

TRANSODONTOID SCREW FIXATION IN TYPE II ODONTOID FRACTURE

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ABSTRACT :

This report covers fourteen cases of type II odontoid fractures operated on in the Neurosurgery Departments of V.K.V. American Hospital, S.S.K. Okmeydanı and Göztepe Hospitals in between 1997 and 1998. All of these unstable cases admitted to the hospitals at least three weeks after the trauma and were treated with transodontoid screw fixation. This multicenter prospective study was recording no complications, mortality and morbidity by this technique. We recommend transodontoid screw fixation to be considered as a preferable treatment of choice, even an alternative to the conservative treatment for the cases with Type-II odontoid fractures.

Key words: Cervical Trauma, Odontoid, Screw Fixation

INTRODUCTION

Among all odontoid fractures, 60 % are Type-II cases, forming a serious subgroup with 6 % mortality and morbidity rate (1, 6,15). Surgery is frequently performed as a means of treatment, as this group reveals a very weak chance of spontaneous fusion with external immobilization. Usual treatment techniques include conservative halo immobilization, C₁-C₂ posterior wiring and surgical fusion. The new concept of transodontoid screw fixation is becoming one of the first choice of treatment for the Type-II odontoid fractures, and even alternative to the conservative treatment. The C₁-C₂ posterior-screwing method is another alternative technique providing more rigid fixation than posterior wiring.

In this study, we discussed the results of transodontoid screw fixation of fourteen Type-II fracture cases reviewing previous reports of the literature.

MATERIAL and METHOD

Fourteen cases of Type-II odontoid fractures were operated in the Neurosurgery Department of V.K.V. American Hospital, S.S.K. Okmeydanı and Göztepe Hospitals in between 1997 and 1998. Mean age of the patients was 41.5 years (range 15 - 79 years). Most of the cases were male (9 male and 5 female). Motor vehicle accident was the major cause of the injury in eleven cases and falling from a height was found in three cases. The only one youngest male was admitted to the hospital 4 days after trauma. The rest thirteen cases admitted to the hospital at least three weeks after the trauma. All of the patients were found to be unstable after the radiologic investigations (Figure 1).

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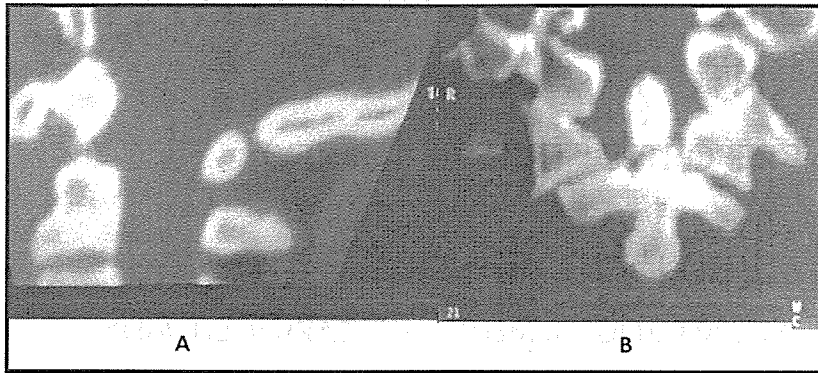


Figure 1. The unstable Type II odontoid fracture

- A. Sagittal CT scan.
- B. Coronal CT scan

The odontoid bony fragment displaced anteriorly (Figure 2) in 10 cases, posteriorly in 2 cases whereas in normal anatomic position was revealed in 2 cases (Figure 3). One case had an anterior arc fracture (Figure 4).

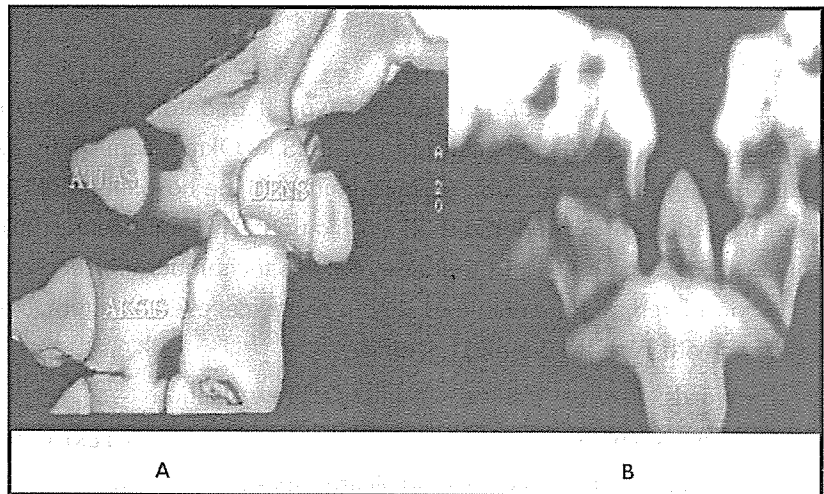


Figure 3. Type II odontoid fracture. A. Sagittal 3-D CT reconstruction. B. Coronal CT scan.

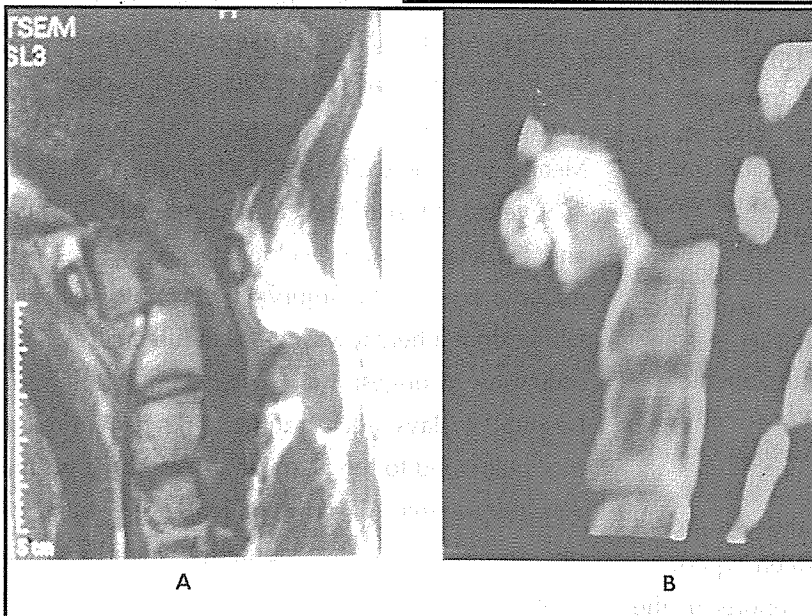


Figure 2. Type II odontoid fracture was dislocated anteriorly in sagittal plane.

- A. MRI.
- B. CT scan.

The neurologic status was regarded according to Frankel scale (9) and clinical findings of the cases are summarized in Table 1. The neurologic status was regarded according to Frankel scale (9) and clinical findings of the cases are summarized in Table 1.



Figure 4. Anterior view fracture of atlas accompanied to Type II odontoid fracture.

CASE ILLUSTRATION:

Case I: A twenty-five years old male. He had a motor vehicle accident (MVA). He complained of severe neck pain after the trauma and progressed restriction of his neck movement. He admitted to one of these neurosurgery centers three weeks after the trauma. His neurological exam was normal but had restricted neck movement. His radiological exams revealed that odontoid Type II fracture dislocated posteriorly and spinal cord compression. He was operated by transodontoid screw fixation and discharged 3 days after the operation (Figure 5).

Case II: A fifty years old female. She had a MVA. She complained of severe neck pain. She admitted to a neurosurgery consultant on the day of the trauma. She was neurologically intact. Her radiological exam revealed C₁ anterior arc and Type II odontoid fracture (Figure 4).

She was followed by Philadelphia collar until a week but her complaint increased by days. She was consulted in our neurosurgery centers and operated by transodontoid screw fixation. She was followed by Philadelphia collar in 4 weeks. Her cervical CT scans demonstrated arthrod Type II fracture (Figure 6) and also anterior arc fracture of C₁.

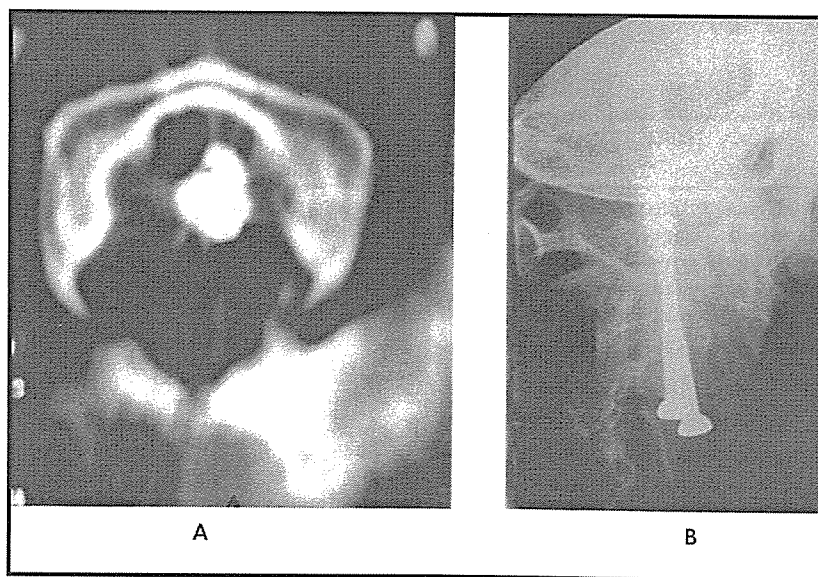


Figure 5. The appearance of screwed type II odontoid fracture.

- A. Axial CT scan.
- B. Lateral cervical X-ray.

Table 1. Summary of fourteen Type II odontoid fractures. (MVA: Motor vehicle accident)

Patient	Age	Sex	Cause of injury	Neurologic Status	Hospitalisation Period	Outcome
1	15	male	Fall	E	3 days	E
2	24	male	MVA	E	4 days	E
3	50	female	MVA	E	4 days	E
4	65	female	MVA	B	3 days	B
5	25	male	MVA	E	3 days	E
6	67	male	MVA	E	2 days	E
7	25	male	MVA	E	2 days	E
8	29	male	MVA	E	2 days	E
9	79	female	MVA	E	2 days	E
10	36	male	MVA	E	3 days	E
11	26	male	MVA	E	3 days	E
12	32	female	MVA	E	3 days	E
13	60	female	Fall	E	3 days	E
14	48	male	Fall	E	3 days	E

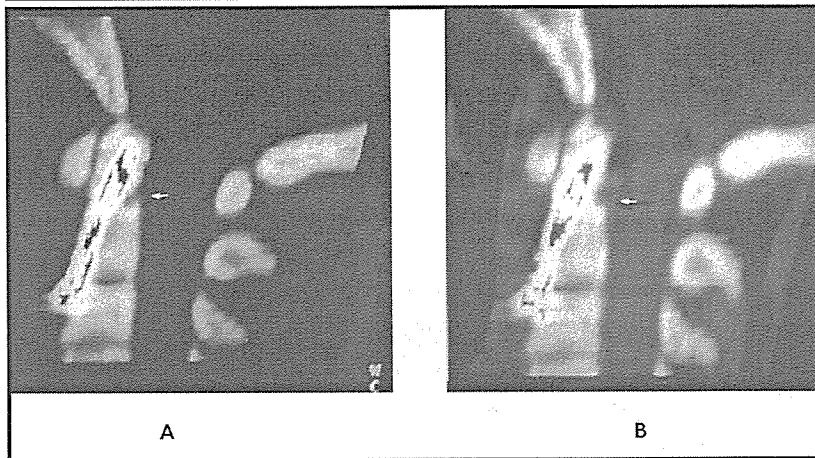


Figure 6. Rearthrosis of Type II odontoid fracture after surgery remarked by arrow (in sagittal CT scan).
A. Postoperative first week.
B. Postoperative 6th month.

Case III: A twenty-four years old man. He had a MVA. He admitted to one of these neurosurgery centers three months after the trauma. He had tenderness and pain in his neck. His neurological exam was normal. He had Type II odontoid fracture and was operated by transodontoid screw fixation technique (Figure 7).

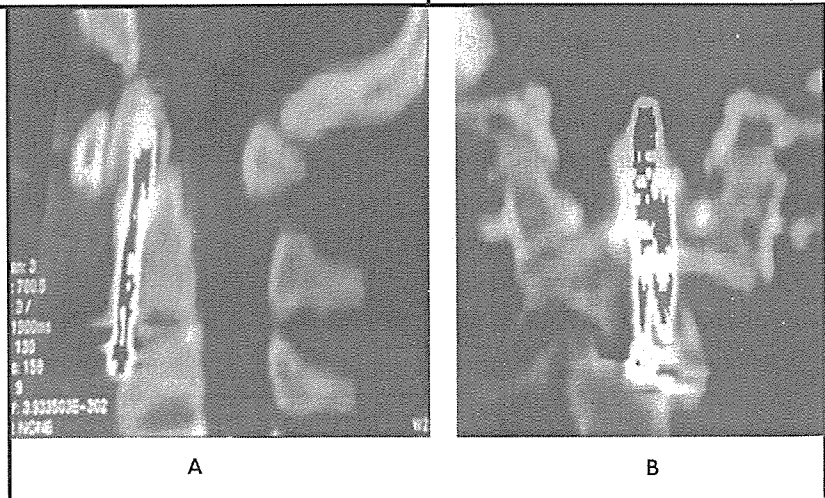


Figure 7. Repositioned odontoid fracture by transodontoid screw fixation demonstrated by CT scan.
A. Sagittal plane
B. Coronal plane.

Transodontoid screw fixation technique was performed as described by Appfelbaum previously (2,3). All of the cases were followed by Philadelphia collar after the operation until 4 weeks. The average hospitalization period was 3 days. There were no complications, no mortality and no morbidity. The patients were evaluated in 3, 6 and 12 months follow-up period. All the patients have remained same as in their preoperative conditions except a 65 year old woman who attended 6 months after the trauma with quadriplegia (Frankel B) was the only case who did not reveal any improvement of neurological status. Even this quadriplegic patient who had myelomalacia problems had some minor benefits from the operation as the possibility of spinal cord injury was retarded through this stabilization operation.

DISCUSSION

The treatment of Type-II odontoid fractures is still a matter of controversy in neurosurgery. The first question is to decide the appropriate treatment approach; whether the operation or conservative treatment with halo brace (14). Once surgery is preferred, then the best surgical procedure must be chosen. Difficulty of spontaneous fusion is the most important problem of the Type-II odontoid fractures mostly being affected by slipping distance between fractured odontoid and the body of C₂. The risk is remarkably increased with distance over 4-6 mm. (8,10,11,12). The age is also important, as the chance of spontaneous fusion decreases over 40 (4, 6, 8). Even some of the young patients may require halo bracing for long survival. But this method carries some difficulties, such as pain, infection at the pinsites, osteomyelitis of the skull, and social life problems such as loss of the job, the income and etc... Halo brace application also causes delay and increases the possibility of non-union complication (8, 16). All fourteen cases of our series had non-union and were operated at least three weeks after the trauma.

Posterior C₁-C₂ wiring and bone fusion is the usual surgical method. As this method carries a risk of slipping until the completion of bone fusion,

external support can be necessary in most cases. Though some series had high bone fusion rates, less successful series are also reported with 80% rate of non-union (10). An alternative surgical method to posterior C₁-C₂ wiring and fusion is posterior C₁-C₂ transfacet screwing technique. It provides more rigid fixation, but odontoid process remains fractured and another transoral route can be necessary in order to remove fractured odontoid. Both of the defined surgical procedures share same disadvantage, fixation of C₁-C₂ complex limits head rotation capacities by up to 50%.

In this study, we represent our fine observations with transodontoid screw fixation which was first presented by the experiences of Böhler in 1982 (5). The C₂ is the only vertebra to be involved, thus there is no anatomical destruction of the upper section of the cervical spine such as posterior arthrodesis. This fact singles out transodontoid screw fixation as a more physiological method, in comparison with posterior wiring or transfacet screw fixation techniques. The method is also biomechanically advantageous to the posterior approaches as it saves head and neck motions. The biomechanic analysis of this method for one or two screw fixation is also well analysed by clinic and experimental studies. There was no significant difference in the successful union rates achieved with either the one or two screw fixation (7,13).

The one and only precondition for success in this operation is the need of an intact transverse ligament. Ruptured transverse ligament can cause severe complication and even fatal results during the operation. The status of the transverse ligament to define whether it is intact or ruptured can easily be detected by MRI.

As a conclusion, we believe transodontoid screw fixation should be considered as the best choice in the treatment of Type-II odontoid fractures because of its low mortality and morbidity rates, minimum need of hospital stay and easily adaptation of social life. We recommend even consideration of cases who can be treated conservatively as candidates for this surgical method.

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