--Preliminary Note--

Diffuse cerebral swelling

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By means of computerized tomography (CT) diffuse cerebral swelling has been shown to exist in the early stages of severe acute head injury4-5. But, to our knowledge, it has not been intensively studied in blunt head trauma. The purpose of this study is to elucidate the clinical features, pathogenesis and outcome of the patients with diffuse cerebral swelling occurring in the case of blunt head trauma.

During the period of 5 years (April, 1977–March, 1982) 288 patients with severe head injuries rated 8 or less on Glasgow Coma Scale had been examined by CT within 24 hours after incurring the trauma. These examinations were performed at Department of Neurosurgery and Critical Care Medicine of Nippon Medical School, Sendagi, Tokyo, Japan. In 45 cases of these patients, occurred diffuse cerebral swelling which caused compression or obliteration of the lateral and third ventricles, as well as of the perimesencephalic cistern. Besides the initial CT which was done using an EMI CT 1010 scanner with a 160×160 matrix, the authors performed contrast enhanced CT carried out by intravenous injection of 50 ml of meglumine amidotrizoate (65% Angiografin®) in adults or of 1 ml/kg weight of the same medium in children9 and serial CT scanning7. The patients' states on admission were graded according to Glasgow Coma Scale5 and clinical results at the time of 3 months after the trauma were graded according to the Glasgow Outcome Scale9.

These patients ranged in age from one to 70 years old, the mean being 23.5 years; 31 were male and 14 female. The majority of the cases were under 30 years of age, most being approximately 20 years old. All the patients showed the Glasgow Coma Scale score of 8 or less (8 : 1 case, 7 : 2 cases, 6 : 10 cases, 5 : 7 cases, 4 : 12 cases, 3 : 13 cases) at the time of admission. There were 32 patients (71%) with a Glasgow Coma Scale score of 5 or less (showing the primary brain stem injury clinically7). Most patients with diffuse cerebral swelling were examined by CT within 2 hours after trauma, the earliest being 40 minutes after the injury. This indicates that diffuse cerebral swelling can rapidly develop after the injury. In 22 (49%) of the 45 patients the initial CT showed the occurrence of other pathological changes. The most frequently occurring was subarachnoid hemorrhage (13 cases). There were also intraventricular hemorrhage (6 cases), scattered small hemorrhages in the deep white matter, corpus callosum and brain stem (6 cases) and

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pneumocephalus (5 cases). The initial CT findings of the patients showing diffuse cerebral swelling were classified into three types: (1) Pure type; demonstrating no other extraparenchymal and/or parenchymal lesions except cerebral swelling. (2) Extraparenchymal type; indicating subarachnoid hemorrhage and/or acute primary intraventricular hemorrhage as well as cerebral swelling. (3) Parenchymal type; showing very small focal scattered hemorrhagic lesions without focal mass effect in corpus callosum, basal ganglia and brain stem regions with or without extraparenchymal lesions as well as cerebral swelling.

There were 21 cases of Pure type, 16 cases of Extraparenchymal type and 8 cases of Parenchymal type. The relationship between the initial CT findings and outcome was shown in Table 1. In the Pure type, 10 (47.5%) out of 21 cases showed good recovery or moderate disability, and mortality rate of this type was 42.9%. In the Extraparenchymal type, only 3 (20%) out of 16 cases indicated good recovery or moderate disability, and mortality rate of this type was 75%. In the Parenchymal type, 8 cases showed neither good recovery nor moderate disability, 3 cases demonstrated persistent vegetative state and 5 cases expired.

The authors performed contrast enhancement in 40 out of 45 cases of acute head injury patients showing diffuse cerebral swelling. Remarkable enhancement of the bilateral cortical sulci and/or sylvian fissures was observed in 90% of the patients. Serial CT scans were performed in 22 out of the 45 patients. Common findings on the serial CT scans were decreased density collection in the subdural space such as subdural effusions or chronic subdural hematomas (12 cases) and ventricular dilatation such as hydrocephalus or cerebral atrophy (6 cases). There were some cases showing the so-called "delayed traumatic intracerebral hematomas" (4 cases), delayed appearance of intraventricular hemorrhage (2 cases) and remarkable cerebral edema of the hemisphere (2 cases).

Post mortem examinations were carried out in 3 of the 19 fatal cases. They showed evidence of diffuse damages in the white matter, as well as hemorrhagic lesions in the hypothalamic, hippocampal and midbrain regions.

The outcome of the patients with diffuse cerebral swelling is shown in Table 2. Thirteen cases were in good recovery and/or persistent vegetative state, 26 cases expired. Six of 13 cases demonstrating in good outcomes were children.

Widespread use of CT in the diagnosis and management of patients with acute severe head injury have ascertained the existence of diffuse cerebral swelling in a very early stage after the trauma. Such evidence has been found commonly in the young patients,
Table 2 Glasgow Coma Scale (GCS) on admission and outcome

<table>
<thead>
<tr>
<th>GCS</th>
<th>Gr/MD</th>
<th>SD/Veg</th>
<th>Dead</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1 (0)</td>
<td>12 (3)</td>
<td>13 (3)**</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2 (2)</td>
<td>4 (2)</td>
<td>6 (1)</td>
<td>12 (5)</td>
</tr>
<tr>
<td>5</td>
<td>4 (2)</td>
<td>3 (3)</td>
<td>7 (5)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>4 (3)</td>
<td>3 (0)</td>
<td>3 (1)</td>
<td>10 (4)</td>
</tr>
<tr>
<td>7</td>
<td>2 (2)</td>
<td></td>
<td>2 (2)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1 (1)</td>
<td></td>
<td>1 (1)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>14 (10)</td>
<td>7 (2)</td>
<td>24 (8)</td>
<td>45 (20)</td>
</tr>
</tbody>
</table>

* GR : good recovery, MD : moderate disability, SD : severe disability, Veg : vegetative, ** ( ) : No. of children

especially in children as shown in this series\(^1\)\(^-\)\(^9\).

As for the CT findings of diffuse cerebral swelling, the authors classified them into 3 types (Table 1). CT findings in Pure type and Extraparenchymal type are similar to those in "acute general cerebral swelling" described by Zimmerman and his colleagues\(^9\). But in these types, there are many cases showing bad outcomes in opposition to the Zimmerman’s results. Especially in extraparenchymal type, their outcomes were very poor. On the other hand, CT findings in Parenchymal type seem to be identical with those in “shearing injuries of the cerebral white matter” reported by Zimmerman and his colleagues\(^9\). None of the patients in this type showed good recovery.

Since the enhancement patterns are similar to those in the acute phase of Reye’s syndrome\(^10\) or in other disorders with pathologic cerebral vasodilatation and hyperperfusion\(^10\), the authors believe that one of the pathogenic mechanisms producing diffuse cerebral swelling might be vasodilatation and/or cerebral hyperperfusion. Zimmerman and his colleagues\(^6\) measured cerebral blood flow in 4 patients with diffuse cerebral swelling by the technique of Orbist (1975) utilizing the intravenous injection of \(^{133}\)Xenon. They found that the mean cerebral blood flow was significantly elevated.

In conclusion, it can be stated that diffuse cerebral swelling are categorized into 3 types ; one of the pathogenic factors of it might be vasodilatation and hyperperfusion ; the children exhibiting diffuse cerebral swelling have relatively good outcome.

References


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