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Spine and Spinal Cord War Injuries during the War in Croatia

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Patients and Methods

From August 1991 to December 1995, during the war in southern Croatia, 96 patients with war spine and spinal cord injuries (mostly penetrating) were treated at the Department of Neurosurgery, Clinical Hospital Split. This hospital was the main evacuation hospital for the area of southern Croatia as well as for a great part of neighboring Bosnia and Herzegovina. After triage (these patients formed the group that did not warrant priority for evacuation from the battlefield), at the first level of care (the aid station and its associated ambulatory care clearing station) and the next level of care (the mobile surgical hospital or field hospital), the patients required transfer by ambulance vehicle or helicopter to the evacuation hospital. Upon arrival, the patients were treated and stabilized in the emergency room.

Antibiotic (penicillin, gentamycin, metronidazole), antitetanic (tetanus toxioid), and antiedematous (corticosteroid bolus) therapies were administered. Foley catheters were inserted and multidisciplinary management was continued.

All patients underwent plain radiography of the involved regions as well as computed tomography, if indicated. Myelography or computed tomographic myelography was performed when there was evidence of cerebrospinal fluid leaking from the wound to locate the site of the dural tear and when progressive neurologic deficit was suspected.

Of the 96 patients, 86 of them (90%) were soldiers and the remaining 10 were civilians (4 women and 6 men). The mean age of the wounded soldiers was 28.3 years (range, 17–61 years), and the mean age of the injured civilians was 38.8 years (range, 15–59 years).

The majority of the patients arrived within 24 hours from the time of injury (range, 1 hour to 15 days). Associated injuries to other organs and systems occurred in 50 patients (52.0%). The patients were separated into two clinical groups according to spinal cord deficit. Deficits were considered “complete” if total loss of function existed and “incomplete” if any function remained below the level of injury.

Our indications (criteria) for surgical intervention were incomplete spinal cord deficit, progressive neurologic deficit, presence of an active cerebrospinal fluid fistula and a grossly contaminated wound, and injuries to the cauda equina.

All other patients were treated conservatively (without laminectomy). Physiotherapy and psychosocial rehabilitation were started as soon as possible for all patients. After completion of the neurosurgical treatment, patients continued their rehabilitation in specialized centers.

Results

War injuries of the spine and spinal cord according to year are shown in Figure 1. War injuries according to the spinal segments are shown in Figure 2. The mechanisms of injury are shown in Figure 3.
Different radiological findings in wounded persons with spine and spinal cord injuries are shown in Table I. Various complications that appeared during hospitalization are shown in Table II.

Of the 96 patients, 27 (28%) were treated surgically, i.e., underwent bilateral laminectomy at the level of the injury. Removal of intraspinal missiles or bone fragments was performed only in cases of compression of the neurologic structures. For 6 patients who were treated surgically because of spinal instability (22.2%), stabilization procedures were performed 2 to 3 months later. All other patients (N = 69, 72%) were treated conservatively. During hospitalization (average length, 17 days; range, 14–93 days), 4 patients (4.2%) died.

Discussion

In this study, we present our experiences in the treatment of patients with spine and spinal cord injuries in the region of southern Croatia. Despite the experiences by different authors, the optimal management of missile wounds of the spine remains controversial and unclear. With each patient we were faced with the dilemma of whether to begin surgical treatment or use a conservative approach. However, surgical management was restricted compared with similar series of spinal injuries in civilians.

According to North Atlantic Treaty Organization doctrine (which was accepted by the Croatian Army Medical Service), indications for the surgical treatment of spin injuries are progressive neurologic deficit and spinal instability. Injuries that cause complete neurologic deficit below the level of injury do not indicate surgery.13

During the Vietnam War, U.S. Army neurosurgical policy dictated obligatory laminectomy for all patients with spinal wounds. Furthermore, during the Korean conflict, Wannamaker advocated early laminectomy for all penetrating spinal injuries affecting the cervical cord.14

During the war in Croatia in a few hospitals in the capital city of Zagreb, all patients with neurologic deficit underwent surgical decompression and spinal canal revision to relieve the compression of the spinal cord. Those procedures created conditions for preservation and activation of the remaining intact portion of the spinal cord.15-18 It is noteworthy that these were mainly selected patients already triaged at other hospitals, and not wounded persons direct from the site of injury. We followed the advice of those authors who advocate more conservative treatment of war spinal injuries.19-22

Our results are in agreement with those of Yashon et al.,23 who concluded that the final outcome in these patients is closely correlated with the initial neurologic status rather than with surgery and that the performance of a laminectomy does not seem to influence the outcome. We agree with Hammoud et al.,24 who wrote: “Laminectomy for treating penetrating missile cord injuries has no significant advantage in terms of neurologic outcome.”

It is interesting that our results are almost identical with those of Rukovanjski,25 who described the experience of treating war spinal injuries that occurred in eastern Croatia and were treated in Osijek Clinical Hospital (the main evacuation hospital in the war zone of eastern Croatia).

Conclusion

Our data suggest that a more conservative approach, rather than laminectomy and removal of fragments from the spinal column, is indicated in the treatment of war spinal column injuries.
canal, yields good results. Surgical treatment should be reserved for patients with leaking spinal fluid, progressive neurologic deficit, spinal instability, and root pain. Modern imaging techniques in diagnostic facilities (computed tomography, computed tomographic myelography), appropriate anatomic diagnosis, and treatment with broad-spectrum antibiotics significantly decrease the likelihood of infection; therefore, the metal and bone fragments need not be removed.

References
