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Spine

A patient with an odontoid fracture and atrophy of the tongue A case report and systematic review of the literature

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Abstract

Background: Traumatic hypoglossal nerve palsy is a rare entity and has rarely been described in association with an odontoid fracture.

Case Description: We present a patient with a posttraumatic odontoid fracture who developed selective weakness of his arms and a unilateral hypoglossal nerve palsy. A systematic review of the literature is presented, and hypothetical causes for the injury are discussed.

Conclusion: Bell's cruciate paralysis and central cord syndrome are probably expressions of the same mechanism rather than 2 separate entities based on a preferential damage of pyramidal crossing arm fibers. C2 fractures with concomitant lower cranial nerve injury are relatively rare and have a reasonably good outcome, especially when unilateral.

Keywords: Axis; Central cord syndrome; Hypoglossal nerve; Odontoid process; Spinal fractures

1. Introduction

Fractures of the odontoid process of C2 account for 10% to 15% of all fractures of the cervical vertebrae [67]. The most common causes are road traffic accidents or falls. Only 3% to 10 % of the patients with an odontoid fracture present with neurological impairment, probably because the spinal cord at this level has a lot of space in the spinal canal, and fractures are more likely to create extra space than compression. This is not to imply that C2 fractures are inconsequential given the known complications of nonunion, chronic pain, or immediate death due to respiratory depression. The frequency of direct mortality caused by a fracture of the odontoid process is not known but estimated to be approximately 25% to 40% [16,41].

The spinal cord injury in these patients is often described as either Bell's cruciate paralysis or central cord syndrome. Classically, the cervicomedullary injury described by Bell results in paresis of the upper extremities with sparing of the lower extremities, whereas the central cord syndrome involves all 4 extremities, but the upper more so than the lower. Because concomitant cranial nerve palsy after cervical spine injury is highly uncommon, we performed a systematic review of the literature to find a possible common denominator. In addition, we describe an unusual case illustrating possible difficulties of diagnosing an odontoid fracture and discuss several likely mechanisms which play a role in traumatic damage to the high cervical spinal cord and its nerve roots.

2. Case report

Patient A is an 88-year-old man, with a previous history of cardiac arrhythmias. While strolling, he became unwell and collapsed. A wound on his forehead indicated that he had fallen on his head. Bystanders administered cardiopulmonary resuscitation for 10 minutes, and when the ambulance arrived, he was found with severe bradycardia and respiratory arrest, necessitating emergency intubation. On arrival at the nearest hospital, he was comatose with a Glascow Coma Scale score of $E_1M_1V_{tube}$. Further investigation did not demonstrate cardiac dysfunction as cause for the patient's collapse. A computed tomography (CT) scan of the brain showed no abnormalities, other than a level of atrophy normal for the patient's age. Within a couple of hours, his neurological condition improved: he opened his eyes spontaneously and obeyed commands ($E_4M_6V_{tube}$). After extubation, weakness in both arms and extensor plantar responses were found. A preliminary diagnosis of ischemic brain stem

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Fig. 1. Sagittal reconstruction of the cervical spine CT scan showing an oblique fracture of the odontoid process with a posterior dislocation of 9 mm. The diameter of the spinal canal at this level is only 8 mm.

infarction was made. Because of progressive swallowing difficulties, he was fed by a nasogastric tube and transferred to our hospital after 2 weeks. On neurological examination, he was fully conscious and orientated, with a right-sided tongue wasting and deviation of the tongue to the right on protrusion. Muscle strength proximal in the right arm and distal in both arms was Medical Research Council grade 4; in both legs, grade 5. Tendon reflexes of the arms were symmetrical but low, as were the knee jerk reflexes. The ankle jerk reflexes were both absent, and there were bilateral extensor plantar responses. His finger-nose coordination was paretic on both sides. Movement and position sense were generally decreased in all extremities. A repeat CT scan of the brain again revealed no abnormalities. Surprisingly, an x-ray of the cervical spine (not made previously) showed an odontoid fracture (Anderson and D'Alonzo type 2) with a significant posterior dislocation, confirmed by subsequent CT scan (Fig. 1). Both a Minerva corset and halo traction were successively applied but did not provide satisfactory external immobilization, so the fracture was stabilized with 2 screws using an anterior approach (Fig. 2). On a postoperative magnetic resonance (MR) scan, an intramedullary hyperintense area was clearly visible at the level of C2, but no abnormal signs were observed in the brain stem. (Fig. 3). Postoperatively, ears, nose, and throat examination

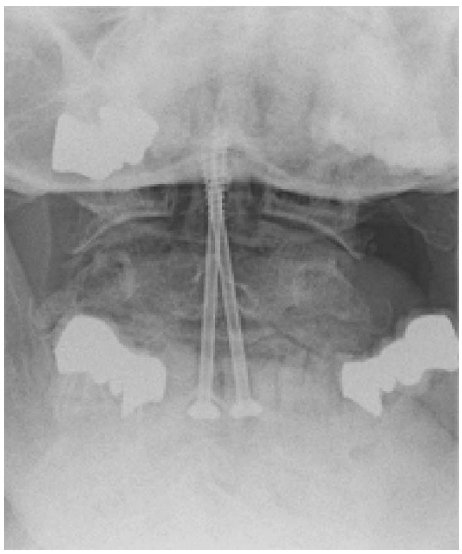

Fig. 2. Postoperative coronal plain x-ray showing anterior screw fixation.

Fig. 3. T2-weighted sagittal MR scan of the cervical spine, showing a high-intensity lesion in the spinal cord at the level of C2.

showed symmetrical movement of the pharyngeal arches and both vocal cords. A video fluoroscopy of swallowing showed an asymmetric, short, and delayed laryngeal movement, being weaker on the right. Because of a persistent unsafe swallowing action, the nasogastric tube was replaced by a percutaneous feeding gastrostomy. After a few weeks, the patient was discharged to a rehabilitation center. Three months later, his swallowing had normalized, and the gastrostomy was closed. His tongue did still protrude to the right, and he complained of persistent weakness and atrophy of the intrinsic hand musculature.

3. Literature search to identify studies

A computer-aided search of MEDLINE and EMBASE from 1966 to 2004 was conducted in January 2004. The search was performed using subject headings and keywords and limited to human studies. For identifying studies regarding long tract and cranial nerve injury, the terms "cruciate paralysis," "central cord syndrome," and "hypoglossal nerve injury" were used. These were combined with a search on "trauma" and on "fractures." In addition, searches were performed on "atlantoaxial dislocation and nerve injury," "occipital condyle fracture and nerve injury," and "odontoid fracture and nerve injury." Articles written in a language other than English, Dutch, French, or German were excluded, as were abstracts, editorials, letters, or comments. Exclusion criteria were further all surgical cases, all non-trauma reports, and rheumatoid arthritis patients.

Using the abovementioned criteria, all studies considered eligible were retrieved, and the final decision was based on the full article. To identify additional eligible studies, the reference lists were screened for journal articles. The data extraction was performed using a standardized form, including the following parameters: (1) year of publication and author, (2) number of reported patients, (3) presenting neurological symptoms differentiated into cranial nerve