COMPOUND INJURIES OF THE SPINAL CORD*

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The prognosis for the return of function following injuries to the spinal cord has been exceedingly poor. Following World War I it was advocated that compound injuries of the spinal cord resulting in complete immediate loss of sensation and motor power below the segment involved be treated conservatively. If the cord had been directly injured by the missile, it was held that surgery would be of no benefit, and merely debridement of the external wound was advised.

The Medical Research Council of Great Britain,3 in a review of World War I spinal cord injuries, found it simpler to state the contraindications for laminectomy. The only indication for laminectomy was an incomplete lesion with progressive increasing signs of functional loss. They advocated early, but not immediate surgery, stressing a wait of 2 to 6 weeks after the injury or until the spinal shock had ended. The Council did not feel that the initial injury was increased by the presence of a foreign body or indriven bone in the cord. One of the primary contraindications put forth against surgery was the presence of a physiologically complete transverse lesion of 48 hours' duration. In this group of cases the prognosis was said to be hopeless and no interference indicated. Yet it was also stated that in the so-called state of spinal shock there may be no evidence of recovery for days or weeks.

This was the confusion existing when we began to care for compound spinal injuries in World War II. We found the x-ray to be very misleading, and anatomically the degree of damage was far more extensive than the x-ray would indicate. Only gross deformities and severe fractures could be seen on x-ray examination. Indriven bone fragments could not be visualized. Since the most important single factor that came out of this war in the surgical treatment of war wounds and prevention of infection was wound excision and not circumcision, we decided to apply the same principles in compound spinal injuries as those used in other wounds. The only possible way to do an adequate debridement is by a formal laminectomy. Moreover, the presence of foreign bodies or indriven bone in the spinal cord does set up a series of pathological changes. These changes are similar to those produced by the presence of foreign material in the brain. Hassin1 reported the cellular reaction following the experimental insertion of cotton in the dog brain. He found lymphocytes, plasma cells, fibroblasts and giant cells. The

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foreign body is surrounded by fibroblasts and these large giant cells. Lichtenstein and Kirshbaum² found a similar reaction to a foreign body in the spinal cord. They report the changes found in an infant’s spinal cord, the foreign material being hair. Here also fibroblasts and giant cells were the predominant features with the addition of dense masses of collagenous connective tissue.

It is felt that the removal of irratant foreign material prevents the development of the above reactions. In addition, the laminectomy allows for repair of the dural defect and the reestablishment of normal circulation in and about the cord. Thus in this seemingly hopeless series of cases an attempt would be made to allow for the maximum return of function of any remaining viable spinal cord structures.

### TABLE 1

**Compound spinal injuries in this series**

<table>
<thead>
<tr>
<th></th>
<th>Immediate Incomplete Paralysis</th>
<th>Immediate Complete Paralysis</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of cases</td>
<td>3</td>
<td>19</td>
<td>22</td>
</tr>
<tr>
<td>Infections</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Improved</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Deaths</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Twenty-two compound spinal injuries were operated upon in this series. Table 1 shows that there was only one death.

The death was that of a 25-year-old Mexican soldier who had a large shell fragment in the spinal canal at the level of C-6. It measured 2×1 inches and was corkscrew in shape. When seen the patient’s condition was very poor, his blood pressure was unobtainable, and he was cold and clammy, but conscious. He had evidence of a complete lesion at the level of C-6. He was given 3 units of plasma and 1,500 cc. of whole blood. The blood pressure came up to 78 systolic, but no diastolic could be obtained. He remained in this condition for approximately 4 hours, and, since there was no improvement, it was decided to do a laminectomy. The operation revealed that the entire cord had been severed by this large foreign body in the canal. He remained cold and clammy with a blood pressure which rarely went over 70, and he expired on the 3rd postoperative day.

Table 1 shows further that there were no postoperative infections. The patients who had an incomplete lesion on admission did very well postoperatively, with function returning rapidly. Of those with a complete lesion, two showed remarkable return of function, and are being reported here.

**Case 1.** This soldier, age 23, had been wounded on September 27 at 1115 hr. by fragments from a high explosive shell. The force of the explosion threw him to the ground; however, there was no loss of consciousness. He was immediately aware of complete numbness from the waist down, inability to move his legs, difficulty in moving his arms, and numbness along the ulnar distributions of both arms. He was seen at 0800 hr., September 28, 21 hrs. after the injury. He was conscious and there was no evidence of shock. At that time there was evidence of a complete transverse lesion at C-7, loss of sensation in all modalities, and a flaccid paraplegia. There was weakness in hand grasp bilaterally and in extension of both forearms. The biceps reflex could be obtained, but was diminished. No reflexes were obtain-