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A Study on Management of hangman`s Fracture

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Abstract

Introduction: *Traumatic spondylolisthesis of C2 (Axis) which is also known as hangman fracture was initially noted in 1965 by Schneider et al. There are two kinds of it, i.e. (i) one of a hyperextensive-distractive mechanism with the very severe neurological lesion leading to the classical injury due to hanging and (ii) one of a hyperextensive-compressive mechanism without neurological lesion of current traffic injuries or with slight neurological symptoms. The latter more often occurring type of injury encompasses a relatively wide range. The optimal therapy for traumatic fractures of the neural arch of the axis is still controversial. Indications for surgery depend on the type of hangman's fracture and/or additional injuries of the intervertebral disc or ligaments. Here we shall share our experience of surgical management of hangman's fracture with review of literature.*

Method: *29 patients with hangman's fracture were treated between 2004 and 2015. All patients presented with neck pain and 7 with neurological deficit.3 patients with stable fracture were treated by rigid collar. Of the 17 surgically treated patients 16 were managed with screws, placed on the C2 pedicles. Of them 7 required additional fixation with rod & screw on the lateral masses of C3 and another with C4 pedicle screw as he had associated C3 body fracture. 1 patient underwent anterior discectomy and fusion with internal fixation.*

Results: *All the patients had good post surgical outcome with satisfactory fusion of the fractures.*

Conclusions: *Surgery provides plausible results. Compared to conservative treatment, it can offer significant benefits: 1) immediate, better and stable reposition; 2) high fusion rate; 3) shortening of the treatment period with better quality of life. Though technically difficult, transpedicular screw fixation is the best option as it preserves the motion more than other techniques.*

Keywords: *Traumatic spondylolisthesis, hyperextensive, hangman's fracture.*

Introduction

Hangman's fractures have been used to describe traumatic spondylolisthesis of C2 since it was initially noted in 1965 by Schneider et al[1]. It is defined as laminate fractures, articulate facets, pedicles or parses of the vertebra axis. Fractures in Hangman are often caused by accidents in the fall, diving or motor vehicle. The typical fractures of the hangman are those with the back side of the vertebral body on one or both sides, as opposed to

the neural arch[2]. In contrast to atypical hangman fractures, asymmetric fractures were more recently defined as a pars interarticularis fracture on one side of the neural arch plus another fractured component, either the rear cortex of the C2 body or the rear neural arch elements on the other[3].

Hangman's fractures account for 20 to 22 percent of all axis fractures and are one of the most common types of high cervical spinal injury [4-6].This injury occurs most often during road traffic accidents (RTAs) and falls due to cervical hyperextension and axial loading[7,8,5,9].

Management guidelines in the literature are based on level III evidence. A recent review concluded that external immobilization is recommended as initial management of traumatic spondylolisthesis, with surgical stabilization and fusion reserved for cases of severe angulation of C2 to C3, disruption of C2-C3 disk space and/or failure to achieve or maintain alignment of fracture with external immobilization[10].

Table 1: Classification of Hangman's Fracture

Classification	Definition	Mechanism
Effendi		
Type I	Isolated hairline fracture of ring of axis	Axial loading and hyperextension
Type II	Displacement of anterior fragment and abnormal disk below axis	Further hyperextension and rebound flexion
Type III	Displacement of anterior fragment andlocked facet at C2–C3	Flexion and rebound extension
Levine and Edwards		
Type I	Non displaced fracture (<3 mm)	Hyperextension and axial loading
Type II	Significant angulation (>11 degrees) and translation (>3 mm)	Hyperextension, axial loading and rebound flexion
Type IIa	Very severe angulation without translation	Flexion-distraction
Type III	Severe angulation and displacement with facet dislocation	Flexion-compression

(Source: "Management of Typical and Atypical Hangman's Fractures", Rafid Al-Mahfoudh et al. Global Spine J 2016;6:248–256)

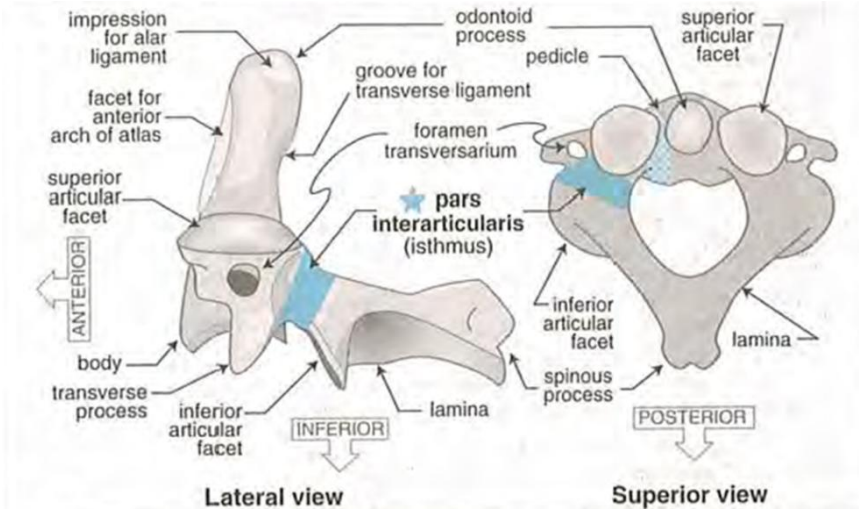
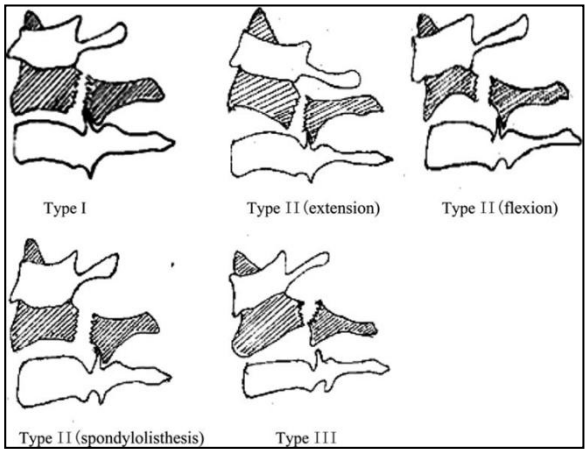
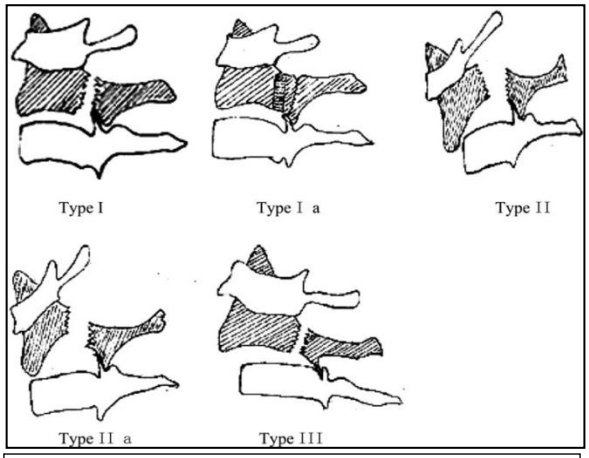


Figure-1: Anatomy of axis

Above illustration shows the lateral and superior views of axis.



Effendi et al. classification



Levine & Edward's classification

Figure-2: Type of Hangman's Fracture

On both classification Type I is stable and Type II & Type III are unstable fractures.

Methods

The study was carried out at the Department of Neurosurgery at the Bangabandhu Sheik Mujib Medical University (BSMMU) in Dhaka, between 2004 to 2015. In order to identify patients, a prospective clinical database of 29 patient records coded as "axis fractures" was used.All radiological and x- ray records have been reviewed. All patients with hangman fractures had inclusion criteria; no exclusion criteria existed. The study has been evaluated and endorsed by an internal review committee.

The clinical notes were reviewed retrospectively for information on the injury mechanism, associated injury, comorbidity, presentation, management and follow- up with regard to clinical and radiological results. The clinical results included complications in the management, pain scores and reported neck rigidity. The radiological results have been independently examined by a neuroradiologist; the osseous union has been evaluated on computed tomography (CT) or plain radiographs.

Inclusion Criteria

- 19 patients had MVA, 8 had a fall, 1 had fall of heavy weight on head and 1 had veil tangled around the neck.

Clinical presentation & investigation

- The entire patient had neck pain. 14 patient presented with neurological deficit 3 had stable fracture.
- All the patients were evaluated with dynamic x-ray of cervical spine under supervision. Most of the patients were further assessed by MRI and CT scan.

Types of management

- 3 patients with stable fracture were treated with rigid collar. Other 22 patients were treated surgically.
- Of the surgically treated patients 14 were submitted to arthrodesis of the fractures with two screws, placed on the C2 pedicles, which allowed a better approximation of the fractures with the alignment of C2-C3. Of them 7ss required additional fixation with rod & screw on the lateral masses of C3. 1 patient underwent anterior discectomy and fusion with internal fixation.

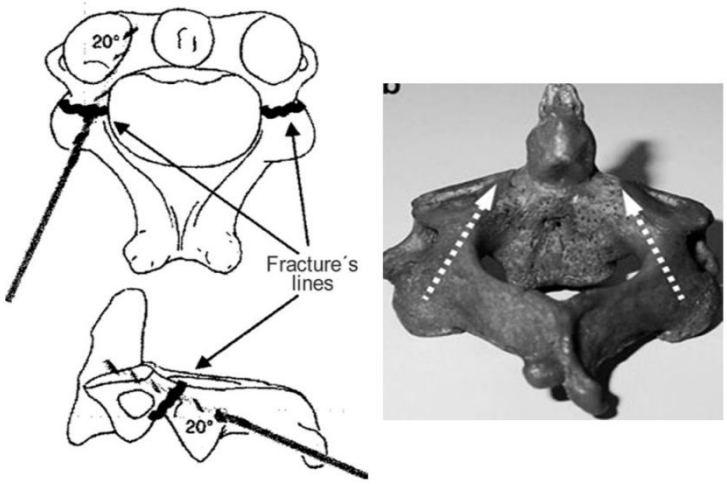
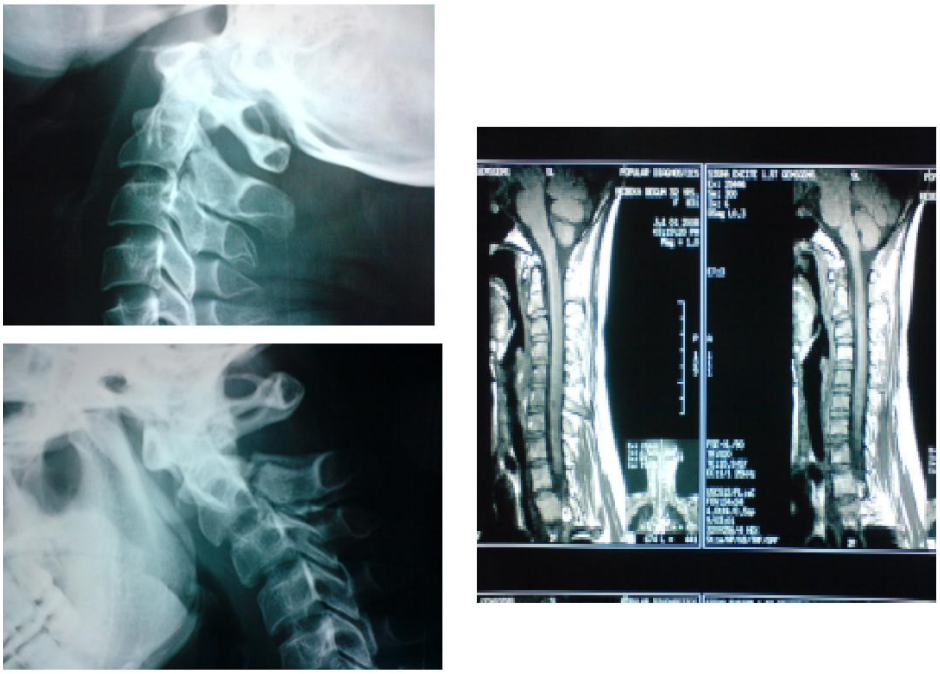


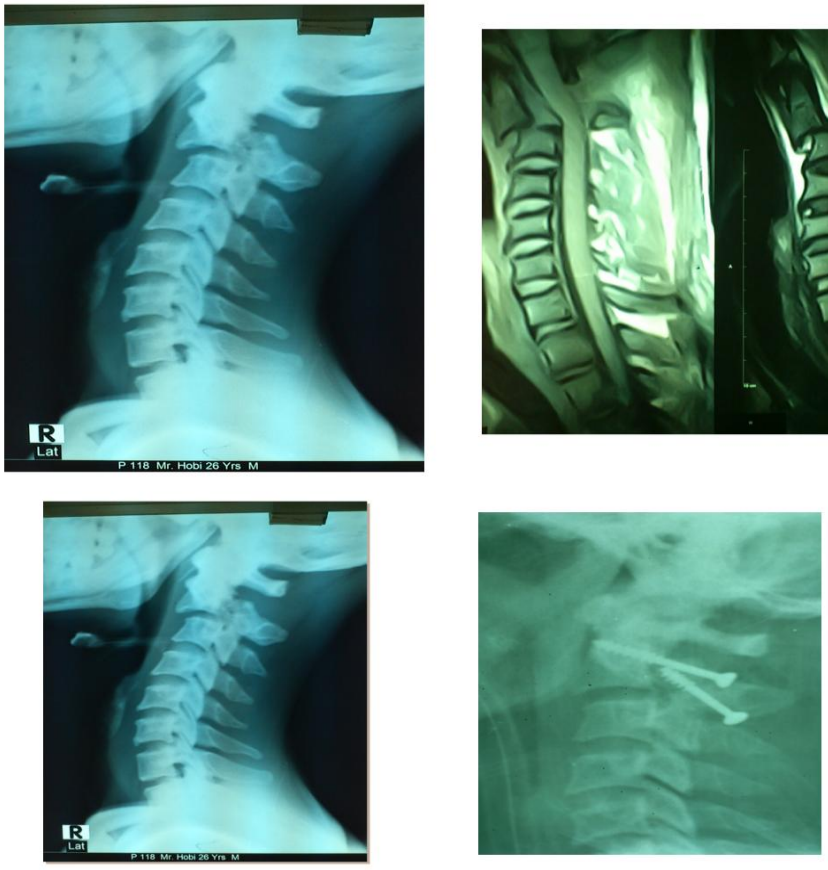
Figure-3: Direction of transpedicular screw placement

Case-1: 32 years female injured by Motor Vehicle Accident (MVA)



Case-2: 25 y Female, H/O fall associated KFS

Case-3: 26 y Male, MVA



Pre & Post-operative x-ray imaging

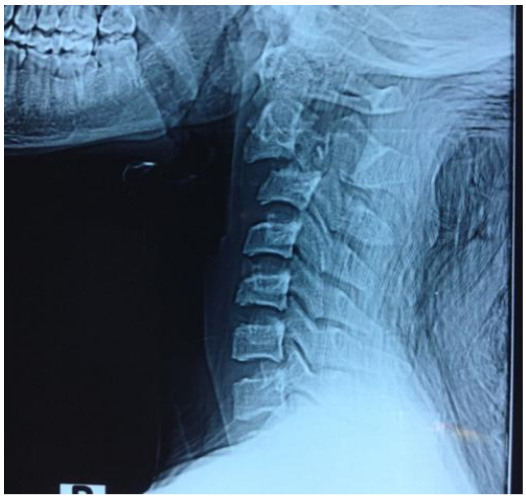


Figure-4: Partial correction after traction

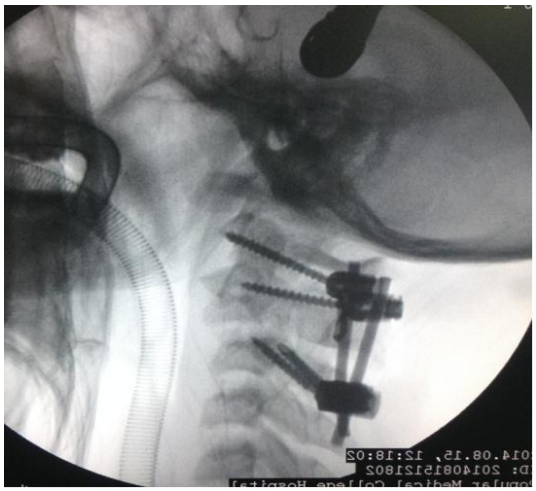


Figure-5: Full correction after surgery

Result

- Most hangman's fractures could be managed successfully with traction and external immobilization, especially in Effendi Type I,Type II and Levine-Edwards Type IIfractures.
- Levine- Edwards fractures of type II a and III must be treated with rigid immobilisation.
- All the patients had good post surgical outcome with disappearance of symptoms and improvement of neurological state.

Discussion

This retrospective analysis was intended to analyze the patterns of the fractures of hangman and to audit our treatment methods. We have tried to determine whether treatment failures with cervical collars are more likely than with halo immobilization.

Conclusion

- Surgery provides plausible results.
- Compared to conservative treatment, it can offer significant benefits.
  - Immediate, better and stable reposition.
  - High fusion rate.
  - Shortening of treatment period with better quality of life.
- Though technically difficult trans-pedicular screw fixation is the best option as it is physiologically and bio-mechanically most sound.

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