A syndrome characteristic of tangential bullet wounds of the vertex of the skull

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Six patients with tangential missile wounds of the vertex of the skull presented symptoms of limb paresis which were more marked proximally in the arms and distally in the legs where there was also sensory loss of a cortical type. Carotid cerebral angiography and operative treatment showed patency of the longitudinal sinus and injury to the medial aspects of the frontoparietal cortex. The term “longitudinal sinus syndrome” formerly applied to these cases is therefore a misnomer since the main underlying cause is cortical injury and not thrombotic occlusion of the superior longitudinal sinus, as previously suspected.

Key Words: bullet wound • missile injury • brain injury • cerebral angiography • war wound • tangential skull injury • cerebral venous sinuses • Nigeria

During the recent civil war in Nigeria six patients were admitted to the Neurosurgery Unit of the University College Hospital, Ibadan, Nigeria, with missile wounds of the vertex of the skull. All of the patients had a tangential type of injury with or without fractures. Neurologically they showed limb paresis, which was more marked proximally in the arms and more prominent distally in the legs where a cortical form of sensory impairment was noted. At operation, mild to moderate degrees of cortical damage of the superomedial aspect of the frontoparietal areas of the brain were encountered. In no case was there evidence, radiological or operative, of occlusion of the longitudinal sinus. These various manifestations were so typical of this particular category of missile head injury that they constituted a definite pattern. This report describes this clinical entity and discusses the mechanism responsible for its occurrence.

Clinical Material

The six patients were all young men in their twenties. After neurological evaluation, they all had routine skull radiographs (anteroposterior, posteroanterior, and lateral views) and under local anesthesia, five of them underwent percutaneous cerebral carotid angiographic study with a 60% solution of urografin (Fig. 1). All patients had an operative debridement of their wounds under general anesthesia. The relevant details of the case histories of the six patients are summarized in Table 1.

Clinical Characteristics

Two types of scalp lesions found in tangential missile wounds are the gutter laceration and the through-and-through wound. The gutter laceration in these patients varied in length from 6 to 9 cm.

The mental state and cranial nerves of the
patients were normal. No instance of papilledema was encountered. Typically, the arm paraparesis was worse in the shoulders and elbows, and the leg paraparesis in the knees and especially the ankles. When seen soon after wounding the paralyzed limbs were initially flaccid and rigid; later they became spastic. The sensory loss was cortical in nature, suggesting a lesion on the superomedial aspect of the cerebral hemisphere. At operation the dura was routinely opened in search of any intracranial lesion.

Preoperatively, little neurological improvement was noted in these patients. In Case 1 and to a lesser extent in Case 2, there was marked and immediate clinical improvement postoperatively, which went on to complete recovery within a fortnight in Case 1. A typical case history is reported below.

Case 2

This 29-year-old Nigerian soldier was shot on top of the head while wearing a jungle hat. He suffered a post-traumatic amnesia of several minutes. When he regained consciousness, he discovered that he could not walk because of heaviness and weakness of his legs, the left more so than the right. Forty-eight hours after being wounded, he developed generalized headaches. He had no convulsion or urinary disturbance.

Examination. The patient was seen at the University College Hospital, Ibadan, 3 days after being shot. He was fully conscious, and correctly oriented, with a dirty 8 cm gutter laceration across the vertex, more to the right of the midline. His speech, cranial nerves, and arms were neurologically normal, and the spine showed no external evidence of injury. There was spastic paresis of the legs, more marked on the left. The left foot was plantar-flexed and inverted, while the right appeared normal. There was profound bilateral weakness of the ankles and toes. He was able to flex the right hip and knee much better than the left. Vibration sense was impaired below the level of the anterior superior iliac spines, again more so on the left side, and joint position sense was absent at the big toes and ankles. The tendon reflexes in the legs were exaggerated, especially on the left, and there were bilateral extensor plantar responses.

The skull radiograph showed a midline depressed fracture which was more extensive on the right than the left (Fig. 2). Carotid angiography done later showed no occlusion of the superior sagittal sinus.

Operation. The depressed fracture fragments were removed. These were found to be compressing the outer dural layer of the superior sagittal sinus as well as the contiguous medial aspects of both cerebral hemispheres, the right more so than the left. The dura was intact; when the part of it under the depressed skull fracture fragment over the right hemisphere was opened, no hema-
Tangential bullet wounds of the skull

TABLE 1
Summary of six cases of tangential missile wounds of the skull vertex

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Wounds of Vertex</th>
<th>Neurological Deficits</th>
<th>Radiological Findings</th>
<th>Operative Findings and Surgical Treatment</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>gutter scalp laceration</td>
<td>paraparesis</td>
<td>(1) depressed fracture of the inner table</td>
<td>depressed bone fragment removed; intact bruised dura; longitudinal sinus intact; contusion frontoparietal cortex</td>
<td>complete recovery in 2 weeks</td>
</tr>
<tr>
<td>2</td>
<td>gutter scalp laceration</td>
<td>paraparesis</td>
<td>(1) depressed fracture (2) patent longitudinal sinus</td>
<td>removal of depressed bone fragment; intact dura and longitudinal sinus; contusion of cortex under bone fragment</td>
<td>almost complete recovery in 4 weeks</td>
</tr>
<tr>
<td>3</td>
<td>gutter scalp laceration</td>
<td>paraparesis</td>
<td>(1) no fracture (2) normal angiogram, no vascular obstruction</td>
<td>intact dura; superficial necrosis of parietal cortex</td>
<td>almost complete recovery in 6 weeks; minimal right foot drop</td>
</tr>
<tr>
<td>4</td>
<td>gutter scalp laceration</td>
<td>paraparesis, right arm weakness</td>
<td>(1) no fracture (2) normal angiogram, good filling of longitudinal sinus</td>
<td>intact dura; congested cortex immediately under wound</td>
<td>almost complete recovery in 6 weeks; minimal right foot drop</td>
</tr>
<tr>
<td>5</td>
<td>through-and-through scalp wound</td>
<td>paraparesis, right arm weakness, sphincter disturbance</td>
<td>(1) depressed fracture and superficially indriven bone fragment (2) patent longitudinal sinus but constricted in middle third</td>
<td>lacerated dura; removal of bone fragment from lacerated paracentral lobe; absence of thrombotic occlusion of longitudinal sinus which bled freely and briskly</td>
<td>gradual but slow recovery for 3 months; lost to follow-up</td>
</tr>
<tr>
<td>6</td>
<td>gutter scalp laceration</td>
<td>quadripareisis worse in legs, sphincter disturbance</td>
<td>(1) depressed fracture, indriven bone fragment in left parasagittal area (2) patent longitudinal sinus constricted in middle third</td>
<td>lacerated dura; removal of the indriven spicule of bone with surrounding hematoma from the left parietal cortex</td>
<td>slow recovery; now on crutches</td>
</tr>
</tbody>
</table>

toma was encountered. There was no breach in the surface continuity of the cerebral cortex that was exposed; rather, the gyri were flattened and the cortex definitely contused.

Postoperative Course. There was practically complete recovery of power in the legs after 4 weeks; the left leg remained slightly weaker.

Discussion

The clinical features observed in our patients were similar to those noted by Holmes and Sargent in patients with tangential missile wounds of the vertex. They attributed the symptoms and signs, however, mainly to thrombosis of the longitudinal sinus and its associated lateral lacunae with consequent venous stagnation over the cerebral cortex. Hence they used the term "longitudinal sinus syndrome." They did not operate on many of their patients, and they gave no autopsy findings in most of those who died. Since many of their cases remained unverified at operation or by autopsy, the role of thrombotic occlusion of the longitudinal sinus in causing this syndrome could only have been incompletely assessed. What was more, they themselves admitted difficulty in distinguishing between the effects of direct cortical contusion and those of sinus blockage.

In our study we have demonstrated the
absence of sinus occlusion by carotid angiography and at operation. Further, the absence of papilledema in all our cases indicates that generalized intracranial hypertension had not occurred.

In the light of these findings, the term “longitudinal sinus syndrome” seems a misnomer that cannot be applied to all instances of the symptom-complex that follows tangential missile wounds of the vertex of the skull.

It now appears that injury to the cerebral cortex of the medial aspects of the frontoparietal region of the brain is the dominant factor in the evolution of this syndrome. Cushing, Jefferson, and Saviozzi were convinced that the so-called longitudinal sinus syndrome could supervene in the absence of thrombosis of the sinus, and they suggested bilateral injury to the motor cortex; more recently Northfield thought that the syndrome was explicable primarily on the basis of bilateral frontoparietal decortication from contusion rather than congestion of the lateral venous lacunae and superior cerebral veins following occlusion of the longitudinal sinus. In our cases the cortical injury was due to extrinsic pressure (Cases 1 and 2), contusion with or without surgically demonstrable superficial necrosis of the imme-
diately subjacent brain (Cases 3 and 4), or the more severe disruption in the form of laceration of the brain by indriven bone fragments with concomitant compression by re-
sultant intracerebral hematoma (Cases 5 and 6).

Holmes and Sargent advised against operative interference since most of their pa-
tients gradually improved. In our experience, a conservative approach seemed justified in Cases 3 and 4 where there was neither a de-
pressed segment of the skull nor indriven bone fragments and spontaneous though slow recovery was occurring. In the presence of a depressed fracture as in our Cases 1 and 2, or indriven bone fragments as in Cases 5 and 6, we believe operative treatment should be undertaken, not only to relieve the extrinsic pressure and enhance rapid clinical re-
covery but also to remove a potential source of intracranial infection and prevent post-
traumatic convulsive seizures.

Summary

We have described six cases of a syn-
drome characteristic of tangential missile
wounds of the vertex of the skull. The typi-
cal clinical features have been summarized,
and from available evidence at angiography
and at operation, we have concluded that
cortical injury of the medial aspects of the frontoparietal region of the brain, and not
thrombotic occlusion of the longitudinal si-


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