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Original Article

Odontoid Fractures

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ABSTRACT

OBJECTIVE: Odontoid fractures make up 10-15% of all cervical fractures. Odontoid process fracture and ligament injury can end up with antero- and posterolisthesis at C1-2 complex, subluxation and spinal cord compression.

METHODS: In this study, 12 cases with odontoid fractures treated at our department were evaluated. The radiological investigations revealed no type I fracture, nine type II fractures and three type III fractures. Eight cases were operated and three cases were treated conservatively. Complete fusion was achieved with no complications in all cases.

CONCLUSION: Until the last decade, odontoid fractures were feared because of high morbidity and dramatic radiological and clinical findings. However, they have now become a curable, benign traumatic lesions thanks to developments in spinal surgery.

KEY WORDS: Fusion, Odontoid fracture, Surgery

INTRODUCTION

Odontoid fractures make up 10 to 15% of all cervical fractures (1,16). Hyperflexion, the most frequent mechanism of injury, causes anterior displacement of C1 and C2 (18). When all axis injuries are reviewed, the injury is seen to concentrate on the odontoid process (3,20). The C1-C2 anatomical and functional complex is the main stay point of conduction of the head weight to the cervical spine and lateral bending of the head (2). The movement at C1-2 level is mainly rotational. Translational movement at the anterior posterior axis is prevented by the transverse atlantal ligament. This ligament also keeps the odontoid process to stable behind the C1 anterior arch. Injuries of the transverse atlantal ligament, alar ligament and cruciate ligament often accompany odontoid fracture. Anterior and posterior slips following odontoid fracture and ligament injury may cause spinal cord compression (1,18).

Anderson and D'Alonzo have classified odontoid fractures in three groups according to fracture position (4). Type I fractures are relatively rare; the fracture line traverses the odontoid tip superior to the transverse ligament. Type II fractures are most frequent and the fracture line traverses the odontoid base. Type IIa fracture is a subtype where there is communicated fracture of the odontoid process base. Type III fractures include the C2 corpus. There are different treatment modalities for each type of fracture. The aim of this study was to review our management algorithm and results.

MATERIALS AND METHODS

In this study, 12 cases with odontoid fractures who were diagnosed and treated at the Dokuz Eylül University Neurosurgery Clinic between 1998 and 2005 are reviewed and presented (Table I). The cases were analysed demographically together with the clinical and radiological data. Radiological studies included AP, lateral cervical X-rays, open mouth odontoid X-rays, computed tomography (CT) of the

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Table I: The distribution of odontoid fracture cases (m: male, f: female, pos: positive, neg: negative)

No	Age	Sex	Complaint	Neuro-deficit	Fracture type	Treatment
1	49	m	Cervical pain	pos	2	Odontoid screw fixation
2	39	m	Cervical pain	neg	2	SOMI
3	47	f	Cervical pain	neg	3	SOMI
4	52	f	Cervical pain	neg	3	C1-2 wire fixation
5	75	f	falling	neg	2	Odontoid screw fixation
6	46	m	Cervical pain	neg	3	Odontoid screw fixation
7	49	m	weakness	neg	2	C1-2 transartiküler fixation
8	34	m	falling	neg	2	Odontoid screw fixation
9	81	f	falling	neg	2	Odontoid screw fixation
10	16	f	Cervical pain	pos	2	C1-2 wire fixation
11	47	f	Cervical pain	neg	2	Rejected surgery
12	75	m	Cervical pain	neg	2	Odontoid screw fixation

craniovertebral junction and magnetic resonance imaging (MRI). The treatment strategy for each case was established individually depending on age, clinical and radiological findings and patient preference. Accordingly, a conservative treatment was planned for type I odontoid fractures. For reducible type II and III fractures displaced more than 6 mm, a surgical procedure for odontoid screw fixation was planned. In cases where time had passed by in which there is an increased risk of pseudoarthrosis, an operative option was selected. A posterior fixation was performed in patients with an irreducible fracture. The choice of treatment was decided after discussion with patients. An operative procedure was selected for cases with type II odontoid fracture who did not wish to use external fixation for a long time.

RESULTS

There were seven male and five female patients. The mean age was 50.2 years, ranging between 16 and 81. The etiology was traffic accident in 9 cases and a fall in 3 cases. The neurological examination revealed minor deficits in 3 cases (%25). In radiological modalities, there was no type I fracture, whereas there were 9 type II fractures and 3 type III fractures. In one case, there was additional head trauma and in another case, a C3-4 dislocation accompanied the odontoid fracture.

Nine cases were operated (%75) and two cases were treated conservatively via a SOMI brace while one case rejected surgery. In operated cases, surgery was anterior odontoid screw fixation in six patients (%66) (Figure 1A,B), C1-2 sublaminar wiring in two patients (%22) and transarticular C1-2 screw

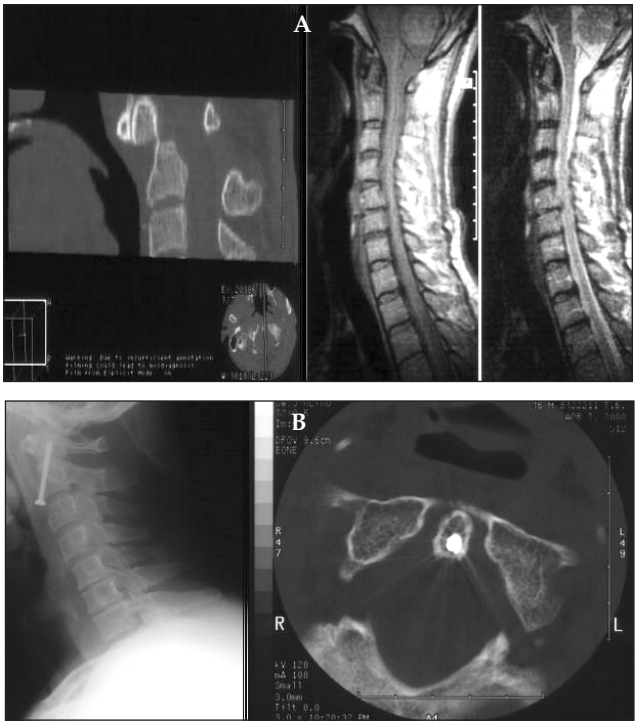

Figure 1A,B: A case with odontoid Type II fracture operated on by anterior screw fixation. The preoperative (**A**) and postoperative (**B**) Films are presented.

posterior fusion (%11) in one case. There was postoperative fusion in all operated cases six months after surgery with full mobilisation. The postoperative follow-up was 3-60 months. A Philadelphia brace was used in all operated cases during the postoperative six weeks. There was no complication or morbidity in operated and non-operated cases with ultimate functional recovery.

DISCUSSION

In determining the treatment strategy of odontoid fractures the D'Alonzo classification, odontoid process displacement and angulation on C2 body, and age played an important role in previous publications (1,2,8,15,23,24,26).

Cervical orthoses are used for conservative treatment (13,14,17,25). In 1996 Polin at al. reported 53% fusion with cervical collar and 74% fusion with halo immobilisation in 36 cases with type II fractures that were treated conservatively (17). In the same article, there was 100% fusion in type I fractures and 53-65% fusion in type III fractures with a cervical collar. In a study on 199 odontoid fracture cases, halo immobilisation sustained perfect fusion in type I and III fractures but there was 28% failure of fusion in type II fractures (11). When the treatment is sole immobilisation, type II fractures demonstrate the highest non-fusion rates. Different study groups reported non-union of 5-60% (22). There was 10% non-fusion in cases with 6 mm and less displacement, whereas, this rate went up to 70% in cases with displacement more than 6 mm (12).

The treatment of choice in these cases is therefore internal fixation with anterior screwing (5,10,19,21). Fixation is maintained by preserving motion of C1-2 complex with this technique. The fusion success of anterior screw fixations has been reported to be 100% (5,10,19,21). In our experience, there was also 100% fusion with anterior screw fixation. The results in this patient group as well as the literature are satisfactory, effective and safe. Therefore, in cases with reducible odontoid type II fracture not wishing to undergo external fixation, we offer an odontoid screw fixation.

In cases with irreducible displacement, surgery with posterior fixation is the choice of treatment (6,7,9). The indications for such cases could not be established in the literature. Fusion rates of 87-100% have been reported with posterior fixation (7,9). Posterior fusion strategies include different occipitocervical fixation and fusion methods such as C1-2 transarticular screwing, sublaminar wiring, C1 lateral mass and C2 pedicule screwing surgeries. In our series, posterior fusion surgeries were done in 3 cases. In one case, the surgery was transarticular screw application and it was sublaminar wiring in two cases. There was fusion in all cases.

CONCLUSION

Until the last decade, odontoid fractures were feared because of high morbidity and dramatic radiological and clinical findings. However, they have now become a curable, benign traumatic lesions thanks to developments in spinal surgery. Odontoid fixation is commonly indicated in cases with odontoid fractures displaced more than 6 mm, particularly in cases where time has gone by. However, in cases with reducible odontoid type II fracture not wishing to undergo external fixation, an odontoid screw fixation can be offered.

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