

**UPPER THORACIC SPINE (D2-D3) FRACTURE-DISLOCATION WITHOUT SPINAL CORD INJURY:
A CASE REPORT**

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ABSTRACT

Fracture dislocations of the thoracic spine are extremely rare and when it occurs, it is considered the most unstable of spinal injuries and is almost always associated with injury to the spinal cord due to narrow spinal canal dimensions. Very few neurologically intact cases of thoracic spine fracture dislocation have been reported in the literature, which are mostly around the dorsolumbar junction and none in the upper thoracic spine. Here, we report a case of 44-years-old man who was in a road traffic accident and diagnosed with fracture dislocation of D2 over D3 vertebra with no neurological deficit. Patient was treated with posterior spinal stabilization, reduction, and D2 laminectomy. Patient remained neurologically intact post operatively. Here, we discuss the significance of this injury and the neural sparing mechanism of posterior neural arch disruption (bilateral pedicle fracture and lamina fracture), which preserves the spinal canal and the spinal cord from being damaged. We also discuss the usefulness of computed tomography scan and magnetic resonance imaging in these injuries and the surgical approaches used in treating them.

Keywords: Fracture dislocation, Surgical approaches, Thoracic spine.

INTRODUCTION

Dislocations or fracture dislocations are common in the cervical spine owing to its ability to allow movements in all directions and then followed by the lumbar spine, which also allows a considerable degree of movement. Dislocations are relatively very rare in the thoracic spine or at least in the upper thoracic spine (literature has reported several cases of fracture-dislocation in the dorsolumbar junction). This is primarily due to the restraining effect of the ribs that do not permit movement in the dorsal spine and the orientation of the facet joints. When they occur, the incidence of spinal cord injury is as high as 80% due to the narrow spinal canal dimensions [1]. The magnitude of the injury is of very high velocity to overcome these restraining factors and dislocate the facet joints. When patients with these injuries present in the Emergency room, ordinary radiographs are not sufficient to understand and study the pattern of injury thus requiring computed tomography (CT) and magnetic resonance imaging (MRI) [2].

CASE REPORT

A 44-years-old male was brought to the ER with a history of road traffic accident while travelling in a car that collided with a truck. Patient did not remember the exact mechanism of injury; he had sustained a high-velocity injury, which was evidenced by multiple injuries in the radiographs. He was diagnosed with a proximal humerus fracture of right shoulder and a distal radius fracture of the left wrist. Patient complained of pain in the upper back, there was tenderness and deformity in the upper dorsal spine. A complete neurological examination was done and found to be normal, Grade E in the ASIA impairment scale. Plain radiographs of the spine were taken and were not adequate to study the injury. CT scan and MRI of the spine was taken, which revealed a complete dislocation of D2 vertebra over D3 vertebra, fracture of anterior column of D2 vertebra and fracture of posterior elements of D3 vertebra (pedicle fracture and lamina fracture) were noted. In the coronal sections, a little bit of lateral translation was also noted. The spinal cord seemed to be normal without any injury on the MRI.

Patient was taken up for surgery 2 days after the injury, where all the fractures were fixed. In supine position first the distal radius fracture was fixed, and then the proximal humerus fracture of the right

shoulder, then the patient was put in prone position and posterior spinal stabilization with pedicle screws from D1 to D5 (staggering long segment) with decompression at D2 lamina and reduction done. Intra operatively, it was noted that there was bilateral pedicle fracture and lamina fracture at D3 vertebra, which must have widened the thoracic spinal canal.

Postoperatively, the patient remained in Grade E of the ASIA impairment scale and was mobilized with a spinal brace on the second post-operative day and subsequently made to walk. The post-operative radiographs were satisfactory, and patient was advised to wear the spinal brace for 3 months.

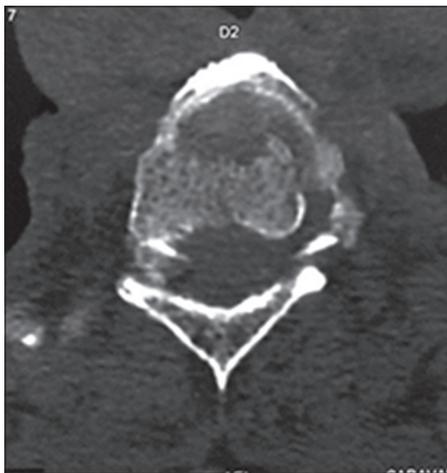
DISCUSSION

The thoracic spine has inherent stability due to factors such as ribs, facet orientation, anterior and posterior longitudinal ligament, ligamentum flavum and the posterior ligament complex (PLC). A considerably high velocity injury is required to disrupt all three columns and dislocate the facet, and in doing so usually results in paraplegia. The incidence of paraplegia was reported as high as 80% due to thoracic spine fracture dislocation as reported by Shapiro *et al.* [1]. In a study by Roaf [3] on the mechanics of spinal injury, quotes that only hyperflexion or hyperextension is not sufficient to dislocate the facets, whereas an associated shear or rotational force is required to rupture the disc, longitudinal ligaments and the PLC to produce a dislocation. As per the Denis [4,5] three column model of spinal stability, a dislocation is the most unstable spinal injury. An associated fracture of the body is due to an added axial compressive force on the spine.

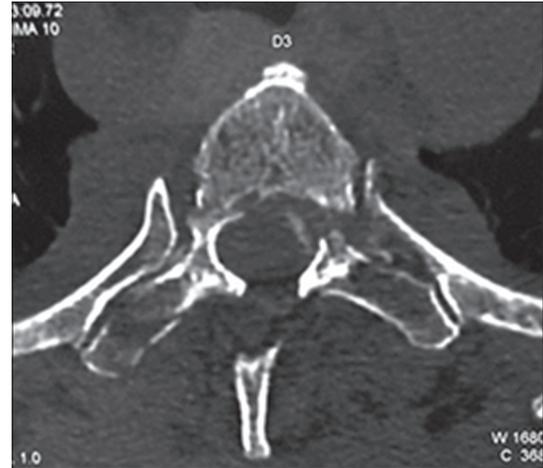
Plain radiographs of the spine were found to be inadequate as mentioned earlier, especially the site of injury being the upper dorsal spine. In a study by Sixta *et al.* [2] it was concluded that CT is the screening modality of choice and criterion standard for thoracolumbar spinal injuries. MRI was more specific and sensitive than CT and plain radiographs because it can pick up extra axial lesions (disc herniations, epidural hematoma) and superior soft tissue detail (spinal cord, ligamentum flavum, longitudinal ligaments and PLC), as described by Provenzale [6]. In our experience, we find both CT and MRI useful while planning the surgery, with MRI being necessary when patient has a neurological deficit.



AQ4 Fig. 1: Computed tomography image with fracture dislocation of D2 vertebra over D3 vertebra



AQ4 Fig. 2: Axial computed tomography image of fractured and dislocated D2 vertebra



AQ4 Fig. 3: Axial computed tomography image at D3 vertebra with posterior (pedicle) neural arch fracture



AQ4 Fig. 4: Sagittal magnetic resonance imaging image of D2-D3 fracture dislocation with no injury to the spinal cord

In these injuries, the high incidence of paraplegia is due to the narrow thoracic spinal canal for the spinal cord to pass. In a study by Lee *et al.* [7] on the anatomy of the thoracic spinal canal it was observed that, the posterior dura-spinal cord distance was greatest at the middle thoracic spine than the upper and lower thoracic spine (T1-4.7 mm, T6-9.5 mm and T12-3.7 mm respectively). However, our patient was ASIA Grade E while he came to the hospital with an injury of this magnitude, and the reason why there was no injury to the spinal cord was probably due to the bilateral pedicle and lamina fracture at D3, which widened the spinal canal for the cord to remain uninjured. Bohler [8] in 1943 described a similar injury where the body was allowed to dislocate with fracture of the neural arch posteriorly resulting in no injury to the spinal cord. He called it "saving fracture of the neural arch" and differentiated it from dislocations where the neural arch was intact thus resulting in very high incidence of paraplegia. Shapiro *et al.* [1] in his paper quotes

that there are only an 11 cases reported in the literature of dorsal spine dislocation with no neurological deficit. Liljenqvist *et al.* [9] in his paper has reported 14 cases of thoracic fracture dislocation without neurological deficit. The reason behind very few cases being reported without neurological injury in the thoracic spine is because, injuries with rotational or translational force in spite of associated posterior neural arch disruption results in transection of the spinal cord most of the times.

In our case we did a posterior spinal stabilization and laminectomy at D2 and did not plan for a staged anterior surgery, as there was no severe comminution of the body. Some papers suggest a combined anterior and posterior surgery and some only anterior reconstruction of the column by thoracotomy. In a case report by Gitelman *et al.* [10] on traumatic thoracic spondyloptosis, it was observed that a single



AQ4 Fig. 5: Post-operative radiograph with posterior spinal implants *in situ*



AQ4 Fig. 6: The post-operative lateral radiograph where the dislocation is reduced with posterior spinal implants *in-situ* and also proximal humerus implants seen

stage posterior stabilization and *in situ* fusion of the fractured level was sufficient, and there was no progression of kyphosis. However, if there is progression of kyphosis during follow up the patient will require an anterior surgery with the corpectomy for the column to be reconstructed. In an article by Obeid *et al.* [11] three cases of fracture dislocation with complete transection of spinal cord in the dorsal spine were reported, where complete vertebrectomy and spine shortening was done. Post-operatively satisfactory coronal and sagittal plane alignment was achieved, as reported by the author. However, there is

no literature available on complete vertebrectomy and spine shortening being performed on neurologically intact patients.

CONCLUSION

Upper thoracic spine dislocations are very rare and in patients with this injury the spinal cord is always injured due to the narrow spinal canal dimensions, unless there is an associated posterior neural arch disruption which widens the spinal canal dimensions like in our case report. A significantly very high velocity injury is required to produce a dislocation in the thoracic spine. When there is clinical suspicion of this injury, the best imaging modality would be CT scans and MR imaging to study the injury pattern and to devise a surgical plan. The most important aspect of the surgery is to preserve the neurological integrity. As for the approach for surgery it can vary from patient to patient depending on the nature, severity of injury and hemodynamic stability of the patient, such as a thoracotomy cannot be performed on a patient with compromised lung functions and many a times patients with dorsal spine fractures have multiple rib fractures with hemopneumothorax. With the pedicle screws and instrumentation available today most of the cases can be approached from posterior to achieve a reduction and stable fixation of these injuries.

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