EUROMEDITERRANEAN BIOMEDICAL JOURNAL
2018,13 (32) 142-144
(*FORMERLY: CAPSULA EBURNEA*)

Case report

TYPE II ODONTOID FRACTURE: A CASE REPORT AND A CORRECT MEDICO-LEGAL EVALUATION.

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ARTICLE INFO

Article history:
Received 25 July 2018
Revised 04 September 2018
Accepted 03 November 2018

Keywords:
Odontoid fracture, traffic medicine, traumatology, forensic medicine.

ABSTRACT

The authors present a case of a 54-year-old man with a fracture at the base of the odontoid process (dens) following a traffic accident. This paper describes the clinical-instrumental approach for research purposes, an objective diagnosis to find the presence of lesions, and the medico-legal issues caused by the difficulty in evaluating the impairment level resulting from this type of injury.

1. Introduction

The fragility of the bone structures of the superior cervical spine, and the fact that the spine's stability relies on ligaments, are key factors in making this cervical region vulnerable to traumas. A fracture of the dens is a frequent lesion of the proximal cervical spine that requires an immediate diagnostic-therapeutic evaluation, because of its potential morbidity/mortality. The outcomes of this lesion, followinga medico-legal evaluation, are often caused by pseudarthrosis characterized by persistent pain symptomatology, which often result in neurologic deterioration with variable severity and characteristics. The authors of this paper report a case study of a fracture at the base of the odontoid process, analyzing the clinical-therapeutic approach and the medico-legal issues.

2. Case Report

A 54-year-old man had a frontal collision with another car driving in the opposite direction while driving in the exit lane for a rest-stop and with his seatbelt properly fastened. Following the impact, the man was rescued from the wreck by local emergency services and immediately transported to the closest ER, to undergo clinical-diagnostic evaluations.

Initial diagnosis reported post-traumatic neck pain and straightening of the normal cervical lordosis. Days after hospital admission, following exacerbation of pain and vertiginous symptomatology, the patient went to another hospital for a cervical x-ray that confirmed a fracture at the base of the dens, with minimal retropulsion of a fragment toward the medullary cavity, extended to the left transverse process with narrowing of the homolateral canal and presence of small bone fragments within the canal. Given the initial diagnosis, the patient was admitted to the hospital for an MRI of the cervical spine, which also showed a fracture of the C2 left lateral mass (**Figures 1-2**). The patient was discharged after three days with a normal neurological examination (NE) and a permanent halo brace was prescribed. In the following months, the patient underwent several diagnostic-instrumental check-ups and specialized neurological examinations in order to monitor the clinical evolution of the lesion. About two years and six months after the accident, the patient underwent a medico-legal examination that diagnosed its after-effects as a paravertebral analgesic contracture, paresthesia of the upper limbs and credible pain and vertiginous symptomatology.

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DOI: 10.3269/1970-5492.2018.13.32
 ISSN: 2279-7165 - Available on-line at www.embj.org

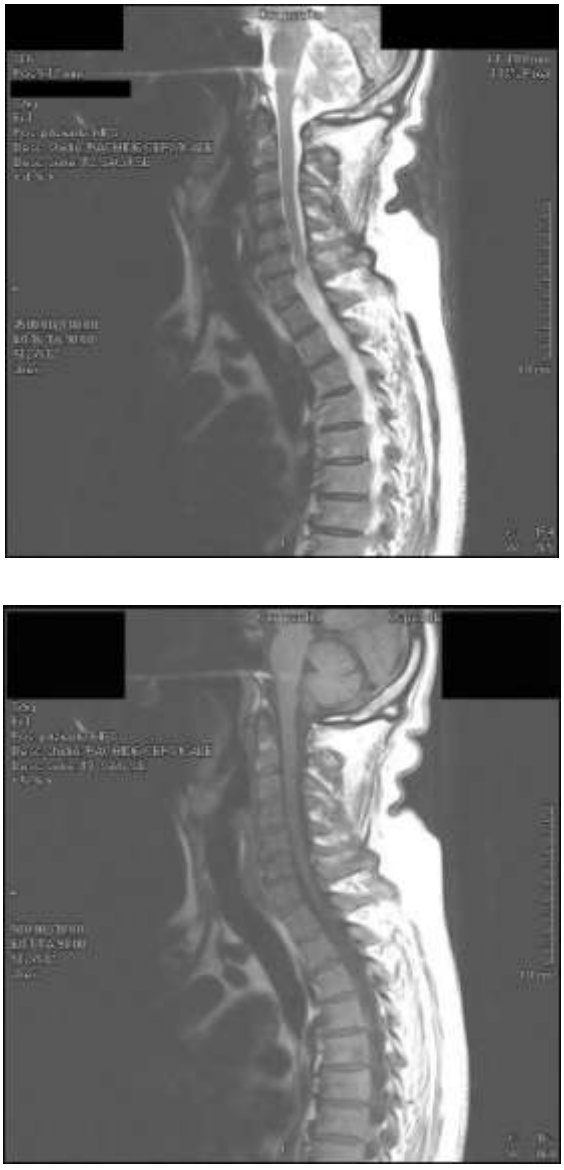

Figure 1 (up) and 2 (down) - Sagittal projection MRI of the cervical spine confirming a type II dens fracture.

3. Discussion

The C2 vertebra, also known as "axis", is unlike the other vertebrae because it has two bilateral masses that articulate with C1, a body that transfers weight to the C3 vertebra and an odontoid process located on the superior surface of the body. The protuberance, or process, articulates with the posterior surface of C1's anterior arch.[1] The articulation of the axis with the atlas acts as a lateral hinge that allows greater axial rotation compared to the rotation that occurs elsewhere on the cervical spine.[2] In absence of intervertebral discs in this articulation, multiple ligaments connect the axis to the base of cranium and atlas, providing stability to the atlanto-axial articulation.[3]

The unique anatomy of the C2 vertebra determines a variety of fractures in the context of significant cervical traumas.[4]Odontoid fractures represent between 5% and 15% of all lesions to the cervical vertebrae.[5] Among all fractures, the most common occur to the dens (41%).[6] The classification of odontoid fractures in three types, as described by Anderson e D'Alonzo[7] in 1974, remains an acceptable classification system. The afore mentioned authors, defined three types of fractures based on 49 patients. Type I fractures were described as oblique fractures on the superior part of the odontoid process. Fractures analogous to the one in the report are classified as type II, when the break occurs at the base of the odontoid process close to body axis. Type III fractures include the odontoid process and extend through the vertebral body of C2. Hadley et al[8] modified the classification system in 1988, describing a type II A fracture segmentally comminuted, highly unstable, extending from the base of the odontoid process to the body of the dens. Further modifications were suggested by Grauer et al [9], who described three subtypes of type II based on the obliquity, fragmentation and if the fracture line is comminuted. Another type of fracture involving the same vertebra is Hangman's fracture, which is characterized by a bilateral fracture between the pedicles of the axis with a variable degree of translation or angulation of C2 onto the C3 vertebra.[10] Type II dens fracture are the most common odontoid lesions and result in atlanto-axial instability.[11] The most common etiologies of type II fractures include motor vehicle accidents (MVA),[12] followed by falls.[13] This type of fracture is very common among the elderly, with a greater incidence in patients over 70 years-old. It was hypothesized that osteoarthritis in the atlanto-axial articulation predisposes older patients to a limited mobility and to a further twisting momentum at the base of the dens, with a consequent increase in incidence for this population of patients.[14] The mechanism responsible for odontoid fractures is usually identified in hyperflexion or hypertension of the cervical region of the spine.[15] Doherty[16] and Moradian[17], through their biomechanical studies, have proven that this type of fracture comes from extension and inclination forces applied to the cervical spine. The typical clinical symptomatology is characterized by cervical pain with the inability, for most patients, to move from the supine position to erect without using their hands. Furthermore, type II odontoid fractures are the most common fractures with no superior cervical sprain that present a primary neurologic injury, which varies from an isolated cranial nerve lesion to pentaplegia.[18] In fact, in patients with a superior cervical spine trauma there are several neurologic lesion types: the most common cranial nerves involved are the hypoglossal nerve and abducens nerve, there can also be several cervical medullary syndromes and a variety of conditions involving the brainstem or paralysis of all four limbs, respectively caused by incomplete or complete lesions of the spinal cord. There could also be signs and symptoms of compression of the vertebral artery – vertigo, seizures, mental alteration and syncope – that can manifest autonomously or associated with symptoms related to spinal cord compression, such as fatigue and muscular atrophy, spasticity, ataxia, hyperreflexivity and pathologic reflexes. A superior cervical lesion can compromise the function of the diaphragm, thoracic and abdominal respiratory muscles, preventing normal autonomous pulmonary ventilation and predisposing the patient to pulmonary infections. With regards to treating type II fractures, most evidence suggests that surgical stabilization is appropriate for severely fragmented fractures, with unstable distraction[19] and spinal cord involvement.

In elderly subjects, treatment with immobilization using a Halo is barely tolerated, hence, it is common to opt for C1-C2 arthrodesis. On the other hand, immobilization with a Halo is indicated for younger patients with stable fractures. The outcome of the clinical results for patients with superior spinal cord lesions depend more on consequent intracranial lesions rather the vertebral lesion itself. The most frequent complications from treating odontoid fractures are pseudarthrosis and unknown lesions.[20] Type II odontoid fractures are associated to a high incidence of pseudarthrosis, independently from a conservative treatment method, which in turn is one of the main causes of secondary neurologic degeneration. [21] From a medico-legal point of view, the diagnosis of mainly neurological sequelae is challenging due to the complexity of the deficits related to the fracture of the dens. Cranial nerve injuries often result in very complex disabilities, with regards to specific functions they affect and that are usually associated to each other; hence, for an accurate diagnosis all related deficits must be considered. For example, a lesion of the VI cranial nerve causes a medial deviation of the eye, side viewing paralysis and diplopia with consequent impaired vision and esthetic deformation. Medullary lesions cause motor-control, sensory and autonomic deficits, with repercussions on self-sufficiency and socio-behavioral functioning. The ASIA scale (American Spinal Injury Association) is used to classify and quantify the entity and severity of the spinal damage, which describes five injury categories. Category A, indicates complete spinal cord injury, B-C-D define incomplete lesions with different severity, and finally category E defines the normal condition. The best neurological prognosis is for incomplete spinal injuries, rather than complete injuries. Other neurological deficits could be due to a vertebral artery compression. Finally, patients with previous odontoid dens fracture commonly present cervical pain, secondary to pseudarthrosis, to which this type of lesion is often linked.

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