A Combination of Quadriparesis in Cervical Spine Injury with Open Humerus Fracture: A Unique Situation and a Review of the Current Concepts of Damage Control Principles in Spine Trauma

Shailesh Hadgaonkar, Kunal C Shah, Chetan Pradhan, Vibhu Krishnan, Ashok Shyam, Parag Sancheti

ABSTRACT

Cervical spine fractures are devastating spinal injuries, which typically occur following settings involving high velocity trauma situations, especially in polytrauma patients. The current article describes a patient, who had a significant, grade IIIB open injury to the arm, accompanying cervical spine injury. The case report describes a 27 years old gentleman, who had suffered from quadriparesis following cervical spine injury with open humerus fracture (grade IIIB). The intricacies of managing such devastating polytrauma, damage control protocol and guidelines, which may be followed during the management of such unique situations have been elaborated and discussed. The ideal protocols and guidelines of damage control philosophy in combined spine injuries with neurological deficit and open extremity fractures are still in the process of evolution and the management steps which may be followed, need to be tapered in accordance with the individual circumstances. The present case may provide a good platform for understanding these issues and explicate the vitality of appropriate, timely management.

Keywords: Cervical spine injury, Damage control orthopedics, Open limb fracture, Quadriparesis.

INTRODUCTION

Cervical spine fractures are annihilating spinal injuries, which typically occur following settings involving high velocity trauma situations, especially in polytrauma patients. These injuries are relatively rare, with a reported incidence of approximately 19-88/100,000. However, the significance of these injuries can never be understated, owing to the high mortality and morbidity rates associated with them and the potentially devastating consequences in circumstances, where an early diagnosis of these injuries might be missed. Due to the complexities involved in the management of such fractures, especially when associated with other grave injuries, there may be challenging circumstances confronted by a spine surgeon, when encountering such traumata.

The current article describes a patient, who had a significant, grade IIIB open injury to the arm, accompanying cervical spine injury. The intricacies of managing such devastating polytrauma, damage control protocol and guidelines, which may be followed during the management of such unique situations have been elaborated and discussed.

CASE REPORT

A 27-year-old gentleman, who was a dental surgeon by profession, was referred to our hospital following initial resuscitation elsewhere, approximately 24 hours after sustaining a high velocity motor vehicle accident. His vitals were stable at admission, with a GCS of 15/15. He had a crush injury to his right arm (Fig. 1) and had profound weakness in his limbs (with a motor power of 2/5 in his
C6-T1 myotomes in his upper limbs and 0/5 in his lower limbs. He was diagnosed to have suffered from a grade IIIB right humerus fracture (Fig. 2) along with a suspected cervical spine injury.

The patient was given tetanus and antibiotic prophylaxis as soon as the patient was received at the emergency department. After thorough irrigation and wound dressing for his arm injury at the emergency, his roentgenograms were performed immediately, followed by MRI of the cervical spine. He was found to have sustained a burst fracture of 5th cervical vertebra, with retropulsed fragments within the spinal canal compressing upon the cord (Figs 3 to 5).

This was a unique situation, as the patient had sustained two major injuries, both of which had to be emergently managed and capable of causing apocalyptic consequences, if not dealt with appropriately. We were faced with the dilemma of the choosing the ideal way of managing such situations, on whether both the injuries had to be managed at the same sitting or as staged procedures; which surgery had to be performed first, whether any specific precautions or steps need to be taken as a
damage control strategy and how to proceed with the postoperative rehabilitation.

We had a co-ordinated multi-departmental approach planned for the patient, with the trauma specialists, plastic surgeons and the spine surgeons simultaneously operating upon the patient at the same stage. The patient was given general anesthesia with endotracheal intubation under fiberoptic guidance. With the spine adequately immobilized, the arm injury was addressed first. Thorough debridement of all the contaminated and devitalized tissues was performed, followed by generous irrigation of the wound. The plan to go ahead with internal fixation using locking compression plate was taken, followed by appropriate soft tissue closure and skin graft harvested from the ipsilateral thigh over the large humeral defect (performed by a plastic surgeon).

The spine injury was then taken care of with corpectomy of the C5 vertebra, followed by interbody fusion with mesh cage and anterior cervical plating (Figs 6 and 7). The entire procedure was uneventful and the patient was managed during the immediate postoperative period in the intensive care set-up. The patient recuperated well postoperatively and underwent gradual mobilization and graded rehabilitation. He had a significant improvement in motor power in all his limbs after surgery and had a satisfactorily improved, final range of motion of the afflicted upper limb too. He had regained a motor power of 5/5 in all limbs in a period of 3 months and started his dental surgery practice after 4 months postoperatively (Fig. 8). At 2 years, his humerus plate was also removed and all the injuries had healed satisfactorily well (Figs 9 and 10).

DISCUSSION

Over the last two decades, the principle of damage control surgery which was initially developed for unstable abdominal injuries has been increasingly acknowledged and applied to virtually every surgical specialty globally. This concept has recently been further extended to severely injured, polytrauma patients with associated
increased risk of detecting cervical injuries in certain specific injury patterns such as, fall from height or concomitant severe head or pelvic traumata. The rate of undetected cervical injuries has been reported to range up to 20% by various authors and the criticality of early recognition of underlying cervical spine injuries in acute trauma management cannot be understated.3,9

In acute trauma, a cervical spine injury must be considered until definitively excluded and cervical spine immobilization should be a part of primary survey. The latest guidelines, however no longer recommend a conventional routine lateral cervical spine X-ray in all polytraumatized patients. The algorithm purported by Georgen, by combining the NEXUS low-risk criteria (posterior midline tenderness, GCS < 15, intoxications, focal neurological deficits and distracting injuries elsewhere in the body) and the Hanson’s high risk criteria (high velocity motor vehicle accident or fall from height > 3 m, significant closed head injury, intracranial hemorrhage on CCT, neurological symptoms or signs referred to cervical spine, pelvic fractures or multiple fractures to the extremity). Unconscious patients or those patients who qualify for the high risk criteria need to undergo spiral CT with 2D or 3D reconstruction during the secondary survey.6-8,10

The optimal timing and the surgical plan in such situations of concomitant polytrauma and spine injuries has been controversial. The role of the second hit imparted by the activation of immune apparatus secondary to any major iatrogenic intervention has been the very basis for recent recommendations in favor of damage control surgery in place of earlier concept of ‘Early total care’. However, in multiply injured patients, especially with coexisting thoracic and abdominal injuries, early surgical stabilization within the initial 24 hours has been proven to reduce the length of hospital stay and pulmonary compromise in acute trauma. Furthermore, persisting, unstable spine fractures may augment inflammatory processes due to secondary tissue damage and related pain stimuli. The primary aim in such situations must be to assess the roles of early surgical requirements with spinal decompression and stabilization; as well as hold down any avoidable secondary inflammatory stresses associated with these procedures during such intensive phases of treatment.6-8,11-13

The management of patients with polytrauma with cervical spine fracture, in patients with gross hemodynamic instability involves initial adequate fluid resuscitation, followed by explorative interventions and surgical repairs of the bleeding organs in case of failed response to fluid management. There, the sustenance of life and resuscitation takes priority over the spinal injury. The management in hemodynamically stable patients is more
lucid and early surgical intervention within 24 hours is especially indicated for the spine injury in any of the following situations: neurological deficits (incomplete or progressive paresis, significant spinal canal compromise with imminent cord injury, instability and open spine injuries). The criteria for instability as described by White and Punjabi includes 3.5 mm sagittal displacement, kyphosis of > 11º, enlarged disk space of > 2 mm and > 50% subluxation of facet joints bilaterally. In the subaxial spines, the types A3, B and C fractures, as described by Magerl et al are biomechanically unstable and require early stabilization.2,3,11-14

There is currently no role of pharmacological agents in neuroprotection in patients with polytrauma and steroids are especially contraindicated in multiply injured patients and open spine injuries. Open fractures of the limbs are an emergency and they are managed with the general principles involving, immediate debridement during the ‘golden hour’ under cover of broad spectrum antibiotics (including cephalosporins, aminoglycosides with crystalline penicillin/other antibiotics with anaerobic coverage in cases of severe contamination). Addition doses of tetanus immunoprophylaxis must be administered as required. Early coverage of skin and soft tissues after extensive debridement greatly aids in preventing infection of the wound and the mode of stabilization (internal or external fixation) may also be decided, depending upon the grade of the open injury as well as the degree of contamination.2,3

In our patient, we followed a multi-departmental approach involving the trauma surgeon, plastic surgeon and spine surgeon. Since the patient was hemodynamically stable and both the humeral and spine injuries deserved to be emergently managed, the patient was planned for single staged procedure involving definitive stabilization. The spine injury involved burst type fracture (Magerl A3) which could be managed with anterior corpectomy in supine position. Since the humerus can be stabilized in the same position, we planned to debride and stabilize the open humeral fracture first. If the extremity fracture needs to be stabilized in an alternate position, spine surgery may be performed first, so that the patient may be safely positioned. The patients should be informed of the raised possibility of spine infections in these scenarios. As aforementioned, steroids are entirely contraindicated in these circumstances.

Polytrauma management in association with spine fractures (especially with an involved open injury) has been one of the most controversial and dubious topics in spine surgery. The ideal protocols and guidelines of damage control philosophy are still in the process of evolution and the management steps which may be followed, need to be tapered in accordance with the individual circumstances. The present case may provide a good platform for understanding these issues and explicate the vitality of appropriate, timely management.

REFERENCES

5. Greenberg MI. Falls from heights. JACEP 1978;7(8):300-301.