ABSTRACT

We report a 30-year-old man with atlanto-occipital dislocation after a traffic accident. Diagnosis was based on radiography, computed tomography, and magnetic resonance imaging. Owing to the critical conditions that did not fulfil advanced trauma and life support protocols, surgical treatment was deferred, and the patient died 10 hours later.

Key words: atlanto-occipital joint; cervical vertebrae; dislocations

INTRODUCTION

Traumatic atlanto-occipital dislocation is a mortal injury.1–4 It is the cause of death in 8 to 35% of traffic fatalities and in up to 10% of fatal cervical spine injuries.5–7 Early diagnosis, immediate adequate immobilisation, prompt intubation, and early internal fixation are the key to survival. Improved pre-hospital care, rapid rescue, and shorter transportation time increase the survival rate upon arrival to hospital. Nonetheless, atlanto-occipital dislocation represents a gross instability in the craniovertebral structures. We report a 30-year-old man with atlanto-occipital dislocation after a traffic accident.

CASE REPORT

In May 2010, a 30-year-old man was admitted to our hospital after having been thrown off from his motorcycle at high speed. At the scene of the accident, the patient had a cardiorespiratory arrest and was successfully resuscitated. He also had a decreased level of consciousness (Glasgow Coma Scale [GCS] score of 3). The neck and spine was immobilised with a rigid cervical collar and a plastic board.

On admission, the patient was unresponsive and haemodynamically unstable. His GCS score was 3, and his pupils were bilaterally isochoric but slightly reactive to light. He had normal heart sounds with a regular rate and rhythm; no murmurs were noted. His extremities were warm and peripheral pulses
were easily palpated.

The patient was intubated. Radiographs of the thorax, pelvis, and cervical spine showed a displacement of the occiput and the atlas and a massive soft-tissue swelling in front of the upper cervical vertebrae (Fig. 1). Cerebral and cervical computed tomography (CT) revealed an atlanto-occipital dislocation with an anterior translation of the occiput. According to the Harris criteria,\textsuperscript{8} the basion was anteriorly displaced (18 mm from a line drawn along the posterior cortex of the axis and 27 mm from the tip of the odontoid). The Powers ratio\textsuperscript{8} was 1.5, and the Wackenheim clivus line\textsuperscript{8} drawn along the clivus was anterior to the odontoid (instead of being tangential). In addition, there were extensive prevertebral soft-tissue swelling, intraventricular haemorrhage, subarachnoid haemorrhage at the frontal lobe, and diffuse disruption at the frontal and occipital lobes (Fig. 2). Cardiothoracic CT did not show relevant injuries. Magnetic resonance imaging (MRI) confirmed the presence of a prevertebral haematoma and disruption of the anterior longitudinal ligament (atlanto-occipital membrane) and posterior longitudinal ligament (tectorial membrane) consistent with complete atlanto-occipital ligamentous disruption. Posterior atlantoaxial

\begin{figure}[h]
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\includegraphics[width=0.4\textwidth]{figure1.png}
\caption{Radiograph showing an atlanto-occipital disruption, prevertebral soft-tissue swelling, and malalignment of the skull and the cervical spine with widening of the atlanto-occipital joints.}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=0.4\textwidth]{figure2.png}
\caption{Sagittal computed tomography showing a 2.7-cm anterior translation of the occiput and extensive prevertebral soft-tissue swelling.}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=0.4\textwidth]{figure3.png}
\caption{Magnetic resonance imaging showing a prevertebral haematoma and disruption of both the anterior and posterior longitudinal ligament consistent with complete atlanto-occipital ligamentous disruption.}
\end{figure}
subluxation and an intramedullary haematoma at the C1-C2 vertebrae compressing the medulla were also detected (Fig. 3).

At this moment, the patient’s pupils became bilaterally mydriatic and nonreactive to light. Thus, barbituric coma was induced and high-dose corticosteroids were administered. Owing to the critical conditions that did not fulfil advanced trauma and life support protocols, surgical treatment was deferred, and the patient died 10 hours later.

**DISCUSSION**

Most patients with an atlanto-occipital dislocation are either immediately dead or survive only for few hours, although survival cases have been reported recently. This injury is mainly ligamentous and occurs as a consequence of rapid deceleration of the trunk in relation to the head. Owing to improved prehospital care, rapid rescue, and shorter transportation time, the number of patients surviving atlanto-occipital dislocation is increasing.

The diagnosis of atlanto-occipital dislocation is challenging. Radiography is not adequate, especially in patients with partial cord injuries and malalignments of the craniovertebral junction. Nonetheless, the diagnosis can be made when there is prevertebral soft-tissue swelling and a noticeable superior, anterior or posterior translation of the occipital condyles in relation to the atlas. Delay in diagnosis might lead to additional neural injury or death, as the disrupted ligamentous structures of the proximal spine are extremely unstable.

The sensitivity of radiography in detecting subtle atlanto-occipital dislocations is low (20 to 76%). The Powers ratio based on the basion-axial interval and basion-dental interval is of high sensitivity. When this ratio is >1, dislocation is likely. When it is successfully applied on lateral radiographs, its sensitivity increases to 100% for atlanto-occipital dislocation. Nevertheless, its sensitivity decreases when anatomic landmarks are not identifiable. In our patient, the Powers ratio was 1.5 (Fig. 4). Prevertebral soft-tissue swelling is another common feature of atlanto-occipital dislocation seen on radiographs. This was retrospectively noted in 37 (90%) of 41 patients with such dislocation. CT and MRI are mandatory to confirm such dislocation, identify any associated fractures, and assess the extent of ligamentous disruption and spinal cord injury.

In a retrospective study of 69 patients with atlanto-occipital dislocation, a wider basion-dental interval was associated to a higher mortality, especially when >15 mm. Patients sustaining such dislocation with cervical cord injury who require cardiopulmonary resuscitation and have a GCS score of 3 are not able to survive. The mortality is even higher when there are associated brain injuries. Our patient presented with all these features and his basion-dental interval was 38 mm.

Apart from the Powers ratio, the cranio cervical relationship can be assessed using the Harris criteria. Atlanto-occipital dislocation is present when (1) the basion is >12 mm of the superior continuation of a line drawn along the posterior cortex of the body of the axis (the posterior-axial line), and (2) the distance between the basion and the tip of the odontoid is >12 mm. Other criteria for detecting atlanto-occipital dislocation include (1) the presence of a gap between the occipital condyles, (2) widening of the condylar surface of the atlas to >5 mm, and (3) the Wackenheim clivus line (a line drawn along the posterior clivus) not intersecting or tangential to the odontoid.

MRI is the best tool for detecting injury to ligaments, neural, and vascular structures as well as any associated haemorrhage. Its sensitivity was reported to be 86% (12 of 14 patients). In our patient, the additional finding of a subarachnoid haemorrhage near the vertebral-cranial junction on CT and MRI supported the diagnosis of atlanto-occipital dislocation.
Given the severe ligamentous instability and fatal consequences of further distraction, early stabilisation should be performed once advanced trauma and life support protocols are satisfied.\textsuperscript{12} Spinal immobilisation must be constant while further diagnostic tests are performed. The early reduction and maintenance of alignment by surgery or the use of orthotics must ensue. Nonsurgical techniques alone have been successful in children, but have failed in adults. Thus, open reduction and internal fixation seem to be the only definitive treatment for adult patients with atlanto-occipital dislocation.\textsuperscript{4,21}

REFERENCES