Unusual Fracture Dislocation of the Craniovertebral Junction

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Summary: We present a rare case of C-1 fracture–posterior atlantoaxial subluxation in which neither fracture of the dens nor preexisting abnormality of C-1 or C-2 was present.

Index term: Atlas and axis

Bilateral posterior translatory atlantoaxial subluxation is an extremely rare hyperextension injury formerly described in the presence of a dens fracture or preexisting lesion of C-1 or C-2. A case of this rare subluxation associated with a fracture of the anterior arch of C-1 is reported.

Case Report

A 47-year-old man was struck on the back of the lower part of the neck by a falling tree, and became quadriplegic and lost tactile sensibility on falling to the ground. Some mild improvement in symptoms occurred during the next 10 to 20 minutes. No significant facial injuries were present. Neurosurgical evaluation diagnosed central cord syndrome, with injury at the C5-6 level. Radiographs showed spondylosis at C5-6, a fracture of the C-7 spinous process at the point of impact, and an unusual fracture dislocation of the craniovertebral junction.

Additional studies were done. Complex motion tomograms (Fig 1A) showed posterior dislocation of the basion relative to the dens. Wackenheim’s line (1) (Fig 1B) was separated from the posterior tip of the dens. The dens-basion distance was increased. The Powers ratio (2) (Fig 1B) was normal and was compatible with posterior atlantooccipital disassociation. The X-line method of Lee et al (3) (Fig 1C) was not positive for atlantooccipital dislocation in that the C-2/opisthion line was not displaced from its intersection with the posterior arch of C-1. It was abnormal in that the basion/C-2 spinolaminar line was a minimum of 8 mm from the dens. There was no dens fracture. Axial computed tomography (Fig 2A) showed a fracture of the anterior ring of C-1. The relationship of the occipital condyles and lateral masses of C-1 was anatomic. Subluxation of the C1-2 facet joints was present (Fig 2B). Subsequent sagittal magnetic resonance images after halo fixation showed stripping of the posterior longitudinal ligament from the dorsal aspects of C-2 and C-3 with minimal extension of the tear into the posterior C3-4 interspace. The findings were considered most compatible with a translatory bilateral posterior subluxation at the atlantoaxial joint with a fracture of the anterior arch of C-1.

Intraoperatively, the ring of C-1 was found to be stable relative to the base of the skull, but the ring of C-2 was hypermobile. An occiput–C-2 fusion, performed by using a threaded Steinmann pin and Songer cables, caused reduction of the subluxation. One month later, a partial corpectomy and diskectomy was performed at C5-6.

At 6-month follow-up, marked improvement was shown in the central cord syndrome. The patient was able to walk without assistance and feed himself, and clinical improvement continued. The craniovertebral junction remained in good alignment with the patient wearing a cervical collar.

Discussion

Previous authors have concluded that for a bilateral translatory posterior subluxation at C1-2 to occur, either a dens fracture or a preexisting abnormality of the dens or anterior arch of C-1 is required (4–6). This includes destruction by tumor or infection, rheumatoid arthritis, and congenital absence or maldevelopment.

This dens of our patient was normal. The anterior fracture of the arch of the atlas was not pathologic nor was there evidence for a preexisting defect. We believe this represents a forceful hyperextension injury in which the atlas fractured instead of the dens. The stripping of the posterior longitudinal ligament and a central cord syndrome at the C5-6 level are compatible with this mechanism (7). Most likely, the injury was caused by hyperextension with pressure of the anterior surface of the dens against the anterior arch. The facet joints at C1-2 disrupted, allowing movement between the two vertebral...
segments and displacement. In this instance, the facet joints remained subluxed after injury. Such a mechanism implies that when a displaced segment of the anterior arch is identified, disruption of the facet joints at C1-2 should be considered.

The most satisfactory treatment for this rare and complex injury is not clearly defined. Arthrodesis between the opisthion, C-1, and C-2 after skeletal traction has been advocated, although it is not known if the alignment will remain corrected (4, 5).

In summary, bilateral posterior translatory atlantoaxial subluxation is an extremely rare hyperextension injury. Formerly, it was thought that the presence of a dens fracture or preexisting lesion of C-1 or C-2 was required. This case indicates that the lesion can also be produced if the anterior arch of C-1 is fractured. The identification of a similar fracture without interfacet subluxation should imply instability because of capsular disruption of the interfacet joints with spontaneous reduction.

References