

lymphatics of the upper portion of the nasal septum and the sub-arachnoid space; (2) that a blood-infection precedes the meningitis.

The cases which this report covers are probably not numerous enough to establish the matter, but I am strongly of opinion that the second of these two theories is the more likely to be true. The fact that in 5 cases the meningococcus was found in the blood while it was absent from or not found in the C.S. fluid strongly supports this view. In one of these the cultures were sent to Dr. Pearson, of Christchurch, and he was able to absolutely confirm the identity of the organism. Case 26, previously mentioned, is also a very suggestive one, for there was a very intense blood-infection, as shown by the culture after only twenty hours' incubation, literally swarming with organisms. At that time there was no headache, no vomiting, no rigidity of neck, no Kernig's sign, or any other of the usual symptoms of meningitis: these developed three days later, and the C.S. fluid was found to be infected.

The meningococcus is very frequently present in the upper part of the naso-pharynx and nasal cavities, and there has been shown to be a definite communication along the olfactory nerves between the sub-arachnoid space and the lymphatics of the upper part of the nasal septum. It would thus appear that a large number of ready-made channels for infection of the meninges are present. It is, however, important to consider the direction of the flow of fluid through these communications. The lymphatics of the upper part of the septum have been injected in the dog by coloured fluids forced into the sub-arachnoid space under pressure. This appears to me to be the direction of the flow, and in all probability the C.S. fluid normally escapes by this route and enters the lymph-stream. If the direction of flow were the reverse operations on the nasal cavities would be more frequently followed by septic infection of the meninges than is the case, for organisms usually travel with the lymph stream and not against it, as is seen every day in lymphangitis in the limbs. It may be pointed out also that there are no lymphatic glands intervening between the nasal lymphatics and the sub-arachnoid space, and thus no filtration action such as takes place in the groin or axilla is possible.

It is usually dangerous to argue by analogy, but the following points are suggestive. The closely allied diplococcus, the gonococcus, occasionally produced arthritis, and the organism has been recovered from the synovial membrane of the affected joint. In these cases no other routes than the blood-stream is open to it to reach the joint. It apparently has an affinity for the synovial membranes. The pneumococcus, like the meningococcus, may be present in an apparently healthy throat. The occurrence of pneumonia is not necessarily due to its direct passage down the trachea, which is against the stream produced by the action of the cilia on the epithelial surfaces. It is probable that the blood-stream is first invaded, and the pneumococcus, having a peculiar affinity for lung-tissue, settles there. In a similar manner the meningococcus has a special affinity for the meninges. That it does not always attack the meninges is, however, shown by the 5 cases in which the C.S. fluid was sterile while the blood was infected.

#### COMPLICATIONS.

These were remarkably few. Two cases had double vision and slight facial paresis. Four cases of epididymitis occurred, and in none of them was there a history of gonorrhœa or any evidence of urethritis: 3 had synovitis, 1 knee-joint, 1 both knee-joints, 1 elbow. All the cases recovered. No mental defects were apparent in any of the men after recovery from the disease.

#### TREATMENT.

With the exception of 2 cases, who were regarded as cases of mild blood-infection, L.P. was done in all the cases as soon after admission to the ward as possible. Anti-meningitic serum was injected intrathecally after the withdrawal of the C.S. fluid. This procedure was repeated every twenty-four hours for from three to seven days according to the severity of the symptoms and the effect of treatment upon them. The first case which occurred was extremely acute, with high fever and a profuse, rapidly spreading hæmorrhagic rash. He died about eighteen hours after the onset of his illness and presented no definite meningeal symptoms, and was conscious till shortly before his death. The second case recovered after five L.P. and intrathecally injections of serum. The third case was treated in a similar way, but, although he improved at first, his progress did not continue satisfactorily, and it was decided to administer intravenous injections of serum. At first it appeared to be beneficial, and it was continued until a serum rash developed. His temperature became very irregular, and his general condition did not improve. It was decided to administer a further injection of serum, and this was followed by symptoms of anaphylactic shock—extreme flushing of the skin and sweating, rapid failure of respiration, with cyanosis and later cardiac failure. Although this case terminated so disastrously it was decided to continue treatment by this method, but to commence the injections as soon as the case was admitted to the ward. In the great majority of subsequent cases this was done. The tenth case was the first in which the blood was subjected to bacteriological examination, with the result that the meningococcus was found in it, the identity of the organism being confirmed by Dr. Pearson. This was a mild septicæmic case, and he recovered after a subcutaneous injection of 35 c.c. of serum. The C.S. fluid was quite clear, did not contain pus or organisms, and was sterile on culture. This case clearly established the possibility of blood-infection with the meningococcus, and strongly supported the view that the infection of the blood is primary and the infection of the meninges is secondary. The treatment of intravenous injections of serum in the early stage of the disease was placed by this observation on a rational basis.