such as Pfeiffer's bacillus. The strains we isolated from the urine grew readily in broth without the addition of serum or blood, and did not give coliform reactions.

In several of the urines, both in fresh catheter specimens and in incubated samples, considerable numbers of Gram-negative diplococci were seen, often in clumps. They also occurred free in pairs and in tetrads. They mostly had flattened opposing surfaces, and were morphologically indistinguishable from meningococci or gonococci. In some of the films they varied from 0.1 to 0.4 μ in their greatest diameter. They were sometimes to be found in epithelial cells from the bladder, and sometimes in clusters. In no case were any considerable number of pus cells seen. The diplococci could not be cultivated as persistent Gram-negative organisms, but appeared to merge into Jaeger's organism, colonies of Gram-positive and Gram-negative rounded individuals alone surviving.

In all the specimens of urine examined in the fresh state, turbidity of varying degree was present. This turbidity was in no case due to pus cells, to blood, or to crystalline phosphates, as gauged by microscopical examination of centrifuged deposits. It was determined, therefore, to filter a specimen of fresh turbid urine from an undoubted case with meningeal symptoms through a tested Berkefeld filter. Filtration was completed in five minutes, and a few loopfuls of the filtrate were spread over the surface of a nasagar plate, proved to be sterile by previous incubation. Examined after four days the plate showed a minute growth. A single colony under a low power lens was grey, punctate, and showed a broken outline. Films were made from this single colony and showed:

- (a) Large numbers of Gram-negative diplococci, morphologically indistinguishable from the meningococcus, also a few Gram-positive forms, the former staining feebly with methylene blue.
- (b) Small Gram-negative bacilli.
- (c) Gram-positive and Gram-negative organisms morphologically similar to Jaeger's meningococcus.
- (d) Gram-negative rod-shaped organisms, with two to six Gram-negative "granules" in its long axis at regular intervals, occasional Gram-positive "granules" being sometimes seen. Each granule was composed of a diplococcus, with flattened opposed surfaces. In some the terminal diplococcus was detached, and was indistinguishable from the meningococcus of Weichselbaum.
- (e) Gram-positive diplo-bacilli, which were sometimes unequal in size.

From the unused portion of the single colony an emulsion was made *in situ* (that is, on the original plate) with a loopful of broth, and fresh plates of nasagar were inoculated in series. These were examined after forty-eight hours, and extremely minute colonies were found in clusters. These under the low power lens were again seen to be grey, punctate, and to have irregular outlines. Films made from these colonies, which were too small to be picked off individually for smears, again showed the films (a) (b) (c) (d) (e) as in the first single colony, with the exception that Jaeger's rounded meningococcus appeared to predominate, Gram-positive organisms being numerous. These small colonies were again subcultured on to fresh nasagar plates, and the growth examined in twelve hours. The colonies now present were, many of them, extremely small, but were all similar in appearance to each other under a low power as regards colour, outline, and punctuation. They were also transparent to the naked eye, and film preparations from isolated colonies, slightly larger than those on the first subculture plate, showed (c) (d) and (e) only, the diplococcal flattened organisms resembling the meningococcus of Weichselbaum being no longer found. Gram-positive organisms, both bacilli and rounded diplococcal forms similar to Jaeger's organism, predominated. The biochemical and serological reactions of this strain of this apparently pleomorphic organism are now being studied, and fresh filtrates of new specimens of urine shown.

It is, of course, obvious that in single colonies showing organisms of diverse morphology and staining reaction pleomorphism is easier to suggest than to prove. In all such cases mixtures of different organisms may be present

which are not derived from a common ancestor, and severe tests of pleomorphism must be established. So far the organisms referred to have successfully passed these tests, though much further work is required before any definite statement can be made as to this or as to the relationship of the various organisms here noted to the meningococcus of Weichselbaum. Enough, however, has been said to justify a plea for extensive bacteriological examination of the urine, side by side with that of the blood, cerebro-spinal fluid, and naso-pharynx, in the present declining epidemic of cerebro-spinal fever.

Disinfection of the Urine.

Owing to the fact that a highly pleomorphic organism appears to be present, bacteriological study of the urine in this disease is one of great complexity and difficulty; but it is, perhaps, not unreasonable to suggest that the meningococcus is only a phase in the life-history of the true infective agent in cerebro-spinal fever is one that is worth full investigation. And in the meanwhile it would appear to be wise to disinfect the urine of all known cases, and of all known carriers of Weichselbaum's meningococcus.

It will, of course, be understood that the presence in the urine of the meningococcus, or of organisms related to it, in no way removes the necessity for examination of the throats of contacts and of secondary carriers as at present carried out, since whatever the true cause of the disease, the meningococcus is certainly associated with it. And even if the meningococcus be eventually shown to be a harmless phase in the life-history of the true infective agent discharged into the urine, it will still be wise to disinfect the latter, as advised by other workers who consider the case for the meningococcus to have been fully proved.

CEREBRO-SPINAL FEVER: DIAGNOSIS AND TREATMENT.

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IN connexion with Colonel Hobhouse's valuable contribution¹ regarding the diagnosis of cerebro-spinal fever, I wish to contribute a few notes on the disease from our experience at the 1st Eastern General Hospital at Cambridge.

In my own open-air ward I have had 19 cases, and have seen two cases at another centre in the command and four other cases at the Eastern General Hospital under Major Wright, which I have included in this paper. This gives a total of 25 cases, which have been drawn from a very wide area, comprising places in Cambridgeshire, Huntingdonshire, Norfolk, Essex, Bedfordshire, Hertfordshire, Buckinghamshire, and Northamptonshire. Three stations supplied ten cases between them. In fourteen instances the patients appear to afford solitary examples of the occurrence of the disease in the locality. Of these 25 cases, 5 have died—a mortality of 20 per cent.—and 2 have been already discharged cured. In 19 the meningococcus was recovered from the cerebro-spinal fluid. In the other 6 the diagnosis was indisputable from the history and clinical symptoms.

In this connexion I should like to refer to certain difficulties in the bacteriological diagnosis which Captain Gaskell has kindly pointed out to me. In several of the cases the cerebro-spinal fluid has proved sterile at the first puncture, but the organism has been grown at a subsequent one. The organism—a Gram-negative diplococcus growing within the cells—is rarely found in smears taken direct from the cerebro-spinal fluid, but has to be cultivated. When, however, the organism with its characteristic intracellular growth is easily found in smears in the cerebro-spinal fluid, either in the first instance or at the second or third attempt, its presence is of grave prognostic import. A further point is the presence or absence of sugar in the cerebro-spinal fluid; this, which is generally absent in the first instance, may reappear as the case improves, and again disappear in a relapse.

Symptoms.

1. Retraction of the head has been present in every case save one—that of a man found unconscious in bed. He died at the end of twenty-four hours with no other symptoms than delirium and air hunger; large diffused purpuric spots were present all over the body. The organism was recovered from the cerebro-spinal fluid, and purulent meningitis was found after death. In this case no rigidity was observable at any time. In all the other cases retraction was present at one time or another, often to an extreme degree, or there was a clear and definite history of its presence.

2. In four of the cases a definite rash appeared. It consisted of discrete papules about the size of No. 1 shot, which did not disappear on pressure, and varied in colour from scarlet to mulberry. The rash was uniform in distribution, affecting the abdomen, the extensor surface of the arms, the backs of the hands, the extensor surface of the thighs and legs, and the dorsal aspect of the feet. In none of these cases had any serum been given. Another type of rash consisted of the large purpuric spots already mentioned. In another fatal case a petechial rash was present on the legs; while in yet another, which is recovering, a purpuric rash was present on the elbows and knees. In two other cases, which were admitted after some weeks of illness, there was a history of a previous rash. From the above account it will be seen that although a rash of such uniformity in aspect and distribution as to warrant the term "specific" occasionally appears, in this series of cases the majority presented no such symptom. As a diagnostic criterion it would appear that the absence of a rash is of slight value. In this connexion it may be mentioned that herpes occurred in eight cases only; in one case it involved the whole labial circle, spreading on to the mucous membrane of the lips; in another both labial and facial herpes appeared on the same side of the face. Herpes would seem to be of sufficiently frequent occurrence to merit its presence being taken into account in arriving at a diagnosis.

3. My observations entirely coincide with those of Colonel Hobhouse as to the slight incidence of any affection of the cranial nerves. Strabismus in one case, diplopia in another, slight nystagmoid movements in a third, and slight ptosis in a fourth, are the only instances met with. The comparative rarity of such symptoms presents a striking contrast to their frequency in tuberculous meningitis, and should prove of value in diagnosis. Excluding fatal cases which have never recovered consciousness, deafness has only occurred twice.

4. The mental condition has presented every gradation from profound coma with inability to swallow, through violent noisy delirium, to a mere condition of mental hebetude. Some patients seem to fall suddenly into a state of coma; two have been found unconscious in the morning after having been in their ordinary health the night before; others, again, after two or three days of headache and vomiting, pass through a period of drowsiness and incoherence into a condition of profound coma.

5. The aspect of the patient presents many phases. In the earlier stages or milder cases there is the suffering look of severe headache; in the more severe cases, a dull appearance suggestive of typhus.

6. Vomiting has always been present except in fulminating cases; the urgency of this symptom has varied from one or two attacks, to a persistence for two or three days.

7. Rigidity of the muscles of the limbs has not been a marked feature. The knee-jerk has, except in one or two instances, been present, it has never been exaggerated; the plantar reflex has always been flexor. Kernig's sign has always been present. In this connexion it may be noted that this sign was absent in several suspicious cases sent in for observation, but which proved not to be cerebro-spinal meningitis. The *tache cérébrale* was invariably present.

8. I wish to draw particular attention to the condition of the sphincters. They have been affected in a considerable proportion of cases. In five of the more severe there has been a period of incontinence both of urine and faeces; while in six other severe cases there has been retention of urine. The striking point is that in five cases in which the cerebral symptoms have been comparatively slight, and where there has certainly been no mental dullness, reten-

tion of urine for two or three days has occurred. This symptom coupled even with mild cerebral symptoms may reasonably give rise to a distinct suspicion of cerebro-spinal meningitis.

9. Finally, as regards the character of the fever, in fourteen cases there was a distinct history of an initial rigor. The subsequent course of the pyrexia varied in a most striking manner. Several of the more severe showed only a small range of temperature. On the other hand, in four confirmed cases in which the cerebral symptoms were slight the pyrexia continued from two to three weeks, and in two instances assumed a curious resemblance to that of a tertian fever.

In conclusion I would submit that the occurrence of headache and vomiting, coupled with retraction of the head and retention of urine, comprise a group of symptoms which should indicate the probable nature of the disease. Kernig's sign is of value in mild suspected cases.

The presence of a rash may be confirmatory, but in forming a diagnosis no weight should be attached to its absence.

As regards treatment I should like to point out the excellent results which, even in severe cases, have followed repeated lumbar puncture with the removal of from half an ounce to an ounce of cerebro-spinal fluid.

Antimeningococcic serum has been injected into the theca, but, in so far as a conclusion is warranted from so small a number of cases, this method does not give better results than lumbar puncture alone.

REFERENCE.

¹ BRITISH MEDICAL JOURNAL, March 6th, p. 419.

LOCAL ANAESTHESIA IN SKIN-GRAFTING BY THIERSCH'S METHOD.

BY

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No doubt the possibility of using injections of local anaesthetics for cutting skin grafts is well known, but having seen its use at the Royal Naval Hospital, Haslar, during the last seven months, we are tempted to publish a brief account of our experience. Since the war provides such an enormous number of granulating wounds where healing can be accelerated by successful skin-grafting, simplifications of this trifling surgical procedure will be specially appreciated at the present time.

The cases we have treated have been granulating wounds caused in a variety of ways—by burns, shell wounds, accidents such as lacerating wounds accompanied by fractures or dislocations, etc.—and the area of wounds grafted at one sitting has varied from one square inch to eight or ten.

The anaesthetic is introduced in two ways according to the size of the graft required.

1. If this be small, up to two or three square inches, after the shaving and cleansing of the site selected the anaesthetic is injected intradermically with an ordinary hypodermic syringe, or better, a larger syringe carrying a hypodermic needle, until the necessary area is infiltrated. The injection should be at such a depth that the skin is blanched and swollen, with a *peau d'orange* appearance. From this immediately a graft can be painlessly cut; in fact, owing to the distension of the layers of the skin itself, the cutting of a satisfactorily thin Thiersch graft is considerably facilitated. The graft so cut is then transferred direct, or after a short rinse in warm saline, to the surface of the wound.

2. If the grafts required are more extensive the infiltration of the whole area is tedious and unnecessary. The quicker and equally satisfactory plan is to block the sensation by an injection at a slightly deeper plane, that is immediately beneath the skin, of a strip above and on each side of the skin area, that is by the ordinary regional method.

The anaesthetics that we have used have been novocain in 1 per cent. solution, urea and quinine hydrochloride