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IMAGES IN FORENSICS

Remarkable findings in suicidal hanging

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Case report

Case 1

A 71-year-old man was found dead in his apartment hanging by a tie that was fixed to the upper hinge of a door. His feet were touching the ground. It was known that he had tried to commit suicide before. At medico-legal autopsy a single furrow was found on the neck with a ligature knot behind the left mandibular angle. Dissection of the neck's soft tissue in layers revealed bilateral fresh hemorrhages in the pharyngeal tonsils with macroscopic delineation of gland follicles (Fig. 1). Fractures of both superior horns of the thyroid cartilage, superficial hemorrhage in the tongue's base, and petechiae of the facial skin and conjunctivae were also present. Except for brain swelling, pulmonary edema, and severe generalized atherosclerosis, no other findings were observed. Toxicological investigations were negative. The cause of death was declared as hanging and the manner of death was ruled suicide.

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Case 2

A 74-year-old man was found hanging from the railing of a bridge, freely suspended by a hemp rope with an estimated drop of 3.5–4 m. The deceased was 160 cm tall and weighed 77 kg. The 1 cm thick rope compressed the neck with a knot on the anterior area of the neck forming a loop that ran above the laryngeal protuberance. The loop ended in a fixed ligature knot behind the left ear. At external examination, dried saliva was found coming out of the right corner of the mouth, draining down over the chin. Autopsy revealed bilateral symmetrical hemorrhages at the sternal insertion of the periosteal-clavicular origin of the sternocleidomastoid muscles, and a complete laceration of all tissue layers between the cricoid cartilage and the hyoid bone that crossed the upper part of the thyroid cartilage and exposed the laryngeal mucosa. The trachea contained a small amount of fine froth with no signs of blood aspiration. A full-thickness transverse laceration, as well as superficial tears in the intima of the right common carotid artery, were also seen proximal to the bifurcation (Fig. 2). Hemorrhages ("Simon's bleedings") beneath the anterior longitudinal ligament of the thoracic and lumbar spine were also present. Toxicological analysis was unremarkable.

Case 3

A 34-year-old man was found hanging in free suspension by a rope in his apartment. According to the man's medical history he had suffered from a depressive disorder. A suicide note was found in the flat. At external examination, a strangulation mark was visible with signs of suspension below the left ear. At autopsy, the most remarkable finding was hemorrhage beneath the anterior longitudinal ligament

Fig. 1 *Case 1* Gross appearance of bilateral hemorrhages in the pharyngeal tonsils

Fig. 3 *Case 3* Gross appearance of "Simon's bleedings" of the cervical spine

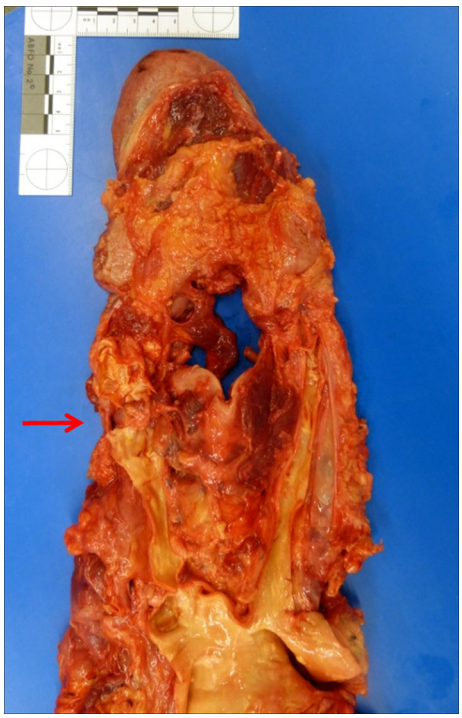

Fig. 2 *Case 2* Gross appearance of the complete laryngo-tracheal separation with the transverse laceration of the right common carotid artery (arrow)

Fig. 4 *Case 4* Gross appearance of the esophagus with circumferential bruising

of the cervical spine (Fig. 3). Toxicological analysis was negative.

Case 4

An 84-year-old man was found dead in his apartment hanging in free suspension. According to the deceased's medical records, he had suffered from a depressive disorder. A suicide note was found in his apartment. External examination revealed a deep furrow with a loop below the laryngeal protuberance. A layer-by-layer dissection of the neck's soft tissues was performed. The subsequent opening of the esophagus showed a purple-red 2 cm wide band of bruising just below the upper esophageal sphincter, involving the whole circumference of the organ (Fig. 4).

Fig. 5 *Case 5* Dried mark of saliva coming from the right corner of the mouth

No other remarkable findings were observed. Toxicological investigations were negative.

Case 5

A 44-year-old man was found dead in his flat. The body was located in the hallway outside the bathroom in a kneeling position. The head of the man was situated within a cabinet, and was pressed against the neck, which was lying on the edge of the cabinet, on the anterior region. A belt was fixed to a heating pipe just above the bathroom door (and above the body) with a noose in the free end. The bathroom door handle was broken. No previous diseases were reported. External examination showed abrasions of the skin on the right temple region, petechiae of the facial skin and in the conjunctivae, and a discrete white mark of dried saliva originating from the right corner of the mouth and running downwards, consistent with the head's position on the cabinet (Fig. 5). The neck showed pressing marks left by the edge of the cabinet. Autopsy revealed hanging as the cause of death and the manner of death was ruled a suicide. After hanging himself, the man's head slipped out of the belt noose due to his body weight and fell upon the facing cabinet. The facial abrasions were attributed to his face hitting the door handle during the fall.

Discussion

Hanging deaths are frequently subject to forensic autopsy to clarify the manner of death. Considering that the most common method of committing suicide has always been hanging [1], homicidal and accidental hanging are only rarely seen [2]. However, the task of the forensic pathologist is to determine whether the person hanged him- or herself, and whether hanging occurred while the person was still alive, or if the decedent was placed in a hanging situation postmortem, e.g., as a masquerade to hide homicide and to simulate suicide. Both a medical history of psychiatric disorders and the existence of suicide notes [3], in concert with the absence of defense-type lesions or blunt force injuries like grab marks, are typical for cases of suicidal hanging. The presence of vital signs is commonly characterized in the forensic literature as local macro- and micro-morphological findings in hanging, which serve as additional criteria for the reconstruction of the sequence of events [4]. As systemic reactions, pulmonary atelectasis, pulmonary microembolism syndrome, and hemorrhages of the bowel and of the accessory breathing muscles have been described in addition to local lesions such as "Simon's bleedings" [5–8].

Here, we briefly report five cases of suicidal hanging with remarkable macroscopic autopsy findings.

In case 1, fresh hemorrhages in both the pharyngeal tonsils and the tongue were found. These findings could be caused by the base of the tongue pressing against the roof of the pharynx due to compression of the floor of the mouth caused by the weight of the body on the tie used for hanging [9].

In case 2, in addition to hemorrhages of the periosteal-clavicular origin of the sternoicleidomastoid muscles, tearing of the intima of the right common carotid artery, and Simon's bleedings, a complete laryngo-tracheal separation was found. All these findings result from the drop effect of hanging (3–4 m) wherein violent axial overstretching and caudo-rostral hyperextension are the predominant forces. Hence, in hanging cases with long-drop, the structures of the neck are injured by strain caused by increased gravitational drag produced by the body's weight. An additional pathogenetic factor, especially for "Simon's bleedings," is the strong lateral stimulation of the lumbar spine due to agonal convulsions in hanging [10]. In this case, the over-traction by the hemp rope, together with the constriction of the neck, produced the laryngo-tracheal laceration at the level of the rope loop's projection. The effect was greater on the anterior side of the neck where the knot forcefully compressed the neck structures. However, these concurrent forces were not enough to produce a complete/incomplete decapitation [11–13] or even various fractures of cervical vertebra 2 (hangman's fractures, common in motor vehicle collisions or judicial hangings) [14].

In case 3, hemorrhages beneath the anterior longitudinal ligament of the cervical spine were observed. "Simon's bleedings" are usually located in the thoracolumbar spine where terminal forceful movements and traction by the body during asphyxia are more pronounced [8, 15]. Their occurrence was also described in the cervical spine in a case of positional asphyxia because of the retroflexion of

the cervical spine [16]. Nonetheless, this finding is a rare observation in hanging cases without a long-drop.

In case 4, the inner surface of the esophagus revealed a circumferential bruising strand below the upper sphincter of the esophagus. Such hemorrhage can be considered as occurring *intra vitam* due to the forceful constriction of the neck by the rope in this case.

In case 5, the mark left by saliva confirmed that the compression of the neck by the hanging belt occurred during life and the downward direction of the dribble was compatible with the head's position on the cabinet. A mark from saliva is considered as a vital reaction as a consequence of the stimulation and irritation of submandibular salivary glands that only occurs during life, due to pressing and friction from the ligature [4]. The saliva often dribbles from the lower side of the mouth, e.g., the side opposite the knot.

As we have demonstrated, single, isolated morphological findings are nonspecific as an indicator of vital origin. In contrast, their absence alone may not necessarily suggest that the body was suspended after death. Under all circumstances it is crucial for the forensic pathologist to be able to detect and to consider unusual autopsy findings as described here in order to reach reasonable medical conclusions on the cause and manner of death in each individual investigation.

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