Fracture Through the Body of the Axis

B Johnson, N Jayasekera

Citation

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Abstract

We present a case of a miscellaneous non-odontoid, non-hangman's fracture of the body of the axis in a 64 year old gentleman following a fall. The fracture was a coronally orientated vertical fracture extending into the lateral masses bilaterally. The fracture was treated conservatively in a sterno-occipito-mandibular immobiliser (SOMI) brace. These fractures represent a small proportion of fractures at this level of the spine. Current classification systems and treatment options for this fracture are discussed.

CASE REPORT

A 64-year-old male farmer, presented to Accident and Emergency (A&E) via helicopter following collapse whilst unloading a cattle trailer. The patient experienced loss of consciousness with retrograde amnesia, and on regaining consciousness he complained of head and neck pain and pins and needles in the upper arms bilaterally.

Mr. W presented to A&E on a spinal board with triple immobilisation of his cervical spine. He was managed in A&E as per the Advanced Trauma Life Support (ATLS) guidelines and was found to have midline tenderness of the upper cervical spine. Neurological examination revealed reduced sensation to light touch within the distribution of the C5 dermatome bilaterally.

Plain radiographs showed no fracture, but computer tomography (CT) of the head and neck (figure 1 and 2) revealed an isolated transverse fracture of the posterior part of the base of the odontoid of the second cervical vertebra. The fracture extended to both lateral masses and involved the transverse foramina.

Figure 1

Figure 1: Axial computed tomographic scans through the body of the axis demonstrating a vertical coronally orientated fracture through the body of the vertebra.

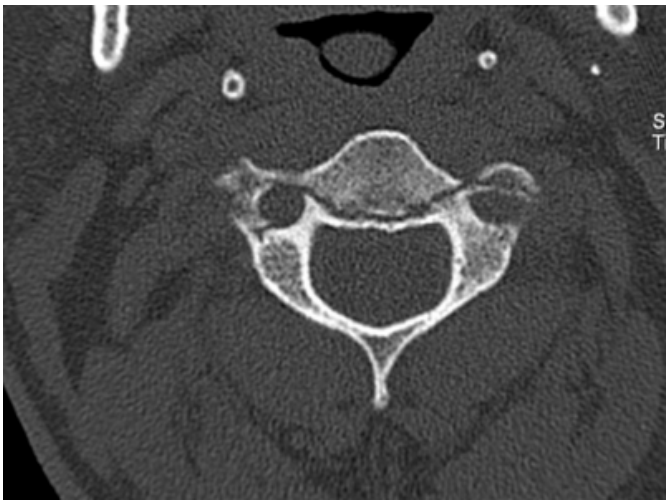

Figure 2

Figure 2: Lateral computed tomographic scans through the cervical spine demonstrating a vertical coronally orientated fracture of the body of the axis.

The patient was admitted and managed with spinal precautions and cervical spine immobilisation in an Aspen collar. Magnetic resonance imaging (MRI) performed 5 days later demonstrated haematoma extending from the first to the seventh cervical vertebra. The posterior wall of the body of the second cervical vertebra was found to have maintained its attachment to the posterior longitudinal ligament and there was no compromise of the spinal canal. There was minimal anterior displacement of the rest of the body of the second cervical vertebra and the anterior longitudinal ligament was intact (figure 3).

Figure 3

Figure 3: A sagittal MRI scan of the cervical and upper thoracic spine showing no compromise of the spinal cord at the level of the second cervical vertebra.

At review following the MRI scan, the patient's dermatomal sensory changes had improved. A SOMI brace was fitted and the patient was allowed to sit up as pain allowed.

DISCUSSION

Fractures of the axis are unique due to the anatomy and biomechanics of the second cervical vertebra (C2). There are three types of fractures of the C2 vertebra: odontoid peg fractures, traumatic spondylolisthesis of the axis (hangman's fracture) and

miscellaneous non-odonoiod, non-hangman's fracture of C2 ([1]). The most common fracture is through the odontoid peg, followed by traumatic spondylothesis which occurs due to fractures of the posterior elements caused by hyperextension injury.

The fracture seen in this case is a non-odontoid, non-hangman's (miscellaneous) fracture of the axis. This is the rarest of the three subtypes ([1]) and accounts for only 7.5% of all fractures of the axis ([2]). Fractures of the C2 proper occur in the region between the base of the odontoid and the pars interarticularis. Following assessment of 15 vertical C2 body fractures Benzel (1994) devised a classification for fractures of the C2 body. This classification system encompasses three types of fracture. The most common fracture type is

the Type 1 fracture which is a coronally orientated vertical fracture. This is the type of fracture seen in this case. Type 2 fractures are less common and refer to sagittally orientated fractures through the body of C2. Type 3 fractures are the same as type III odontoid fractures described in the Anderson and D'Alonzo classification, as these are not strictly fractures of the odontoid peg, but rather fractures through the body of the C2 vertebra.

Benzel (1994) determined the relevant forces necessary to produce each fracture type. The type of fracture in this case is produced by 4 possible mechanisms as described by Benzel (1994): i) extension with axial load ii) hyperextension with axial load iii) flexion and axial load iv) flexion distraction. Despite different mechanisms of injury Benzel (1994) observed the imaging findings to be surprisingly similar. The sagittal fractures are caused by axial loading to the point of failure.

The literature on the management of fractures of the body of the axis is sparse ($_4$). Greene et al (1997) describe a treatment algorithm for fractures of the C2 body. They recommend 8 to 12 weeks of halo vest or SOMI immobilisation for patients with significant fractures of the vertebral body, pedicle or lateral masses. Immobilisation for 6 weeks was recommended for patients with less severe or more stable injuries. Periodic follow up in clinic and with imaging was suggested to ensure healing and alignment was adequate. From the cohort of 67 patients with C2 body fractures followed up by Green et al (1997) only one patient (1.6%) underwent surgical intervention for a non union.

German et al (2005) looked at all the current literature on the management of vertical C2 body fractures. Of the 48 cases reviewed 44 of the cases were successfully treated non-surgically. German et al (2005) conclude these fractures are amenable to non surgical management for a number of reasons. Firstly the upper cervical spinal canal is more capacious than the lower cervical canal, providing a greater degree of safety regarding the spinal cord injury than observed in the subaxial cervical spine. Secondly, as a general rule C2 body fractures do not compromise the spinal canal as Type 1 fractures are often minimally displaced and unlike the classic traumatic spondylothesis of the axis the bony ring remains essentially intact. C2 body fractures are often not significantly comminuted which helps to optimize the chance of establishing a solid arthrodesis. In conclusion German et al (2005) believe that the current evidence in the literature strongly suggests that Type 1 vertical fractures of the C2 body can be treated by non surgical means.

Fujimura (1996) classifies 31 axis fractures on the basis of their radiographic injury pattern: avulsion, transverse, burst or sagittal. In their series all the avulsion (tear drop) fractures and the two cases involving transverse fractures healed with external immobilisation. Two of the three burst fractures were treated with C2-C3 anterior interbody fusion as this is a comminuted fracture of the axis body with multiple fragments dislocated anteroposteriorly. Therefore fragments of the posterior half are likely to retropulse into the spinal canal. Fifteen of the seventeen sagittal fractures healed with non operative treatment. The other two were associated with type III dens fractures and atlanto-axial fusion was carried out. Fujimura et al (1996) conclude that many axis body fractures are stable injuries and therefore non-operative treatment should be selected as the primary therapy. However it is appropriate to carry out surgical intervention depending on the extent of dislocation and the presence of associated injuries.

Hadley (1989) reviewed the management of 44 patients who had sustained fractures involving the vertebral body and treated only one (2.3%) of these patients surgically as there was a 5mm subluxation of C2 on C3. This therefore highlights a role for surgical management of this type of fracture and Hadley (1989) states the decision to undertake surgical intervention will be dependent upon the types of fracture involved and the degree of associated subluxation, usually at C2-3.

Bohay (1992) describes three vertical fractures of the axis within the vertical plane, all of which were managed successfully with non operative management with a halo vest or a Philadelphia collar. Korres (1994) described 14 patients with avulsion (tear drop) fractures of the anteroinferior portion of the axis, all of which were successfully managed with cervical immobilisation.

Is the case described in this case report Mr. W was treated in a SOMI brace which is in keeping with the recommendations in the current literature as the fracture was minimally displaced but extended into the lateral masses bilaterally. Hadley (2002) highlights the necessity for a greater amount of data on the management of fractures of the C2 vertebral body within the guidelines for the management of acute spinal injuries. Although the literature suggests that such fractures can be treated by immobilisation, there is no Class I or Class II medical data addressing the management of traumatic fractures of the body of C2.

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Author Information

Benjamin Johnson, M.B.B.S.
Senior House Officer, Department of Trauma and Orthopaedic Surgery, University Hospital of North Staffs

Nalaka Jayasekera, M.R.C.S.
Specialist Registrar, Department of Trauma and Orthopaedic Surgery, University Hospital of North Staffs