Scarf-Related Hangman’s Fracture: A Case Report
Chee-Kidd Chiu¹, Chris Yin-Wei Chan², Lim-Beng Saw³, 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

Introduction
Traumatic spondylolisthesis of the axis (C2) was described by Schnider 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 – this 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 vertebrae. 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...
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 leading 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 biomechanical 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 Efendi 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