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Anterior Screw Fixation for a Pediatric Odontoid Nonunion

A Case Report

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Study Design. A case of an odontoid nonunion in a child treated with anterior screw fixation.

Objectives. To demonstrate that an anterior screw procedure can be performed with an odontoid nonunion with resultant fusion to maintain range of motion.

Methods. A 15-year-old boy presented with pain in his neck following a rugby football injury. Admission plain radiographs and computed tomography scan demonstrated an odontoid nonunion. Radiographs of a previous cervical spine injury 2 years before demonstrated a missed odontoid fracture.

Results. The child was initially treated conservatively with halo vest immobilization, which did not result in healing. Direct anterior screw fixation was performed and the fracture united 5 months following surgery.

Discussion. The nonunion was asymptomatic for 2 years until the second injury when it became clinically symptomatic. It did not respond to conservative treatment and was unstable on screening requiring operative intervention.

Conclusions. Very few cases have been reported of pediatric odontoid nonunions. If the fracture pattern allows, then direct anterior screw fixation should be considered in order to maintain range of motion at the atlantoaxial articulation.

Key words: odontoid fracture, nonunion, instability, screw osteosynthesis. **Spine 2005;30:E28–E30**

The purpose of this report is to reinforce to spinal surgeons to the benefit of direct anterior screw fixation of odontoid nonunions in the pediatric age group, therefore maintaining the maximum range of motion at the atlantoaxial joint. Fractures of the odontoid are common in children and can result in atlantoaxial instability. This can lead to spinal cord compromise and spinal stabilization is therefore imperative.[1] Posterior fusion is associated with a higher fusion rate but reduces cervical rotation by 50% and flexion-extension by 10%.[2] We found only one other report of direct anterior screw fixation for a pediatric odontoid nonunited fracture, but no mention of resultant fusion was made.[3]

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Case Reports

A 15-year-old boy presented to the accident and emergency department with neck pain following a rugby football tackle. During the tackle, he was lifted and came down onto his head. His neck pain commenced immediately.

Physical examination showed tenderness in the upper cervical spine. He was reluctant to move the neck in any direction but was neurologically intact.

Plain radiography was performed showing a fracture through the base of the odontoid process, and computed tomography (CT) scan confirmed the fracture but suggested it may be a nonunion as there was sclerosis at the margins (Figure 1). Further imaging, *i.e.*, bone scan, was not performed at the referring hospital to confirm the nonunion.

Conservative treatment was initiated with halo-vest immobilization, as it was unclear that the fracture was a clear nonunion. At 3 months, a further CT scan demonstrated no signs of union.

Following no sign of union and continuing pain, the child was referred to our spinal unit where the decision was made to attempt direct anterior screw fixation because of the fracture pattern.

Further questioning uncovered a similar injury 2 years previously, and review of the plain films demonstrated an undisplaced odontoid fracture that explained the nonunion seen on the admission CT scans.

A standard anterior approach was performed, and two partially threaded 3.5-mm screws were inserted across the fracture using a lag screw principle without direct bone grafting into the nonunion site (Figure 2). The child was then treated in a hard cervical orthosis. A follow-up CT scan at 5 months demonstrated fusion (Figure 3); the orthosis was removed and physiotherapy commenced. With physiotherapy, he regained full range of rotation and full flexion-extension (Figure 4).

Discussion

Odontoid fractures were classified into three types according to Anderson and D'Alonso.[4] In the reported case of a Type II fracture, which is the most common fracture, it occurs through the base of the dens and is inherently unstable.

Initial treatment is by immobilization with an orthosis such as a halo-vest. Successful fusion occurs in 37% to 75% of cases.[3] Several factors have been identified to increase nonunion such as fracture gap, age, comminution, and lack of immobilization. In the reported case, lack of diagnosis and immobilization could account for the resulting nonunion.

Authors have recommended posterior C1–C2 fixation and fusion in Type II nonunions with a gap of more than

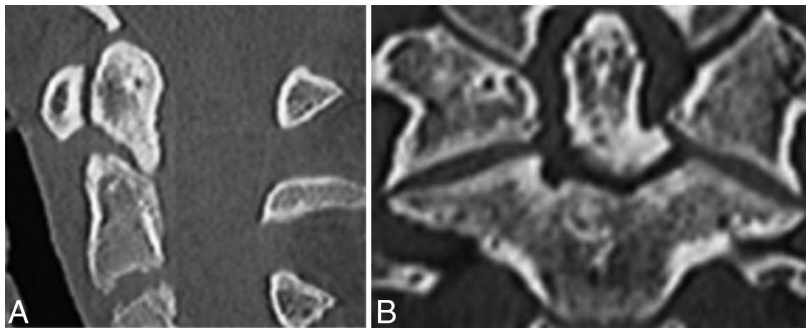

Figure 1. Computed tomography scan demonstrating the nonunion of the dens with sclerotic fracture edges.

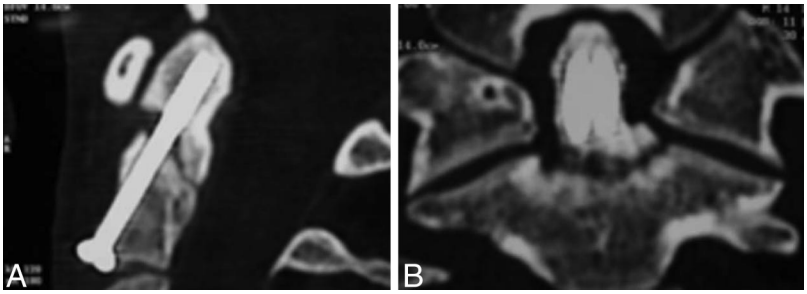

Figure 2. Computed tomography scan demonstrating screw position postoperation.

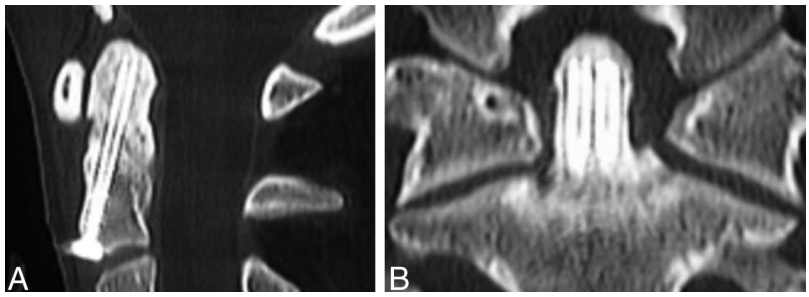

Figure 3. Computed tomography scan demonstrating union with two anterior screws at 5 months post-operatively.

2 mm,[3] but this can be avoided with anterior screw fixation. This should be avoided as it would produce 50% reduction in rotation and 10% reduction in flexion-extension.[2] Treatment of children with unstable odontoid nonunions should be by direct screw fixation if the fracture pattern is transverse or perpendicular to the screw orientation from the anterior approach. For reverse obliquity fractures, a posterior C1–C2 fixation would be required. Apfelbaum *et al* reported a 15-year-old child in their series but did not comment on whether the child was in the recent or remote group. There was no mention of whether the fracture united. Twenty-five percent of their remote fractures did not unite.[3] The duration of the nonunion should not affect the decision to perform the above procedure as if the nonunion fails to unite; then posterior surgery can be performed.

Figure 4. Full rotation following direct anterior screw fixation of odontoid fracture.

■ Conclusion

Close scrutiny of plain radiographs should be performed to avoid missed injuries. Computed tomography can confirm the diagnosis and comment on age of fracture. Direct anterior screw fixation should be the treatment of choice in odontoid nonunions regardless of the age of the fracture but depending on the orientation of the fracture to avoid disabling reduction in cervical range of motion.

■ Key Points

- Odontoid fractures should be considered in the evaluation of a child with cervical injury resulting from contact sports.

• To confirm the diagnosis and the age of the fracture, a computerized scan should be performed.
• The treatment should be direct anterior screw fixation for permissible fracture patterns in odontoid nonunions regardless of age of fracture.

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