The Analysis of Body Water Compartments in Postoperative Craniotomy Patients
Part 3: The Effects of Dexamethasone*

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In a previous communication the effects of craniotomy upon the body water compartments of patients with intracranial mass lesions were reported.\(^{17}\) There was a loss of body weight and a decrease in total body water on the first postoperative day principally due to decrease of extracellular water and plasma volume. The weight loss was regained on the second postoperative day with a general expansion of all body water spaces to well above the preoperative level, especially in the extracellular compartment period, despite body weight continuing to decrease, total body water returned to, but not less than, its preoperative level, thus maintaining its relative expansion.

The study was repeated with the use of an osmotic diuretic (Mannitol) administered immediately preoperatively.\(^{18}\) The principal differences from the untreated group occurred on the second postoperative day. The Mannitol-treated patients continued to lose weight and all body water compartments were contracted, contrary to the expansion noted on this day in untreated patients.

The use of exogenous glucocorticoids to minimize cerebral edema in the postoperative period of brain tumor surgery has been widely advocated. For this reason we have studied the effects of dexamethasone upon the postoperative water metabolism of nine patients undergoing craniotomy for brain tumor.

Methods

The age, sex, weight, type of tumor, and its location in each patient is given in Table 1. None of the patients was in acute distress preoperatively and each was anesthetized with intravenous sodium pentothal and succinylcholine, intubated, and maintained with fluothane-oxygen mixture. All patients did well postoperatively without any complications with the exception of Case 23 who suddenly developed a hemiplegia on the sixth postoperative day and in whom reoperation revealed cerebral edema but no hemorrhage. The patient survived the removal of more gliomatous tissue. Determinations of the fluid content of body water compartments, plasma and urinary electrolyte contents, and osmolarity were made in the immediate preoperative period. All patients were started on dexamethasone, 10 mg intravenously, at the time of surgery and were then maintained on dexamethasone, 4 mg every 4 hours, during the postoperative period under study. The preoperative studies were then repeated twice in each patient, once during the early postoperative period (1st or 2nd postoperative day) and again in the late postoperative period (6th or 7th postoperative day).

The laboratory methods were isotopic dilution techniques described by Moore\(^{15}\) for total body water (TBW), Walser, et al.,\(^{23}\) for extracellular water (ECW), and Silver\(^{19}\) for plasma volume (PV). Electrolytes were determined with a Coleman flame photometer and osmolality was determined with a Fiske osmometer (freezing point depression).

The study was carried out in a fasting state on all patients in the exact manner as described previously\(^{17}\) and the volume of each body water compartment was similarly calculated.

The patients were maintained on the routine hospital diet preoperatively with fluids generally restricted, and on the operative day total fluids, given intravenously, averaged 2 liters, the estimated blood loss being replaced and the difference given as 5% glu-
cose in water. On the first postoperative day the cooperative patients received 1000 mg of 5% glucose in water and 500 to 1000 ml of the routine hospital liquid diet. On the second postoperative day the patients were placed on a full liquid diet and then a soft-to-regular diet on succeeding days. The objective was to keep the total fluid intake to between 1500 and 2000 ml daily, by nasogastric tube if necessary.

**Results**

**Body Weight and Water Compartments.** On the first postoperative day all four of the patients studied lost weight. The weight loss averaged 5% of the initial weight or 3.4 kg. The range of values recorded for the body water spaces are noted in Table 2 and average changes (in percentages of preoperative values) are recorded in Table 3. Total body water showed no consistent change: three patients showed an increase in total body water and one patient lost body water, averaging a gain of 4%. The total plasma volume also showed no consistent change. Three patients had distinctly increased plasma volume but the marked fall of plasma volume in the fourth patient studied on this day reduced the average to a gain of only 1%. The extracellular water (ECW) showed a decrease in two patients and an increase in two patients. On this first postoperative day, the preceding changes in general paralleled those found in the untreated and Mannitol-treated series. Loss of body weight, however, was more marked in the steroid-prepared group, even double that of the other series (Fig. 1). This appears not to be due to loss of TBW which, if anything, tended to increase slightly in dexamethasone-treated patients in contrast to a distinct decrease in the untreated patients on this day. The ECW decreased on the average, similar to untreated or Mannitol-treated patients, but the decrease was not at all as consistent and therefore not really comparable to the tendency of this space to decrease in these other series on this day. Three of the four patients on dexamethasone showed increased plasma volume in contrast to this compartment shrinking in untreated patients on this first day.

On the second postoperative day the patients treated with dexamethasone all had reduced body weights, averaging a 3% decrease but this was a 2% increase from the severe loss recorded on the first postoperative day. By contrast, on the second day the untreated patients had all regained the weight loss of the first postoperative day (Fig. 1). As noted in Table 2, there was an increase in the total body water in four of five patients treated with dexamethasone, averaging 3% above the preoperative level. Total

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**TABLE 1**

*Age and sex of patients, nature of intracranial lesion and change in postoperative weight*

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Age, Sex</th>
<th>Nature of Lesion</th>
<th>Preop. Weight (kg)</th>
<th>Postoperative Weight (% of Preop.)</th>
</tr>
</thead>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Op. 1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>21</td>
<td>71 M</td>
<td>glioblastoma, left temporal</td>
<td>75.6</td>
<td>98 91</td>
</tr>
<tr>
<td>22</td>
<td>61 M</td>
<td>glioblastoma, right fronto-parietal</td>
<td>48.0</td>
<td>97 96</td>
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<tr>
<td>23</td>
<td>42 M</td>
<td>glioblastoma, right fronto-parietal</td>
<td>84.0</td>
<td>95</td>
</tr>
<tr>
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<td>60 M</td>
<td>glioblastoma, left temporal</td>
<td>48.3</td>
<td>96 97</td>
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<tr>
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<td>71 F</td>
<td>metastatic carcinoma, left temporo-parietal</td>
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<td>98 99</td>
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<tr>
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<td>meningioma, right temporal</td>
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<td>98</td>
</tr>
<tr>
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<td>glioblastoma, left temporal</td>
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<td>85 83</td>
</tr>
<tr>
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<td>astrocytoma, right temporal</td>
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<td>99 95</td>
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<tr>
<td>Average</td>
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<td></td>
<td>63.2</td>
<td>95 97 96 93</td>
</tr>
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