

 **IMAGES OF SPINE CARE**

The hyperextension triad of type II odontoid fracture, posterior atlantoaxial dislocation (reducible in flexion), and C1 posterior arch fracture: implications on emergency management and anterior versus posterior surgical approach

A 45-year-old man presented with quadripareisis following a motor vehicular accident. Computed tomography of the craniocervical junction showed type II odontoid fracture, posterior atlantoaxial dislocation (post-AAD), and fracture of posterior arch of the atlas (Fig. 1). On immobilization in extension, there was worsening of posterior AAD (Fig. 2, Left). Thus, traction was applied in flexion, which reduced the dislocation (Fig. 2, Right). In the operating room, the

feasibility of anterior odontoid screw was assessed under an image intensifier; however, the necessary space for anterior approach could not be obtained as the reduction was achieved only in flexed position. Therefore, the patient underwent a C1 lateral mass and C2 pars screw and rod fixation through posterior approach. Postoperative radiographs were satisfactory (Fig. 3), and the patient showed gradual improvement in neurologic status.

The above mentioned triad, associated mechanism, and management issues in odontoid fracture have never been addressed [1–3]. It is possible that hyperextension forces on CVJ caused type II odontoid fracture, with avulsion of anterior longitudinal ligament resulting in posterior displacement of distal fragment of dens. The C1 posterior arch fracture may be caused by impact of suboccipital portion of the skull during hyperextension. Although AAD and other cervical spine injuries are usually stabilized in extension in emergency, this rare triad requires flexion position for stabilization [4]. On flexion, the intact transverse ligament probably brings the distal dens fragment into alignment. The implication on surgical decision lies in the inadequate corridor available for anterior odontoid screw fixation. Hence, the posterior approach with the C1–C2 fixation would be the best bet for this rare triad [5,6].

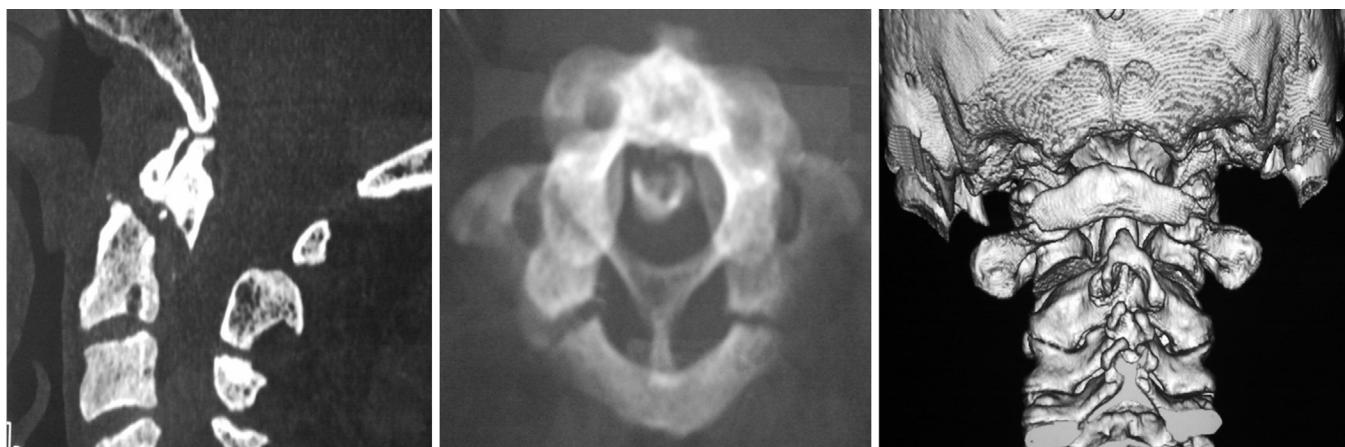


Fig. 1. Preoperative radiographs of craniocervical junction (CVJ) showing rare triad of posterior atlantoaxial dislocation (AAD), Type II odontoid fracture, and fracture of posterior arch of C1 (Left) sagittal CT, (Middle) axial CT, and (Right) 3-D reformat posterior view.

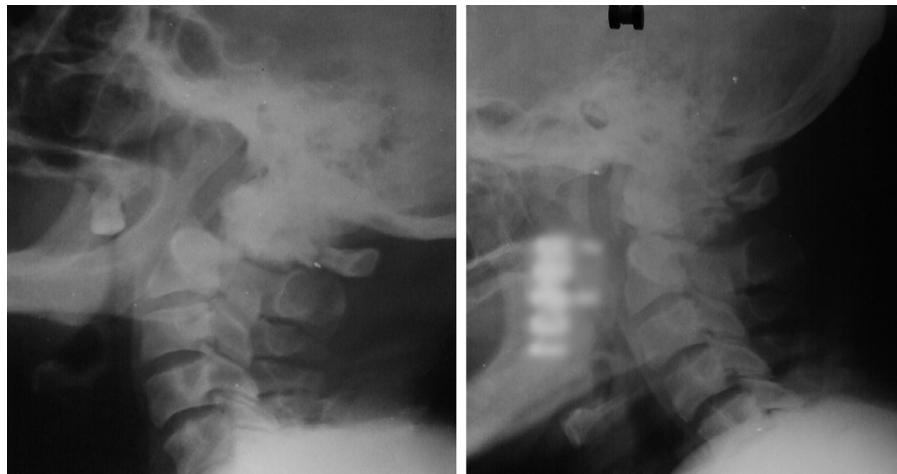


Fig. 2. Preoperative X-rays of craniocervical junction (CVJ) showing (Left) worsening of posterior atlantoaxial dislocation (AAD) after application of traction in extension (Right). Traction in flexion reduced the dislocation.

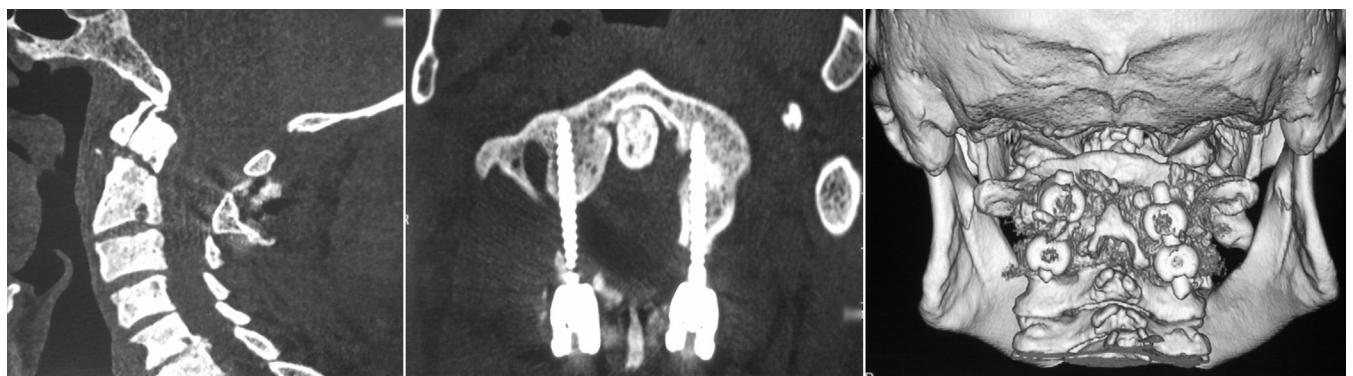


Fig. 3. Postoperative radiographs of craniocervical junction (CVJ) after the C1 lateral mass and C2 pars screw and rod fixation using posterior approach—(Left) sagittal CT, (Middle) axial CT, and (Right) 3-D reformatted posterior view showing reduced C1–C2 joint and odontoid process well aligned with the C2 vertebral body.

References

- [1] Ben Aïcha K, Laporte C, Akrout W, Atallah A, Kassab G, Jegou D. Surgical management of a combined fracture of the odontoid process with an atlas posterior arch disruption: a review of four cases. *Orthop Traumatol Surg Res* 2009;95:224–8.
- [2] Meng H, Gao Y, Li M, Luo Z, Du J. Posterior atlantoaxial dislocation complicating odontoid fracture without neurologic deficit: a case report and review of the literature. *Skeletal Radiol* 2014;43:1001–6.
- [3] Spoor AB, Diekerhof CH, Bonnet M, Oner FC. Traumatic complex dislocation of the atlantoaxial joint with odontoid & C2 superior articular facet fracture. *Spine (Phila Pa 1976)* 2008;33:E708–11.
- [4] Meena RK, Dhandapani S. Chance fracture in ankylosing spondylitis—not merely by chance! Danger of injudicious use of skull traction. *Spine J* 2015;doi: 10.1016/j.spinee.2015.06.065. pii: S1529-9430(15)00674-9.
- [5] Dhandapani S, Singh H, Rajan SK, Sharma K. Posterior approach to suboccipital-craniovertebral junction in patients with occipital pressure ulcer. Proposal of Y shaped occipito-cervical incision. *J Pediatr Neurosci* 2014;9:205–6.

- [6] Ryken TC, Hadley MN, Aarabi B, Dhall SS, Gelb DE, Hurlbert RJ, et al. Management of acute combination fractures of the atlas & axis in adults. *Neurosurgery* 2013;72(Suppl. 2):151–8.

Sivashanmugam Dhandapani, MCh
Ankur Kapoor, MCh
Rajesh Meena, MCh
Department of Neurosurgery
Post Graduate Institute of Medical Education and
Research (PGIMER)
Sector 12, Chandigarh 160012, India

FDA device/drug status: Not applicable.
Author disclosures: **SD:** Nothing to disclose. **AK:** Nothing to disclose.
RM: Nothing to disclose.
Funding source for this study: None.
Conflict of interest related to this study: None.