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A variant of Jefferson like fracture at C7 vertebrae without any sensory deficit in a traumatic sub-axial cervical spondylolisthesis

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ABSTRACT

The management of cervical sub axial spondylolisthesis is a challenging task for all spinal care specialists because there is a lack of literature on the disease's diverse clinical presentations. Sub axial spondylolisthesis is a freak injury with a wide range of clinical manifestations. Particularly decision-making concerning the monitoring of such patients is difficult in a secondary trauma centre. The spinal column is a dynamic system that protects nervous innervation throughout the body while also enabling the head and neck to move freely. Spinal cord fractures are a major cause of mobility and mortality in trauma patients and a skeletal fracture is linked to 56% of cervical spinal cord traumas. Cervical spines fractures are classified based on the degree involved and are traditionally divided into three groups: C1, C2 and sub-axial spine (C3 to C7). Severe spinal cord injury and quadriplegia are commonly associated with trauma-related high-grade spondylolisthesis in the sub axial cervical spine. In rare circumstances, such pathology has resulted in minimal to no neurological deficits. We present a case of 45-year-old male presented with alleged history of fall from bike and is associated with history of injury over neck and over head with no other significant clinical complaints.

Keywords: Sub axial spine, Spondylolisthesis, Jefferson fracture, Neurological deficits

1. INTRODUCTION

In addition to injury groups such as compressive flexion, tensile and flexural extension and distractive flexion and furthermore, when a patient sustains a pure axial direction applied load, there is a chance that a 3 model (Jefferson) like fracture would then develop in sub-axial cervical spine injury problems (Nightingale et al., 2002). Wiltse system classifies spondylolisthesis into 4

categories based on the aetiology: Dysplastic, isthmic, pathogenic, debilitating and traumatic. Acute traumatic spondylolisthesis is incredibly rare. The type of injury, anatomy, amplitude of instability and extent of slip all contribute to the appropriate management decision (Tenny and Gillis, 2021).

Cervical fractures have historically been the subject of study into traumatic spinal injuries. There is a lack of studies on distressing high-grade spondylolisthesis of the cervical spine. These injury issues generally result in severe spinal compaction and neurological problems. Nevertheless, in rare cases, such pathophysiology has resulted in minimal neurobiological negotiated settlement (Konan et al., 2022).

Sub axial spinal cord fractures can be caused by high-impact mechanisms including such car accidents and falls from great heights, as well as reasonable processes such as interaction and non-contact sports. Lower energy mechanisms, including such ground-level falls, can also occur. Because of the extensive range of motion permitted in this area of the spine, the spinal column is prone to injury (Gagnet et al., 2018). The mechanisms involved of injury result in a variety of rupture structures as well as soft - tissue injuries.

Vertebral fractures could indeed take place in a variety of ways. A flexion compaction method can result in an upper and lower edges teardrop fracture (Jiang et al., 2015). This injury is frequently associated with the failings of the posterolateral tension band. An enhanced version teardrop fracture is an avulsion damage done by an extension mechanism and is intrinsically more stable than a flexion teardrop fracture. When an axial load is placed to the spinal cord in neutral alignment, compression and burst fractures occur. The load is transferred to the vertebral body via the disc, which then continues to fail (Woiciechowsky et al., 2004).

The discoligamentous complex is made up of the anterior ligaments, the intervertebral disc and the posterior ligaments (DLC). Three sub axial cervical spine column injuries can be totally bony, entirely discoligamentous or a mixture of the two (Han et al., 1976). A diversion mechanism, frequently using a rotational force, can cause facet joint subluxations and disc or capsule disruption. An axial load was applied to a spinal cord in slight flexion caused the injury to the posterior suspense band. A distraction and extension moment can end up causing anterior structures. Because of this injury, the superior vertebral body could translate posterior, resulting in a spinal cord injury (Mead et al., 2016).

2. CASE REPORT

This is a case of 45-year-old male presented with alleged history of fall from bike and is associated with history of injury over neck and overhead with no other significant clinical complaint. On primary assessment patient was alert and conscious and cooperative. On external examination he has tenderness over cervical spine and doesn't have any other external injuries. GCS on presentation was E4V5M6 and power of 5/5 over all limbs with no focal neurological deficit. On further evaluation x-ray cervical spine was done which was suggestive C7 vertebral fracture (Figure 1), similar to a type III (or Jefferson fracture) which is a burst-type fracture that involves three or more fractures through the ventral and dorsal aspects of the C1 ring.

The mechanism of the injury is a pure axially applied load. On further evaluation MRI-Cervical spine with whole spine screening was done which showed sign of altered curvature of cervical spine with fracture of C7 spinous process with Grade-1 Anterolisthesis of C6 over C7 vertebrae (Figure 2) with no features s/o compressive myelopathy. CT-Cervical spine was done and was suggestive of Fracture of spinous process of C5, C6 vertebrae (Figure 3).

Patient was planned for 360-degree spinal fixation but underwent anterior cervical discectomy and fusion at the level of C7 due to financial constraints. Postoperatively x-ray cervical spine was done and showed metallic plates & screws in situ (Figure 4). Postoperative recovery was uneventful.

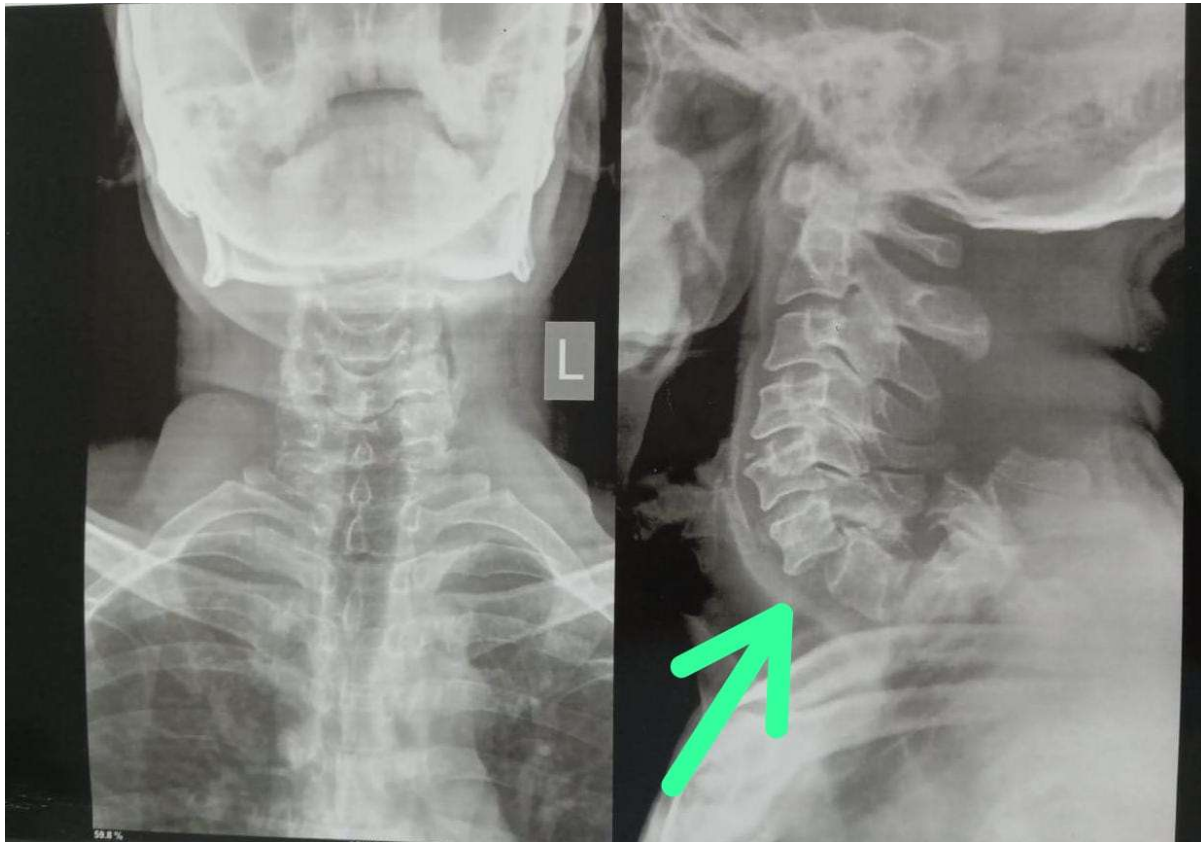


Figure 1 X-ray cervical-spine AP & lateral view (Green Arrow) showing fracture of spinous process of C5, C6 vertebrae



Figure 2 MRI-Sagittal T2/STIR cervical spine showing fracture of spinous process and adjacent soft tissue edema



Figure 3 CT-Cervical spine axial, coronal & sagittal sections showing fracture of spinous process of C5, C6 vertebrae

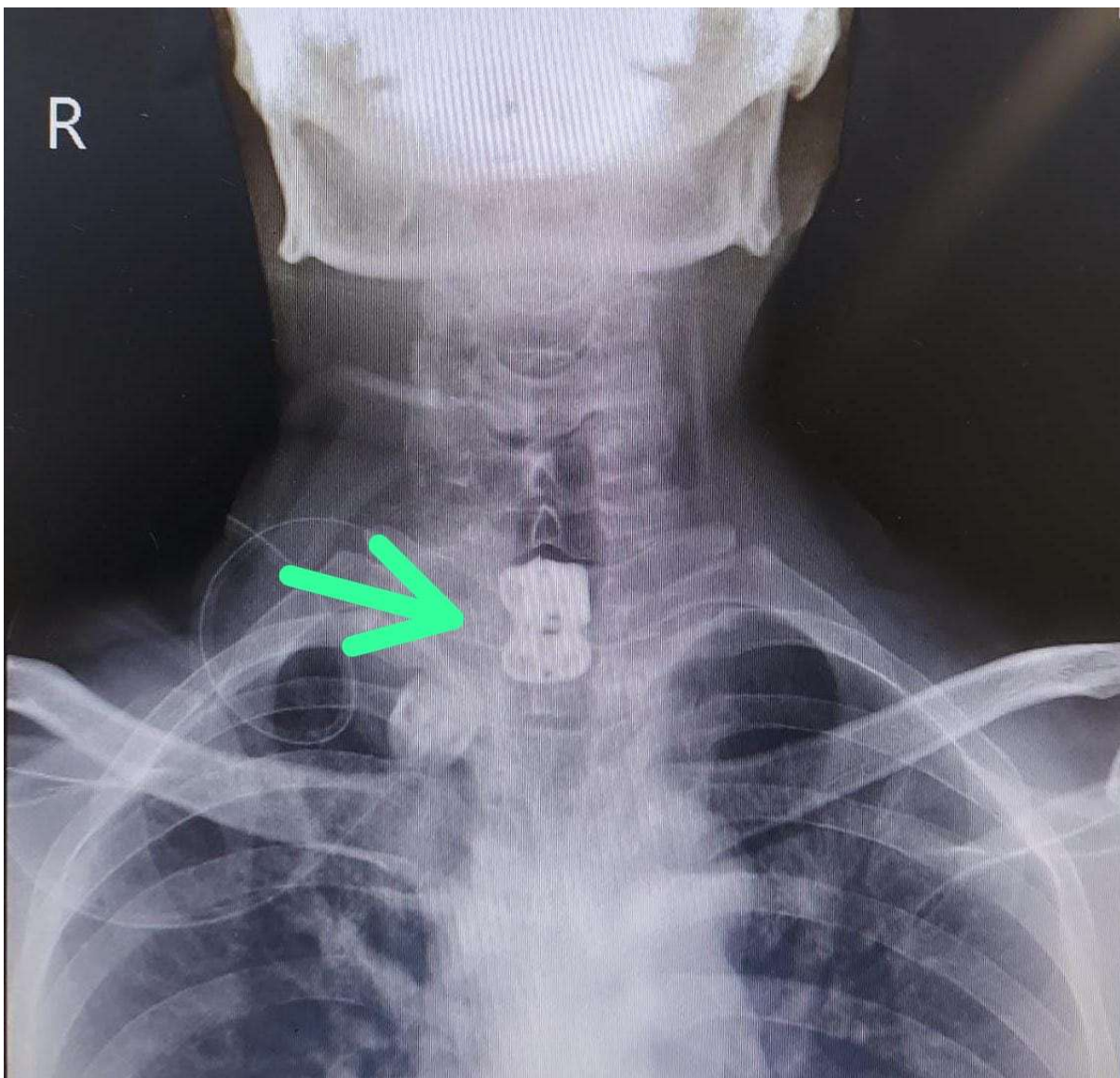


Figure 4 X-ray cervical spines AP view (Green Arrow) showing metallic plate and screw in situ

3. DISCUSSION

Patients who have topmost cervical spine instability are at risk for fatal cervical spinal cord injury. The treatment objectives are early diagnosis, reduction, immobilization and stabilization. Trauma, on the other hand, is the leading common cause of upper cervical spine destabilization (Cheung and Luk, 2016). The majority of upper cervical injuries are caused by blows to the head (e.g., motor vehicle accidents and falls). The kind of injury is influenced by the direction of the vector field (i.e., blows to the head versus deceleration of the torso) (Torretti and Sengupta, 2007).

Allen and colleagues identified a deterministic categorization of sub-axial spinal cord injuries in 1982. Based on the vector field (initial dominant force) and getting bigger and bigger tissue failure, this system classifies middle and lower vertebral fractures into six groups (based on the attitude of the spine at failure) (Zaveri and Das, 2017). A shear strength mechanism is recommended by abnormal connections between vertebral bodies (because ligaments do not fail in compression) (Martínez-Pérez et al., 2015). Shear flexion, flexural extension and interruptive flexion are the three most prevalent injury types. In addition, when a patient endures a pure axial direction applied load, there is the chance of developing a multiple model like fracture in sub-axial spinal cord injuries, which was first explained in 1984 with particular reference to thoracic spine injuries (Lee et al., 1998). Tissue pathology should indeed be evaluated using magnetic resonance imaging (MRI). Even before necessary, computed tomography (CT) and plain x-ray (with or without flexion-extension views) should be acquired (Florkow et al., 2022).

The duration of surgical procedure has been the subject of extensive study. The doubt of whether early surgical treatment for people with symptomatic spinal cord injury gives rise to improved results, reduced hospital and a decreased risk of long-term health problems (Rath and Balain, 2017). Paxinos and colleagues conducted physiological studies and found that an anterior discectomy and fusion with a locked plate had been adequate to stabilize flexion-distraction stage-3 serious injuries in the lower cervical spine in the lack of mention of osteoporosis. In the exclusion of an extrusion disc fragment, a dorsal open reduction and normalization procedure is used (Nakashima et al., 2011).

At every level, sub axial cervical fractures follow similar trends. Compaction fractures because anterior vertebral body height damage without canal negotiated settlement or neural injury (Mc-Mordie et al., 2022). Burst injuries are a type of ruptured disk in which the vertebral body is retropelled into the cervical canal. C7 burst fractures are more likely to result in kyphotic deformity than some other levels of the receivers' cervical spine. Teardrop fractures occur as a result of cervical flexion or flexion-extension, resulting in an anterior-inferior vertebral body fracture. Additionally, there are three-column fractures that extend from the anterolateral vertebral body to the posterior ligaments and are completely volatile. Preemptive facet fractures are debatable; many of them are extremely unstable or can result in paralysis (Torlincasi and Waseem, 2022).

4. CONCLUSION

With the exception of the middle and lower cervical fractures, which have been classified into 6 categories based on force vector (initial dominant force) and getting bigger and bigger tissue inability (based on the attitude of the spine at failure). A shear force methodology is suggested by unusual connections between vertebral bodies (because ligaments do not fail in compression). Compressive flexion, compressive extension and distractive flexion are the three most prevalent injury types. Furthermore, when a person sustains a pure axially impact stress, there is a risk of developing a three-column framework like fracture in sub-axial cervical spine injuries.

Informed consent

Written & Oral informed consent was obtained.

Authors' contributions

Chava Aravind kumar has collected information and prepared the manuscript, Dr. Paresh Korde have operated the case, and this article has been thoroughly reviewed by Dr Chandrashekhar Mahakalkar, Dr Shivani Kshirsagar, Dr Abhishek Chowdary and Dr Ashwin Jain. Dr Ashwin Jain also helped in preparing the case report. All the authors have read and agreed to the final manuscript.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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