

Scarf-Related Hangman's Fracture: A Case Report

Chee-Kidd Chiu¹, Chris Yin-Wei Chan², Lim-Beng Saw², Mun-Keong Kwan²

Abstract

Background: Injury to the cervical spine due to a scarf-associated accident has not been reported in the literature. We present a case of a hangman's fracture in a 43-year-old woman that resulted from a scarf-related injury as a consequence of a motor vehicle accident.

Purpose: To identify the mechanism of a scarf-related injury causing Hangman's fracture.

Case Report: A 43-year-old woman was involved in a motor vehicle accident. She was wearing a scarf, which is a common clothing accessory for women in Malaysia. The scarf was violently torn off her head during the injury, causing a type I hangman's fracture. A halo vest for a total period of 3 months was applied.

Conclusion: A scarf-related injury can cause an injury that resembles judicial hanging, leading to a traumatic spondylolisthesis of the axis. Careful evaluation of the cervical spine radiographs is crucial as occult fracture of the axis can be missed.

Key Words

Axis · Hangman · Spondylolisthesis · Spine · Trauma management and education

Eur J Trauma Emerg Surg 2010;36:180–2

DOI 10.1007/s00068-009-8212-2

Introduction

Traumatic spondylolisthesis of the axis (C2) was described by Schneider et al. [1] as a traumatic bilateral avulsion of the neural arch of axis from its vertebral body with or without dislocation of the C2 on C3 vertebra. This was considered to be similar to an axis fracture that occurs following judicial hanging – thus justifying the usage of the term “hangman's” fracture.

Injury to the cervical spine associated with a scarf has not been described in the literature. We present a case of a type I hangman's fracture in a 43-year-old woman that resulted from a scarf-related injury as a consequence of a motor vehicle accident.

Case Report

A 43-year-old woman riding pillion on a motorcycle was involved in a motor vehicle accident when the driver of the motorcycle lost control and skidded after evading an oncoming vehicle. The woman was wearing a scarf, which is a common women's clothing accessory in Malaysia. The patient later recalled that her scarf got caught on some part of the motorcycle and was violently torn off her head. She was brought to the accident and emergency department of our clinic with neck pain and limited range of movement.

Initial clinical assessment revealed a small area of abrasion over the anterior aspect of the neck (Figure 1). Mild tenderness extended over the upper cervical spine. Flexion, extension, rotation, and lateral flexion movement was limited as the patient resisted movement due to pain. She had no neurological abnormalities. Radiographs of the cervical spine revealed no obvious fracture. A diagnosis of soft tissue injury was made. Consequently, a neck collar was applied and she was prescribed analgesics.

Due to persistent neck pain, the patient was referred to the spine registrar on call for further evaluation. Reexamination of the initial cervical X-ray showed a slight loss of the normal cervical lordotic curve between the C2 and C3 vertebra. A faint lucent line was visible across the C2 pars interarticularis (Figure 2). Computed tomography (CT) scan of the cervical spine revealed a minimally displaced fracture ring of axis (Figure 3). A diagnosis of type I hangman's

¹Orthopedic Surgery, Clinical School, International Medical University, Seremban, Malaysia,

²Orthopedic Surgery, University of Malaya Medical Center, Kuala Lumpur, Malaysia.

Received: November 1, 2008; revision accepted: February 5, 2009;
Published Online: June 30, 2009



Figure 1. Abrasion over anterior aspect of the neck.

fracture was made. The patient was placed in a hard collar and a halo-vest brace was subsequently applied. Three months later, radiographs and CT cervical scans showed union of the fracture, and the halo-vest was removed.

Discussion

The axis of the vertebra is described to be in the transitional vertebral plane; the body of axis remains joined to the atlas and cranium, while the neural arch remains joined to the other cervical vertebra, with the pars interarticularis connecting the two. Thus, a

hyperextension and axial loading force translates into a high shearing force, stretching the pars interarticularis of the axis. Initially, a violent hyperextension force will stretch the anterior structures and compress the posterior structures, causing them to tear apart and resulting in a pars interarticularis fracture. Continuation of this force causes the anterior longitudinal ligament and anterior disc to be torn and, if the force continues for an extended time, the disc is separated from C3 and there is C2–C3 dislocation [2]. A bio-mechanical study on a human cadaver showed that anterior–posterior shearing forces applied to the vertebral axis resulted in fractures in the pars interarticularis [3]. This study further proved that the pars interarticularis is the weak link between the body and the neural arch of the axis when a high shearing force is applied.

At the time of the accident, this patient was wearing a scarf around her neck that also covered her hair, chin, and nape. The scarf was subjected to a violent pulling force and torn off her head, causing abrasion over the anterior aspect of the neck. This force mimics the hyperextension and axial loading force that is involved in the mechanism that caused hangman's fractures.

The classification of hangman's fracture is based on the system described by Effendi et al. [4], with modifications proposed by Levine and Edwards [5]. Occult fractures of the ring of the axis, especially type I fractures, can be missed on plain radiographs and if left untreated, they may lead to nonunion of the fracture. Clinical suspicion of fracture warrants further radiographic or imaging investigations. In this respect, a CT scan of the cervical spine is invaluable to both the

Figure 2. Cervical radiograph – lateral and anteroposterior view. On the lateral view, there is loss of the normal lordotic curve of C2 on C3 (white arrows). A lucent line seen across the C2 pars interarticularis (black arrow).



Figure 3. Computed tomography scan of the cervical spine shows fracture C2 pars interarticularis (white arrows).



experienced and inexperienced clinician [6]. A CT scan provides good visualization of the cervical spine, especially the upper and lower segments which may not be well visualized on plain radiographs. Compared to dynamic radiographs of the spine, a CT scan causes less discomfort to the patient and a lower risk of precipitating neurological deficits.

The hangman's fracture typically does not cause neurological deficit for two main reasons: first, there is a large space available for the spinal cord in the upper cervical region; second, the forces across the C2 and C3 vertebral bodies during injury produce an enlargement of the spinal canal rather than a constriction. A low rate of neurological deficit is documented in the literature [1, 4, 5].

In conclusion, a scarf-related injury can cause damage similar to that seen with judicial hanging, leading to a traumatic spondylolisthesis of the axis. The primary care physician or the emergency room personnel should be alert for the possibility of axis fractures in patients with a history of a violent scarf-related injuries.

Conflict of interest statement

The authors declare that there is no actual or potential conflict of interest in relation to this article.

References

1. Schneider RC, Livingstone KE, Cave AJ, Hamilton G. Hangman's fracture of the cervical spine. *J Neurosurg* 1965;22:141-54.
2. Francis WR, Fielding JW. Traumatic spondylolisthesis of the axis. *Orthop Clin North Am* 1978;9:1011-27.
3. Teo EC, Paul JP, Evans JH, Ng HW. Biomechanical study of C2 (axis) fracture: effect of restraint. *Ann Acad Med Singap* 2001;30:582-7.
4. Effendi B, Roy D, Cornish B, Dussault RG, Laurin CA. Fractures of the ring of the axis: a classification based on the analysis of 131 cases. *J Bone Joint Surg* 1981;63:319-27.
5. Levine AM, Edwards CC. The management of traumatic spondylolisthesis of the axis. *J Bone Joint Surg Am* 1985;67:217-26.
6. Lin JT, Lee JL, Lee ST. Evaluation of occult cervical spine fractures on radiographs and CT. *Emerg Radiol* 2003;10:128-34.

Address for Correspondence

Chee-Kidd Chiu
 Orthopedic Surgery
 Clinical School
 International Medical University
 Seremban, Negeri Sembilan 70300
 Malaysia
 Phone (+60) 6767 9896
 e-mail: cheekidd@yahoo.com