the part of the patient's tissues obviously occurs, and the pessimistic view of predisposition to a second attack is explained to some extent by the continued presence of the bacilli in some of the crannies of the upper respiratory tract, where they lead a saprophytic existence, and are ready to reinfect should opportunity arise.

Animals injected with dead cultures of influenza bacilli do not develop antitoxic or bactericidal properties in the serum but agglutinins may be aroused to a small extent.

The serum of convalescents was examined for the presence of agglutinins in a few instances.

The serum of five patients, taken two to three weeks after the onset, failed to show a significant excess of agglutinins over and above that of normal persons (Martin).

Six other cases whose serum was examined four to ten days after the onset agglutinated a culture isolated from one of them in dilutions of 1 in 80 to 1 in 320 in different cases; whereas six normal serums failed to agglutinate the same emulsion in dilutions higher than 1 in 20 (Cruikshank). In both series of observations the macroscopic method was employed, and the tubes were kept at 50° C. for four hours.

The serums of five convalescents were examined for specific antibodies by the method of Bordet and Gengou. Indication of a certain amount of complement fixation was given by some, but not sufficiently greater than the normal serums used as controls to be regarded as significant (McGowan). Perhaps too long a time (two to three weeks) had elapsed since the onset of infection before the observations were made.

Some observations (Martin) on the phagocytic activity of the leucocytes in sputum indicate that increased phagocytosis of the haemophilic bacilli occurs as a response to infection. The sputum of three cases in an epidemic who suffered from bronchitis for some days was examined daily in an absolutely fresh condition. These particular sputa contained each day innumerable numbers of small Gram-negative haemophilic bacilli, and when stroked upon blood agar afforded nearly pure cultures. For twelve, fourteen, and seventeen days respectively from the onset of illness, although the sputum contained abundant pus cells, the bacilli were all extracellular. Then with striking suddenness the picture changed and the majority of the leucocytes contained the small bacilli often to the number of forty to fifty per cell. After the periods mentioned, active phagocytosis was observed so long as the sputum contained the bacilli. In many cells they were obviously undergoing digestion, being enclosed in minute vacuoles and having lost their power of taking up the carbol-fuchsin used to stain the specimens. In each case coincident with the observation of phagocytosis improvement occurred in the condition of the patient and the sputum became more purulent but rapidly diminished in quantity. Whether this occurrence of phagocytic activity was conditioned by the formation and outpouring of opsonins was not determined, but it appears likely that this interpretation is just.

Consideration of the Evidence Pointing to B. influenzae as the Cause of the Epidemic.

Sanction for regarding Pfeiffer's bacillus as the etiological factor in influenza rests upon:

1. The frequent discovery of this organism in the respiratory tract of persons suffering from this epidemic disease, whereas it is uncommon to find it in persons who have not recently become convalescent from influenza.
2. *B. influenzae* has been recovered from the blood of a few of the severe cases during an epidemic.
3. It commonly occurs in the lesions of those cases which succumb to complications, such as pneumonia and meningitis.

Indirect evidence from the presence of immune bodies in the serum of convalescents, such as occurs in whooping-cough, has not, we believe, been forthcoming hitherto.

The experience of the recent epidemic amongst British troops in France has been that cases in which catarrh was present and suitable material forthcoming for examination have also been associated with the presence of small haemophilic bacilli in the respiratory tract.

The frequent failure of bacteriologists to recover *B. influenzae* from cases during the first few days of their illness when uncomplicated by catarrh, and their absence from or presence in small numbers in the sputum, even when such is forthcoming at this stage, is no new experience, and has led several bacteriologists to question the essential etiological significance of this microbe and to regard its later presence in the sputum as an epiphenomenon.

The difficulty in discovering *B. influenzae* in early cases may, however, be attributed to the bacilli multiplying in the mucous membrane of the trachea and bronchi without at first producing an excess of reactive secretion.

As regards the presence of Pfeiffer's bacillus in the blood, the recent experience coincides with previous experience. It was recovered from the blood in two out of sixty-eight attempts, both in serious cases of the disease. It was found twice in the cerebro-spinal fluid of cases in which meningitis supervened, and the association with post-influenzal pneumonia was striking, it being recovered in forty out of fifty-three instances at the autopsy.

Some immunological observations made during the recent epidemic also lend support to the view that *B. influenzae* was the cause of the epidemic.

The amount of agglutination observed by Cruikshank in the serum of his cases four to ten days after the onset of the fever is certainly significant of infection by the bacilli isolated by him, and perhaps the failure of other bacteriologists to observe this may have been due to their waiting too long before undertaking the tests. Further, the sudden development of phagocytic activity by the leucocytes on or in the mucous membrane and its coincidence with improvement of the patient's condition and disappearance of catarrh is highly suggestive of a definite reaction on the part of the host to infection by these particular microbes.

"SPACING OUT" IN THE PREVENTION OF MILITARY EPIDEMICS OF CEREBRO-SPINAL FEVER.

BY

CAPTAIN J. A. GLOVER, M.D., D.P.H., R.A.M.C.

We were crowded enough to cause a pestilence among us. *Defoe.*

The main etiological factors producing military outbreaks of cerebro-spinal fever appear to be six—namely:

1. *Season*—the first quarter of the year.
2. *Severe weather* of all kinds and particularly sudden variations, east winds, and intense cold.
3. *Antecedent epidemics of influenza.*
4. *Causes temporarily lowering resistance*, such as antityphoid inoculation, fatigue, strenuous training, nostalgia, railway journeys, and the strangeness of barrack life to the new recruit.
5. *Overcrowding.*
6. *A high carrier rate* of epidemic strains of the meningococcus in the population at risk.

The first two factors are altogether beyond our control, the third and fourth are very largely so, but are susceptible of many ameliorations by forethought. The fifth and sixth factors are almost entirely in our hands, and at home at any rate, after four years of war, no plea of military necessity for overcrowding can be accepted. As the Commissioners of 1861 said, "In any case overcrowding should utterly be put an end to." These two factors are in fact indices of the efficiency of our sanitary stewardship.

Asked to define overcrowding, we may say that overcrowding is the slightest excess over the "mobilization standard." This standard is the utmost concession that can be safely made to military emergency. It gives the least possible space that will just suffice to fulfil the lowest permissible standards of the most indulgent hygiene. Anybody who doubts should smell the early morning air of a

hut in which have slept its full mobilization number of men. Energetic orderly medical officers who care to make 4 a.m. rounds of the barrack-rooms and huts of the units under their care will find the nose an excellent guide.

Mobilization standard means as a rule an increase of 50 per cent. of the number allowed by peace standard. The "peace standard" laid down by the Royal Commission of 1861 enjoins 60 sq. ft. floor space and 600 cubic ft. air space per man, and a distance of 3 ft. between beds.

As the ordinary barrack-room accommodated 24 men in peace time, mobilization standard means usually 36 men, and owing to fireplaces, cupboards, etc., with 36 men the beds are only 1 ft. 4 in. apart, instead of the 3 ft. of "peace standard." This number of men, 36, is still frequently exceeded, and I have known 48 and even 57 men sleep in barrack-rooms of 24 peace standard in most distinguished regiments.

Most of the huts erected since the war are of two main types, the first 60 ft. by 20 ft., the second 60 ft. by 15 ft. With the first type (60 ft. by 20 ft.) "mobilization" standard means thirty men, and (after allowing for the stove in winter) about 1 ft. 4 in. between beds; whereas, with the second type (60 ft. by 15 ft.), "mobilization" standard (often transgressed with this type) means twenty-two men, and at least 2 ft. 6 in. between beds.

Assuming equal supervision of ventilation and rigid adherence to mobilization standard in this respect, the smaller pattern scores heavily. But it is this fatal beauty of space between the beds that affords great temptation to hard-pressed and hygienically unprincipled authorities to put in more beds, and so to overcrowd; and the 60 ft. by 15 ft. huts are therefore more often in excess of mobilization than their larger compeers.

Overcrowding influences the incidence of cerebro-spinal fever partly by its depressing effect, partly by shortening the distance between man and man, and so facilitating the transmission of infections of the upper respiratory organs, since the virus is sprayed into the surrounding air in droplets of secretion during coughing, sneezing, and loud speaking.

Thus overcrowding favours the occurrence not only of cerebro-spinal fever but also of its forerunners, the catarrhal diseases such as influenza, which so often precedes it, and it also promotes our sixth etiological factor—a high carrier rate of epidemic strains of the meningococcus.

The Close Relation between Overcrowding and Carrier Rate.

Were it not for differences in the efficiency of ventilation and for differences due to catarrhal diseases which increase the spraying range of the individual, the relation between the space separating the beds and the carrier rate of a unit would be almost a simple inverse ratio. In the last seventeen months I have examined 12,000 non-contacts largely in connexion with the question of overcrowding, and whilst I do not propose to weary the reader with endless tables, I shall try to summarize the results in as useful a form as possible. Some of the results are shown in detail in a special report to the Medical Research Committee, March 6th, 1918. The chief thing to remember is that efficient ventilation and space between the beds are the vital points; mere floor space and mere cubic space are not at all of the same importance.

Taking barrack-rooms and huts together, it was found that strict adherence to a mobilization standard usually gave a carrier rate of just under 10 per cent.—that is, those agglutinating with one or other of the standard type serums of Gordon. Epidemic meningococci only are counted.

This (with ordinary barrack ventilation always understood) means that a distance of about 1 ft. 4 in. between beds corresponds with a carrier rate of about 10 per cent. A very slight excess above "mobilization" very rapidly sent up the carrier rate to between 10 and 20 per cent. If the beds were closer than 1 ft., 20 per cent. was almost invariably found, and if the distance were under 9 in., 28 to 30 per cent. was usual. A "peace" standard of accommodation, unless there were some gross defect of ventilation, rarely yielded a carrier rate over 5 per cent.

It was noted also that if overcrowding occurred in a unit which had not previously been overcrowded, two things happened: First, a marked rise in the carrier rate occurred, usually within a fortnight, reaching its maximum about three weeks after the overcrowding began; this is

termed the "warning rise," and when the other factors which have been enumerated were present, and the carrier rate reached 20 per cent., cases of the disease usually began to occur.

Secondly, the proportion of carriers of epidemic or agglutinable strains of the meningococcus to carriers of inagglutinable strains very markedly increased.

In every case the carrier rate of non-contacts of the same unit was approximately equal to the carrier rate of the actual contacts of the case.

Rise in Non-contact Carrier Rate a Storm Signal.

A sharp rise in the non-contact carrier rate to over 20 per cent. is as sure a storm signal of imminent trouble as it is a sign of overcrowding or dangerously deficient ventilation.

Whilst overcrowding produced a rise in the carrier rate very quickly, a return to mobilization standard was not sufficient to reduce the carrier rate markedly, but the carrier rate was reduced with remarkable success by spacing out the beds to 2½ ft. distance between each, although not at so fast a rate as overcrowding will raise it. To raise the carrier rate by overcrowding was both easier and quicker than to diminish it by spacing out.

Thus, a camp which had been purged by six months of spacing out, and which had a carrier rate for the month of March (1918) of 0.5 per cent., was severely overcrowded in April (beginning on April 20th). By May 2nd the carrier rate was over 30 per cent.

This camp forms so excellent an example of the effect of two periods of overcrowding alternated with a period of spacing out that I propose to outline its recent meningococcal history.

The sequence of events down to the end of November, 1917, has been described in a paper on the epidemic of cerebro-spinal fever of 1917 at X Dépôt,¹ but for convenience I shall briefly recapitulate the story from the beginning of the war.

The first outbreak was in January and February, 1915, and followed severe overcrowding. There were 19 cases, with 11 deaths. No information is obtainable as to carrier rates or as to the type of meningococcus infecting the patients.

The second outbreak began in February, 1916. Seven cases occurred, all due to meningococcus Type II. Only contacts were examined, but this was done on a very wide scale by Captain M. Flack, and in most cases the "contact" carrier rate was over 20 per cent. I have no information as to the overcrowding, but as the "mobilization" standard of each hut was taken as 32 instead of 30, it follows that each man had only 37.5 square feet of floor space, whilst, allowing for the stove, there would be almost exactly one foot between the beds. It is therefore certain that there was some overcrowding in 1916, though I am informed it was not nearly so severe as in the preceding or following years.

In August, 1916, Captain Flack commenced a series of observations on the carrier rate of non-contacts at the dépôt, which I have continued, so that for more than two years the carrier rate of the dépôt has been under continuous observation. Almost every week 100 men have been examined.

In August, 1916, the carrier rate was 10 per cent., that of October 6 per cent., November 4.6 per cent. Now began slight overcrowding, but not until December 1st, 1916, was the overcrowding severe. The carrier rate commenced to rise at once. On December 9th it was 17 per cent., on December 23rd 19 per cent., and on December 28th two cases of the disease occurred. At the end of January, 1917, a sharp outbreak of cases occurred. On January 27th the average carrier rate of the contacts was 60 per cent.; on February 5th both contacts and non-contacts showed carrier rates of over 70 per cent. The dépôt was now reduced to about nominal mobilization standard, but men were still thirty-two in each hut, and cases continued to occur until the end of March.

The great majority (70 per cent. at least) of both patients and carriers in 1917 were infected by meningococcus Type II. Twenty-one cases in all occurred in 1917.

Scheme of Prophylaxis.

In September, 1917, a scheme of prophylaxis was submitted to the D.D.M.S. after consultation with the commandant and the senior medical officer of the dépôt. Its

chief provision was the spacing out of all beds to 2½ ft. distance. This meant reducing the number of men in each hut from 32 to 23, thereby incidentally increasing each man's floor space from 37½ sq. ft. to 52; similarly it meant reducing the number of men in barrack-rooms from 36 to 26. This involved a reduction of 1,265 beds below the mobilization standard, the beds being returned to store. (It should be noted again that the mobilization standard had been erroneously calculated on a 32 bed per hut basis.)

The other provisions included simple devices for fixed (hopper) window ventilation, the postponement of anti-typhoid inoculation until the recruit's second month, provision of larger medical inspection premises, prevention of overcrowding in Y.M.C.A. and similar premises, and the provision of a large spray hut capable of treating two platoons simultaneously if necessary, and weekly samples of 100 men as a guide to the current carrier rate.²

I have no doubt that the spacing out was by far the most important, ventilation coming second, and probably the postponement of the inoculation (until the recruit is to some extent acclimatized) third. Spray treatment was used for entrant recruits only until May.

The scheme was to come into force if a warning rise occurred in the carrier rate, or at the beginning of the "danger period," that is, the winter months. The carrier rate, which had been low in August, 1917, showed a considerable rise in September, and on September 27th a sample of 100 trained soldiers (who are distributed two in each hut) gave a carrier rate of 17 per cent. Permission was then obtained to put the scheme into force, and "spacing out" was practically accomplished by October 4th, 1917.

The success of the scheme exceeded all expectations, the carrier rate fell steadily throughout the winter. The average for December, 1917, was 3 per cent., compared with 16 per cent. average for 1916. For January, 1918, it was 4 per cent., compared with 60 per cent. for January, 1917. For February, 1918, the average was 4 per cent., compared with the 72 maximum and 40 per cent. or over average for the February of 1916. For March, 1918, the average was 0.5 per cent., compared with 20 per cent. for March, 1917. This is only a quarter of what is usually regarded as the irreducible minimum of the civil population, 2 per cent.

For the first time in four years of war the winter months had passed not only without an outbreak, but without a single case of cerebro-spinal fever. Not only had the scheme done what was intended in the prevention of cases of cerebro-spinal fever and the elimination of carriers, but the dépôt had also been almost free from other infectious diseases, and had been extraordinarily healthy. That this was not entirely due to a favourable winter is shown not only by subsequent events, but also by the fact that another dépôt situated ten miles away, which was severely overcrowded, had a sharp outbreak of cerebro-spinal fever during January and February.

But perhaps the most striking proof of the efficacy of spacing out is furnished by the fact that when overcrowding again began, and cases and high carrier rates followed in its wake, the infection was due to a type of meningococcus other than Type II, to which had been due all the cases in 1916 as well as six-sevenths of the cases in 1917, and 70 per cent. of the carriers, as well as nearly all the cases in several subsidiary outbreaks in the reserve battalions fed by recruits from the dépôt. The house was indeed swept and garnished of its Type II infection, and when the overcrowding came again the devils, worse than the first, that entered in and abode there were Types I and III.

Recurrence of Overcrowding and of Carriers.

Spacing out came to an end on April 19th, 1918, after a reign of 193 days. Then came the great call up of previously exempted men, mostly miners. The dépôt authorities, particularly the senior medical officer, were fully alive to the dangers of overcrowding, and from the first made strenuous efforts to prevent it, but so fast did recruits pour in that extra accommodation in the shape of tents toiled painfully in the rear of the rapidly increasing strength of the garrison instead of anticipating it. Hundreds were continually arriving without notice, and had to be put in already overcrowded accommodation.

Overcrowding began on April 20th, and by April 25th it was extremely severe, worse than at any previous time, remaining very severe for three weeks. The carrier rate had been 1 per cent. on April 10th. On April 17th and 26th new arrivals only were examined, those on April 26th not having slept more than one night in the dépôt, showed 3 per cent.

A sample of 100 men on May 2nd, who had been some time in the dépôt, showed 31 per cent. carriers. The danger signal had indeed come, but the season was May, and it was hoped that this might avert an outbreak. On May 7th, however, the first case of the disease was diagnosed. One barrack-room on May 9th showed the high carrier rate of 41 per cent. On May 19th and the

three following days four cases occurred, all, like the first, due to Type I meningococcus. On and after May 20th all men (about 4,000) who had been three weeks or more in garrison received a six days' course of spray treatment with a solution of zinc sulphate 1.2 per cent. in the spray hut, each man having ten minutes' treatment each day. A large sample of 375 of these men examined immediately after the conclusion of the six days' treatment showed an average carrier rate of 16 per cent., those from barrack-rooms being still well above 20 per cent. By May 25th, however, the accommodation allowed of a

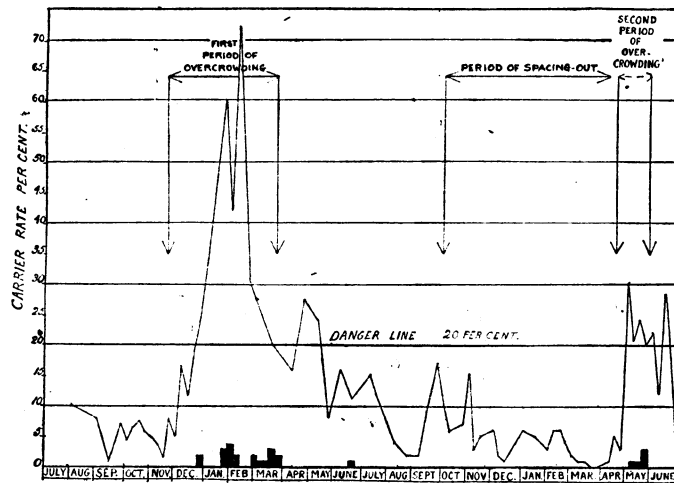


Chart showing effect of alternate overcrowding and spacing out upon case incidence and non-contact carrier rate of cerebro-spinal fever at X Dépôt. Line = weekly carrier rate. Columns = weekly incidence of cases.

"mobilization" standard, and by June 8th tentage had been obtained sufficient to allow of the following modified spacing out: 7 men to each tent, 27 to each hut, and 30 to each barrack-room.

The carrier rates in the barrack-rooms remained high for some time, the overcrowding having been worst in them, but there were no further cases until after a severe epidemic of "Spanish" influenza in July, when two more cases occurred.

The events at this dépôt may be summarized in a few words, as follows:

1. "Spacing out" almost completely purged the dépôt of the previous Type II infection. (Spacing out, that is, to 2½ ft. between beds—that is, twenty-six beds in each barrack-room, twenty-three in each hut.)
2. Subsequent severe overcrowding raised the carrier rate to 30 per cent. in a fortnight, and in about three weeks was followed by a series of cases of the disease, although the usual danger season was well past.
3. This new infection was due to Type I in all cases, and the majority of carriers carried Type I or III instead of II as in the previous outbreaks.
4. The recruits entered with a low carrier rate, which multiplied rapidly in the overcrowded state of the garrison.
5. An extremely well marked rise in the carrier rate ("the warning rise") took place before the actual cases occurred.
6. The average "contact" carrier rate was substantially the same as the average "non-contact" carrier rate of the same period for the same class of accommodation.
7. A marked rise in the proportion of carriers of epidemic strains (that is, those agglutinating with the four standard serums of the Central Cerebro-spinal Fever Laboratory) to carriers of organisms culturally resembling the meningococcus, but not agglutinating, was found in the non-contact samples after the commencement of the overcrowding.

This increased proportion of agglutinable strains, which was also found in the 1917 epidemic period, constitutes a second danger signal. (See article previously cited.)

7. Cases ceased to occur as soon as the *dépôt* was spaced out to some extent (barrack-rooms 30, huts 27, tents 7 men in each) and carrier rates declined, those of the barrack-rooms remaining high for two months.

Effects of Spacing Out in Other Units.

The results of "spacing out" beds to 2½ ft. in other units were equally remarkable. The table gives the results in four instances with men sleeping in barrack-rooms all severely overcrowded when the men were first examined.

Effects of "Spacing Out" on "Severely Overcrowded" Barrack-rooms.

Unit.	Date of First Swabbing.	Percentage Carrier Rate before Spacing Out.	Period Spaced Out Approximately.	Date of Second Swabbing.	Percentage Carrier Rate after Spacing Out.
No. 1	Sept. 29	22.0	8 weeks	Dec. 6	2.0
No. 2	Oct. 2	28.0	6 weeks	Nov. 23	7.0
One room of No. 2	Oct. 2	38.5	6 weeks	Nov. 23	4.5
No. 4	Oct. 26	28.0	5 weeks	Nov. 30	4.5

At the same time great attention was paid to the ventilation, which, particularly in the first instance, had been greatly interfered with by lighting restriction regulations. Other classes of accommodation, such as huts, Aylwin huts, and loose-boxes, yielded equally satisfactory results with spacing out, but details need not be given here.

The importance of reducing the carrier rate of a unit is not limited merely to the prevention of cerebro-spinal fever in the unit itself. A home unit with a high carrier rate involves the sending of highly infected drafts to transports and front line conditions where overcrowding is really inevitable. It also involves a certain, though small, number of cases occurring in civilians, usually the soldier's children, from infection by carriers returning on leave.

There are several practical points in the prevention of cerebro-spinal fever that I have not touched upon.

First, the well known fact that it is recruits in the first months of service who chiefly suffer from the incidence of the disease, would seem to indicate that this class of soldier should be protected by special "spacing out" (preferably to the full "peace standard") during the winter months, at any rate for his first three months of service.

Secondly, corners of rooms and huts are usually found to have carriers sleeping in them; this is no doubt due to

"dead end" ventilation. Partitions in huts (such as occur in a well known naval pattern) and barrack-rooms are therefore injurious, as they double the number of corners beside interfering with ventilation generally.

Thirdly, small subdivisions of a unit's sleeping accommodation, such as occur with tents or Aylwin huts or loose-boxes, limit infection, but at the same time focus it. A sample of 100 men in crowded Aylwin huts, for example, gave an average carrier rate of 15 per cent., whilst one hut in the sample had a 50 per cent. rate.

GENERAL CONCLUSIONS.

1. A high carrier rate usually denotes overcrowding and dangerously unhygienic conditions, even though no cases of the disease may have recently occurred.

2. Whilst sporadic cases may occur in a military as in any other community with any carrier rate, anything approaching an epidemic of cerebro-spinal fever is heralded by a warning rise of considerable height in the carrier rate.

3. Severe overcrowding will probably be accompanied by a carrier rate (serological) of at least 20 per cent. This percentage is indicated as the danger line in the War Office Memorandum on cerebro-spinal fever (March, 1917). A carrier rate of this height will usually imply that the mobilization standard of 40 sq. ft. per man has been infringed, and that beds in the unit examined are less than 1 ft. apart. It should be regarded as a signal for prompt and effective action to diminish overcrowding, and to improve ventilation.

4. The distance between beds is of paramount importance.

5. Carrier rates between 10 and 20 per cent. are unsatisfactory, and imply a certain amount of overcrowding; they must be watched with suspicion.

6. Carrier rates from 2 to 5 per cent. may be considered usual under the best conditions obtainable in barracks and hutments.

7. Under the same conditions of overcrowding ("non-contacts") carrier rates agree substantially with "contact" carrier rates.

8. Quite a moderate degree of "spacing out" of beds, combined with simple methods for improving ventilation, are highly efficient agents in reducing high carrier rates.

9. When a unit shows a high carrier rate, a distance of at least 2½ ft. between the beds should be enforced. The "peace" standard would, of course, be even more effective.

10. Recruits should be specially spaced out during their first three months of service.

REFERENCES.

- 1 R.A.M.C. Journal, January, 1918; Journal of Hygiene, July, 1918.
- 2 For details see the article previously quoted, R.A.M.C. Journal, January, 1918.

A CASE OF SUBACUTE INFECTIVE ENDOCARDITIS.

BY

BERNARD HUDSON, M.D.CANTAB., M.R.C.P.,
MAJOR R.A.M.C.(T.C.)

HAVING read with great interest the paper by Lieutenant H. J. Starling, R.A.M.C., on five cases of subacute bacterial endocarditis, reported in the issue of the BRITISH MEDICAL JOURNAL for August 17th, I am tempted to give an account of a case of endocarditis of great interest which has recently been under my observation in No. 2 Red Cross Hospital, France.

The patient, a man aged 40, died eight weeks after admission to hospital. He was sent with a diagnosis of "endocarditis." On admission he was pale, somewhat wasted, and in a typical "typhoid" condition, drowsy, and of slow mentality.

There was no history of previous rheumatic fever or any other disease. He stated that he was perfectly well till about five weeks previously, when he commenced to get severe headaches, malaise, and was very easily fatigued. There is no previous record of his temperature or cardiac condition.

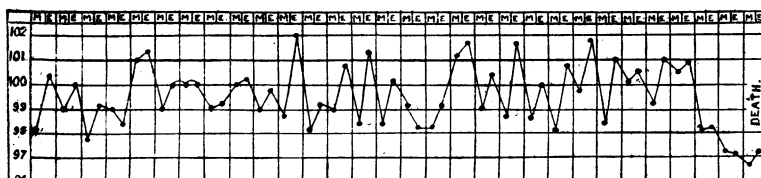
On examination the apex beat was not displaced, nor was there any obvious enlargement of the heart. On auscultation a loud diastolic murmur was heard, conducted up the sternum to the aortic valve. There was also an apical systolic murmur. The pulse was 80, and of distinct water-hammer type. There was nothing abnormal in the chest or the abdomen. The spleen could not be felt. The patient was covered with an eruption of small petechial spots, which kept coming out in crops throughout the course of the disease.

A copy of the temperature chart is attached.

The urine contained a slight cloud of albumin, but otherwise presented nothing of special importance. Cultures made from the blood on several occasions were always sterile. A blood count was done many times, but there was never any leucocytosis, the number of white cells being between 7,000 and 8,000.

For treatment, courses of anti-streptococcic serum and also vaccines were tried, but with no effect whatever.

The course of the case was extremely slow, and the patient almost imperceptibly went downhill. The cardiac murmurs kept changing in quality throughout the disease, but the heart never became enlarged, and the apex beat all through remained in its normal position; the pulse was slow and regular throughout, and preserved its aortic quality.



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