INTRACRANIAL HEMATOMAS ASSOCIATED WITH PENETRATING WOUNDS OF THE BRAIN*

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This presentation is a study of a consecutive series of 316 penetrating wounds of the brain with particular reference to the occurrence of intracranial hematomas. The data were made available through the concerted effort of the Medical Officers who were for varying lengths of time associated with an Army Mobile Neurosurgical Unit in Korea. This unit was attached to a Mobile Army Surgical Hospital, the most forward medical institution offering major surgical facilities. The period represented is from October 13, 1951 through October 31, 1952. The report is composed entirely of cases in which operation was performed.

By way of definition, any compound wound with entry into the cranial vault and laceration of the meninges, regardless of the severity or extent of cerebral destruction, is considered as a penetrating wound of the brain. This is intended as a broad classification, embracing the through-and-through wounds and other such descriptive terms as tangential wounds of the brain. The conventional and generally accepted terms are used in the classification of the hematomas. The subcortical or intracerebral hematomas in this series refer, in general, to hematomas of the missile canal resulting from laceration of vascular radicles in the path of the missile. When a hematoma was found to occupy the ventricular cavity, out of particular interest, this was classified as an intraventricular hematoma. Direct visualization of the hematoma was the criterion for this diagnosis and in all instances the penetration traversed the ventricular system.

It should be stated that an effort was made to differentiate between a hematoma and a few small clots. It is admittedly difficult to conceive that a missile could penetrate the cerebral substance without provoking some small amount of hemorrhage. Of assistance was the impression gained at operation as to the actual degree of space occupancy. As a rule following sufficient exposure, the hematoma forcefully extruded from its confines. On the contrary, with avulsive wounds of the head and brain occasionally large hematomas were found; however, they were not confined and therefore were not considered as intracranial hematomas in this series. A confined hematoma in excess of 20 cc. was felt to be of clinical significance and was used as a criterion for the diagnosis of hematoma.

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HEMATOMAS WITH PENETRATING WOUNDS OF BRAIN

ANALYSIS OF CASES

Type of Missile. In 286 of the 316 cases the injuries were the result of shell fragments. Shell fragments include fragments from mortars, mines, grenades or artillery shell. There were 18 instances in which the offending missile was the result of small arms fire. In the remaining cases the injuries were the result of blasting mishaps or the exact agent causing the injury was unknown. The actual size varied from a few millimeters in diameter to several centimeters. In the instances of tangential or glancing wounds, frequently there were no intracranial metallic fragments, the indriven cranial bone fragments being accountable for the cerebral penetration.

Site of Injury. In 260 cases of the series (82 per cent), the primary involvement was limited to one cerebral lobe, not taking into consideration involvement below the cortical level. In 44 cases, more than one lobe was involved in the primary injury. This latter group comprised principally the

<table>
<thead>
<tr>
<th>Site of Hematoma</th>
<th>No. of Hematomas</th>
<th>Incidence (% of series)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epidural</td>
<td>13</td>
<td>3%</td>
</tr>
<tr>
<td>Subdural</td>
<td>77</td>
<td>21%</td>
</tr>
<tr>
<td>Intracerebral</td>
<td>87</td>
<td>23%</td>
</tr>
<tr>
<td>Intraventricular</td>
<td>2</td>
<td>0.2%</td>
</tr>
</tbody>
</table>

glancing or tangential, the avulsive, and more extensive type of wound. There were 10 cases in the series in which there were two distinct penetrating wounds, and there were 2 instances in which three distinct penetrating wounds were found.

Of some interest was the location of these wounds. There were 149 penetrating wounds that primarily involved the frontal lobes; 94 involved the parietal lobes; 75 involved the temporal lobes; 25 involved the occipital lobes; and 12 primarily involved the cerebellum. In this series, there seems to be a slight predilection for the left-sided injuries. Fifty-one per cent of the wounds primarily involved the left hemisphere, whereas 39 per cent primarily involved the right hemisphere. Four per cent involved the cerebellum and 6 per cent of the injuries were of a midline nature thus producing bilateral primary involvement.

Incidence of Hematomas (Table 1). Of the 316 cases of penetrating wounds, 146 (46.2 per cent) were complicated with confined intracranial hematomas. Thirty-five of these patients presented more than one anatomically significant hematoma at operation. It was noted that the subdural and intracerebral hematomas were frequently associated. Thirty-one of the 35 patients who were found at operation to have more than one anatomically significant hematoma presented an intracerebral as well as a subdural hematoma.