There was ample exposure for exploration in detail, but ligature of the innominate artery required more room if rough handling of the sac was to be avoided. The portion of the manubrium sterni which is closely related to the sterno-clavicular joint was cleared back and front and divided with a chisel. There was no interference with the first costal cartilage. The divided portion of the sternum carrying the sterno-clavicular joint and the inner portion of the clavicle was retracted upwards and to the left. The innominate artery was now seen clearly in its entire length (2 inches). The veins were not visible, the pleura caused no embarrassment, and the nerves remained hidden. The thyroidea ima branch was present. Two No. 2 catgut ligatures were passed round the main artery distal to this small branch (Figs. 1 and 2). They were tied slowly and gently to avoid, if possible, rupture of the coats. Pulsation in the aneurysm ceased and the radial pulse disappeared. Each pulsation of the artery now had the appearance of a sledge-hammer blow on the point of occlusion. For safety a third ligature was placed nearer the aorta. The thyroidea ima branch was ligatured with fine silk.

The divided clavicle and portion of sternum were replaced, the former being held in position by sutures through drill-holes in the bone. In three days the radial pulse reappeared, and in a week it was of normal volume. Six weeks later some faint pulsation could be felt in a very small swelling at the site of the original sac. Four months after operation there was no pulsation. Six years later the case was examined by Mr. R. A. Stoney of Dublin. He kindly reported that the patient appeared quite well. A small lump could be felt, but there was no pulsation or thrill.

Comment

Ligature of the innominate artery is not a difficult operation provided the exposure is adequate. Exploration, and the clearing of the deep surface of the manubrium sterni, are greatly facilitated by turning down the middle portion of the clavicle. In most cases I think this should be the first major step in the operation.

If ligature of the innominate is seen to be necessary a portion of the sternum should be divided and retracted upwards with the inner end of the clavicle. This can be accomplished without division of the first costal cartilage.

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CEREBROSPINAL FEVER

A REVIEW OF 500 CASES TREATED BY CHEMOTHERAPY WITHOUT INTRATHECAL SERUM

BY

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For the purpose of comparison of the results of the various forms of treatment Table I gives the case-mortality figures for cerebrospinal fever patients admitted to this hospital during the last 10 years.

TABLE I

	Intrathecal Serum					Sulphanilamide and Intrathecal Serum	Sulphapyridine and Intrathecal Serum	Sulphapyridine or Sulphathiazole without Intrathecal Serum		
	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942
Cases ..	2	4	5	15	14	15	53	322	158	59*
Deaths ..	2	1	3	5	6	2	11	29	13	3
% ..	100.0	25.0	60.0	33.33	42.87	13.33	20.75	9.03	8.22	5.1

* Only first 20 cases (1 death) are included in the present series.

Within a period of two years and two months (Jan., 1940, to Feb., 1942) 500 patients admitted to the Cardiff City Isolation Hospital suffering from cerebrospinal fever were treated by chemotherapy without intrathecal antimeningococcal serum. As this is one of the largest series of cases of cerebrospinal fever ever so treated, a brief analysis, together with a few observations, may be of general interest. The ages ranged from an infant of 6 weeks, who made a complete recovery (examined 12 months after discharge), to a fatal case in a person aged 70 years. All cases of cerebrospinal fever which were admitted during the period are included, even those that were moribund and died within a few minutes of admission. The total number of deaths was 43, furnishing a gross mortality rate for the whole series of 8.6%.

With a disease such as cerebrospinal fever, which has a fulminating form that often kills on the first day, a totally erroneous case-mortality rate is obtained if cases that end fatally within 24 hours of admission are excluded. Were such a procedure adopted in this series the case-mortality rate would have been recorded as only 4.8%.

Age and Sex Distribution

Table II gives the sex distribution and case-mortality rates of the various age groups.

TABLE II

Age Group	Males			Females			Total Cases		
	No.	Deaths	%	No.	Deaths	%	No.	Deaths	%
0-3 months	—	—	—	1	—	—	1	—	—
3-6 "	6	2	33.3	7	2	28.6	13	4	30.8
6-12 "	16	1	6.2	11	1	9.1	27	2	7.4
1-5 years	62	4	6.4	53	3	5.6	115	7	6.1
5-10 "	27	1	3.7	29	3	10.3	56	4	7.1
10-15 "	27	2	7.4	24	—	—	51	2	3.9
15-20 "	50	—	—	21	—	—	71	—	—
20-25 "	22	—	—	11	1	9.1	33	1	3.0
25-30 "	19	1	5.3	5	—	—	24	1	4.2
30-35 "	20	2	10.0	21	3	14.3	41	5	12.2
35-40 "	10	1	10.0	6	—	—	16	1	6.2
40-45 "	10	3	30.0	7	2	28.6	17	5	29.4
45-50 "	5	1	20.0	5	—	—	10	1	10.0
50-55 "	4	—	—	8	2	25.0	12	2	16.6
55-60 "	5	2	40.0	—	—	—	5	2	40.0
60-65 "	4	2	50.0	—	—	—	4	2	50.0
65-70 "	2	2	100.0	1	1	100.0	3	3	100.0
70-75 "	—	—	—	1	1	100.0	1	1	100.0
All Ages ..	289	24	8.3	211	19	9.0	500	43	8.6

It is noteworthy that in the favourable age group 10 to 30 years there were 179 cases with but 4 deaths, giving a case-mortality rate of only 2.2%. In the subgroup 15 to 25 years there were 104 cases with but 1 death—i.e., a case mortality of even less than 1%; whereas among four patients of over 65 years there was no instance of recovery. From this will be seen the importance of furnishing the age distribution for any case-mortality figures for cerebrospinal fever. There were 44 non-civilians in this series, all of whom recovered, probably on account of their general fitness, favourable age-grouping, and early admission to hospital for treatment.

Proposed Classification

From my experience of cerebrospinal fever I believe the following classification covers all types of cases.

1. *The Meningococcal Septicaemic Type.*—(a) Acute, fulminating, exhibiting the Waterhouse-Friderichsen syndrome with adrenal haemorrhages, purpuric eruptions, pallor, and collapse; such patients frequently die before development of meningitis. (b) Chronic meningococcaemia with intermittent periods of pyrexia, usually petechiae and arthritis, occasionally lesions resembling erythema nodosum, and rarely maculopapular eruptions. This type of case may recover spontaneously or proceed to meningitic involvement unless adequately treated with chemotherapy.

2. *The Meningitic Type.*—(a) Acute; (b) subacute; (c) chronic (including the post-basis variety of Gee and Barlow in infants).

3. *The Encephalitic Type.*—Though every case of meningitis is essentially one of meningo-cortico-encephalitis, cases undoubtedly occur, fortunately rare, in which lesions are found deep in the nervous tissue. In fact, at necropsy on one of my cases meningococci could be demonstrated in the internal capsule. These cases are difficult of clinical recognition, but the

brain-stem appears often to be involved with signs of bulbar palsy, especially pharyngeal paralysis and severe respiratory distress, but at the onset no pulmonary lesions are detectable. This type of case is usually fatal.

Special Diagnostic Features

It was observed that slight nuchal rigidity was a far more constant and early finding than Kernig's sign. Photophobia was conspicuous mainly by its absence. Contrary to the general impression regarding infants, a bulging anterior fontanelle was uncommon, but, rather, a depressed fontanelle was often present, being probably due to vomiting and consequent dehydration. The abdominal, knee, and plantar reflexes appeared to have no diagnostic significance except that the abdominal reflexes were almost invariably absent in those cases bordering on coma.

In only three instances did more than one case occur in the same household, but in one household there were 3 cases.

Eruptions and Complications

Purpuric eruptions, generally petechiae which appeared on the first or second day of disease, were present in 39% of cases, usually occurring in the more severe ones; but extensive purpuric eruptions were occasionally found in comparatively mild cases. Herpes—generally on the face, around the lips, though sometimes occurring in unusual situations, such as on the digits or palms of the hands—was present in 33% of the cases, usually towards the end of the first week of the disease. Unlike pneumonia, the presence of herpes was of no prognostic import. Both herpes and purpuric eruptions occurred in an additional 16% of the cases. The accompanying photograph shows an extensive herpetic eruption in a woman aged 31, who had an attack of but moderate severity.

Severe herpes in a case of cerebrospinal fever of moderate severity: complete recovery.

The following were the main complications: Transient strabismus, 77; bronchopneumonia, 12 (usually confirmed post mortem); arthritis, 29 (mainly the larger joints); deafness, temporary and partial 11, total and permanent 7; transient albuminuria, 91; conjunctivitis or iridocyclitis, 17; transient paresis of arms, 3; temporary facial paralysis, 10; transient ptosis, 8; transient hemiplegia, 1; temporary mental derangement, persisting well into convalescence, 4; hydrocephalus, 5; dysphagia, due to severe neck retraction, 2; transient nystagmus, 2; orchitis, 1.

Differential Diagnosis

The following cases were erroneously admitted as suffering from cerebrospinal fever: Tuberculous meningitis, 25;

pneumococcal meningitis, 8; aseptic meningitis, 10; influenzal meningitis, 2; subarachnoid haemorrhage, 9; poliomyelitis, 16; polio-encephalitis, 8; influenza, 58; lobar pneumonia, 8; bronchopneumonia, 14; miliary tuberculosis, 1; cerebral abscess, 1; cerebral tumour, 1; infective endocarditis, 1; frontal sinusitis, 1; tonsillitis, 14; otitis media, 2; bronchitis, 12; glandular fever, 1; tetanus, 1; rheumatic fever, 2; dysentery, 2; diphtheria, 1; pyelitis, 1; adenitis, 1; pleurisy, 3; gastritis, 1; measles and encephalitis, 1; whooping-cough and bronchopneumonia, 1; mastoiditis, 1; rubella and rheumatism, 1; paratyphoid B fever, 5; fractured base of skull, 1; uraemia, 3; catarrhal jaundice, 1; septic arthritis, 1; diphtheria, 2.

Conversely, cases notified as the following proved to be cerebrospinal fever: Polio-encephalitis, 1; poliomyelitis, 1; diphtheria, 2; typhoid fever, 1.

Chemotherapy

Sulphapyridine was employed in 471 cases and sulphathiazole in the remaining 29. Sulphathiazole appeared to be equally effective in promoting recovery and was less prone to produce nausea and vomiting.

Two grammes (4 tablets) was given by mouth on admission and repeated in 4 hours' time; then 1 g. 4-hourly for the next 72 hours; then 0.5 g. 6-hourly for a further 3 days. After the first 250 cases the dosage was increased to 2 g. 4-hourly for 4 doses and then 1 g. 4-hourly for 96 hours, followed by 0.5 g. 6-hourly for a further 3 days. The increased dosage was found to have a slight effect in diminishing recurrences and septic complications such as arthritis. Children under 12 years received half the adult dosage, and infants under 12 months a quarter. In all, 1,935 lumbar punctures were performed without any untoward effects—an average of 4 for each patient. No general anaesthetic was administered. Apart from relieving headache, the reduced intracranial pressure was considered less damaging to the nervous tissue. Incidentally, the cerebrospinal fluid furnished a satisfactory guide to the progress of the disease. No case was regarded as out of danger if the sugar had not returned to normal. Only 6 ventricular and 5 cisternal punctures were considered necessary. If the patient was comatose the tablets were crushed and given in nasal feeds. If vomiting occurred after ingestion of the drug or the patient were delirious and nasal feeding were difficult, the sodium salt of sulphapyridine was given in the earlier cases by intramuscular injections; but as sloughing often ensued in spite of care, this practice was discontinued and the sodium salt in equivalent doses was injected intravenously with three times its volume of normal saline. In severe cases, or if there were much dehydration, the sodium salt of sulphapyridine was given intravenously in about 0.5 to 1 litre or more of normal saline in 5% glucose solution by the vacoliter drip method.

Only one patient in the whole series received serum intrathecally. This was a woman aged 40 who had a fatal relapse after having been free from symptoms for 6 weeks after the cerebrospinal fluid had returned to normal. During her relapse chemotherapy appeared to have no effect, and no improvement followed the intrathecal serum, but there was slight temporary improvement after an intrathecal injection of her own blood serum. Two children, both aged 1 year, had second attacks after intervals of 2 months and 3 months respectively. In one instance the organism was of the same group in both attacks, but in the other case the organism could not be cultured on the first admission. The second attacks responded well to chemotherapy.

Fluids were pushed in all cases, as, to my mind, dehydration can contribute materially to a fatal issue. Furthermore, the giving of adequate fluids probably lessens the incidence of haematuria due to the depositions of acetyl derivatives in the kidneys. One patient who ultimately recovered and had been in coma for 10 days was given fluids by nasal feeds at 4-hourly intervals during that period.

Since extensive haemorrhages are not infrequently found in the adrenals, in the acute septicæmic cases, 5% glucose-saline (0.5 to 1 litre) was given intravenously as indicated above, as sodium chloride and glucose are advocated in case of adrenal damage (McCance, 1936). In addition such cases received

synthetic cortical extract (desoxycorticosterone acetate) intramuscularly, and in order to combat toxæmia 30 to 60 c.cm. of meningococcal antitoxin was also given intravenously in the glucose-saline. Several patients whose pulses were imperceptible on admission made complete recoveries on these lines. In all, 56 patients received glucose-saline intravenously, 34 serum intravenously, and 44 cortical extract intramuscularly. It was generally unnecessary to cut down on a vein for intravenous therapy. This new method of treating the acute fulminating septicaemic type of case was first introduced in this hospital early in 1940, and was published (Harries, 1940) in March of that year.

Patients who developed such complications as arthritis or iridocyclitis in convalescence received a second course of chemotherapy. All patients were given glucose freely, and even in the mildest purpuric cases a little common salt was added to the diet. If bromides were given as sedatives the sodium salt was administered rather than the potassium salt. Two patients who had neck retraction of such a degree as to prevent deglutition were successfully treated by the injection of a few cubic centimetres of novocain into the post-cervical muscles (Harries, 1936).

Sulphonamide Reactions.—These in the main were not alarming. Skin eruptions developed in 26 cases, jaundice in 4, marked cyanosis in 14, and transient haematuria in 3. No case developed agranulocytosis. One child, however, died from suppression of urine, probably due to renal damage; but permission for necropsy was not obtained.

No person in attendance contracted the disease. No masks were worn, as I believe the wearing of these predisposes to nasopharyngeal congestion and catarrh, which probably lowers the resistance of the mucous membrane. It is likely that infection of a healthy nasopharynx produces a temporary carrier state, with subsequent immunity. The giving of small prophylactic doses of sulphonamides in suspected cases had no effect on the meningococci except that the organisms appeared to be rendered drugfast, and large doses administered later were then less effective.

Bacteriological Investigations.—Morphological meningococci were found in 465 cases, or 93%. Cultures were obtained in 214 cases; of these 93% belonged to Group 1 and 3.7% to Group 2, while 3.3% were inagglutinable. Clinically, the various strains seemed to be of equal virulence.

Summary

A series of 500 cerebrospinal fever cases is recorded, with a gross mortality rate of 8.6%.

An age-distribution table indicates the most favourable age group as 15 to 25 years, with 104 cases and a case-mortality rate of just under 1%.

A suggested classification of all forms of cerebrospinal fever is given.

A new treatment for the acute fulminating septicaemic type is described.

Of the strains of the meningococci cultured 93% belonged to Group 1.

My thanks are due to Dr. Allison, who confirmed our bacteriological findings and who typed the organisms; to Prof. Duguid and Dr. Boissard for post-mortem examinations; and to Drs. Murphy, T. Thomas, Herapath, Lennox, Evans, and Garfield, quondam resident medical officers at this hospital, for their assistance in the treatment of the cases.

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W. L. Downing (*J. Iowa State med. Soc.*, 1941, 31, 538), who records 11 cases in persons aged from 24 to 67, 4 of which were fatal, states that acute pancreatic necrosis is still an unsolved disease. When the diagnosis is doubtful, early exploration should be performed to avoid overlooking perforated peptic ulcer or other emergencies. If acute pancreatitis is found, and disease of the biliary tract is present, cholecystotomy or choledochotomy, or occasionally cholecystectomy, is indicated. Operation should be avoided in the hyperacute type. If the diagnosis is certain, conservative measures should be used. Early operation is advisable in all patients with acute or chronic cholecystitis to avoid the complication of acute pancreatitis.

THE MANGLED FOREARM TREATMENT IN A SKELETON SPLINT WITH FIXED SKELETAL TRACTION

BY

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In a compound fracture of the forearm, in which the bones are shattered and there are extensive lacerations, a complex problem in immobilization results. Given good fortune, an ordinary plaster may prove very satisfactory; yet one can remember several cases in which removal of a plaster became an urgent necessity to allow further surgical treatment. The result was that redisplacement of the bones took place and the sepsis gained nothing from the loss of immobilization.

I have found the following method very useful in these severe cases. The advantages are that there is no danger of circulatory failure due to a tight plaster and that the wounds

FIG. 1.—Posterior view. Note that the Kirschner wire which transfixes the metacarpal does not interfere with movements of the thumb or pierce any of the extensor tendons.

can be fully inspected without disturbing the immobilization. The wound toilet needs no lengthy description except to emphasize the importance of excising all non-viable muscle and of providing a perfect drainage system if one feels that the wound is still contaminated even after excision.