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Case report Open Access

Pentaplegia and Facial Bone Fracture: A Survivable Injury

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Abstract

Pentaplegia is a spinal cord injury at or above C4 level, resulting in complete loss of motor functions below the injury level and paralysis of respiratory muscles. Facial injuries might be a factor for early identification of these patients and in implying prompt management. Here, we report a patient who was injured in a motor vehicle accident and sustained facial injury and cardiopulmonary symptoms. His imaging studies showed atlanto-axial dissociation and maxillary fracture. He survived the accident but continued to have pentaplegia. Presence of facial fractures might help in suspicion and early identification of such injuries, where prompt management remains essential for survival in complete pentaplegia and for avoiding deterioration in incomplete injuries.

Keywords: Atlanto-axial dislocation; Cervical spinal cord injury; Facial fracture; Pentaplegia

Introduction

Pentaplegia is defined as cervical spinal cord injury (CSI) above C4 level which results in complete paralysis of upper and lower extremities (tetraplegia) in addition to respiratory muscle paralysis. Head and neck movements might be preserved to a very limited degree as per level of facial muscle involvement; however, chest and diaphragmatic muscles are paralyzed and a ventilator is necessary for breathing [1].

Most spinal cord injuries, including cervical, are caused by trauma to the vertebral column, hence affecting the spinal cord. Any fracture-dislocation at axis or atlas levels is usually fatal, mostly diagnosed post-mortem [2]. Here, we present a case of pentaplegia, which survived, after traumatic atlanto-axial dissociation associated with maxillary fracture, and discuss the correlation between facial fracture and CSI, its early diagnosis and management practices.

Case Study

A 25 year-old male involved in motor-vehicle-accident was found by rescue team at the site of accident to have evident facial injury in addition to apnea and bradycardia. Immobilization of cervical spine, endotracheal intubation and mechanical ventilation was performed immediately. Then, the patient was transferred to emergency room where X-rays (Figure 1) and CT evaluation (Figure 2) showed complex atlanto-axial injury with C1-C2 dissociation in addition to superior maxillary fracture (Figure 3). There was no brain injury. Neurological exam revealed complete pentaplegia. The patient underwent C1-C2 posterior fixation (Figure 4). Three-year post-surgery, the patient is still alive in a special care unit requiring ventilator.

Discussion

Traumatic cervical dislocation is usually caused by severe deceleration injury; where strong shearing and rotational forces damages the spinal ligaments. It is usually fatal because of secondary neurologic and vascular insults [1].

Emergency medical service personnel should assume spinal cord injury when faced with any trauma patient. Clinical criteria, usually used as a guide for the need of spinal immobilization, are: altered consciousness, neurologic abnormality, evidence of intoxication, pain or tenderness over the spine area, distracting painful injury, and/or significant trauma [3]. However, even in the absence of above mentioned factors, spine immobilization should be applied until lateral cervical spine X-ray is negative [4].

The American College of Surgeons suggests high risk of CSI with injuries above the clavicle level [5]; others do not agree with this correlation [6]. We reviewed the medical literature using cervical spine injury, face trauma and related terminologies for such correlation studies and found ten relevant studies (Table 1). The CSI incidence associated with facial trauma ranged from 2% to above 10%. Some studies introduced Glasgow Coma Scores (GCS) in facial trauma patients, which enhanced the correlation between facial trauma and CSI [6]. Two recent studies on millions of trauma patients reported CSI incidence in 6.7% of facial fractures [7], 4.9-8% in isolated facial fracture and 7-10.8% in multiple facial fractures [8].

Since CSI is difficult to identify in the field but other injuries encountered in similar incidents like craniofacial fractures are readily identified [1], assertion of such correlation may contribute to decrease in the percentage of missed diagnoses.

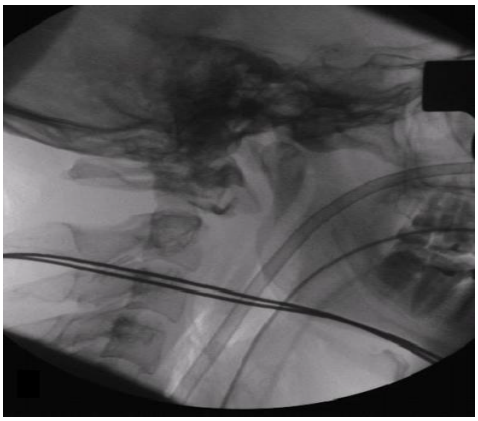

Figure 1: Pre-operative X-ray shows atlanto-axial dissociation.

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Figure 2: (A) Lateral and (B) Postero-anterior 3D reconstruction CT-scan showing gross C1-C2 dissociation.

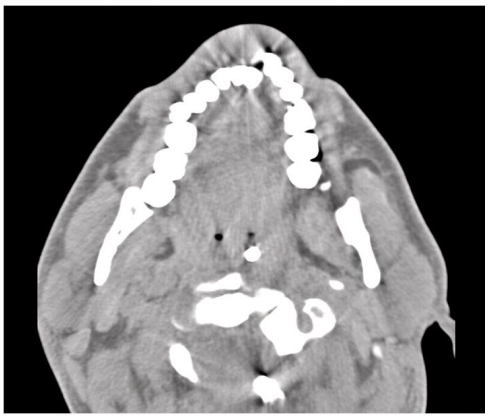

Figure 3: Axial CT-scan showing maxillary fracture.

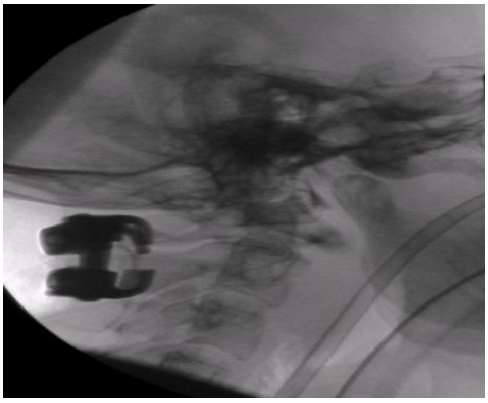

Figure 4: Post-operative lateral view of cervical spine showing dissociation-reduction with fixation.

Diagnosis of atlanto-axial dissociation, if present, is usually not clinically obvious and the physician should have high index of suspicion with patients arriving with facial injuries, breathing difficulties, neurological deficits or with symptoms of neurogenic shock such as hypotension and bradycardia. An early diagnosis of atlanto-axial dissociation through radiography and CT-scan imaging will prevent delay in treatment and any further injury.

Preliminary treatment starts on site, by securing ABCs and immobilizing the patient. Various immobilization techniques exist with no comparative study to identify the optimal approach [9]; nonetheless, stabilization decreases mortality rate and complete spinal cord lesion from 55% to 39% [10].

The most prognostic factors to be monitored in such patients are cardiac, hemodynamic, and respiratory parameters. To prevent reduced perfusion to the spinal cord, hypotension should be corrected promptly and mean-arterial-pressure maintained above 85-90 mmHg in the first week which correlates with better long-term neurological outcome [11]. Continuous breathing assessment should be performed because delayed swelling or hematoma formation might obstruct the airway, even if respiratory distress was not present from the beginning.

Also, there are some currently controversial treatment modalities, which aim at early neuroprotection and/or minimizing secondary injury like steroid injection and hypothermia. Clinical studies indicated that methylprednisolone administration within 8 hours post-injury might be able to improve neurological and functional outcomes [12]. Additionally, recent animal studies and patient reports indicated the role of moderate intravascular hypothermia (33°C for 48 hours) in improving patient status by at least one ASIA level [13-17].

Displaced spine injuries should be reduced and alignment maintained either by surgery or orthotics. Emergency surgery is not part of the standard early treatment for patients with complete tetraplegic or pentaplegic; however, once patient is stable and medically cleared to undergo surgery, open reduction and internal fixation is in-order. Emergency surgical decompression is required in case of incomplete neurological injury with evidence of neural compression by diagnostic imaging. Recent studies shows less neurological deficit (ASIA D as compared to ASIA C) with early decompression (within 24 hours) for non-traumatic acute central cord injury patients [18]. However, decompression surgery timing and outcome is still a controversial issue in traumatic injuries.

Conclusion

Complete high CSI are becoming more survivable due to increased awareness among health care personnel on early identification and advancement in management to prevent further injury. An important red flag for upper CSI is respiratory distress, and facial fracture is another hint of CSI. Prompt recognition of such injuries is extremely important because these might be incomplete or survivable cases. Unfortunately, our patient did not recover any of his functions, but he survived a lethal injury.

Reference	Facial injury patients	% of CSI patients
Lewis et al. [19]	84 facial fractures	30.95% had high level CSI
Haug et al. [20]	563 patients with facial fractures (mandibular fracture 91%)	1.24% had high level CSI
Williams et al. [6]	676 patients with facial injury	4.2% had CSI
Hills et al. [21]	700 facial injury with AIS ≥2 (285 facial injury with AIS=3 or 4)	2% had CSI (2.8% had CSI)
Roccia et al. [5]	2482 patients with maxillofacial trauma	0.85% had amyelic cervical spine fractures
Elahi et al. [22]	3356 patients with craniomaxillofacial fractures	3.69% had CSI and increased to 8.86% with multiple facial fractures
Mithani et al. [23]	4786 patients with maxillofacial fractures	9.63% had CSI
Mulligan et al. [7]	117417 facial fractures	6.7% had CSI and increased to 7.8% with combined facial fracture and head injury
Mulligan et al. [8]	148478 facial fractures	4.9-8.0% had CSI for different single facial fractures and 7.0-10.8% had CSI with two or more facial fractures

Table 1: Studies correlating cervical spinal injury with facial injuries, were identified in PubMed and EMBASE medical literature databases.

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