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CASE REPORT

Posterior atlantoaxial dislocation without fracture or neurological symptoms treated by transoral–posterior approach surgery: a case report and literature review

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Abstract

Background Atlantoaxial dislocation usually results from hyperextension trauma and is almost always accompanied by odontoid fracture and neurological symptoms. In most cases, patients with atlantoaxial dislocation die instantly. This is a rare report of posterior atlantoaxial dislocation without fracture and neurological symptoms effectively treated by transoral–posterior approach surgery, and only eleven similar cases have been previously reported.

Objective To describe the very rare case of an adult posterior atlantoaxial dislocation patient without fracture who was neurologically treated using transoral–posterior approach surgery and to review the relevant literature.

Method A 52-year-old man riding a motorcycle was rear-ended by a car. Using X-ray, computed tomography (CT) scan and magnetic resonance imaging (MRI), he was diagnosed with posterior atlantoaxial dislocation without a related fracture or a significant change in spinal cord signal. Transoral–posterior approach surgery with sustained skull traction was used after failed closed reduction.

Result During a 6-month follow-up observation, the lateral cervical spine radiography and sagittal reconstructions of CT scans demonstrated no instability of the atlantoaxial complex. Few patients experience posterior atlantoaxial dislocation without a related fracture or spinal cord deficit. For a patient who experiences trauma with hyperextension, such as in rear-end collisions, X-ray, CT scan and MRI should be performed to ensure that this injury is diagnosed. It is necessary to perform surgery to recover atlantoaxial stability, even in the absence of fracture or neurological symptoms.

Conclusion Transoral–posterior approach surgery is a safe and effective way to manage irreducible posterior atlantoaxial dislocation.

Keywords Atlantoaxial dislocation · Transoral–posterior · Skull traction

Introduction

Posterior atlantoaxial dislocation resulting from traffic accidents usually causes death immediately regardless of odontoid fracture, and very few patients have survived, both with and without neurological symptoms. Related reports describing treatments for posterior atlantoaxial dislocation in the absence of fracture or neurological deficit are very rare. By using conservative traction, most dislocations have been reduced. Posterior or anterior internal fixation and fusion should be supplemented to increase atlantoaxial complex stability. Although a few similar cases have been reported subsequently, the choice of ideal treatment strategy remains controversial and the prognosis is not fully clear. Here, we present a new case which was treated effectively through a combined anterior–posterior approach. The patient was informed that data concerning the case would be submitted for publication and he consented to publish the data.

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Case report

A 52-year-old male patient riding a motorcycle was struck by a car and brought to the local county hospital immediately. He was diagnosed as atlantoaxial dislocation, multiple

soft tissue laceration and dislocation of the left ankle joint. According to the county hospital medical record, the conscious and vital parameters of this patient were normal, and he complained about pain in his neck and throat. After 2 days of treatment, including reduction in the ankle joint, debridement of soft tissue laceration and immobilization with a neck collar, the patient was transferred to our hospital for further diagnosis and treatment. Physical examination immediately upon arrival in our hospital showed that motion of his neck was obviously limited, but movements of his limbs were normal with grade IV–V force. Neurological function was defined as E according to the American Spinal Injury Association's (ASIA) standardized neurological classification of spinal cord injury.

Neither severe brain nor abdominal–thoracic injury was found by the initial CT scan. Anteroposterior, lateral and open-mouth X-ray of the patient's cervical vertebrae demonstrated a retro-positioned atlas and total atlantoaxial dislocation (Fig. 1). CT scanning and MRI confirmed the X-ray findings (Fig. 2). There was no cord compression or significant change in the spinal cord signal (Fig. 3).

Four kilograms of skull traction was applied to this patient. Intraoperative real-time fluoroscopy showed that the distance between the atlas and axis was enlarged but was still suitable for reduction. We did not increase the traction strength to avoid causing severe spinal cord injury. The preoperative plan was partial odontoidectomy to reduce

Fig. 1 Lateral radiography of the cervical spine shows posterior dislocation of the atlas with respect to the axis

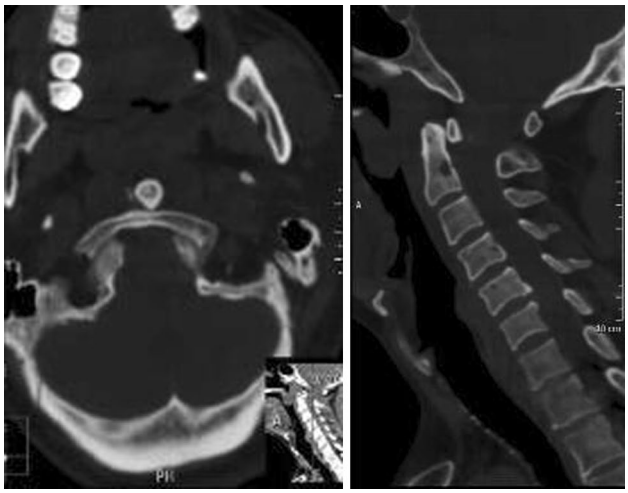

Fig. 2 Axial CT scans confirmed that the odontoid peg was ventral to the anterior arch of the atlas (**a**). Sagittal reconstructions verified lack of rotation or fractures of the odontoid

dislocation. We exposed the axis and atlas by a transoral and retropharynx approach [1] with oral tracheal intubation instead of nasal tracheal intubation anesthesia for convenient nasal disinfection. We performed intraoperative real-time X-ray after anterior atlantoaxial release, which indicated a reduction in atlantoaxial dislocation (Fig. 4). Then, we performed closure in anatomical layers and without grafting in the anterior procedure. Keeping the tracheal cannula and skull traction, we changed the position of the patient for posterior approach surgery. We fixed C1–C2 by an implant

Fig. 3 MRI demonstrated no cord compression or intramedullary cord signal abnormality at the level of the atlantoaxial dislocation

pedicle screw system under lateral fluoroscopy autografted with the morselized iliac crest bone. We did not use any spinal cord monitoring, except a wake-up test.

After the operation, we removed the oral tracheal cannula immediately and moved the patient back to the ward with cardiac monitoring. This patient did not experience complex complications, iatrogenic neurological deficits or postoperative infection. Postoperative lateral radiography and CT scans of the cervical spine showed that there was no instability of the atlantoaxial complex (Fig. 5) and neck and throat symptoms disappeared gradually. His postoperative recovery was very favorable. Three months after the operation, the patient was instructed to remove his neck collar. He has returned to normal life, goes to work and is self-sufficient.

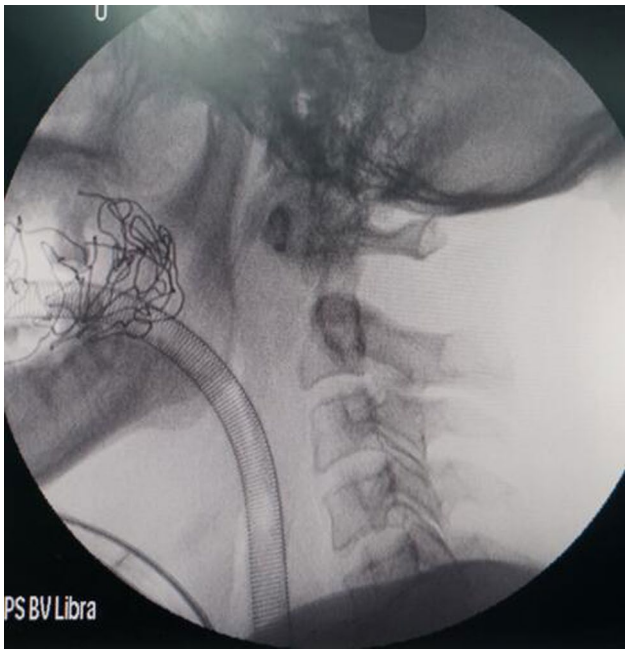

Fig. 4 After anterior atlantoaxial release, intraoperative real-time fluoroscopy showed that the atlantoaxial dislocation had been reduced

Discussion

According to the anatomical structure of C1–C2, the anterior arch of the atlas and the transverse ligament form an osteo-ligamentous ring to create an interlocking odontoid process that combines with interlocking articular processes to provide the main stability of the atlantoaxial complex. Odontoid fracture and ligament rupture characterize most atlantoaxial dislocations. Severe trauma from extension and slack ligaments always results in the odontoid slipping out of the osteo-ligamentous ring and the atlas with respect to the axis, which is called posterior atlantoaxial dislocation. Only 11 cases similar to the present case have been reported in the English-language literature [1–11]. Based upon past experience, cervical spine injury with hyperextension that produces posterior atlantoaxial dislocation like this generally causes immediate and lethal spinal cord damage. However, in the emergency room, this dislocation might be missed due to a lack of symptoms related to neurological deficit and odontoid fracture. Therefore, the incidence of this type of dislocation is likely much higher than previously reported. Haralson et al. [4] believed that posterior atlantoaxial dislocation may be caused by hyperextension with variable amounts of distraction. The neural canal at the atlantoaxial level can be roughly divided into three parts: the odontoid, the spinal fluid and the spinal cord [12]. In some cases, the spinal cord will not be compromised because the neural canal provides adequate space. Tucker and Taylor

Fig. 5 Lateral cervical spine radiography and sagittal reconstructions of CT scans demonstrated stability of the atlantoaxial complex 3 months after the operation

corroborated this idea, finding that canal area decreased to 36% in a skeletal study of simulated posterior atlantoaxial dislocation [13].

Regarding posterior atlantoaxial dislocation diagnosis in the absence of neurological symptoms or odontoid fracture, the atlas and axis are not clearly observed using plain radiography of the cervical spine because the cranial bones overlap and some patients compulsively adopt head or neck positions that obscure the view. Therefore, we guess the misdiagnosis of atlantoaxial dislocation is not infrequent during routine anteroposterior and lateral radiography of the cervical spine. With regard to patients who suffer trauma with hyperextension, such as in a rear-end collision, we should be mindful of this situation and conduct additional examinations, such as tomography and open-mouth X-ray. Despite the low resolution for soft tissues, CT scan shows the bony structures of the atlas and axis clearly. In this case, the structures of the C1–C2 complex were clearly visualized by CT axial scanning. The odontoid peg had slipped from the dorsal to the ventral side of the anterior arch of the atlas, and there was no sign of odontoid fracture. MRI has the advantage of high resolution of soft tissues. In this case, the curve of the cervical spinal cord was changed, as shown by MRI, but there were no abnormal signals or cord compression at the level of C1–C2. Hence, we should use MRI, CT scan and CT three-dimensional reconstruction for a patient with a history of hyperextension trauma.

There are two major methods for treating posterior atlantoaxial dislocation, including closed reduction through traction and open reduction by operation. Closed reduction for this kind of case is effective but dangerous due to the risk of neurological deficit and immediate death caused by overdistraction of the C1–C2 complex. High technical skill and a suitable traction weight are required. Some authors managed this type of dislocation by closed reduction using the three-phase method described by Wong et al. [2, 15, 16]. Some cases have been reduced successfully with 7–10 kg of traction [2, 14, 15]. After the dislocation is reduced, these patients should wear a cervical collar for 3 months in case of instability [2]. Two reported cases required posterior fusion of C1–C2 after closed reduction to treat persistent instability [14, 15].

Posterior atlantoaxial dislocation without odontoid fracture or neurological symptoms is very rare, and there is not a standard operation technique for this kind of dislocation. Jiang et al. [11] reported a similar case treated via an anterior retropharyngeal approach with partial odontoidectomy. In our case, after anterior atlantoaxial release, the atlantoaxial dislocation was reduced. Therefore, we do not believe that partial odontoidectomy is necessary for all cases of posterior atlantoaxial dislocation. Although this surgery was successful, some questions remain. For example, we do not know whether the closed reduction failure was caused by insufficient time or weight of traction or whether changing traction posture favors reduction, but this operation is associated with a very high risk of spinal cord injury and immediate death. Therefore, we suggest applying spinal cord monitoring to closed reduction when choosing the time and weight of traction.

Compliance with ethical standards

Conflict of interest None of the authors has any potential conflict of interest.

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