Case Report

Hangman's Fracture – A Case Report and Review of Literature

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ABSTRACT

Hangman's fractures are bilateral fractures of the C2 pars interarticularis produced during hyperextension injuries. C2 fractures are the most common form of cervical spine injury. A patient was admitted with the complaints of weakness of the left upper and lower limb following a road traffic accident. His face was spared. CT scan of the cervical spine showed bilateral pars fracture with a broken fragment. He was treated by anterior cervical fusion with tricortical bone graft and fixation between C2 and C3 with plate and screws, in the third day following trauma. The patient had immediate improvement following surgery. His weakness completely recovered and he came to follow up after one month walking without support. The anterior approach to the Hangman's fracture is a very effective and easy procedure. Autologous tricortical bone graft gives strength as well as good fusion to the spinal column. However, careful patient selection is necessary for this. The outcome is very much rewarding to the patient.

Keywords: *Hangman's fracture, anterior approach, C2 body fracture, Goel's classification*

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INTRODUCTION

Hangman's fractures are bilateral fractures of the C2 pars interarticularis produced during hyperextension injuries.[1] C2 fractures are the most common form of cervical spine injury. C2 fractures can be roughly divided into three categories: fractures of the dens, Hangman's fracture involving both pedicles, and atypical fractures.[2] In 1965, Schneider et al. coined the term 'Hangman's fracture', which is the second most common fracture of the second cervical vertebra.[1,3,4] It accounts for 4%–7% of spinal fractures and about 1/5 of cervical vertebral fractures.[5] Hangman's fracture occurs most commonly due to anatomical features, mechanical susceptibility, embryological attributes etc.[4,5] Hangman fracture is classified according to Levine & Edwards (Table-I, Fig. 1). It is widely and mostly used classification.[4] However, a new classification system was presented by Goel et al. (Table-II), taking into account the atlanto-axial instability.

Table-I: *Hangman's fracture classification by Levine & Edwards (1985)[6]*

Type	Description
Type I	<3 mm displacement, no angulation
Type II	>3 mm displacement, significant angulation
Type IIA	The most striking modification, significant angulation without translation due to hinging of the anterior longitudinal ligament (ALL)
Type III	Angulated anterior fragment with facet joint dislocation

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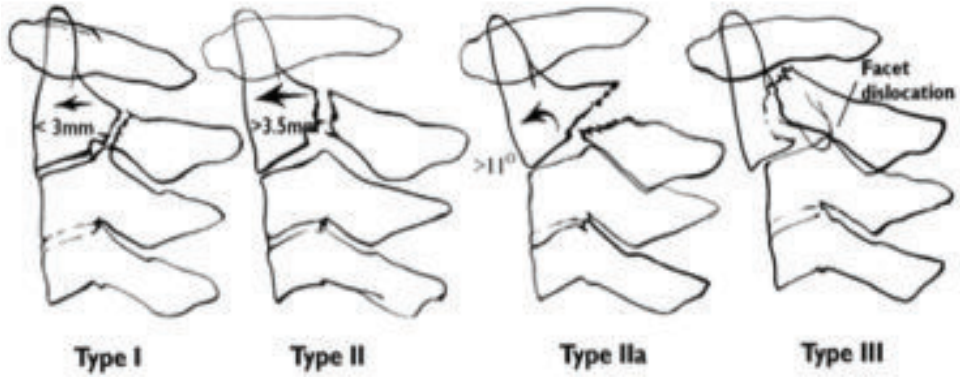

Fig. 1: *Hangman's fracture classification by Levine & Edwards (1985)*[6]

Table-II: Classification of hangman's fracture by Goel et al. (2022)[7]

Type	Description
Type 1	No atlantoaxial or C2–3 instability
Type 2	Presence of C2–3 instability and no atlantoaxial instability
Type 3	Presence of atlantoaxial instability and no C2–3 instability
Type 4	Presence of both atlantoaxial and C2–3 instability

Other classification of Hangman's fracture include Williams, Seljeskog & Chou, Pepin & Hawkin, Francis & Fielding, Effendi et al., Levine & Rhyne.[8] Li, Zhong & Wang described another classification for atypical Hangman fractures.[9]

The mechanism of injury are usually four types: motor vehicle accident, falling from a height, falling on a flat surface (or falling over), and others (such as strike by heavy objects or unknown cause and mechanism of the injury).[5] The site of injury in the C2 can occur at any part, but mostly in the facet joints followed by bony fracture. Anterior element injury is more than middle or posterior element injury.[10] There are two types surgery preferred for Hangman's fracture: either the anterior cervical discectomy and fusion between C2-C3 or the posterior cervical fixation and fusion can be done in these patients. However, the procedure depends on the type of injury and stability of the fracture.[8,11] If necessary combined procedure (i.e., both anterior and posterior approach) can be done.[4] Here, we describe a case of Hangman's fracture type IIA admitted under our care. It was unstable and with a bony fragment. In this patient, anterior cervical decompression and fixation was done between C2 and C3.

CASE REPORT

A 45-year old non-diabetic, non hypertensive male patient was admitted under our care following a motor vehicle accident. He was well alert and oriented without any signs of cerebral concussion. He had neck pain, weakness of the left upper limb and lower limb. His weakness was more at the grip of the right hand, and flexion of the elbow joint. He had weakness of the flexion of the hip and flexion of the knee. The muscle power was 4/5 in the rt. upper limb and 4/5 in the right lower limb. His x-ray of cervical spine showed forward displacement of the C2 over the C3. in the lateral view there was also a fracture fragment behind the body of the C 2 (Fig. 2). CT scan of cervical spine showed displacement of the C2 over the C3, fracture fragment behind the body of C2, bilateral pars

Fig. 2: Preoperative x-ray of cervical spine showing fracture of the posterior part of C2 vertebral body

inter articularis fracture of C2 (Fig. 3), while MRI of cervical spine showed displacement of C2 over the C3 and compression of the dural tube on the left side (Fig. 4).

He was prepared for operation. He was positioned supine on the operating table with head slightly extended and in the midline. A skin crease incision was given. The C2-C3 was reached in the anterior approach. Discectomy of C2/C3 was done. There was fracture fragment in the posterior aspect of the body of the C2 vertebra. This was also removed. The dural tube became free. Then a tricortical bone graft, taken from the right iliac crest was placed in the C2/C3 space. C2-C3 was fixed with titanium plate and screws (Fig. 5). Wound was closed in layers. The patient was reversed after surgery. Then he was shifted to recovery ward, from there he was shifted to general ward. On the next day the patient said that he was feeling more power on his left side. He was released on the fourth post operative day. Before discharge the patient had regained full power of both upper and lower limb muscles. His post operative x-ray showed a good alignment and good fixation (Fig. 6). The patient improved rapidly without any notable complication.

Fig. 3: *Preoperative CT scan of cervical spine*

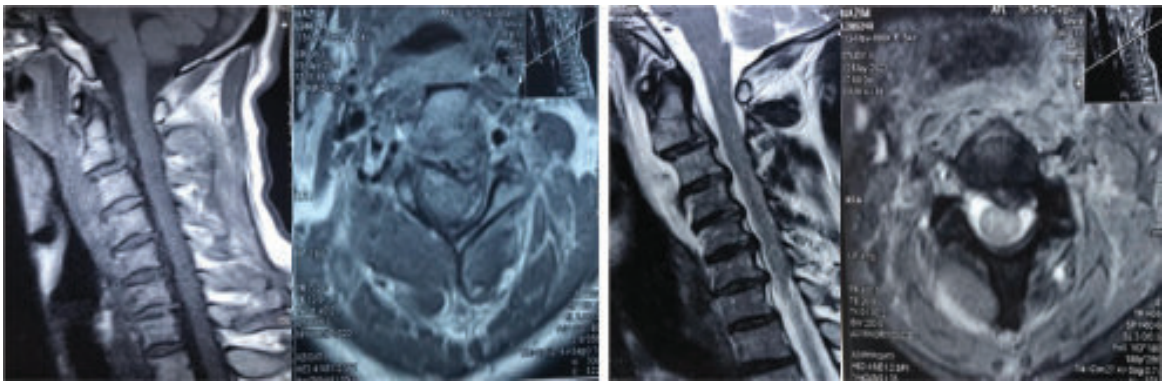

Fig. 4: *Preoperative MRI of cervical spine*

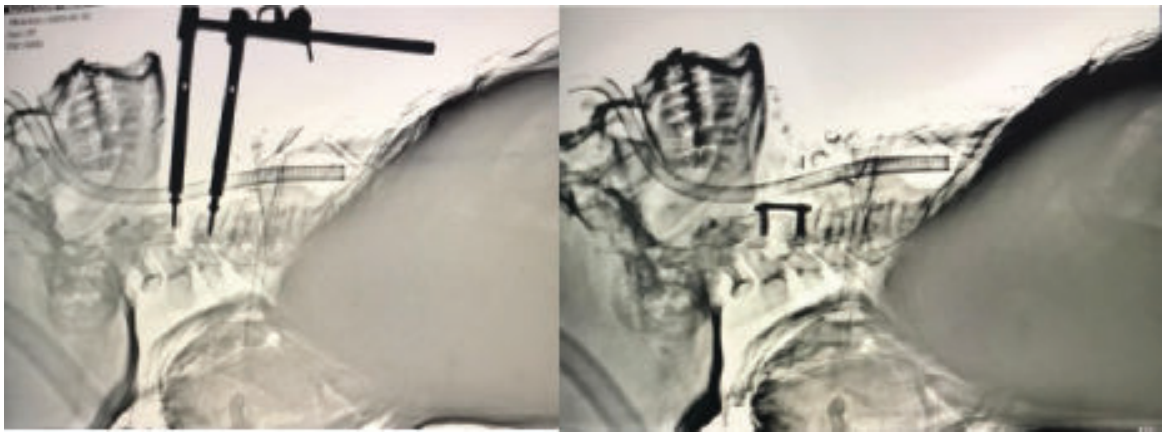

Fig. 5: *Peroperative x-ray of cervical spine*

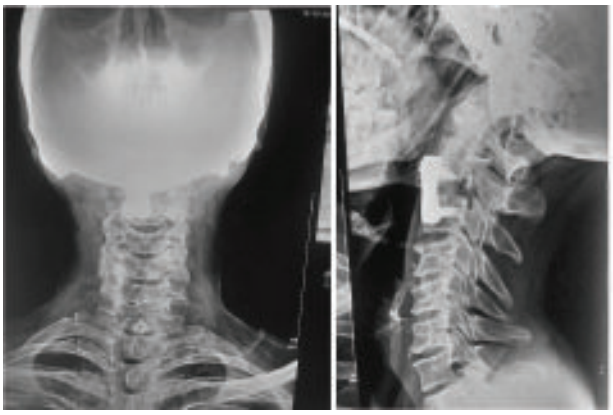

Fig. 6: *Postoperative x-ray of cervical spine*

DISCUSSION

Some of the authors follow the Roy-Camille criteria, which are similar to those developed by White and Panjabi, are reliable in the selection of patients for surgical treatment.[12] Depending on the site of fracture surgical approach can be modified. Therefore, a surgeon has to be accustomed with both anterior and posterior approaches. A high cervical extra-pharyngeal approach in all 12 patients, cervical discectomy, and autologous bone fusion of C2–C3 with a titanium plate were performed by Rajadurai et al. they also followed them up to one year and the result was good.[3] In our patient we have used tricortical autologous bone graft and anterior approach. Prost et al. reported anterior approach in four patients and posterior approach in seven patients with excellent outcome.[2] Khan et al. also reported posterior fixation of the C2 and C3 for Hangman's fracture.[13] Mahmoud et al. compiled the complications of anterior approach. These were surgical site infections, local hematoma, voice alterations, donor site pain, dysphagia and transient cerebral ataxia.[1] However, we observed none of those complications in our patient.

The most common cause of neurological deficit in hangman's fracture presents clinically as an incomplete neurological impairment.[14] It may be due to the translation or angulation of C2/3 or the bony fracture fragment compressing the dural tube. Our patient had presented with left sided hemiparesis, which had improved after the surgery. The muscle power of upper and lower limb before surgery was 3/5 and after surgery was 5/5.

Effendi type 1 fractures are usually considered stable and type 3 fractures are considered unstable, but there is no consensus regarding the stability of type 2 or type 2a fractures.[15] Our patient had a fracture of the C2 vertebral body and the fracture fragment displaced posteriorly, resulting in compression of the dural tube. Therefore, surgery was undertaken to decompress the dural layer and fusion by tricortical bone graft. Following this, it was fixed with plate and screw between C2 and C3. The result was very good and the patient rapidly improved.

CONCLUSION

The anterior approach to the Hangman's fracture is a very effective and easy procedure. Autologous tricortical bone graft gives strength as well as good fusion to the spinal column. However, careful patient selection is necessary for this. The outcome is very much rewarding to the patient.

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Authors' Contribution: Both authors were equally involved in patient selection, clinical diagnosis, management and data collection. Both of them were equally involved in literature search and review as well as manuscript preparation, editing and final submission.

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