FLUID AND ELECTROLYTE BALANCE FOLLOWING CRANIOTOMY*

BURTON L. WISE, M.D.

Department of Neurological Surgery, University of California School of Medicine, and
Neurosurgical Service, Fort Miley Veterans Administration Hospital,
San Francisco, California

(Received for publication November 10, 1955)

Metabolic balance studies, such as those performed by Moore and his co-workers,21 have clarified the aberrations of fluid and electrolyte metabolism that occur during and following surgical procedures. The data thus obtained provided a rational basis for fluid and electrolyte administration during the operative and postoperative periods.

There are at least two important reasons for such investigations in patients with intracranial lesions. First, the electrolyte content of intravenous fluids, and possibly of body fluids, affects the cerebrospinal fluid pressure in animals12,20,33 and in man.3 Secondly, lesions in certain areas of the brain are associated with unusual abnormalities of electrolyte metabolism, e.g., "cerebral salt wasting"24,32 and hypernatremia and hyperchloremia.1,2,8,17,28

In this paper, the results of metabolic balance studies in 2 patients following craniotomy and in 1 patient after ventriculography will be presented and studies in 5 other patients following craniotomy will be mentioned. In addition, 2 instances of marked hyponatremia which occurred after the removal of pituitary tumors will be described.

METHODS

The oral intake data were estimated from standard tables.4 (Moore and Ball21 stated that in their studies calculated intake data were close to the values obtained by analysis of the diet.) Sodium and potassium in urine and serum were measured on a Baird flame photometer with lithium as the internal standard.

The other determinations include 24-hour urinary excretion of nitrogen,13 17-ketosteroids4 and free corticoids,26 the concentration of eosinophils in peripheral blood,27 and the serum chloride concentration29 and carbon dioxide combining power.23

In Cases 1 and 2, in which balance data were fairly complete, the charting has been done according to the method of Moore and Ball.21 The intake is charted upward from the base line, the output downward from the intake line. The difference is the net balance, which, if positive, is cross-lined above

* Supported in part by funds from Institutional Research Grant No. 43-F from the American Cancer Society.
the base line, if negative, is colored black below the base line. Thus, the intake, output, and net balance are visible at a glance. The other charts are explained in the legends.

CASE REPORTS

Case 1. A 12-year-old boy entered the University of California Hospital on Nov. 26, 1954. In September 1946 and again in March 1947, the patient had undergone

resection of a cystic cerebellar astrocytoma, followed by postoperative radiation therapy. He remained well from 1947 to October 1953, when occasional morning vomiting appeared. Subsequently, intermittent headaches, fatigability and ataxic gait developed.

On admission the significant clinical findings were underaction of the left lower face, a left extensor toe response (Babinski), and a tendency to fall to the left.

On Dec. 5, 1954 suboccipital craniectomy was performed, and a cerebellar astrocytoma extending into the cisterna magna was partially removed.

Except for hyperthermia, which persisted for several weeks, the patient’s postoperative course was uneventful.

---

**Figure 1.** Case 1. From above downward: body temperature (°C.), nitrogen balance, potassium balance, sodium balance, and serum sodium concentration. The preoperative levels of serum electrolyte concentrations, urinary steroid excretion and serum protein are listed on the right side of the chart. The manner of depicting the balance data is described in the text under "Methods."