CEREBRO-SPINAL MENINGITIS: DIAGNOSIS AND PROPHYLAXIS.

BY
A. LUNDIE, M.B., CH.B. EDIN.,

BACTERIOLOGIST, ALDERSHOT COMMAND;

D. J. THOMAS, M.R.C.S., L.R.C.P., D.P.H. OXON.,
SPECIALIST SANITARY OFFICER, ALDERSHOT COMMAND;

AND

S. FLEMING, M.B., CH.M. EDIN., D.P.H. CANTAB.,
SPECIALIST SANITARY OFFICER, ALDERSHOT COMMAND,

LIEUTENANTS, R.A.M.C.

We have already been asked what directions we can give to the general practitioner to enable him to make a speedy diagnosis of this disease. Our best answer would be simply to state what we do to help regimental medical officers in the present circumstances, and what we think might further be done to help them.

There are many men of great experience and sound judgement in the command to which we are attached who in civil life are acknowledged to be men of more than average ability, and we know they come across many cases of obscure fevers which they really cannot diagnose to their own satisfaction. We feel that as soon as they have read our preliminary article they will recognize that they have been dealing with mild cases of the disease.

"Experience is fallacious and judgement difficult," and we ourselves would not attempt a final diagnosis without bacteriological confirmation. The practitioner and the regimental medical officer both wish to know what constitutes a case that ought to be referred to the laboratory. Any case that is hard to diagnose within two or three days is a case for the bacteriologist, as are, of course, those cases whose gravity, as shown by their symptoms, requires immediate diagnosis.

In military service and in Government colonial practice the matter is extremely easy, for there is free and liberal intercourse between the different special branches of the service, and when anyone who has not the facilities for making his own diagnosis bacteriologically or by any other special method finds himself at a loss to elucidate the cause of an obscure disease, he frankly calls in the specialist who is most likely to enlighten him upon it, and frequently several specialists are consulted before it is considered that justice has been done to the case. It is different in civil life, where each specialist costs a heavy, often prohibitive, fee—a fact that we must take into account in our recommendations.

Cerebro-spinal fever is a disease as protean in its manifestations as malaria, but that may be relatively a meaningless statement to home practitioners who have not had experience of that disease. Malaria simulates so many different diseases that a far-seeing Government has made it absolutely compulsory that all its medical officers who go abroad on military or colonial appointments should have sound training in tropical medicine and hygiene. It costs much money, but it saves vastly more in the end. The result of this highly specialized training is that in tropical countries not even a black man is satisfied that the best has been done for him if his blood has not been examined microscopically. It may seem a startling statement, but it is absolutely true that a larger percentage of black men, even savages, who come to hospital as patients know what a microscope is than of hospital patients in our own country.

But even in this country the commanding officer of a military hospital will not accept a diagnosis of such a disease as typhoid fever, or sometimes even tuberculosis, without a pathological finding to support it. It is quite right that it should be so, and the more experienced the officer is, the better is he acquainted with the numerous pitfalls of diagnosis that can be clearly exposed by scientific methods.

What happens in practice at the present time may well be illustrated by a consideration of the diagnosis of the disease at each of the separate stages in which it occurs.

STAGE I.—Catarrhal.

Stage I is usually detected almost by accident. The accident of a severe case happening in a regiment causes

an examination of all the men who slept in the same room as the patient for several nights before he took ill. Having heard of a case anywhere, we proceed there at once, having made the following arrangements: We pack up a number of West's swabs in a case. These swabs are bent wires, thinned at the distal end and slightly-roughened to to make them hold the wool firmly. They are enclosed in bent glass tubes, and look like Bellocq's sound in glass instead of metal. In the same bag we also carry a number of plates of "nasgar" medium, or a modification of it made at Millbank. We inoculate these plates at once and return them to the bag. We put in along with them a hot-water bottle at a temperature of 98° C., and renew it as frequently as necessary if our journeys are at all prolonged. These are the methods of the Local Government Board, and we are highly satisfied with them. It is certainly the most likely way to get a successful culture of the meningococcus, to inoculate the swab bearing it at once on the plate and then bring it home. We find in practice that the West's swab obviates the necessity of using a tongue depressor, and it serves that function itself, if it is simply introduced sideways till it reaches the uvula, when it is suddenly slipped behind the palate by a deft movement, and the swab is extruded against the posterior wall of the pharynx. The tube is then turned sideways and withdrawn, and the next man called forward before the first has had time to recover from his astonishment. The directions given to the patient are to look the operator straight in the eye. The operator fixes the eye of the patient for an instant (and it has a wonderful psychological effect), and tells him to open his mouth as widely as possible, and then goes through the manœuvre very quickly. In doing a large number tact and gentleness are of the utmost value.

The rest of the proceeding is done at the laboratory. The plates are incubated for twelve to twenty-four hours, and the likely colonies are subcultivated on plates and incubated at 37° and 23° C. Colonies growing at 37° and not at 23° and having the requisite appearances, are taken as meningococcus, and the person from whom they are obtained is declared a carrier.

We find in practice that all our carriers have catarrh. On one occasion we experienced an eerie or, to use an expressive Scottish phrase, an uncanny, feeling when the roll of contacts was called and the two men who fell out were seen to be suffering from catarrh of a severe degree. On another occasion one carrier was distinctly in the second stage of the disease. He recovered, however, in three days after simple spraying with 1 in 1,000 potassium permanganate.

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STAGE II.—Septicæmic.

Stage II is that febrile condition which is undiagnosable, unless it passes on to Stage III, which is sometimes as hard to diagnose. Occurring in an epidemic, it ought to give rise to the profoundest misgivings. The palate is often still red and spotted. There may be minute vesicles on it. The pharynx is more or less inflamed. The voice is often husky, and there may be a little dry, harsh cough. There may also be nasal catarrh and profuse discharge. Herpes labialis is common.

Swab designed by Mr. West, Aural Surgeon, St. Bartholomew's Hospital; about one-third natural size. I. Wire about the thickness of an ordinary knitting needle, beaten flat at the curve. II. Wire and swab in sterilized glass tube. III. Swab extruded in use.

There is often more or less elevation of temperature; but this is not of much diagnostic value. The face is very often flushed, and there may be some conjunctival injection. There may also be a greater or less degree of mental confusion just as this stage begins to merge into the third.

The reflexes, if examined at this stage, are often amazingly exaggerated. The condition might be mistaken for the supreme effort of a malingering expert, who has frequently been the subject of medical clinics, but for the facial expression which is somewhat characteristic. There is an expression seen often in the beginning of the sleeping stage of trypanosomiasis, and it may be helpful to those who have witnessed this disease to recollect this in examining a case.

This is the septicæmic stage, and no doubt diplococci are already in the blood stream, and are being excreted by the urine. We have already found them in the urine, in great abundance, but pure cultures are not so easy to obtain as would be imagined, and this point is being at present elucidated at the Lister Institute by Dr. Hort, to whom we are indebted for the original idea of urine examination. Meantime we are trying a method of our own, as the urine promises to be a good material on which to make a diagnosis. At this stage it is often possible to find a few meningococci in the cerebro-spinal fluid, but they usually seem to be dead, and do not give cultures on the usual media. There may be, however, a good deal of albumin present in the fluid.

STAGE III.—Meningeal.

The third stage comes on at varying intervals. Sometimes the whole syndrome is run through in a few hours, leaving the patient dead, with the practitioner wondering what killed him. It may set in after mysterious attacks of vomiting, lasting three days, and there being no other symptoms may cause the gravest suspicions of criminal administration of poison, and much valuable time may be lost on a wholly erroneous search for the poison. No doubt part of the nucleus of the vagus is profoundly affected at this time by toxins. Almost any error of diagnosis might be committed, owing to the protean aspect of the clinical picture. Kernig's sign is very valuable in diagnosis, but it is a late sign. Head retraction is more useful, and pain on attempting to move the neck. The meningeal cry is seldom heard. Some cases go on to death without any pain. At other times the headache is appalling. Rash and spots are not very common, and it would be a pity to wait for them. They are probably due to a mixed infection. The *tache cérébrale* ought not to be confused with the wheal caused by scratching the skin, seen in toxic stages of early tuberculosis. The *tache* is a redness without any wheal; it is evanescent. The other is more lasting, and often quite palpable. Macewan's sign is stated to be of value in the examination of children. We have found it in both children and adults. It is, of course, a late sign. A tympanic note is obtained on percussion of the lateral ventricles. It is quite easy to verify it by using a sound head as a control. One's scepticism is at once disarmed by testing a typical case.

It seems a pity to dwell on this stage; our object is to anticipate it. We realize that the disease is far advanced when it can justify its evil appellation, "meningitis."

In mild cases, such as occur at the onset of an epidemic, there may be pus cells enough to give a distinct turbidity to the cerebro spinal fluid, but apparently no organisms. Even ten or more minutes may be insufficient to find a single one, so we early learnt a method of enrichment that seldom failed. The fluid was promptly citrated to prevent coagulation, and then 3 per cent. glucose was added to it. The mixture was then incubated for twelve to twenty-four hours, and at the end of that time examined. Abundant growth is common, even inside the leucocytes. The same method is excellent for urine examination.

Cultures of the meningococcus are easily got on our Cambridge Hospital (Aldershot) medium, which consists of egg, yolk and white, 66 per cent.; distilled water, 33 per cent.; and to every 100 c.cm. of the mixture, glucose 3 per cent. is added, and the whole is inspissated at 70° C. for two hours or more, according to the freshness or otherwise of the egg. This medium was made first in the Cambridge Hospital to supply a deficiency in the supply of Loeffler's medium for the diphtheria bacillus.

On this medium we find the meningococcus has great tenacity of life, and can, without subculture, survive five days at least in the outside pocket of a service great-coat, carried about in all weather conditions including snow, during long motor-car journeys in the country in the pursuit of our investigations.

Conclusion.

We hope these notes will convince the profession that the disease is more widespread than is usually recognized. It probably gives fair warning of its onset by catarrhal symptoms, and often goes no further. In its second stage it may run a long non-malignant course, giving plenty of time to arouse suspicion, and, if correctly diagnosed, would probably be cured by suitable treatment. During an epidemic, routine examination of all sore throats would probably be of more value in stopping the disease than the examination of a vast number of alleged contacts, most of whom are perfectly healthy, and the examination of cases in the second stage could be made a matter of consultation. The health officer on his visits gives much help to his colleagues in the regiments, and the same ought to be possible in civil life, but this is a matter for the civil administration.

As regards the treatment of the catarrhal stage, we have expressed some doubt as to the efficacy of spraying. Sometimes a carrier may give a positive, a negative, and then a positive result in succession, and it might be urged that the swabbing was inefficient, or that the condition had recurred, or that the spraying had no effect. All these are possibilities, and information on the subject is wanted, but it will eventually be supplied by statistics and more careful work.

We would advocate as an adjuvant to these measures the use of an autogenous vaccine, as it is certainly a valuable help in such throat conditions. One of ourselves prepared three such vaccines for his own use at successive stages of a pharyngitis, and each time different organisms were used, and the eventual issue was satisfactory. The most striking effect was produced by the first dose. In our view, the probability is that by the use of autogenous vaccines many flabby uvulas and throats would be restored to a healthy condition, and thereby prevented from offering a safe harbour to the meningococcus. It is hard to conceive that the meningococcus ever holds undisputed possession of any mucous membrane, or ever even obtains a hold at all, unless its vitality has already been lowered by some means or other.

When we publish statistics of cases, including Stage I, it will be seen that the death-rate is lower than in pneumonia.

CEREBRO-SPINAL MENINGITIS.

THE INTERPRETATION OF EPIDEMIOLOGICAL OBSERVATIONS BY THE LIGHT OF BACTERIOLOGICAL KNOWLEDGE.*

By JOSEPH A. ARKWRIGHT, M.D.,

LISTER INSTITUTE, CHELSEA.

Characteristics of Epidemics.

ONE of the most outstanding features of epidemics of cerebro-spinal meningitis is the isolation or want of ascertained contact between the cases of the disease.

The majority of houses attacked afford only one case, but the proportion varies in different epidemics. In the Texas epidemic (1912) reported by Steiner,¹ out of 2,135 cases 313 (14.7 per cent. of cases) occurred in houses with more than one case, and of 1,957 houses attacked 135 (6.9 per cent.) had more than one case.

It is, however, a feature of such multiple house attacks that the cases have often occurred simultaneously in the same house, as in the striking occurrences reported by Robb² at Belfast, when five cases occurred almost simultaneously in one house on two separate occasions at the outbreak of the epidemic. Where an interval elapses between multiple cases occurring in a single house, it is often considerably longer than the time which has been regarded as the incubation period by several writers—that is, one to five days.

* A paper read before the Epidemiological Section of the Royal Society of Medicine on March 5th (see JOURNAL for March 13th, p. 467).