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Technique

Double insurance atlantoaxial fixation

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Abstract

Background: An alternative technique of atlantoaxial fixation is described, which combines the trans-articular method of fixation described by Magerl in 1982 and the interarticular technique described by us in 1988.

Methods: Between January 2001 and January 2005, 18 patients underwent the discussed method of fixation at the Department of Neurosurgery at King Edward VII Memorial Hospital in Mumbai, India. Fifteen patients had congenital craniovertebral anomaly and 3 patients had posttraumatic atlantoaxial instability. Fourteen patients had basilar invagination with "fixed" atlantoaxial dislocation, and 4 patients had mobile and reducible atlantoaxial dislocation. The mean follow-up period was 22 months (range, 3-50 months).

Results: Successful atlantoaxial stabilization was achieved in all patients and was documented with dynamic radiography. There was no incidence of implant rejection. There were no neurological, vascular, or infective complications.

Conclusion: The described method of atlantoaxial fixation that incorporates the advantages of the 2 currently more frequently used techniques of lateral mass fixation could be an alternative method of fixation.

Keywords: Atlantoaxial dislocation; Craniovertebral anomalies; Atlas; Axis

1. Introduction

Various methods of fixation and fusion for atlantoaxial dislocation have been described, accepted, and successfully used. However, the search for the biomechanically most appropriate method of fixation for this clinically vexing problem continues. The popularity of the transarticular method described by Grob and Magerl [10] in 1982 and the interarticular method described by us in 1988 [5,8] can be gauged by the large number of recently published papers discussing the clinical experiences and the biomechanical issues concerning lateral mass fixation techniques [12-14]. We had recently discussed the feasibility of distraction of the facets of atlas and axis and craniovertebral realignment in the treatment of basilar invagination and fixed atlantoaxial dislocation [2-4,6,7,9].

We present an alternative technique of atlantoaxial fixation and joint distraction for the treatment of both atlantoaxial dislocation and basilar invagination, which incorporates the advantages of both the interarticular and transarticular techniques and provides a firm fixation of the region. Onlay and interfacetal bone grafts subsequently produced bony fusion. The technique and merits of this method of fixation are presented on the basis of an experience with 18 surgically treated cases over a 4-year period.

2. Material and methods

2.1. Surgical indications

The technique of atlantoaxial fixation used in the series was used randomly and the cases were not consecutive. The case selection was primarily based on the local anatomical situation gauged after the exposure of the region and manipulation of the joint in cases of atlantoaxial dislocation

Abbreviations: C1, first cervical; C2, second cervical; CT, computed tomography; VAS, visual analogue scale.

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with or without the presence of basilar invagination. The size of the pedicle and the location of the facets after their exposure and manipulation determined the case selection. The operating associate of the author also decided the performance of the technique to a certain extent. In general, our current preference of atlantoaxial fixation is the technique discussed in this report. The method was used in 14 cases where there was basilar invagination and in 4 cases where there was mobile and reducible atlantoaxial dislocation. Fifteen patients had a congenital craniovertebral anomaly and 3 patients had posttrauma atlantoaxial instability. All cases with basilar invagination had "fixed" atlantoaxial dislocation, and 11 cases had assimilation of the atlas.

2.2. Clinical profile

Our patient population comprised 12 males and 6 females (mean age, 22 years; range, 9-52 years) (Table 1). Three patients had histories of significant trauma. There was no fracture of any part of the axis or atlas. In the rest of the patients, there was either an insignificant or nonexistent history of trauma; so in these patients, atlantoaxial instability was probably congenital in nature. The VAS scoring was done to assess the severity of pain, and Nurrick's grading was used to assess the extent of myelopathy. Seventeen patients had varying degrees of quadriparesis, and none of them had quadriplegia. One patient had neck pain as the only presenting symptom. Seven patients had normal sensations. Kinesthetic sensations were affected in 10 patients, and spinothalamic sensations were affected in varying degrees in 7 patients.

2.3. Investigations

All patients were examined with plain radiography, which included lateral (flexion and extension) and anteroposterior transoral views. In addition, CT with sagittal reconstruction, CT angiography, and magnetic resonance imaging were carried out in all patients.

Table 1
Principal presenting clinical features

No.	Clinical features	Number of patients	
		Preoperative	Postoperative
1	Neck pain	18	Recovered in all 18
2	Weakness		All patients improved and were able to walk unaided
	Able to walk unaided	10	
	Needed support to walk	6	
	Unable to walk even with support	2	
5	Sensations		All patients improved. Residual affection of kinesthetic sensations in 3 patients; residual partial affection of spinothalamic sensations in 2
	Normal sensations	7	
	Kinesthetic sensations affected	10	
	Spinothalamic sensations affected	7	

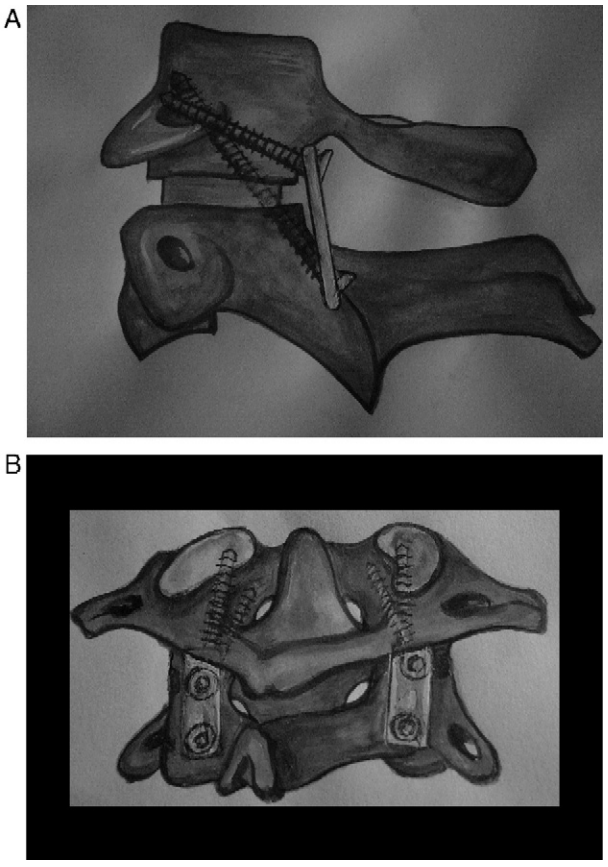

Fig. 1. A: Line drawing showing the construct. Metal plate is placed flush to the lateral masses of atlas and axis after adequately preparing the host area. A screw is passed directly into the facet of C1 through a hole in the plate. The C2 screw is a transarticular screw as described by Grob and Magerl. Bone graft with or without a spacer is placed in the articular cavity. B: Posterior view of the line drawing.

2.4. Operative technique

The related anatomy of the region [1,11] and the basic steps of surgery have been enumerated in our previous publications on the subject [2-9] (Fig. 1). Cervical traction was given before induction of anesthesia and the weights were progressively increased to approximately 5 kg or one sixth of the total body weight. The patient was placed prone with the head end of the table elevated to about 35°. Use of operating microscope facilitated the dissection and added safety to screw implantation. The atlantoaxial facet joints were widely exposed on both sides after sectioning of the large C2 ganglion. The exposure of the facet of the atlas is significantly difficult in cases with basilar invagination as it is located markedly rostrally. Thick capsule overlying the joint space was sharply cut, and the facet joint was widely opened. The cartilage at the articular surface of the facets of the atlas and axis was widely removed using a microdrill.