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Pediatric odontoid fracture causing Brown-Sequard syndrome : A case report

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An odontoid fracture leading to Brown-Sequard syndrome (BSS) is an uncommon condition with only seven cases reported to date. To our knowledge, there are no reports of occurrence in paediatric patients. We report a paediatric odontoid fracture leading to Brown-Sequard syndrome (BSS) with satisfactory recovery following surgical treatment. Odontoid fractures may lead to Brown-Sequard syndrome in cases of high-energy trauma in paediatric patients. Direct anterior screw fixation may be a treatment of choice in paediatric odontoid fractures of the comminuted, displaced type when occurring in conjunction with neurologic injuries.

Keywords : odontoid fracture ; Brown-Sequard syndrome ; paediatric.

INTRODUCTION

Brown-Sequard syndrome (BSS) is caused by hemisection of the spinal cord and is usually seen in the setting of a penetrating injury with associated spinal trauma or a spinal neoplasm in the cervical or thoracic region. Its clinical manifestations are characterized by concurrent ipsilateral hemiplegia and loss of proprioceptive sensation along with contralateral loss of pain and temperature sensations. Odontoid fractures uncommonly lead to Brown-Sequard syndrome ; only seven cases, all occurring in adults, have been described to date (*1,2,4,6,8,10*). Additionally, fractures of the odontoid process are rare in children, with few cases reported (*1,2,4,6-10*). There are no prior reports of odontoid fractures associated with BSS in paediatric patients. We report such a case with satisfactory recovery following surgery.

CASE REPORT

A 13-year-old boy presented to the emergency department with posterior neck pain, bilateral hand tingling, and motor weakness following an automobile traffic accident. Motor strength of the right extremities was 1/5 for the upper extremity and 2-3/5 for the lower extremities. A sensory examination demonstrated significantly decreased pain and

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Fig. 1a. — Preoperative plain open mouth view showing the fracture gap in the synchondrosis area.

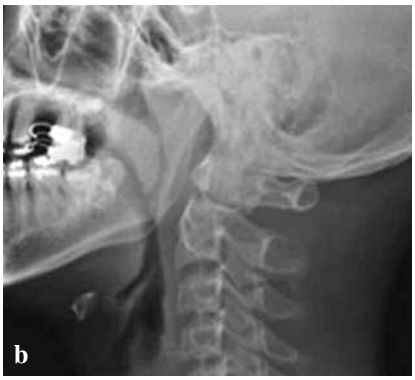

Fig. 1b. — Preoperative plain lateral radiographs showing the fracture gap in the synchondrosis area and the posterior displacement.

Fig. 1c. — Immediate postoperative open mouth view demonstrating fixation of the fracture with two cannulated screws.

Fig. 1d. — Six month postoperative lateral radiographs demonstrating good alignment and healing.

temperature sensation below the left C4 dermatome. Loss of proprioception, vibration, and discriminatory touch sensation below the right C4 dermatome were also noted. Deep tendon reflexes of the right upper and lower extremities were slightly hyperactive. Babinsky's reflex was also present on the right side.

Plain radiographs revealed an odontoid type II fracture at the base of the synchondral fusion area with posterior displacement of the process (Fig. 1a, 1b). Computerized tomography demonstrated a comminuted fracture and posterior beak of the fracture fragment (Fig. 2a, 2b). Sagittal and axial T2-weighted magnetic resonance imaging revealed an abnormal focal hyperintensity around the C2 vertebra level (Fig. 3a, 3b, arrows).

Surgical management included anterior direct fixation with two cannulated screws. Satisfactory screw placement and reduction were achieved on immediate postoperative roentgenograms. At the six month follow-up, a motor examination demonstrated right upper extremity strength of 4/5 and right lower extremity strength of 5/5. A nearly total recovery of light touch, proprioception, and temperature discrimination were also observed. Subsequently, the patient was able to walk independently without any support, negotiate stairs with minimal assistance, and independently carried out most ADLs. The follow-up radiograph of the cervical spine six months after injury demonstrated advanced bony healing of the odontoid fracture (Fig. 1c, 1d).

Fig. 2a. — Preoperative coronal CT image demonstrating the comminuted fracture fragment in the base of the odontoid process.

Fig. 2b. — Preoperative sagittal CT image demonstrating the comminuted fracture fragment in the base of the odontoid process and the posteriorly displaced fracture beak.

Fig. 3a. — The T2 sagittal MR image demonstrates focal high signal change in the spinal cord (arrows).

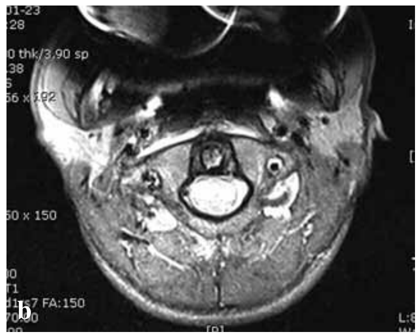

Fig. 3b. — The T2 axial MR image also demonstrates high signal change in the right side of the spinal cord.

DISCUSSION

There are few reports on posteriorly displaced odontoid fractures in children. Odontoid fractures in children are almost always displaced anteriorly because of the compression of a strong transverse ligament to the posterior surface of the odontoid process under flexion force (*9*). This case shows posterior displacement of the odontoid fracture, which was caused by an injury mechanism such as an extension and distraction force, which caused compression of the odontoid process by the atlas.

Neurologic complications of odontoid fractures in children are in contrast with the complications described in adults because of the relatively capacious cerebrospinal fluid space at C-1 and C-2 (*9*). To the best of our knowledge, there is no report of neurological deficits such as a Brown-Sequard syndrome in odontoid fractures in children like the present case. Wu *et al* (*10*) reported that the pathophysiology of BSS in the posteriorly displaced odontoid process with the fracture extending into the axial body and the compression of the spinal cord may have played a major role in causing BSS, although it was reported in an adult.

In children, odontoid fractures usually occur at the level of the basilar odontoid synchondrosis and correspond to type 2 fractures. The general consensus is to treat odontoid fractures in younger children conservatively (*1,7*). The cartilaginous synchondrosis has excellent healing capacity. The synchondrosis fuses between the ages of 7 to 9 (*3*). This implies that in older children, odontoid fractures must be considered and treated identical to their adult counterparts. Multiple factors should be taken into account when determining the therapeutic course for odontoid fractures, including the fracture type, degree of injury, age of patient, and neurologic status. Surgical intervention is generally considered when conservative therapy fails (*5*). Although the present case demonstrates a nearly fused state in the synchondral area at the base of the odontoid process because the patient is an older child, this might also be a weak point considering the patient's odontoid synchondrosis has not completely changed to bony tissue as the patient is not an adult.

There are two general approaches depending on the presence/absence of the transverse ligament rupture ; posterior C1-C2 arthrodesis and anterior direct screw fixation. In the present case, we performed a direct anterior fixation with two cannulated screws to avoid an unnecessary limitation of cervical rotation and flexion/extension by posterior fusion, and because the fracture pattern was oblique with posterior displacement (*11*).

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