The *cacum*, *ascending*, *transverse*, and *descending colon*, and *rectum*, were also empty and collapsed.

Heart.—The pericardial sac contained about two ounces of blood-stained fluid. The heart showed no abnormality.

The *lungs* were soft and congested. The condition was most marked at the bases.

The *brain* showed patchy subdural haemorrhages, the largest of which was in extent about the size of a two-shilling piece. They were mainly on the superior surface, and in the region of the frontal lobes. There was an extensive haemorrhage into both lateral ventricles and into the fourth ventricle. On section, three distinct areas of haemorrhage could be seen in the substance of the medulla oblongata.

It will be seen from the above report that the woman was beyond cure, for death was obviously due to paralysis of the respiratory centre in the brain as the result of haemorrhage, and this accounted for the failure which attended our efforts at artificial respiration.

The case provides an example of the necessity for training women to seek ante-natal care; had this been obtained here, a fatal result would have been unlikely. With ante-natal care there should be no deaths from eclampsia.

LOBAR PNEUMONIA AS AN INFECTIOUS DISEASE.*

BY

C. H. WHITTLE, M.A., M.D.CAMB., M.R.C.P.LOND.,

CLINICAL PATHOLOGIST, ADDENBROOKE'S HOSPITAL, CAMBRIDGE.

(Ernest Hart Scholar, British Medical Association.)

SOME eighty strains of pneumococci have now been collected, and I have published three papers giving in detail the results of the work up to March, 1928.^{1 2 3}

The conclusions arrived at last year⁴ have been amplified and confirmed. Lobar pneumonia, broncho-pneumonia, and empyema occurring in previously healthy persons are invariably caused by pneumococci of high virulence, measured by the effect on mice; whereas such conditions as terminal pneumonia and post-operative pneumonia, arising in subjects whose health is already impaired, are commonly caused either by pneumococci of feeble virulence, or by organisms such as *Strep. salivarius*, *M. catarrhalis*, Friedländer's bacillus, etc. The pneumococci of low virulence resemble these catarrhal organisms in other respects, for like them they are frequently the cause of chronic bronchitis, conjunctivitis, nasal catarrh, and other comparatively minor infections of the respiratory tract and of the membranes and sinuses adjoining it. A large proportion of the pneumococcal strains recovered from such conditions set up a chronic, low-grade type of infection in the mouse which may last as long as three weeks and ends in septicaemia. This response is unexpected and differs so completely from the typical septicaemia, which is fatal within forty-eight hours, that it calls for further detailed investigation. A number of mice affected in this way have been collected and are being examined, by serial sections of viscera, etc., in order to discover the nature and site of the lesion.

The pneumococci causing lobar pneumonia or broncho-pneumonia in man have repeatedly been found to produce a parallel lobar pneumonia or broncho-pneumonia in the rabbit when introduced by the trachea. The symptoms, course of the disease, morbid anatomy, and histology in the two species are strikingly similar. In addition, strains of feeble virulence, from cases of terminal pneumonia, bronchitis, etc., have so far failed to produce any sign of pneumonia in the rabbit. Over twenty experiments on rabbits have been performed, but to complete the series a few more strains from lobar pneumonia are required. I am working out the results in detail, in co-operation with Dr. J. F. Gaskell.

There is now evidence, collected from several cases,⁵ that the virulence of pneumococci remains unchanged during the period when they can be recovered from human lesions. At the end of three or four weeks no change was noted in the virulence of the strains recovered. Needless to say, the "type" also remained unchanged. Similar stability has also been noted in a strain recovered from a patient

on three occasions during an attack of bronchitis. Though the intervals between the attacks were as great as eighteen months, the organism isolated in the second and third instance exhibited the same cultural and immunological reactions and possessed the same virulence as the one first isolated. Moreover, on each occasion it was obtained in pure culture. It appears, therefore, that a single strain of pneumococcus can produce recurrent attacks of bronchitis in a suitable subject. Such a subject may be considered peculiarly susceptible to such a strain. Whether each attack is the result of fresh infection, or whether it represents a flaring up of a process which is always smouldering but gives no symptoms, is a question to which no immediate answer can be given.

The important question as to whether the feebly virulent pneumococci are capable of becoming sufficiently virulent to set up pneumonia in a healthy person has also been investigated. Attempts have been made to raise the virulence of some of them by various passage experiments on mice. Though in one case passage inoculations have been continued for over a year, with thirty passages, there was no appreciable increase in the virulence. These results are in marked contrast to the rapid increase in virulence following passage of strains which were originally of high virulence, but which had been allowed to deteriorate; compare Griffith's results.⁶ The pneumococci of feeble virulence, like those of high virulence, therefore present a striking constancy and stability in their virulence.

The serological "type" of the pneumococcus affords little evidence of its power to produce pneumonia save in so far as Type I organisms have all been highly pathogenic, and therefore potentially pneumonic, and Group IV organisms mostly the reverse. The dearth of Type II strains still persists (compare Griffith's statistics for the same period, 1924-27⁷).

CONCLUSIONS.

1. Lobar pneumonia and broncho-pneumonia arising in previously healthy subjects are caused by pneumococci whose virulence is invariably high.

2. Such minor infections as nasal catarrh, chronic bronchitis, conjunctivitis, etc., may be produced by a pneumococcus, but its virulence is of an altogether different and lower order. Pneumococci of this class are nevertheless able to set up pneumonia in a debilitated subject, though they share this power with a number of other organisms commonly found in the respiratory tract, such as *Strep. salivarius*, *M. catarrhalis*, and Friedländer's bacillus.

3. The first class of pneumococci possess virulence which is stable over considerable periods of time (at least four weeks) *in vivo*, and which is specific to the type of lesion they produce. This class may be regarded as the pneumonia-producing, or pneumonic, type of pneumococcus.

4. The second, or catarrhal, type also possess a stable order of virulence, and their conversion into the pneumonic type has so far proved impossible by the usual methods of passage.

5. All the experimental evidence shows that the pneumonic highly virulent type of pneumococcus is the one responsible for the epidemiological spread of pneumonia; the less virulent catarrhal type is negligible in this respect. The mode of spread is by contact, evidence of which is given in a paper I expect to publish shortly in conjunction with Dr. R. Ellis. The strains of epidemiological importance can be recognized by their high titre of virulence for mice (vide Gaskell, Bradshaw Lecture, 1927). The isolation of persons harbouring in their throats pneumococci of this type is therefore a measure worthy of consideration in attempting to prevent the spread of lobar pneumonia.

I wish to thank Dr. J. F. Gaskell for suggesting the lines of research and for his unfailing help and criticism; and Professor W. E. Dixon for the hospitality of his laboratory and for his help in drawing up this report. I should like, too, to take the opportunity of expressing my gratitude to the British Medical Association for its generous support.

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* Summary of an investigation: report to the Science Committee of the British Medical Association, 1928.