

CEREBROSPINAL FEVER: NOTES ON 251 CASES TREATED AT THE SALISBURY ISOLATION HOSPITAL.

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THE following brief notes relate to cases of cerebrospinal fever which have occurred in Salisbury and the surrounding district and in some neighbouring military camps, from December 15, 1914, to June 30, 1917.

The first case was admitted to the Salisbury Infirmary on December 15, 1914, and from that date until February 23, 1915, 36 cases were admitted; of this number, 16 died in the Infirmary, 3 recovered and were sent back to their homes, and the remaining 17 were transferred to the Salisbury and District Joint Isolation Hospital on account of the impossibility of treating the increasing numbers of cases in a ward of a General Hospital. Five of these 17 subsequently died at the Isolation Hospital. The total number of cases, both military and civil (including the 17 mentioned above), admitted from February 23, 1915, to the Isolation Hospital, was 232, making the total number of cases admitted into both hospitals 251.

The following table gives separately the number of military and civil cases, the recoveries and the deaths at all ages and at certain age groups, and the percentage of the fatal cases to the total number of cases in each age group:—

| | | <i>Military.</i> | | | | |
|---------------------------------------|----|------------------|----------------------|------------------|-------------------------------|-------|
| Number of cases at certain age groups | | Number of cases | Number of recoveries | Number of deaths | Percentage of deaths to cases | |
| Total number at all ages.. | .. | 155 | 101 | 54 | .. | 34·8 |
| Number under 20 years of age .. | .. | 54 | 31 | 23 | .. | 42·6 |
| " 20 to 25 .. | .. | 55 | 40 | 15 | .. | 27·3 |
| " 25 to 30 .. | .. | 21 | 13 | 8 | .. | 38·1 |
| " 30 to 40 .. | .. | 17 | 11 | 6 | .. | 35·3 |
| Over 40 .. | .. | 8 | 6 | 2 | .. | 25·0 |
| | | <i>Civilian.</i> | | | | |
| Total number at all ages .. | .. | 96 | 40 | 56 | .. | 58·3 |
| Under 1 year of age .. | .. | 8 | 3 | 5 | .. | 62·5 |
| 1 to 5 years .. | .. | 21 | 5 | 16 | .. | 76·2 |
| 5 to 10 .. | .. | 14 | 6 | 8 | .. | 57·1 |
| 10 to 15 .. | .. | 10 | 2 | 8 | .. | 80·0 |
| 15 to 25 .. | .. | 19 | 12 | 7 | .. | 36·8 |
| 25 to 45 .. | .. | 17 | 10 | 7 | .. | 41·2 |
| 45 to 65 .. | .. | 6 | 1 | 5 | .. | 83·3 |
| Over 65 .. | .. | 1 | — | 1 | .. | 100·0 |

From the table above it will be seen that the fatality rate of the military cases, 34·8 per cent, is lower than the corresponding rate for civil cases, 58·3 per cent. The higher fatality rate at all ages among the civilians may in some measure be attributed to the comparatively large proportion of fulminant cases which occurred in the cases in the 1914 to 1915 epidemic period; but in the main it is due to the fact that many of the cases were infants and young children. It will be seen that 53 (or 55·2 per cent) of the civilian cases are under 15 years of age, having a fatality rate of 69·8. Among persons past middle life the mortality rate was also high (85·7 per cent).

When the thirty-six (37·5 per cent) civil cases in the age groups 15 to 45, which most closely correspond to the all-ages group of the military cases are examined,

it will be seen that the fatality rate of the civil cases is 38·9 per cent, and that of the military cases 34·8 per cent. Although the civil fatality rate is four per cent higher than in the military cases, the rates are calculated on small figures, and too much reliance cannot be placed on them.

Of the 251 cases dealt with, there were 47 fulminant cases, 163 severe cases, and 41 mild cases.

The length of illness of 110 fatal cases was as follows:—

| Period of illness | Civil cases | | Military cases | | | |
|--------------------|-------------|----|----------------|----|----|----|
| Less than one week | .. | .. | 24 | .. | .. | 25 |
| One to two weeks | .. | .. | 5 | .. | .. | 4 |
| Two to four weeks | .. | .. | 8 | .. | .. | 12 |
| Over four weeks.. | .. | .. | 19 | .. | .. | 13 |
| | | | 56 | | | 54 |

The longest duration of illness before death was 129 and 131 days respectively in civil and military cases.

In the civilian cases there were 56 males, and of these 21 recovered and 35 (or 62·5 per cent) died; and 40 females, 19 of whom recovered and 21 (or 52·5 per cent) died.

The civilian cases, with few exceptions, occurred amongst the working classes, and except in three cases there was a definite history of association with soldiers or camp workmen, or of residence in camp areas.

Civilian patients within a radius of twenty-five miles were conveyed to the hospital by motor ambulance, and even the most severe cases seemed to stand the journey well.

The ambulance used was a 20-h.p. Scout, body of wood, panels with glass windows, interior varnished wood, all washable. The patient was kept warm with hot-water bottles and blankets.

Age Distribution.—The disease may occur at any age, among the cases treated at Salisbury the youngest was 3½ months, and the oldest aged 72 years.

CLINICAL SYMPTOMS AND SIGNS.

In all cases headache was present, usually of a severe type, and there was pain and stiffness on moving the head in varying degrees according to the severity of the case. In two very severe cases there was no stiff neck on admission, but in twenty-four hours this sign was pronounced. Difficulty in swallowing, due to extreme retraction of the head, was present in a few cases. Vomiting, sometimes associated with diarrhoea, was present in 162 cases on admission, and had probably been present in some of the cases admitted unconscious, in regard to which no history of the illness was obtainable. Kernig's sign was present in 199 cases. Twenty cases had herpes on the face on admission. Many cases had rashes on admission, the eruption being of various types, papular, hæmorrhagic, and purpuric spots being most common; two cases had petechial rashes on the joints. Broncho-pneumonia was present in fifteen cases. Bronchial symptoms of a catarrhal type, probably meningococcal in character, occurred in some cases; these were usually of a temporary transient character, lasting only a few days, and did not seem to influence the course of the disease. Convulsions occurred in seven cases at the commencement of the illness; three of these cases were under 1 year of age; of the remaining four, one was 3½ years, one 7½ years, one 18 years, and one 26 years of age. With three patients convulsions occurred at a late stage of the disease, only one of these recovered. Retention of urine (m

frequently observed in female cases) did not indicate a bad prognosis when occurring at an early stage of the illness; it also occurred as a late development in hopeless cases. One hundred and twenty-nine cases, when admitted, were more or less unconscious with delirium, frequently violent and maniacal. Some cases were quite comatose. Hæmaturia was present in four military cases of severe type, two of which were fatal. The other two made a complete recovery. Albuminuria occurred in 11 cases—10 military and 1 civilian—3 of these cases died. Of the recovery cases, one only had albuminuria on leaving the hospital. Strabismus when present generally occurred in infants. A child, aged 5, who recovered, had ptosis of the right eyelid on admission. At least four patients recovered with blindness of one eye, caused by panophthalmitis, and in two cases the eye was subsequently removed. Nystagmus occurred in one case as a complication and sequela, the patient when discharged being otherwise in good health. In three cases orchitis occurred as a complication during convalescence. Total deafness occurred as a sequela in three cases in which recovery was otherwise good. One patient, a male, aged 29, who died after five days' illness, had hemiplegia on admission. Another male, aged 18, had facial paralysis, but recovered with no paralysis. Hydrocephalus was occasionally seen amongst the children affected.

THE TYPE OF THE DISEASE.

Acute Fulminant Type.—Duration of illness from a few hours to five or six days. These cases were usually comatose or semi-comatose on admission with hæmorrhagic rash and incontinence; they were often delirious and troublesome and did not recover consciousness.

Severe Type.—These cases present several varieties; on admission, some did not appear to be very severe, but became so and ended fatally in two or three weeks; others became chronic, the course of the disease lasting sometimes several weeks before death occurred. The latter patients became very emaciated with mental degeneration and incontinence. The rapid recovery of some patients admitted with delirium and high temperature and apparently suffering with a most severe form of the disease, was remarkable. As a rule in severe cases which recovered improvement began in less than two weeks, although it is worthy of note that certain severe cases began to recover after a long period.

Mild Types.—These cases had headache, stiff neck, and generally vomiting; were sensible on admission, and Kernig's sign was present. Convalescence commenced a few days after admission. Cultures from cerebrospinal fluid or throat swabs were positive. The cerebrospinal fluid in these cases was generally excessive in amount, either clear or faintly turbid (cloudy).

Chronic cases became emaciated; those ending fatally usually developed tremor of the hands, sometimes purpuric or petechial rashes, loss of memory and incontinence, and usually took nourishment well. Mental derangement in a chronic case, associated with wasting, tremor, and incontinence, indicate, I consider, a fatal termination; in fact I have only seen one case with these signs recover. On the other hand, I have had recoveries of cases with emaciation, in which the mental capacity has remained good, and after the acute stage the patients have not had incontinence. Three patients were admitted with swollen joints and myocarditis, their condition before admission suggesting acute rheumatism. In these cases meningococci were found in films made direct from cerebrospinal fluid, which in all these cases was turbid and excessive in amount; two of these

cases recovered, the cardiac signs and swelling of the joints disappearing during convalescence. Arthritis affecting the knee or ankle joints occurred in seven patients as a complication or sequela, two of these being fatal cases. The temperature does not appear to take any definite or typical course. Cases with some of the highest temperatures recorded recovered, and in some severe cases of the fulminant type, where the illness ended fatally in a few days, the temperature did not rise above 100° F., or remained normal.

Diagnosis.—For correct diagnosis, lumbar puncture is essential. The cerebrospinal fluid of the first forty-five cases was examined and reported as positive by Dr. Penfold, of the Lister Institute. Of the remaining cases the fluid of 163 was more or less turbid and diplococci were found in films made from the fluid withdrawn, although in some of these cases no growth was obtained from cultures on trypsin agar or blood serum (about 15½ per cent). In two cases the fluid was blood stained, and in one of these diplococci were found and a positive growth was obtained; in the other case no growth resulted, but a throat swab furnished a positive growth. In forty-one cases the cerebrospinal fluid was clear and excessive in amount. In these cases the albumin was generally increased, and in some eight of them a positive growth was obtained by culture. In the other clear fluid cases, the diagnosis was confirmed by subsequent punctures and a positive throat swab was obtained.

The amount of fluid withdrawn varied, the average being from thirty to fifty cubic centimetres. In some cases the fluid was in quantity and under considerable pressure, as much as eighty or 100 cubic centimetres escaping at times through the needle. The cells found in the fluid were chiefly of the polymorphonuclear variety, the diplococci being both extra- and intra-cellular. I have not found the position of the cocci, as regards the cells, to afford any assistance in prognosis. One patient, a male, recovered with nephritis as an after effect; four cases (already mentioned) with impaired vision. In the majority of cases which recovered health has not been completely restored for some months; in others the recovery appeared to be fairly good, many patients having resumed their occupations. The average period in hospital of recovery cases was: civilian cases forty-five days, military cases sixty-six days. Since the opening of a military carrier centre at Sutton-Veny and the transference to this centre of military cases on convalescence, the duration of the stay in hospital of military cases has been reduced, as in 1915 and 1916 military patients were retained in hospital until two successive negative throat swabs were obtained.

Treatment.—I do not think that drugs have any specific action. In the earlier cases (1915), in addition to lumbar punctures and serum, many drugs were tried, soamin, urotropine, neosalvarsan, and potassium iodide, without apparently any decided influence on the course of the disease in various cases, and their use has been discontinued. For the relief of headache and sleeplessness morphia, morphia and atropin, heroin, bromide and chloral, were successful; aspirin was very beneficial in the milder cases. In the severe forms, morphia and heroin were given freely with satisfactory results. Saline solution given per rectum or intravenously, always did good. Brandy was necessary in many cases. Pituitary extract and ether were found preferable to strychnine. Hot saline baths and hot sponging were used a good deal and were found most useful, relieving restlessness and headache, lowering the body temperature and promoting sleep. Lumbar puncture is essential, both as regards diagnosis and

treatment; I have used Barker's needles and canulas, no syringe being used to withdraw fluid.

Serum Treatment.—The result of serum administration in the earlier cases was unsatisfactory, in fact the use of it was discontinued for a time. From April to October, 1915, Flexner's serum was used with fairly good results. During 1916 and 1917 reliance has been chiefly placed on lumbar puncture and the administration of serum. The Lister Institute serum has been employed for military cases, with a few exceptions. For civilian cases, "Burroughs Wellcome" and "Mulford" sera have been employed. In the severest cases, in addition to intrathecal doses, serum has been given intravenously, with saline solution. The administration of adrenalin, ten minims every four hours, hypodermically for twenty-four hours, in cases with purpuric rashes and also for hæmaturia, has given very promising results.

In some cases the result of serum seemed remarkable, and in my opinion, with serum-treated cases, there is more rapid recovery in severe cases, and less likelihood of relapses and sequelæ. The serum is warmed before use and allowed to run in by gravity through the canula with funnel and tubing, the amount of the dose being determined by the amount of the cerebrospinal fluid withdrawn. I think it is advisable never to insert as much serum as cerebrospinal fluid withdrawn, forty to fifty cubic centimetres being a maximum dose at one administration for an adult. Chloroform was the anæsthetic usually given when necessary for lumbar punctures. I have not seen any reason to abstain from giving an anæsthetic in these cases; where serum is to be administered it is better given under an anæsthetic. In the severe cases with rigidity, it is often impossible to puncture without an anæsthetic. In mild cases, where no serum was to be administered, or simply for diagnostic purposes, it was generally quite easy to puncture without an anæsthetic.

NURSING.

The importance of skilled nursing in cases of cerebrospinal fever cannot be overrated and the recovery of several of our patients must be attributed to the constant care and attention they received from the matron and nursing staff of the hospital.

DIRECT INFECTION.

The following cases are examples of direct infection:—

(1) F. R., aged 3½ years, was admitted to hospital on February 10, 1915, with a history of one day's illness. L. R., aged 3½, a twin brother of F. R., was admitted on the same day, February 10, 1915, with a history of five days' illness. Both had occupied the same bed; both died.

(2) E. D., aged 27, was admitted to the hospital January 16, 1915, with a history of a few hours' illness; ten days later, her mother, Mrs. D., was admitted, and on the same day the *fiancé* of E. D., a Canadian corporal, was admitted into a military hospital, suffering from cerebrospinal fever. Mrs. D. and the corporal were present when E. D. was removed, and both of them may have kissed or embraced her. All these cases proved fatal.

(3) A little boy, B. H., aged 5 years, died after a very brief illness on December 30, 1916. He was found to be suffering from cerebrospinal fever. On December 31, 1916, A. H. (brother of B. H.), aged 7 years, was admitted to hospital suffering from cerebrospinal fever. He recovered. The brothers had been sleeping together.

During 1917 investigations regarding the type of meningococcus found in military cases were undertaken by the bacteriologists of the Military Hospital, Sutton-Veny. In addition to the positive cases, there were admitted, with symptoms suggesting cerebrospinal fever, 141 cases. Of these, twenty were civilian and 121 military cases. The larger number of military cases may be due to the fact that soldiers with symptoms suggesting cerebrospinal fever are at once sent to hospital. In the civilian cases, as a rule, the disease is fairly definite on admission. Mild cases of cerebrospinal fever in civilians may possibly be overlooked, and if this be so, probably the apparently higher recovery rate of the military positive cases may be attributed to this cause. The ultimate diagnosis of twenty civilian cases admitted as (?) cerebrospinal fever and found not to be cases of the disease was as follows: Influenza, 5; pneumonia, 7; bronchitis, 1; gastro-enteritis, 1; hysteria, 1; tubercular meningitis, 2; tonsillitis, 1; cerebral tumour, 1; poliomyelitis, 1.

In all cases, excepting the two cases of tubercular meningitis, the cerebrospinal fluid was clear, and nothing was found on examination. The final diagnosis of 121 military cases admitted as (?) cerebrospinal fever in which the original diagnosis was not confirmed were as follows: Influenza, 40; sunstroke, 3; concussion of brain and spine, 4; dental caries, 1; dilated heart, 1; epilepsy, 3; pneumonia and broncho-pneumonia, 13; scarlet fever, 4; tonsillitis, 5; otitis, 2; pericarditis, 1; appendicitis, 1; measles, 3; malaria, 1; loss of memory, 1; myalgia, 4; renal disease, 3; cerebrospinal fever contact, 1; bronchitis, 7; vaccinia, 5; gastritis, 2; neuralgia, 2; rheumatism, 5; anti-typhoid inoculation 5; headache, 3.

Dr. Ord has kindly allowed me to give particulars relating to eighteen of the earlier cases who were under his care at the Salisbury Infirmary.

I must also express my thanks to my colleagues in Salisbury for their assistance in administering anæsthetics when necessary, and also to the bacteriologists of the Military Hospital, Sutton-Veny.

Reviews.

ROLL OF COMMISSIONED OFFICERS IN THE MEDICAL SERVICE OF THE BRITISH ARMY.

By the late Colonel William Johnston, C.B. Aberdeen: University Press. 1917. Pp. lxxii and 638. 10 $\frac{1}{2}$ × 7 $\frac{1}{4}$.

To many of the older officers of the Royal Army Medical Corps this volume has an interest apart from its avowed object, in that it was a labour of love on the part of a well-known, highly and justly esteemed officer of the Corps, to whom we owe much more than most of us recognize, even those with some fragments of knowledge on the subject.

The personal note contributed by Sir William Babbie, V.C., with the bibliography of Johnston's work, explains why his memory is so respected—for his personal qualities and for the work he did.

The Roll covers the period June, 1727, to June, 1898, and it is of course essential for the proper understanding of the Roll itself, that some account should be given of the vicissitudes of the Medical Services of the Army at various times. This is naturally technical to a considerable degree and not very easy reading, but one has the impression that part of this ground has been surveyed—more in outline—by other authors in previous articles; if not, it appears desirable that Lieutenant-Colonel H. A. L. Howell should supply such a sketch, for which there is no one better qualified. The development to its present stage of the