SALT-LOSING OTORRHOEA

BY

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Basal fractures of the skull are uncommon in children (Harris, 1957), and the following report is presented because it illustrates the development of two complications in a case of this nature.

Case Report

A boy, aged 3 years and 11 months, was admitted to the Bristol Royal Infirmary following an accident in which he ran into the road and was knocked down by a car.

On admission he was crying, and was drowsy but rousable. There was clinical evidence of a closed fracture of the right femur, and blood and cerebrospinal fluid were coming from his left ear. No other abnormality was found on clinical examination of the central nervous system. An antero-posterior view of the skull showed a vertical fracture in the middle of the left petrous temporal bone in a position to implicate the ear. Radiological examination also confirmed the presence of a transverse fracture of the upper third of the right femur. Traction was applied to the right leg and he was given 500,000 units of crystalline penicillin intramuscularly twice daily.

Thirty-six hours after admission the child complained of a severe headache and vomited. His temperature was 101° F. (38.3° C.), and pulse rate 144. Severe opisthotonos with marked head retraction was present. Lumbar puncture was performed and yielded a turbid fluid at a pressure of 50 mm. C.S.F. There were 2,000 cells per c.mm., of which 70% were polymorphs and 30% lymphocytes. The protein content of the fluid was 180 mg./100 ml. Examination of a film made of the centrifuged deposit showed numerous pus cells and possibly two isolated groups of pneumococci.

In view of these findings, intramuscular penicillin was increased to 1 mega unit four-hourly and intrathecal treatment with 10,000 units of crystalline penicillin daily was begun. Oral sulphadimidine, 0.5 g. four-hourly, was added. Cultures later confirmed the presence of pneumococci. The parents now recalled that a week before the accident the child had been seen by the school doctor for earache. Although they could not recollect which ear was painful it seemed possible that the pneumococcal meningitis may have arisen from a pre-existing ear infection.

Clinically, the patient showed a satisfactory response to treatment so far as his meningitis was concerned. Forty-eight hours after the onset, although neck retraction had increased still further, there was no disorder of consciousness to indicate deterioration. The rectal temperature had fallen to between 99 and 100° F. (37.2 and 37.8° C.). The C.S.F. showed a falling cell count, and no pneumococci were now seen on microscopy or obtained on culture. Dehydration, however, was becoming quite marked, and examination showed a dry, inelastic skin and soft eyeball tension. Oral intake of fluids was still excellent, and these were therefore increased.

Lumbar punctures on each of the first three days of treatment of the meningitis showed that the pressure of C.S.F. was very low. The fluid escaped from the needle only when the child cried. On the fourth day lumbar puncture failed. The possibility of a spinal block was considered, and because of this and the continued loss of C.S.F. from the ear, a neurosurgeon (Mr. G. L. Alexander) was asked to see the child. Cisternal punctures were attempted under both local and general anaesthesia, and because these were un-

successful tonsillar herniation was considered. A further lumbar puncture was, however, successful, and hyalase was given intrathecally with the penicillin.

The fluid balance chart for the four days following the commencement of treatment for the meningitis showed a daily oral intake of fluid of 1,290 ml., 1,780 ml., 1,300 ml., and 1,250 ml. respectively. His renal output for the corresponding period was 250 ml., 120 ml. plus wet beds, 100 ml. plus wet beds, and on the fourth day wet beds only. There was no visible sweating. The child's pillows were, however, persistently saturated by the discharge of C.S.F. from the left ear.

Five days after admission, and in spite of increased and adequate intake of fluids, it was obvious that his dehydration was increasing. The child was now apathetic and anorexic, and had generalized muscular hypotonia. The blood pressure was 95/50. Inelasticity of the skin and soft eyeball tension were more exaggerated. Examination of the electrolytes showed: plasma N.P.N., 50 mg./100 ml.; plasma Na, 122 mEq/l.; plasma K, 4.1 mEq/l.; plasma Cl, 82 mEq/l.; plasma proteins, 20.5 mEq/l. Dehydration was therefore confirmed biochemically and a profound loss of Na and Cl demonstrated.

The loss of C.S.F. from the ear continued, and it was now apparent that surgical intervention would be necessary to seal the fistula. On the evening of the sixth day after admission the child was transferred to the neurosurgical unit at Frenchay Hospital. The next day left temporal craniotomy and exploration of the upper surface of the left petrous bone was performed (Mr. G. L. Alexander). No crack or leak was seen, and muscle was tacked in blindly beneath the dura below the petrous ridge. The wound was closed.

The first operation was unsuccessful, and Mr. Alexander carried out a second operation four days later. During the period between the two operations the child's fluid intake by mouth had continued to be excellent, and in addition 3 g. of extra salt was given daily.

At the second operation retromastoid exposure of the petrous bone was performed. A vertical crack was seen in the petrous bone, occupying most of its length and extending down to the jugular foramen. No fluid could be seen escaping, but a thin layer of extradural blood clot was organizing over the fracture. This might have obscured a small opening. A sheet of muscle was laid in an extradural position and the wound closed.

This procedure was a complete success. The C.S.F. otorrhoea ceased and all clinical signs of dehydration disappeared. Two days later antibiotic therapy was discontinued. Estimation of the blood electrolytes showed them to be entirely normal. Treatment of the fractured femur was continued, and eight weeks after admission the child was returned home, having made an excellent recovery. His C.S.F. then showed no abnormality.

Discussion

There is no doubt that the low sodium chloride in the blood of this patient was due to the copious loss of C.S.F. from the ear as a result of the fractured base of skull. Most fistulous fractures into the ear seal off spontaneously, and it is very rarely necessary for the surgeon to have to explore the posterior fossa in order to stop an aural leak (Alexander, 1958, personal communication).

Pneumococcal meningitis itself still carries a very high mortality in spite of modern antibiotic therapy (Pengelly, 1955). Electrolyte imbalance is a well-recognized complication of cerebral lesions, and if a condition of hyponatraemia and hypochloreaemia is met with during the course of a meningitis three possibilities usually present themselves.

Doxiadis *et al.* (1954) studied 19 children with tuberculous meningitis and came to the conclusion that a correlation was to be found between the abnormal electrolyte pattern and the occurrence of serious vomiting. In this case no vomiting

was encountered after the three hours during which the acute meningitis became clinically apparent, and hence this possibility is excluded.

Welt *et al.* (1952) discuss the salt-wasting syndrome which has been described in a group of patients with a variety of cerebral lesions (Peters *et al.*, 1950). The very nature of the cerebral disease, which was diffuse in each instance, defied any attempt to analyse the site of the responsible lesion. It would seem that hypothalamic involvement leads to renal tubular loss of sodium and chloride. These patients, however, responded favourably to the administration of salt; this was not so in the present case.

Adrenal apoplexy due to the Waterhouse-Friderichsen syndrome presents a typical fulminating picture; this was not seen during the evolution of the present case, and can undoubtedly be dismissed on clinical grounds alone.

The normal daily production of cerebrospinal fluid in a patient of this age is only 100–150 ml., but it has been shown that if artificial drainage is provided several litres a day may be produced (Best and Taylor, 1955). It is impossible to estimate the amount of C.S.F. lost by this child, but it must have been considerable. On one day alone, the child received 3,050 ml. of fluid plus additional salt orally and 925 ml. of normal saline intravenously. In spite of this, although the clinical evidence of dehydration became less marked, the blood electrolytes failed to return to normal. The low pressure of the cerebrospinal fluid is probably another indication of the seriousness of the leak. It was only after the fistula was sealed off surgically that the patient rapidly improved and the blood electrolytes returned to normal values.

Summary

A case is presented in which a child sustained a fracture of the base of the skull complicated by pneumococcal meningitis and a copious C.S.F. otorrhoea.

The loss of C.S.F. induced serious dehydration due to a "salt-losing" syndrome, and surgical intervention was necessary to close the fistula.

Our thanks are due to Professor A. V. Neale for much helpful criticism and advice. We are also grateful to Dr. J. E. Cates, Mr. G. L. Alexander, and Mr. A. L. Eyre-Brook, under whose united care the patient came during his stay in hospital, for permission to publish this case.

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"There appear to be two schools of thought as to the duty of hospitals towards the elderly. One is to try to provide little else than a permanent residence for as many as possible and the other is to consider each admission to be temporary unless or until continuous care is proved to be unavoidable. The former system will give permanent care only to the few who are admitted. These will be well looked after while a vast and increasing majority will continue in distress. The latter system, on the other hand, makes the hospital service available to a larger number of people because beds will become vacant by frequent discharges. It will be possible to give early treatment and care to those who need it when they need it and enable them to return to the community, which is surely a hospital's purpose."—Report to December 31, 1957, of Hospital Personal Aid Service for the Elderly (King Edward's Hospital Fund).

Medical Memoranda

Sensitivity to Penicillin in British Poliomyelitis Vaccine

This poliomyelitis vaccine contains a small amount of penicillin. In a recent reply to a question regarding the safety of giving it to a penicillin-sensitive person, it was stated, "To our knowledge no report has been made of any case of sensitization to the antibiotics" (*Brit. med. J.*, 1958, 1, 1555). In view of this reply, and the increasing use of the vaccine, the following report of a case may be of general interest.

CASE REPORT

An apparently healthy boy aged 12 was given an injection of 1 ml. of the British vaccine into the left upper arm. He had a history of sinus trouble, and was known to be sensitive to penicillin, having developed a generalized erythematous rash during treatment with the drug following a toe injury. There was no history of any other specific allergic disorder, and he had never had an attack of bronchospasm. In his family, two maternal aunts have skin disorders. One develops eczematous reactions when in contact with the metal of jewellery and suspenders. The other has urticarial reactions with no apparent specific cause.

The day after the injection I was called to see the boy. He complained of a severe frontal headache, and was lethargic, anorexic, and generally unwell. A few hours after the injection a sparse itchy rash had appeared on the trunk and limbs, with the rapid development of vesicles, especially on the right buttock and leg. He was afebrile, the chest was clear, and there were no abnormal signs referable to the central nervous system. Treatment with an antihistamine was begun with good results.

Three days after the injection, however, he complained of breathlessness and of a tight feeling across the chest. Bronchospasm was present, but was quickly abolished with an antispasmodic. Treatment with this and the antihistamine was continued. Six days after the injection a dose of the antihistamine was missed. He felt worse generally, and the bronchospasm returned, but settled when treatment was resumed.

Though the acute chest and skin symptoms and signs settled, the headache persisted, being severe at times and difficult to relieve. The general malaise also remained. He was therefore examined by Dr. J. P. Bound, consultant paediatrician, Victoria Hospital, Blackpool, who agreed, however, that there were no abnormal signs referable to the central nervous system.

After 10 days the persistent symptoms began to improve, and on the thirteenth day treatment was stopped, with no recurrence of them. He had been afebrile throughout. Eleven days after treatment ended (twenty-four days after the injection) the signs and symptoms of mumps appeared.

COMMENT

In view of the known sensitivity to penicillin in this case, and the absence of other precipitating factors, I think that the skin reaction must be considered as part of a sensitivity reaction to the small amount of penicillin in the vaccine. The bronchospasm may have been related. The precise origin of the severe headache must be conjectural.

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Treatment of Cardiac Arrest

Several articles on cardiac arrest have appeared in the medical press (*Brit. med. J.*, 1956; Briggs *et al.*, 1956; Milstein, 1956; O'Reilly and Ohlke, 1956; Wylie, 1956). These have stimulated us to consider afresh how our efficiency in dealing with this emergency can be improved. As Milstein (1956) has said, cardiac arrest is an emergency which may suddenly face any surgeon, anaesthetist, radiologist, or physician, and it is well that even the most junior member