

Kasuistik – Casuistics

Fractures of the Axis Caused by Hanging

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Summary. Prerequisites for fractures of the neural arch of the axis in the region of the isthmus (hangman's fracture) during hanging are considered to be a long drop and a submental knot. A case is presented showing that hangman's fracture arising in hanging can result from stretching of the neck combined with antero-flexion of the head.

Zusammenfassung. Als Voraussetzungen für das Entstehen von Frakturen des Axisbogens in der Isthmus-region (hangman's fracture) beim Erhängen werden ein erheblicher Fall in die Schlinge und eine Lokalisation der Laufschnalle unter dem Kinn angesehen.

Es wird ein Fall von Erhängen mit einer sog. hangman's fracture beschrieben, bei dem die Axisverletzungen durch die Streckung des Halses und Anteroflexion des Kopfes entstanden sind.

Key words: Erhängen – Axisbogenfraktur, Erhängen

Fracture of the neural arch of the axis in the region of the isthmus (hangman's fracture) is, the cervical spine injury desired in judicial hanging, because of its usual concomitant fatal injury to the spinal cord. The general opinion is that the prerequisites for this type of fracture are the drop and the submental knot. However, a case recently observed showed that hangman's fracture can arise even if the knot is not located submentally.

Case Report

A 42-year old man was found hanging on a line. One end of the line was tied to the branch of a tree, the other arranged as a ligature around his neck with a running noose immediately behind his left ear. The findings at the scene showed that the man had climbed a ladder, arranged the line and jumped from the ladder. The length of the drop was estimated to be 2–3 meters.

Autopsy

There was an impression around his neck corresponding to the ligature, that is, with its highest point immediately behind the left ear. The epiglottis was transected at its base and the surrounding soft tissue showed extensive hemorrhage.



Fig. 1. The impression of the noose around the neck with the highest point behind the left ear

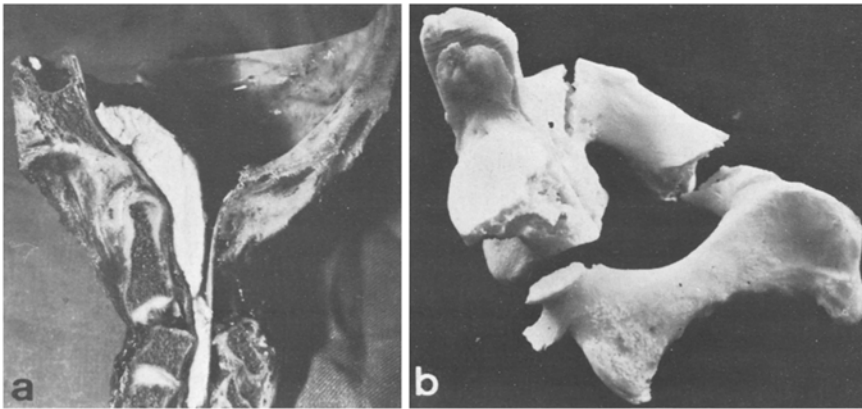


Fig. 2a. Soft tissue injuries of the cervical spine. Sagittal section. **b** Axis injuries

Careful investigation of the cervical spine showed:

Soft tissues: There were hemorrhages and lacerations of the dorsal neck muscles at the level of the atlas and axis with tearing of the ligamentum flavum between the axis and C3. The intervertebral disc between the axis and C3 was lacerated, mainly in its dorsal part, as was the posterior longitudinal ligament at this level. The anterior longitudinal ligament was avulsed from the superior part of the anterior side of the body of C3 and lacerated on the left at this level. No lacerations of the joint capsules of the lateral joints between the atlas and axis were present, but there were hemorrhages around the left joint. Hemorrhages were also found around the apophyseal joints between the axis and C3, mainly on the left side.

Movement testing of the removed cervical spine showed that the injuries to the soft tissues permitted extreme anteroflexion of the head to the right.

The axis: There was a fracture running through the posterior part of the left superior joint surface and the foramen transversarium with several small bone fragments present. An infraction (incomplete fracture) ran from the posterior part of the right superior joint surface in an inferior direction. Furthermore, a fracture in the right half of the neural arch was present, running from

the inferior joint surface posteriosuperiorly, and a small infraction ran from this fracture in an anterior direction on the lateral surface of the neural arch. Both transverse processes were split off. The remaining cervical vertebrae were intact.

The course of events in this suicide, the movement test and the injuries to the soft tissues and the axis showed that the neck had been stretched and the head anteroflexed to the right.

Discussion

Reviews of the history and pathology of judicial hanging have been given by Maurice-Williams 1973 and Schneider et al. 1965. Wood-Jones in 1913 emphasized the importance of the position of the hangman's knot for the localization of a possible fracture to the base of the skull or to the neural arch of the axis. More exactly, he considered retroflexion (hyperextension) of the head essential for producing fracture of the axis, and thus the knot must be submentally located.

People committing suicide by hanging often show minor injuries to their cervical spines (Saternus et al. 1974), but fractures of the neural arch of the axis are rare, obviously due to the drop usually being too short.

The findings in the present case clearly show that with a drop of 2–3 meters a violent stretching of the neck occurred, and due to the localization of the knot behind the victim's left ear an anteroflexion (hyperflexion) of the head to the right. This movement of the head evidently caused not only the fracture of the left anterior part of the neural arch and the infraction gaping superiorly in the right superior joint surface due to forward bending of the odontoid process and the body of the axis in relation to its neural arch, but also the torsion fracture in the right part of the neural arch due to the stretching of the neck being more pronounced on the left than on the right side.

As mentioned above a hangman's fracture produced in the classical way is considered due to traction of the neck and retroflexion of the head. The present case shows that the fracture can arise from traction being combined with anteroflexion of the head. This finding is in good agreement with the results of a recent investigation on the genesis of fractures of the axis in accident victims (Sköld) which indicates that in such cases hangman's fracture usually arises from anteroflexion of the head (in combination with traction or compression of the cervical spine).

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