Fracture of the atlas through a synchondrosis of the anterior arch complicated by atlantoaxial rotatory fixation in a four-year-old child

Fracture of the atlas is rare in children. We report a case of fracture of the atlas through a synchondrosis of the anterior arch complicated by atlantoaxial rotatory fixation in a four-year-old girl.

Fracture of the atlas accounts for 10% of injuries to the cervical spine and 2% of all spinal injuries.\(^1\) Injury to the cervical spine is rare in children and represents only 1.9% to 9.5% of all cervical injuries.\(^1\) Fracture of the atlas complicated by atlantoaxial rotatory fixation has only been reported to our knowledge in one adult case associated with a so-called Jefferson fracture.\(^2\) We describe the rare combination of a fracture of the atlas through a synchondrosis of the anterior arch with atlantoaxial rotatory fixation in a four-year-old child.

Case report

A four-year-old girl was referred to our department 18 days after sustaining a head injury by falling downstairs and striking her head on the floor. Immediately after the accident, she had been taken to a local neurosurgical clinic complaining of headache and neck pain. A CT scan of the head revealed no abnormality. However, the symptoms persisted and the next day she attended a local orthopaedic clinic. A plain radiograph of the neck showed no abnormality. She was prescribed a supportive collar, medication and rest at home. Although the pain gradually improved, a torticollis persisted. She was subsequently referred to our department.

On examination, she held her head in the ‘cock robin’ position (Fig. 1). Active movements of the neck were not possible because of pain and paravertebral muscle spasm. Neurological examination was normal. Plain anteroposterior and lateral radiographs showed no definite abnormality except for lateral curvature of the cervical vertebrae. The atlantodental interval was 2 mm, within normal limits. An attempted open mouth view failed to provide information on the state of the atlantoaxial joint because of pain and a restricted range of movement. A CT scan, however, revealed a fracture on the left side of the anterior arch of the atlas, with changes anteriorly suggestive of callus formation. The atlas was rotated 10° with respect to the axis. The displacement (Fig. 2) was consistent with type II atlantoaxial rotatory fixation according to Fielding’s classification.\(^3\) MRI showed a high signal area in the anterior arch of the atlas on the T1-weighted image, but no abnormal findings in the spinal cord.

![Fig. 1](image)
Figure 2a shows axial CT scans, and Figure 2b 3D reformatted CT scan, through C1-C2 showing a fracture through an anterior atlantal synchondrosis (arrow) and atlantoaxial rotatory fixation. Figure 2c shows a composite image of C1 and C2.

Table I. Summary of reported paediatric cases of a fracture of the isolated anterior arch of the atlas

<table>
<thead>
<tr>
<th>Authors</th>
<th>Gender/Age (yrs)</th>
<th>Mechanism of injury</th>
<th>Neck pain</th>
<th>Cervical muscle spasm</th>
<th>Decreased ROM*</th>
<th>Head tilt</th>
<th>Neurological deficit</th>
<th>Delayed diagnosis (d)</th>
<th>Treatment</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mikawa et al5</td>
<td>M/4</td>
<td>Fall</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes (a few days)</td>
<td>Cervical traction for 3 wks and cervicothoracic brace for 8 wks</td>
<td>Full function</td>
</tr>
<tr>
<td>Judd et al4</td>
<td>M/6</td>
<td>Fall onto head</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Malibu cervical orthosis for 8 wks</td>
<td>Full function</td>
</tr>
<tr>
<td>Bayar et al1</td>
<td>F/2.5</td>
<td>Fall onto head</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes (2 days)</td>
<td>Cervical collar for 3 mths</td>
<td>Full function</td>
</tr>
<tr>
<td>Thakar et al7</td>
<td>M/5</td>
<td>Fall onto head</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes (4 days)</td>
<td>Hard collar for 6 wks</td>
<td>Full function</td>
</tr>
<tr>
<td>Reilly and Leung6</td>
<td>M/6</td>
<td>Fall onto head</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Transoral reduction, Halo vest</td>
<td>Full function</td>
</tr>
<tr>
<td>Our study</td>
<td>F/4</td>
<td>Fall onto head</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes (18 days)</td>
<td>Traction for 4 wks and cervicothoracic brace for 9 wks</td>
<td>Full function</td>
</tr>
</tbody>
</table>

* ROM, range of movement
The diagnosis of a fracture of the atlas through a synchondrosis of the anterior arch combined with atlantoaxial rotatory fixation was made. The patient was admitted immediately and placed on traction. The torticollis gradually improved. Four weeks after admission, the pain had resolved, a CT scan showed good callus formation, traction was discontinued and a cervicothoracic brace applied. The patient was discharged five weeks after admission. The brace was retained for a further two months.

A CT scan four months after injury showed that the fracture had united. At follow-up one year after injury, the torticollis had resolved. There was no pain or restriction of movement and no neurological abnormality. Plain radiographs of the cervical vertebrae showed no instability of the atlas and axis.

Discussion

Isolated fractures of the anterior arch of the atlas in children are very rare. Five cases have been described (Table I), with no mention of atlantoaxial rotatory fixation. The cause of injury was a fall in all cases and a fall onto the head in four. Clinical symptoms of neck pain, cervical muscle spasm, decreased movement and head tilt were observed in all five cases. The definitive diagnosis was delayed in four of the six cases, including our patient. The absence of apparent abnormalities on plain radiographs and delay in obtaining a CT scan contributed to the tardy diagnosis. One patient was treated with Halo vest stabilisation, while the other four were managed conservatively using an orthosis or traction. The outcome was good in all cases. No patient had residual pain or loss of movement. Fracture of the anterior arch of the atlas should be suspected when a child who has fallen onto the head presents with neck pain, cervical muscle spasm, torticollis and a decreased range of movement. In these cases, CT examination should be undertaken, particularly if plain radiographs show no abnormality or are difficult to interpret.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References