

Neglected Posttraumatic Atlantoaxial Spondyloptosis with Type 2 Odontoid Fracture: A Case Report

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Learning Point of the Article:

Neglected atlantoaxial dislocation is a rare injury, can be frequently missed, and can be managed by C1-C2 posterior instrumentation with joint remodeling and manipulation.

Abstract

Introduction: In atlantoaxial context, spondyloptosis has been defined as a situation when both the inferior facets of atlas are fixed anterior to the superior facets of axis. Such an injury scenario is a rare presentation with a few reported cases in available literature.

Case Report: We present a case of post-traumatic anterior atlantoaxial dislocation or spondyloptosis associated with a Type 2 odontoid fracture in an adult patient who presented to us 3 months after injury. After failed attempts of closed reduction with traction, open reduction and posterior instrumentation with fusion were done using joint remodeling technique. 6-month follow-up showed completely reduced facet joints with near complete fusion.

Conclusion: Long-standing complete C1-C2 dislocations pose a challenge for a surgeon because of the associated difficulty in joint reduction. Joint remodeling and manipulation have antiquated transoral odontoidectomy as excellent results have been achieved by direct posterior approach.

Keywords: Atlantoaxial dislocation, odontoid fracture, spondyloptosis

Introduction

Spondyloptosis is defined as complete slippage of a vertebral body over the vertebra below it. In atlantoaxial context, spondyloptosis has been defined as a situation when both the inferior facets of atlas are fixed anterior to the superior facets of axis [1]. Such an injury scenario is a rare presentation with a few reported cases in available literature. Moreover, most cases of atlantoaxial dislocation have a rotational component primarily caused in young patients with Down's syndrome, rheumatoid arthritis, or cervical vertebral anomalies [2, 3]. We present a case of post-traumatic anterior atlantoaxial dislocation or spondyloptosis associated with a Type 2 odontoid fracture in an adult patient who presented to us 3 months after injury.

Case Report

A 25-year-old male suffered from a fall over 100 feet in a bus from a cliff. He was managed in a local hospital with humerus plating for fracture of humerus shaft. The patient presented to us 3 months later following inability to extend his neck and new-onset weakness in left upper limb. On examination, the patient was found to have monoparesis of left upper limb along with upper motor neuron lesion signs including bilateral ankle clonus and exaggerated deep tendon reflexes. Motor power in bilateral upper limbs is depicted in Table 1. On radiological evaluation, the patient was diagnosed to have anteriorly displaced Type 2 odontoid fracture with complete dislocation of atlas over axis such that bilateral atlas inferior facets were locked anterior of axis superior facets (Fig. 1). Skull traction was

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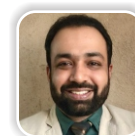
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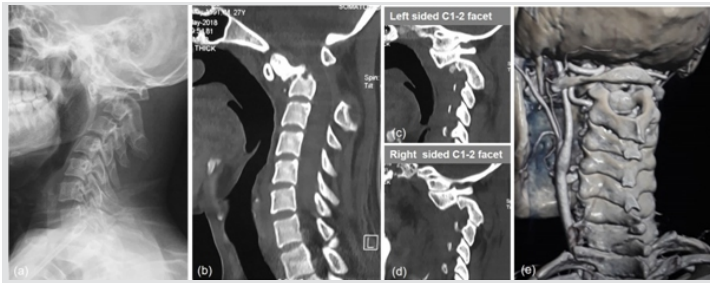


Figure 1: (a) Lateral radiograph of cervical spine with anterior translation of C1 over C2 and fractured and anteriorly displaced dens. (b) Sagittal view computed tomography (CT) showing Type 2 odontoid fracture with anterior displacement and angulation. (c and d) Sagittal cuts through the facet joints showing locked right and left facet joints. (e) CT angiogram done to see anomalous vertebral artery anatomy showing exposed superior articular facets of C2.

applied in the pre-operative period with sequential weight incrementation upto 10 kgs but the facet joint reduction was not achieved. Subsequently, open reduction and posterior fixation was planned.

Operative procedure

The patient was placed prone in OT table on Mayfield traction under intraoperative neuromonitoring (IONM) support. Posterior midline incision was used to expose inferior aspect of C1 and C2. Bilateral C2 nerve roots were preserved. C1 inferior facets were not visible. Bilateral superior facets of C2 were encountered first. Partially threaded polyaxial C1 lateral mass screws were placed bilaterally by carefully retracting C2 ganglion and nerve root caudally (Fig. 2 and 3). C2 pars screw were placed, and high-speed burr was used to burr out overriding superior facets of axis after retracting the nerve root cephalad. Intraoperatively axial traction and careful neck extension manoeuvre was done to achieve reduction, and rods were connected (Fig. 4). This was followed by decortication of inferior aspect of C1 posterior arch and C2 lamina and pars. Iliac crest graft was used to bridge the decorticated C1-C2 gap to achieve fusion. The patient was extubated and discharged in 4 days. The patient was allowed full mobilization and all activities of daily living in a hard cervical collar for 12 weeks following which the collar was gradually weaned off. At 6-month follow-up patient showed full neurological recovery in left upper limb (5/5 in all myotomes bilaterally) with early bone formation between C1 and C2 posteriorly.



Figure 3: (a-c) Post-operative computed tomography scans sagittal views through facet joints and dens showing completely reduced inferior facets of C1 over superior facets of C2 vertebra and dens reduced over C2 body. (d and e) Axial cuts through C1 and C2 showing screw placement through C1 lateral mass and C2 pars.

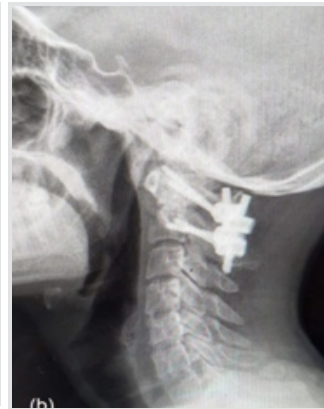


Figure 2: Post-operative lateral radiographs of cervical spine showing complete reduction of atlas over axis following posterior instrumentation and joint remodeling.

Discussion

Purely traumatic atlantoaxial dislocation is an extremely rare injury. Atlanto-axial joint is peculiar and different than subaxial cervical spine in being horizontal in orientation. Thus, anterior translation of atlas over axis is prevented only by ligamentous restraints. Primary stabilizer is the transverse ligament while secondary stabilizers are the apical and alar ligaments. Hyperflexion at this level may either lead to rupture

of transverse ligament or Type II odontoid fracture like in this case leading to the loss of restraint and anterior translation of atlas over axis. Atlanto-axial dislocation can occur at any age and signifies high high-velocity trauma. The clinical presentation is highly varied and may range from neck pain (50%), limb weakness (70%), and pyramidal signs (90%) [4, 5]. It can also present with serious complications like such as respiratory depression, vertebral artery dissection, and quadriplegia [6, 7]. Other differentials with similar presentations include torticollis, atlanto-axial rotatory subluxation, and anteriorly displaced odontoid fractures [8]. Our patient presented with late onset of neurological symptoms and subsequently late presentation to the hospital. An associated complication with late late-presenting cases is irreducibility of atlantoaxial joint due to peri-facet fibrosis. Salunkhe et al. have described gradual progression of atlantoaxial subluxation to irreducible dislocation leading to worsening of symptoms of pain and myelopathy [9].

Various methods to reduce a dislocated atlanto-axial joint include cervical halter traction with increasing weight [10], anterior odontoidectomy followed by posterior fusion [11], transoral anterior release and atlantoaxial reduction plate [12], and posterior only fixation with facet joint manipulation and facet joint remodelling alone or in combination with each other [13, 14]. Kirankumar et al. reported a series of nineteen patients

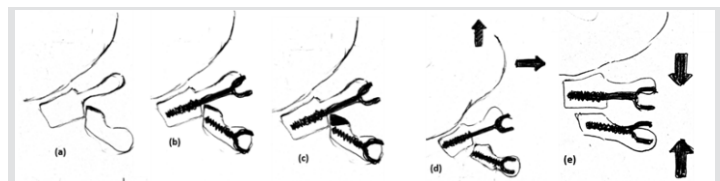


Figure 4: Schematic diagram showing facet joint remodeling and manipulation helping in subsequent reduction through posterior approach. (a) Locked facets of C1 over C2 (spondyloptosis) and (b) C1 lateral mass and C2 pars screws in place. (c) Shaded part of C2 superior facet is the overhanging part preventing reduction by routine maneuvers needing burring or osteotomizing composing the step of "joint remodeling." (d) Application of forces in the direction of arrowheads obtained, namely intraoperative cervical traction and gradual neck extension to bring about reduction. (e) Application of compressive forces along the cervical rods to bring about fusion.



Table 1: Motor power in bilateral upper limbs at presentation

Myotome	R	L
C5	5	3
C6	5	3
C6	5	3
C7	5	2
T1	5	2

with remote isolated Type 2 odontoid fracture with atlantoaxial dislocation. All patients with irreducible atlantoaxial joints were managed with transoral odontoidectomy followed by posterior fusion [11]. At present, irreducible atlantoaxial joints are managed with direct posterior reduction and fusion by facet manipulation and remodelling. Joint manipulation involves distraction of C1-C2 joints while remodelling involves drilling or osteotomizing parts of C1 or C2 facets, thus facilitating reduction [9, 13]. Salunke et al. in their article reported 6 cases of irreducible atlantoaxial joints. They tried to delineate factors which predict feasibility of direct posterior reduction of atlantoaxial joint which include movement on dynamic X-rays, a malunion ruled out on computed tomography CT scan, and locked facets [9]. Another article reported a series of 14 patients with 12 patients having rotatory dislocation and 2 patients having translation. All were managed using direct posterior reduction and fusion after drilling and removal of articular cartilage [14]. A number of new instruments like such as T type and L type reducers have been used by various authors to

facilitate joint reduction in cases of subluxed atlanto-axial joints, but these instruments are less beneficial in long-standing complete dislocations [15].

We attempted closed reduction with gradually increasing weights on cervical traction but were unable to attain joint reduction. This was because old injury and the locked facet anatomy, also because of the fact that cervical traction forces work best in reduction of subaxial cervical spine. We managed to reduce the facets by burring out the anterosuperior part of superior facets of axis. This manoeuvre facilitates joint reduction by increasing the space for insinuation of osteotome and subsequently unlocking and reduction of the facets by controlled extension of neck. The results were satisfactory with respect to radiological joint reduction and neurological recovery.

Conclusion

Long-standing complete C1-C2 dislocations pose a challenge for a surgeon because of the associated difficulty in joint reduction. Joint remodeling and manipulation have antiquated transoral odontoidectomy as excellent results have been achieved by direct posterior approach.

Clinical Message

Traumatic atlantoaxial dislocations are extremely rare injuries. A high index of suspicion is warranted to make an early diagnosis and prompt management to obtain optimum clinical results. Irreducible atlantoaxial dislocations should be subjected to surgical reduction and fixation.

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