

Anterior Cervical Plating for An Axis Tear Drop Fracture: Case Report

Nijith O Govindan, Manjunath DS, Prathap Kumar, Biju M Nair, Jayadev, Jyothi Prasanth, Jim Thomas, Christeena Jose

Nijith O Govindan, MS-Ortho, Orthopaedic Surgeon, Department of Orthopaedics, Sunrise hospital, Kakkanad, Kochi, India

Manjunath D S, MS-Ortho, Senior Consultant Orthopaedics and Spine Surgeon, Department of Orthopaedics, Sunrise hospital, Kakkanad, Kochi, India

Prathap Kumar, FRCS (Tr & Orth), Consultant Upper limb Surgeon, Department of Orthopaedics, Sunrise hospital, Kakkanad, Kochi, India

Biju M Nair, FRCS, Senior Consultant in Joint replacement & Lower limb Arthroscopy, Department of Orthopaedics, Sunrise hospital, Kakkanad, Kochi, India

Jyothi Prasanth, DNB-Ortho, Junior Resident, Department of Orthopedics, Academy of Medical education, Pariyaram, Kannur, India

Jayadev, DNB-Ortho, Junior Resident, Department of Orthopedics, Academy of Medical education, Pariyaram, Kannur, India

Jim Thomas, DNB-Ortho, Junior Resident, Department of Orthopedics, Baby Memorial Hospital, Arayidathupalam, Kozhikode, India

Christeena Jose, M. Sc Biostatistics, Department of Biostatistics, Sunrise Hospital, Kakkanad, Kochi, India

Correspondence to: Nijith O Govindan, Orthopaedic Surgeon, Department of Orthopaedics, Sunrise Hospital, Kakkanad, Kochi, India.

Email: nijithgovindan@gmail.com

Telephone: +91-9745601731

Received: July 21, 2016

Revised: September 17, 2016

Accepted: September 21, 2016

Published online: October 27, 2016

ABSTRACT

Axis tear drop fractures are infrequent injuries attributed to hyper extension and flexion of neck. In unstable tear drop fractures there will be posterior displacement of vertebral body, anterior longitudinal ligament disruption and anterior rotation of antero-inferior vertebral body fragment. Most of the unstable tear drop fractures are associated with neurological deficit due to incomplete spinal cord injuries like

anterior cord syndrome. We present a case of traumatic unstable C2 flexion tear drop fracture without neurological deficit. We have treated the patient successfully with anterior cervical plating and tricortical bone grafting after removal of tear drop fragment and discectomy. This patient was mobilized on next day after surgery and neck mobilization started after 3 weeks. The patient in our study was followed up for 6 years and found to have no sequelae related to the injury. Unstable tear drop fracture needs to be fixed irrespective of the presence or absence of neurological deficit. Open reduction internal fixation with low profile plate and tricortical bone graft, shaped to fit the defect and disc space, through high anterior retropharyngeal approach is a promising treatment for unstable tear drop fractures.

Key words: Tear drop fragment; Cervical plating; Tricortical bone grafting; Discectomy

© 2016 The Authors. Published by ACT Publishing Group Ltd.

Govindan NO, Manjunath DS, Kumar P, Nair BM, Jayadev, Prasanth J, Thomas J, Jose C. Anterior Cervical Plating for An Axis Tear Drop Fracture: Case Report. *International Journal of Orthopaedics* 2016; 3(4): 650-653 Available from: URL: <http://www.ghrnet.org/index.php/ijo/article/view/1797>

INTRODUCTION

Tear drop fractures are rare injuries occurring in upper and lower cervical region. It occurs most often at C5 vertebrae followed by C6 and C4, sometimes involving the nearby vertebrae^[1]. The reason for this is that normal cervical spine has a lordotic angle and the stress is more on C5 during flexion of the neck^[2]. In the upper cervical region, axis vertebrae fracture is the most commonly reported and the incidence come to nearly 3% of cervical spine injuries^[3]. Like any other tear drop fractures C2 tear drop fractures are also caused by flexion and hyper extension injuries. Management of the tear drop fractures are based on the stability of the cervical segment. The spectrum of management varies from conservative to surgical including immobilization, traction, corpectomy with fusion,

corpectomy and fusion with prolonged skeletal traction or fixation via combined anterior and posterior approach, anterior decompression with plate fixation etc^[4]. Anterior decompression with plate fixation is the standard treatment for unstable tear drop fractures.

CASE REPORT

We report a case of flexion tear drop fracture of C2, with C2-C3 instability, without neurological involvement. Twenty three year old male patient was brought to the emergency department following a road traffic accident. He was a pillion rider, sustained injury to neck following head on collision. Patient was examined and possible head injury was ruled out. He was complaining of severe upper neck pain without any sensory motor symptoms. On examination there was tenderness of upper cervical spine and para spinal spasm without any neurological deficit. Initial CT showed teardrop fracture of the axis vertebrae (Figure 1).

Cervical spine was immobilized with Philadelphia collar. MRI was taken to know the associated ligaments, soft tissue and spinal cord status. There was anterior tear drop fragment, signs of ligamentous disruption, posterior displacement of upper column, increased pre-vertebral shadow and decreased disk space posteriorly with annular tear (Figure 2).

Surgical techniques

Patient was taken for surgery on the third day of admission. Patient was positioned supine with neck hyper extended by cervical traction through tongs and 2 kg weight. Also a roller sheet was kept under the cervical spine in order to make the cervical spine hyper extended. Under general anesthesia, a right sided high anterior retropharyngeal approach was used. Horizontal skin incision was put along the neck crease, subcutaneous tissue and platysma incised in the same plane. Facial vein ligated, submandibular gland retracted superiorly, exposed diaphragm and mylohyoid, superior thyroid, lingual and facial artery also associated veins ligated and divided between hyoid bone and pharyngeal structures medially and carotid sheath and sternocleidomastoid laterally. Hypoglossal nerve dissected, isolated and protected. Longus coli identified and divided vertically. Subperiosteal flaps are elevated. Fragment identified and excised with removal of disc and curettage of end plate. A tricortical strut of bone was taken from iliac crest and prepared into an 'L' shape in order to fit into the defect and the disc space. Low profile locking plate was applied. Wound was closed in layers after attaining hemostasis. Postoperative neurological examination was within normal limits. Postoperatively Philadelphia collar was continued for 2 weeks followed by soft cervical collar for another 6 weeks. Patient was mobilized on the next day of surgery and neck mobilization started on the third week. Dynamic X-rays of cervical spine shows no evidence of instability (Figure 3).

DISCUSSION

The term 'tear drop fracture' was initially proposed by Schneider and Kahn in 1956^[5]. Tear drop fractures are mainly categorized in to two types based on the mechanism of injury i.e., flexion tear drop fracture and extension tear drop fracture. Tear drop injury has been described as forward displacement anterior fracture fragment of the vertebral body, midsagittal fracture of the posterior vertebral body fragment with retro-pulsion causing cord compression and neurological sequelae, one or more neural arch fractures, widening of inter laminar spaces, inter spinal spaces, facet joint and ligaments disruption at the inter vertebral level inferior to the affected vertebrae^[6,7,8]. Like

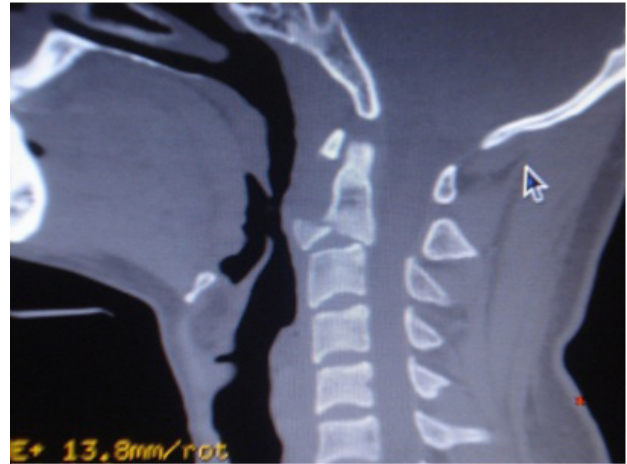


Figure 1 CT cervical spine showing tear drop fracture fragment.



Figure 2 MRI of cervical spine showing disco-ligamentous disruption.



Figure 3 Dynamic (flexion) X-ray showing stable upper cervical spine segment with plate and screws in-situ.

any other tear drop fractures C2 tear drop fracture is also caused by flexion and hyper extension. Hyper extension injuries are common in elderly following trivial trauma, which are usually stable and

characterized by intact disco-ligamentous complex. Anterior longitudinal ligament originates from the base of the axis vertebrae. Any forceful pull of the anterior longitudinal ligament can cause avulsion fracture of the antero-inferior vertebral body. During hyper extension of cervical vertebrae there is avulsion of the intact Sharpey's fibers which penetrate the former ring apophysis^[9]. Flexion tear drop fracture in Axis is mainly characterized by disruption of disco-ligamentous complex always followed by high velocity injury and most of the fractures are unstable which may or may not be associated neurological deficit. Commonly reported incomplete spinal cord injury is the anterior cord syndrome (10) but may also lead to other incomplete injuries. Injuries of the vertebral and carotid artery should be always borne in mind while managing case of tear drop fractures.

Radiological investigation includes standard X-ray, both antero-posterior and lateral projections. Soft tissue shadow, tear drop fragment and increased inter-spinous distance is very well seen in X-ray. Computerized tomography is ideal for demonstrating sagittal fracture involving the vertebral body and posterior elements. MRI may be done to demonstrate the extent of soft tissue and spinal cord injury.

Management of tear drop fractures may be conservative or operative based on the stability. In flexion tear drop fractures decompression can be done by corpectomy for the fracture body^[11,12]. Corpectomy, with removal of the vertebral body fragment and fusion is another standard method of treatment. Removal of the vertebral body, anterior corpectomy and fusion, with iliac or fibular bone graft is also commonly done. But this technique may cause graft dislodgement or disappearance especially if the posterior longitudinal ligament is injured. Delayed kyphotic angulation may also occur. The methods for resolving these problems includes prolonged skeletal traction following the surgery, or fixation via combined anterior and posterior stabilization, or anterior decompression with plate fixation^[13,14], or anterior decompression and plating with intervertebral Cages.

The case in which we have reported is a flexion tear drop of C2 with instability C2-C3 without neurological deficit. There was no history suggestive of head injury, clinically and radiologically head injury was ruled out. The patient's only complaint was severe pain in the neck. On examination, there was para-spinal spasm with tenderness of upper cervical spine. In the initial CT, cervical spine tear drop fracture fragment with increased inter spinous distance and pre vertebral soft tissue shadow was noted. Further imaging was carried out and fracture of vertebral body, signs of ligamentous disruption, increased inter laminar and inter spinous distance, and posterior displacement of upper column associated with increased pre vertebral shadow was noticed. In the third day patient underwent ORIF through anterior retropharyngeal approach (Figure 4).

We have removed the antero-inferior teardrop fragment along with discectomy, tricortical bone grafting and plate fixation (Medtronic-Zaphir). Tricortical bone graft was taken from the right iliac crest, the graft was prepared in an L-shaped manner in order to fit into the disc space and vacancy created by removal of the teardrop fragment. Philadelphia collar was given for two weeks following by soft cervical collar for 6-weeks. Early mobilization of the patient was possible and this helps prevent complications due to long-term bed rest such as pulmonary infection, urinary tract infection, decubitus ulcer, gastrointestinal and psychiatric problems in addition to the nursing and rehabilitation issues. The patient in our study was followed up for 6 years and found to have no sequelae related to the injury.



Figure 4 Healed horizontal surgical scar on the upper neck region.

Unstable tear drop fractures need to be fixed irrespective of the presence or absence of neurological deficit. Open reduction internal fixation with low profile plate and tricortical bone graft shaped to fit the defect and disc space is a promising treatment for unstable tear drop fractures. Major advantage of our technique is that the bone graft is more biological, and hence fusion will be faster compared to intervertebral Cage. Since the patient is young the longintivity of intervertebral Cage is questionable. Future possibility of graft dislodgement and loss of alignment are much less compared to ilium and fibula transplants. Also there is less chance for future foraminal narrowing and cord compression. Shape of the graft can be decided based on the intra-operative findings of the defect, unlike other graft options.

CONCLUSION

Flexion tear drop fractures of axis vertebrae are very rare. Most of the flexion tear drop fracture are unstable fractures and may not present with neurological deficit. Excision of the fragment and intervertebral disc along with stabilization of cervical spine by anterior cervical plating and tricortical bone grafting is an ideal treatment for axis tear drop fractures. Patient can be mobilized at the earliest. The patient in our case report was followed up for 6 years and found to have no sequelae related to the injury so far.

CONFLICT OF INTEREST

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

REFERENCES

- 1 James J. Yue, Paul C. Ivancic, and David L. Scott. Teardrop fracture following head-first impact in an ice hockey player: Case report and analysis of injury mechanisms. *Int J Spine Surg.* 2016; 10: 9. Published online 2016 Feb 3. doi: 10.14444/3009, PMID: PMC4852594.
- 2 Danielle Steilen,* Ross Hauser,* Barbara Woldin, and Sarah Sawyer Chronic Neck Pain. Making the Connection Between Capsular Ligament Laxity and Cervical Instability. *Open Orthop J.* 2014; 8: 326-345 Published online 2014 Oct 1. doi: 10.2174/1874325001408010326 PMID: PMC4200875.
- 3 Korres DS, Zoubos AB, Kavadias K, Babis GC, Balalis K. The 'teardrop' (or avulsed) fracture of the inferior angle of the axis. *Eur Spine J* 1994; 3: 151 - 4.

- 4 Cong Wang, Hui Ma, Wen Yuan *et al.* Anterior C3 corpectomy and fusion for complex Hangman's fractures. *Int Orthop.* 2013 Jan; **37(1)**: 89-93, Published online 2012 Nov 25. doi: 10.1007/s00264-012-1703-6, PMID: PMC3532645.
 - 5 Schneider RC, Kahn EA. Chronic neurological trauma to the spine and spinal cord. Part I. The significance of the acute flexion or "teardrop" fracture dislocation of the cervical spine. *J Bone Joint Surg (Am.)* 1956;**38**:985-997
 - 6 Torg JS, Pavlov H, O'Neill MJ *et al.* The axial load teardrop fracture. A biomechanical, clinical and roentgenographic analysis. *Am J Sports Med* 1991; **19**: 355-364.
 - 7 Lee C, Kim KS, Rogers LF. Triangular cervical vertebrae body fractures: diagnostic significance. *AJR Am J Roentgenol* 1982; **138**: 1123-32.
 - 8 Kim KS, Chen HH, Russell EJ *et al.* Flexion teardrop fracture of the cervical spine: radiographic characteristics. *AJR Am J Roentgenol* 1989; **152**: 319-26.
 - 9 Motsitsi LN. Bomela Tear-drop Fractures of the Cervical Spine N.S. *Central African Journal of Surgery.* 2009 July-Aug; 14(2): 9-12. Code Number: js09027
 - 10 Nancy E. Epstein* and Renee Hollingsworth. Diagnosis and management of traumatic cervical central spinal cord injury: A review. *Surg Neurol Int.* 2015; 6(Suppl 4): S140-S153. Published online 2015 May 7. doi: 10.4103/2152-7806.156552 PMID: PMC4431046.
 - 11 Bohlman HH, Boada E. The Cervical Spine Research Society, editors. The cervical spine. 2nd ed. Philadelphia: Lippincott; 1989. Fractures and dislocations of the lower cervical spine; p. 355.
 - 12 Pierce DS. Acute treatment of spinal cord injuries. In: Pierce DS, Nickel VH, editors. The total care of spinal cord injuries. Boston: Little Brown and Company; 1977. p. 1.
 - 13 Bohler J, Gaudernak T. Anterior plate stabilization for fracture-dislocations of the lower cervical spine. *J Trauma.* 1980; **20**: 203-205.
 - 14 Castaing J. Les traumatismes recents du Raquis cervical inferieur: traitement chirurgical par voie anterieure. *Rev Chir Orthop.* 1984; **70**: 519-522.
- Peer reviewer:** Richa Gupta, MD, House no 3233, sector 37-D, Chandigarh, 160036, India.