

## Long Drop Suicidal Hanging with Autopsy Finding of Cervical Spine Fracture: A Rare Case Report

Sharma Neha\*, Dey Arijit\*, Tyagi Swati\*, Pandit N. Jay\*, Prasad Kulbhushan\*\*, Gupta K. Sudhir\*\*\*

**Authors Affiliation:** \*Resident \*\*Assistant Professor \*\*\*Professor & Head, Department of Forensic Medicine & Toxicology, All India Institute of Medical Sciences, New Delhi, Delhi 110029, India.

**Reprints Requests:** Arijit Dey, Senior Resident, Department of Forensic Medicine & Toxicology, All India Institute of Medical Sciences, New Delhi, Delhi 110029, India.

E-mail: [arijit.forensic@gmail.com](mailto:arijit.forensic@gmail.com)

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### Abstract

Cervical fracture is a rare presentation in suicidal hanging but a common finding in judicial hanging where the person is dropped from a calculated height, resulting in fracture dislocation at the level of 2<sup>nd</sup>-3<sup>rd</sup> or 3<sup>rd</sup>-4<sup>th</sup> cervical vertebrae. In case of long drop hanging cervical fracture with or without dislocation is commonly found; possibly due to a greater tractional force due to longer height of suspension. We describe a case of an average built male weighing 72 kg who hanged himself by jumping off a roof top, with a drop length of 4.14m. On autopsy in addition to common findings of a hanging case, complete transection of spinal cord and fracture dislocation of cervical vertebrae C2-C3 were found along with hematoma. In this case of long drop hanging, there was fracture of cervical spine with ligature knot being placed at sub-occipital position which is a rare autopsy finding.

**Keywords:** Hangman's Fracture; Long Drop; Sub-Occipital Knot; Suicidal Hanging.

### Introduction

Suicide rate has been alarmingly high globally as well as in India especially in the urban region. Hanging remains to be the widely followed method of suicide except in few countries like United States of America where firearms are used more commonly. In India, hanging is used most commonly as a suicide method among males and females especially in 20 - 35 years of age, while the occurrence is less among children and elderly [1]. Hanging is the form of mechanical asphyxia where the body is suspended by a ligature around the neck, the constricting force being the weight of the body or weight of a part of the body [2]. It can be complete where feet are off ground or incomplete/partial where feet touch ground or any support. Most of the cases reported are of atypical hanging i.e. knot is placed at position over the neck other than nape of neck; and typical hanging is the one in which knot is placed over the nape of the neck. Most of the cases reported of complete hanging are of short drop i.e. height not more than 2 meters and rarely do we find a case of long drop where the height of fall is above 2

meter (may range over 6 meters). This is commonly seen in judicial hanging. A typical finding associated with such long drop is fracture of the cervical vertebra commonly known as hangman's fracture [3-8]. The most common pattern of cervical spine injury includes anterior longitudinal ligament disruption of the lower cervical spine, disk space widening, and no vertebral body displacement. We discuss a case of long drop suicidal hanging by an elderly person, who jumped off the roof of a building, with a jute rope as a ligature material and whose postmortem examination revealed fracture-dislocation of upper cervical vertebra and associated spinal cord injury.

### Case Details

A 68 years old male was found in completely hanged position with a jute rope as a ligature material, at his residence and the height of suspension was about 6.5 m from the knot. The dead body was removed from the hanging position and was taken to AIIMS casualty where he was declared brought dead. Suicide notes written on a

piece of paper and also over the shirts worn were recovered (Fig. 1,2).



Fig. 1:



Fig. 2:

Autopsy was conducted in the mortuary of Department of Forensic Medicine & Toxicology, AIIMS, New Delhi and the findings were as under-

#### External Examination

Deceased was moderately built with length 167 cm and weighing 72kg. Rigor mortis was well developed; postmortem lividity was fixed and present in glove and stockings distribution. Both eyes and mouth were closed. Ligature material was a grey colour braided thick jute rope present encircling the neck in two loops with a single

running knot. The knot was present over lateral aspect of neck. The circumference of noose including the knot was 32 cm. There were three free ends emerging from the knot which were 414cm, 10 cm and 14 cm long.

*Ligature mark*- Ligature mark was reddish brown colour, incomplete, parchmentised, in upper half of antero-lateral aspect of neck, directed oblique, upwards and backwards merging with posterior hairline and nape of neck. It was 4 cm below mentum and 11 cm above suprasternal notch, 4 cm wide with intervening normal skin. Laterally it was 1 cm below left mastoid process and 3 cm below right mastoid process. Width of the mark was 2.5 cm on both left and right lateral aspect of neck. Total circumference of the ligature mark was 32 cm.

The other injuries on the body included-

- i. Reddish colour abrasion of size 5 cm X 0.8 cm placed horizontally over the chin across midline.
- ii. Lacerated wound of size 4 cm X 0.5 cm placed horizontally on right side of forehead 4.5 cm above the eyebrow at midline; on dissection underlying sub-scalp hematoma was present.
- iii. Two reddish abrasion of size 1cm X 0.5 cm and 1cm X 0.4 cm present at outer aspect of base of right thumb.



Fig. 3: Ligature material

### Internal Examination

On dissection of neck, the tissue underlying the ligature mark was dry, pale, glistening, devoid of any extravasation or hematoma. The cervical vertebra along with spinal cord at the level of C2 and C3 vertebra was completely transected and associated with hematoma in surrounding area. The thyrohyoid complex was intact. The tracheal mucosa was congested. All other visceral organs were congested. Stomach was filled with partially digested food matter with no characteristic smell. The cause of death was declared as 'Shock due to injury sustained to cervical vertebra at the level of C2 and C3, in a case of antemortem hanging' (Fig. 3,4,5).



Fig. 4: External neck injury



Fig. 5: Internal neck injury

### Discussion

Cervical fracture by hanging is a rare finding and mostly seen in long drop suspensions [9]. Schneider et al. in 1965 coined the term Hangman's Fracture to describe cervical vertebrae injuries following a series of car accidents where there was bilateral avulsion of the neural arch of the axis (C2) from vertebral body with or without dislocation of the C2 vertebral body on C3, due to similarity to cervical fracture observed after judicial hanging as a sequel to violent and rapid hyperextension of the head [10]. Anterior aspect of the neck is vulnerable to any mechanical compression as the veins, arteries and nerves are easily compressible. The posterior aspect of the neck is partially protected by the cervical vertebra, but these are also not spared from injuries. Whenever the length of fall is longer than the height of the victim, it will cause injury to the cervical vertebra due to the axial, gravitational force and torsion of the neck. In judicial hanging, height of the person is measured and then he is suspended at a height more than the height of victim. Greater the height and weight of the person, greater is the profoundness of injury. In judicial hanging there is usually a long drop in order to lead to instantaneous death caused by fracture of the upper cervical spine which results in a corresponding spinal cord injury [11,12]. Nokes et al. summarized the past studies on judicial hanging cases and suggested that the amount of energy needed around the neck to produce instantaneous unconsciousness with cervical fracture, dislocation, fatal spine cord and brainstem disruption without decapitation is approximately 1,700 J, which is calculated using the formula, Body weight (kg) X 9.81(m/s<sup>2</sup>) X drop height (m) [13].

In the present case the victim was an elderly man who jumped off a rooftop by tying bedsheet with suboccipital knot around the neck, free ends of ligature or the drop was 4.14 m in length; which was much greater than his own height, producing tractional force more than sufficient to cause instantaneous death and complete transaction of spinal cord at the level of cervical vertebrae C2 and C3 along with hematoma. A typical hangman's fracture is fracture of cervical spine at the isthmus of the axis caused by retro flexion in combination with anteroflexion of the head in hanging with a long drop and a sub mental knot [14,15]. But Fabrice Dedouit et al. reported a case of complete post hanging decapitation where the cervical spine broke between the third and the fourth cervical vertebrae with fractures of extremities of the spinous processes of the 2<sup>nd</sup> and 3<sup>rd</sup> cervical

vertebrae with no fracture in the region of isthmus. The spinal fractures occurred due to the combination of axial traction, shearing force and crushing forces [16]. In the study conducted by Nikolic' et al. cervical spine injuries were identified in only 3.3% of short-drop hangings and 80% of subjects with cervical fracture were aged 66.5 years and above. Fracture commonly involved lower cervical spine injury in association with disruption of anterior longitudinal ligament with disk space widening and no displacement. These injuries mainly occurred with an anterior knot position due to pressure on the posterior neck and cervical spine hyperextension<sup>17</sup>. In a retrospective study conducted by James and Nasmyth-Jones in 1992 on 34 persons judicially hanged, only six had fracture to the axis and one had cervical osseous fracture; the results indicating that traditional hangman's fracture occurred in only a small proportion of cases of judicial hanging [18]. Takahito Hayashi et al. conducted a prospective autopsy study using postmortem multislice computed tomography (pmMSCT) visualizing hangman's fractures in 1 case (3.1%) of 32 cases of hanging where longer drop with a lateral knot was used [19]. Ghormade et al. reported a similar case of cervical fracture by long drop (6.3 m) using a nylon rope and sub occipital position of knot, and deep laceration was present over anterolateral aspect of neck [20].

In the present case there is long drop (4.14 m), sub occipital position of knot and cervical fracture without any laceration over the neck; possibly due to use of bedsheet as ligature material which is softer as compared to nylon rope. In the present case, the deceased fell down from a distance of 4.14 m before suspension and constriction by the rope. Usually, in such long drops, there is every chance of partial or complete decapitation due to traction force. However, there was fracture dislocation of Cervical 2<sup>nd</sup> and 3<sup>rd</sup> vertebrae along with complete transection of spinal cord. The deceased was an average built person with body weight 72kg, which was insufficient to cause enough gravitational pull, thus preventing decapitation even after sufficient traction. Perhaps, the deceased jumped from the edge of the roof top after tightening the rope, which is sufficiently high up to cause sudden twist of the neck before suspension along with gravitational pull due to positional effect. This movement at the time of suspension was probably responsible for the Cervical fracture & dislocation.

## Conclusion

Fracture of cervical vertebrae is not a common finding in suicidal hanging and is mostly seen in judicial hanging associated with long drop. Even in long drop hangings, cervical fracture are commonly found among elderly, possibly due to osteoporotic changes in the vertebrae. The findings in this case are consistent with the observation, complete transection of C2 and C3 was seen in an elderly male after suspension from height more than 6 meter.

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