



SURGICAL MANAGEMENT OF ODONTOID FRACTURES, AN INSTITUTIONAL EXPERIENCE.

Neurosurgery

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ABSTRACT

Introduction- Odontoid fractures occur as a result of high impact trauma to the cervical spine. Hyperextension of the cervical spine is The most common mechanism of injury. Odontoid fractures occurs in 10 to 15% of all cervical spine fractures . Fracture of the odontoid process is classified into one of three types which are type I, type II, or type III fractures. Of all the types of odontoid fractures, type II is the most common and accounts for over 50% of all odontoid fractures .

Materials and Methods- This is a prospective study conducted over 2 years in Neurosurgery Department, Andhra Medical College & King George Hospital, Visakhapatnam.

Result: A total of 18 odontoid fractures were managed in the period of two years, out of which 2 were kept conservative and 16 were operated. Out of 16, 11 were operated with odontoid screw and 2 underwent C1-C2 fixation and 3 patients underwent Transoral Odontoidectomy with posterior occipito-cervical fixation

Conclusion: The treatment of odontoid fracture is complex and should be planned according to the type of odontoid fracture and neurological deficit. Odontoid screw will suffice in patients with type II fracture with undisplaced fragments. Posterior C1-C2 fixation is a better choice for complex odontoid fractures. Transoral odontoidectomy and occipito-cervical fixation is reserved as the last option.

KEYWORDS

Odontoid fracture, Odontoid screw, Posterior C1-C2 fixation, occipito-cervical fixation

INTRODUCTION

The odontoid or dens is a bony projection from superior aspect of C2 vertebra or axis. The odontoid enables the rotatory movement of C1 and C2 and odontoid provides the largest single component of lateral rotation of cervical spine. Dens is attached and is held in place by many ligaments like transverse atlantal ligament, apical ligament and cruciate ligament. C2 fractures are subdivided as odontoid fractures, Hangman's fractures, and atypical fractures. The most common among these is the odontoid fracture . Odontoid fractures account for 10% to 15% of all cervical spine fractures. Odontoid fractures have been divided into 3 major types according to the classification of Anderson and d'Alonzo (image1)

- Type I is an avulsion of the odontoid tip by the alar ligaments.
- Type II occurs at the base of the odontoid process.
- Type III extends into the body of the axis.

Type II fractures may show different directions of the fracture line and are classified by Grauer et al² as Type II A, Type II B and Type II C (image 2). Type IIA is a minimally displaced or nondisplaced. The fracture extending from anterior-superior to posterior-inferior, or a transverse fracture is type II B. Type IIC is a fracture line extending from anterior-inferior to posterior superior or a fracture with significant comminution³.

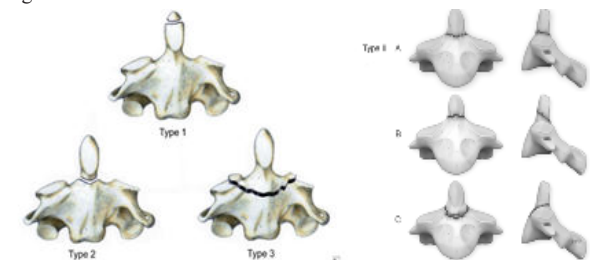


image1

image2

Between the types of odontoid fractures, type II is the most common and form 50 % of all odontoid fractures. Type III odontoid fracture is second most common of odontoid fractures. Type I odontoid fractures are rare¹. Odontoid fractures are potentially serious due to the proximity of brainstem and the great mobility of the cranial-cervical junction and treatment aims to re-establish stability of the atlanto-axial complex. Type I can be treated nonoperatively using an immobilization brace for 6 to 8 weeks. Types II and III have to be analyzed according to the instability and displacement. The surgical treatment options include odontoid screw , posterior C1-C2 fixation and Transoral Odontoidectomy with posterior occipito-cervical fixation

AIMS AND OBJECTIVES

To analyse different types of odontoid fractures in our institute and modalities of management of odontoid fracture and their clinical outcome.

MATERIALS AND METHODS

This is a prospective study carried out in Department of Neurosurgery of King George Hospital, Visakhapatnam from August 2018 to January 2021. The factors studied demographic factors, Type of fracture and characteristics (type, displacement, etc.), surgical details and clinico-radiological outcome. All patients with traumatic odontoid fractures between age 18 to 60 years were included in this study. Patients with systemic diseases like rheumatoid arthritis, congenital cranio-vertebral junction abnormalities were excluded in this study. The initial pre-operative evaluation was performed with anterior-posterior (AP) and lateral dynamic plain radiographs of the upper cervical spine . Further CT scan and MRI scans were done to further analyze bony and soft tissue pathology.

Surgical intervention was performed in type II and type III odontoid fractures due to its advantage in stable fixation, thus permitting an early mobilization and rehabilitation¹. Patients with undisplaced type II fractures (type A) (image3) were operated with anterior odontoid lag screw(image 4). Patients with displaced type II (type B and type C)

were applied traction intra-operatively and after confirming reduction under C arm, anterior odontoid lag screw was placed. Posterior C1-C2 fixation was done in patients in whom alignment was not achieved on traction and cases of complex odontoid fractures like Type II C (image 5). Transoral Odontoidectomy with posterior occipito-cervical fixation was performed in case of severe anterior compression or atlanto-axial dislocation with odontoid fracture.

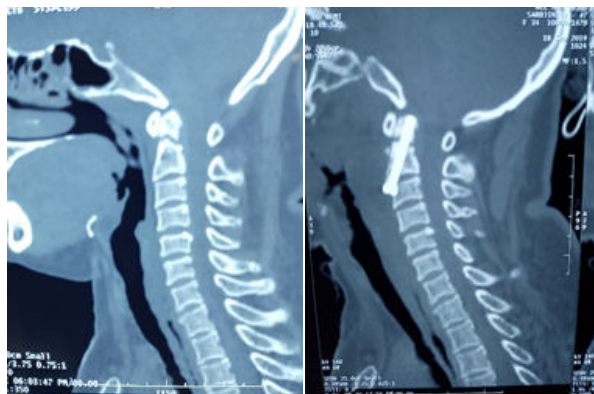


image 3

image 4

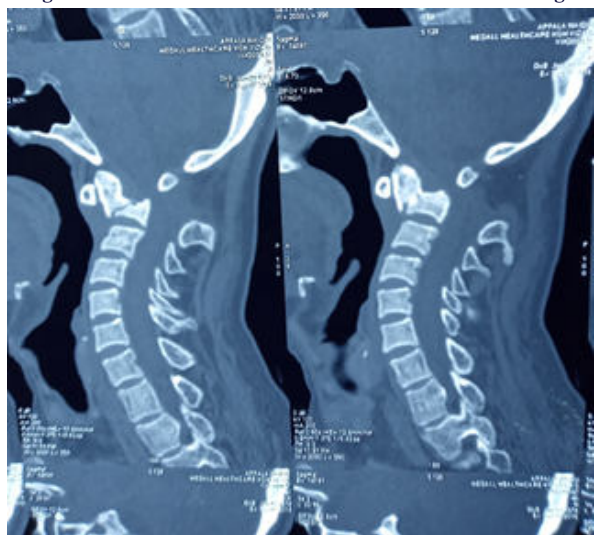


Image 5

RESULT

A total of 18 cases were managed in the department of neurosurgery Andhra Medical College and King George Hospital, between Aug2018 to January 2021. A total of 18 odontoid fractures were managed in the period of two years (fig 1), out of which 2 were kept conservative and 16 were operated. 17 were males and 1 was female and all between age 20-55 and all had history of trauma. Out of which 1 was type I and was managed conservatively.

Total 16 patients presented with Type II odontoid fracture, out of which 5 were Type II-A fractures, 8 were Type II-B fractures and 2 were Type II-C fractures. One patient of Type II-A presented after 3 weeks of trauma and was stable neurologically, hence was managed conservatively with brace and immobilisation

A total of 14 cases were operated of type II fracture. 4 type II-A and 5 Type II-B were managed with odontoid screw as fracture was aligned, and post-operative period was uneventful with good fusion and normal neurological status.

Traction was applied in total 3 cases of type II-B fractures as screw trajectory was not achievable. Two of these cases showed good alignment and were operated with odontoid screw with normal recovery. In one case alignment was not achieved, and was operated with posterior C1-C2 fixation with stable neurological outcome.

Three cases presented with Type II-C with quadriparesis, power was 3/5 in all limbs and had severe anterior compression. All three were

operated with Transoral Odontoidectomy with posterior occipito-cervical fixation. Two patients had stable outcome with gradual improvement in power but with severe restriction of neck movements. There was a mortality of a patient with Type IIC.

One patient presented with Type III odontoid fracture with severe anterior compression and alignment was not achieved on traction. Patient underwent Transoral Odontoidectomy with posterior occipito-cervical fixation with stable outcome. (Fig 2)

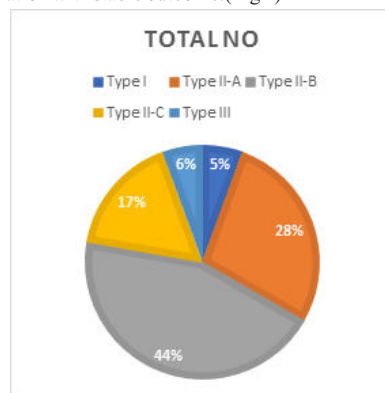


Fig 1

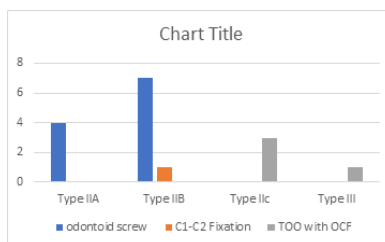


Fig 2

DISCUSSION

The aim of the treatment is to reestablish the stability of the atlanto-axial complex by restoring the alignment of the odontoid process and prevent secondary complications due to non-union and instability⁵. Conservative management using a halo brace is associated with variable fusion rates between 53-93%⁴. Shetty *et al.* showed fusion rate of 84.2% in conservative management in stable type II fractures⁶. But some other studies favour surgical management as the mobilisation of the patient can be done early and due to better fusion rates⁷⁻⁸. In our series we managed 2 cases conservatively, out of which one was type II A odontoid fracture and both cases showed good results. Aldrian *et al.* showed a good fusion rate of 87% after odontoid screw fixation in type IIA fracture and have also recommended it as the first line of management⁹. Shrinivasan *et al.* could successfully operate with odontoid screw in 84.6% type II fractures with an 82% fusion rate¹⁰. The fusion rate after odontoid screw is 87-100% according to results in the available literature¹¹⁻¹². This is comparable with our result as we operated 11 cases with odontoid screw with fusion rate of 100% with no complications. If the angle of the odontoid fracture line is straight and screw trajectory across the fractured segments is achievable, fixation with odontoid screw is preferred as it provides better functional results⁴. However when the line is oblique and even on traction the screw trajectory is not achievable, posterior C1-C2 fixation is a better option. Magerl technique of C1-C2 fixation has a fusion rate of 98% in the reported literature¹³. This procedure is technically difficult and requires a learning curve. The Goel/Harms technique of C1-C2 fixation is more versatile when compared to the former procedure⁷. There is, however, a risk of 1.3-5.8% (more with Magerl technique) of vertebral artery injury in posterior fusion procedures¹⁴. We operated 2 cases with posterior C1-C2 fixation with no complication and the results are comparable with the studies.

Occipito-cervical fixation is the final option available when segmental posterior C1-2 fixation procedures cannot be performed and when the patient has undergone a simultaneous transoral decompression for significant compression or malunion. We performed Transoral Odontoidectomy with posterior occipito-cervical fixation in 3 cases. Two of these patients had a good fusion and results were comparable to literature¹⁵. But the patients developed significant restriction of neck movement.

There was mortality of a single patient in our series. This was comparable to the published literature (surgical mortality 4%)⁵.

CONCLUSION

Anterior odontoid screw fixation gives good results and it should be considered as treatment of choice in well-reduced odontoid fractures as it preserves cervical motion. Posterior C1-C2 fixation is also associated with excellent fusion rates but should be reserved for patients in whom odontoid screw is not feasible. For complex odontoid fractures with severe anterior compression or associated atlanto-axial dislocation, Transoral Odontoidectomy with posterior occipito-cervical fixation can be considered but it is associated with high morbidity.

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