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.

REFERENCES

- Best, C. H., and Taylor, N. B. (1955). *Physiological Basis of Medical Practice*, 6th ed. Baillière, London.
Doxiadis, S. A., Goldfinch, M. K., and Philpott, M. G. (1954). *Brit. med. J.*, 1, 1406.
Harris, P. (1957). *Arch. Dis. Childh.*, 32, 488.
Pengelly, C. D. R. (1955). *Brit. med. J.*, 1, 870.
Peters, J. P., Welt, L. G., Sims, E. A. H., Orloff, J., and Needham, J. (1950). *Trans. Ass. Amer. Physns.*, 63, 57.
Welt, L. G., Seldin, D. W., Nelson, W. P., German, W. J., and Peters, J. P. (1952). *A.M.A. Arch. Intern. Med.*, 90, 355.

"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.

A. FOWDEN, M.B., Ch.B.,
General Practitioner, Blackpool.

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

of the hospital staff should know what are the essential steps in initiating immediate and adequate cardiac massage. In a patient who is well oxygenated before cardiac arrest, the maximum time which can be allowed before the establishment of artificial circulation is three and a half minutes; if, as so often happens, hypoxia has been a contributing factor in causing the arrest, then the time limit before irreversible cerebral damage occurs is even shorter than this.

The steps necessary for establishing cardiac massage through a thoracotomy incision are unfamiliar to most general surgeons and other clinicians, and they very often

cardium must be incised. (5) Adequate cardiac massage produces a palpable peripheral pulse and a systolic pressure of 70–80 mm. Hg; therefore an assistant must check the blood pressure while massage is being continued. (6) The rate of massage depends chiefly on the speed with which the ventricles fill during diastole. (7) Electrical defibrillation should not be attempted by anyone who is not familiar with this procedure.

The chart has been divided into two sections in order to emphasize that the only treatment necessary *without delay* is the institution of *efficient cardiac massage*; once adequate

MANAGEMENT OF CARDIAC ARREST

DUTIES OF PERSONNEL

ANAESTHETIST	SURGEON	NURSE	ASSISTANT SURGEON	OTHERS
1. When carotid pulse cannot be felt or heart cannot be heard inform surgeon and ask assistant to record time. 2a. Stop all anaesthesia. 2b. Respirate patient with 100% oxygen. 2c. Tilt patient head down 15 degrees. 2d. Pass endotracheal tube as soon as possible. 3a. When cardiac massage is established check radial or carotid pulse. 3b. Check B.P.	1. When possible confirm presence or absence of pulsation in aorta. 2a. Open left chest in 4th interspace with transverse incision from sternal margin to mid-axillary line. 2b. Massage the heart.* 3. When adequate massage has been continued for 3 minutes, pause to see if contractions have returned; if not, follow col. 2 below.	1. As soon as absent pulse is reported bring emergency thoracotomy set. 2. Bring emergency tray of syringes and drugs.	1. Insert rib spreader and cut 1 or 2 adjacent cartilages for adequate exposure. 2. Stand by to relieve surgeon massaging the heart. 3. Start I.V. if no one else is available.	1. One person call out time at one minute intervals until adequate massage is established. 2. One person start I.V. and assist anaesthetist.

Possible situation existing after adequate Massage and Oxygenation

1. The heart resumes a normal beat

- Continue massage in rhythm with beat until contractions are vigorous and B.P. is maintained at 80 systolic.
- If contractions do not improve or if they become weaker give adrenaline 1:1,000 0.5–1 ml. into the cavity of the right ventricle.
- If the heart is contracting well but the B.P. remains low a noradrenaline (4 mg. in 500 ml. 5% glucose) drip should be started.
- Observe the heart for at least 30 minutes of adequate action before closing the chest.
- Close the chest with adequate haemostasis.

*CARDIAC MASSAGE

Adequate Cardiac Massage should produce a palpable peripheral pulse and should be carried out thus:

Grasp the heart with the whole hand, apply pressure with the palmar surfaces of the fingers and the thenar eminence. Do not use the finger-tips. If the heart is large use both hands. 80–90 contractions per minute is the most effective rate, but this may be difficult to maintain. The rate must be slow enough for the heart to fill during diastole, and the maximum rate possible may be only 50–60 per minute.

The cerebral and coronary circulations can be improved by occluding the aorta below the origin of the left subclavian artery. The clamp should be released every 20 minutes to allow circulation to the kidney.

2. The heart remains in arrest

- Open the pericardium.
- Observe the action of the ventricles for diagnosis.
- Observe the colour of the heart: if it is well oxygenated it will be a good pink colour.

A. The heart is in fibrillation

- Procaine 1% 2–10 ml. into cavity of right ventricle.
- Massage for 3 minutes awaiting action of procaine.
- If no result use electric defibrillator (one of the thoracic surgical unit or a senior anaesthetist will be responsible for this).
- If shock is ineffective (or defibrillator is not available) give adrenaline 1:1,000 0.5–1 ml. into cavity of right ventricle.
- If spontaneous beat returns follow col. 1.
- If heart is in asystole follow col. 2 B.

B. The heart is in asystole

- Continue adequate massage.
- Give CaCl 10% 5–10 ml. into cavity of right ventricle.
- If asystole persists and the heart is a good colour, give adrenaline 1:1,000 0.5–1 ml.
- If heart beat returns follow col. 1.
- If asystole persists continue massage up to two hours or until the heart fails to fill in diastole.

hesitate too long before embarking upon what seems to them a very drastic procedure. Even when the chest has been opened and the heart exposed there is much uncertainty about the correct way to massage the heart, and valuable time may be wasted injecting drugs which can do more harm than good at this stage. It has therefore seemed good to us to follow the example of Nowill and Hobler (1956), who have reported their chart on "The Management of Cardiac Arrest."

After consultation with the surgeons and their assistants who may need the help of such instructions we have modified the chart to include only the information that is immediately necessary, first, to establish adequate cardiac massage, and, secondly, to re-establish spontaneous cardiac action.

We have stressed the importance of the following points:

- (1) The thoracotomy incision must be large enough to allow good exposure of the heart.
- (2) Because of the danger of rupture of the ventricles the finger-tips must not be used to massage the heart; if the heart is compressed between the thenar eminence and the palmar surfaces of the fingers this danger is avoided.
- (3) Drugs must not be given until adequate massage has been continued for at least three minutes and until the type of arrest has been diagnosed.
- (4) This diagnosis cannot be made until the pericardium has been opened; therefore, if the heart does not start contracting within three minutes of the onset of massage the peri-

culation has been established there is time to consider the next steps that may be necessary to restore spontaneous action. A sterile emergency thoracotomy set is always ready in every operating suite of our hospital and is available also for the x-ray rooms in which the cardiac and neurological diagnostic procedures are carried out, since these adjoin the main operating theatres.

The chart is hung in every scrub-room in a position where it can be studied by surgeons, nurses, and anaesthetists whenever they wash their hands, and a copy is given to each new resident together with further information that will enlarge upon some of the points given in the chart.

No doubt many hospitals have a similar routine worked out already, but, since we have seen no reference to such a chart in the British medical literature, we think that publication of our chart may be of value.

NORMAN S. MACPHERSON, F.R.C.S.,

Department of Surgery,

GWENDA M. LEWIS, F.F.A. R.C.S.,

Department of Anaesthetics,

Christian Medical College and Hospital, Vellore, South India.

REFERENCES

- Briggs, B. D., Sheldon, D. B., and Beecher, H. K. (1956). *J. Amer. med. Ass.*, 160, 1439.
Brit. med. J., 1956, 2, 1165.
 Milstein, B. B. (1956). *Ann. roy. Coll. Surg. Engl.*, 19, 69.
 Nowill, W. K., and Hobler, R. E. (1956). *Anesthesiology*, 17, 624.
 O'Reilly, K. S., and Ohlke, R. F. (1956). *Canad. med. Ass. J.*, 75, 202.
 Wyllie, W. D. (1956). *Brit. J. Anaesth.*, 28, 551.