

Case report

VIDEO FOOTAGE OF A COMPLETE AND TYPICAL HANGING: ANALYSIS OF THE HANGING SEQUENCE

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ABSTRACT

Investigating a body found hanged, without eyewitnesses, to determine the cause and manner of death can be difficult. Video surveillance footage can help document the events and provide useful data for the proper assessment of the case. The authors report the case of an 86-year-old man found suspended on the outer wall of his home and who died following the hanging carried out as a suicide. The images taken by the surveillance camera are useful for reconstructing the incident and to confirm that the cause of death is attributable to the hanging, without the interference of extrinsic factors. The sequence of events relating to hanging and subsequent convulsive movements typical of the last moments of life, as seen from the video surveillance recordings, does not seem to differ much from those described in the experiments reported in the literature. The reporting of this suicidal event has yet to be considered a significant isolated case study for the study of the human hanging process.

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1. Introduction

Investigating a body found suspended from a fixed point by means of a lace, implies determining the cause and distinguishing the type of suicide (hangings), accidental or homicidal by third parties (suspension of a corpse).

Specifically, identifying cases in which a suicide has occurred, often represents an important challenge for the forensic pathologist.

Accidental hanging occurs in about 5% of all hanged cases [1], [2].

Most of these cases involve newborns but can also occur in adults during some autoerotic behaviors.

Murder, on the other hand, is very rare. In fact, about 95% of hangings are suicides because it is rather difficult to suspend a conscious person, especially if an adult, since a struggle could occur.

Such cases mainly occur when the victim is a child, an individual with disabilities or when the aggressor has a physical strength significantly greater than the victim [3], [4], [5].

The only case of homicide linked to the method of hanging, but not caused by it, is the suspension of a corpse: in this case, a murder occurs in a way unrelated to hanging, and is then concealed through a simulated hanging.

Therefore, despite the rarity of the possibility of murder, in all cases of death by hanging, it must always be excluded through a detailed investigation of the crime scene and a thorough an autopsy.

In fact, often the thanatological data alone, may be insufficient. An example is reported in an article relating to the hanging of a 33-year-old man, found dead on the floor behind the entrance door of an apartment building [6].

The victim's brother claimed to have found him suspended in the stairwell on the top floor of the building. When he tried to rescue him, the victim fell three floors through the stairwell.

The autopsy was essential to confirm suicide by hanging and the blunt traumatic injuries were caused by the post-mortem fall, ruling out a potential murder carried out by his brother.

It is therefore clear that, in such cases, the circumstantial data, such as the statements provided by any eyewitnesses present at the crime scene, take on considerable importance, especially if consistent with what will be found later during body inspection.

However, the presence of video surveillance images, can certainly help to accurately define the time of death and discern, although not always with certainty, between possible suicidal, accidental, and homicidal causes.

2. Case presentation

The body of an 86-year-old man was found suspended from the outer wall of his home on a sunny winter day (Figure 1).

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Figure 1. Corpse position at the time of discovery.

Before proceeding with the external examination and the cadaveric section, it was decided to investigate the presence of any fractures of the cervical vertebrae, even if in hangings these might not be detectable through cadaveric inspection alone.

The following radiological scans of the skull and cervical vertebrae were carried out, finding the absence of fracturing lesions (Figure 2).

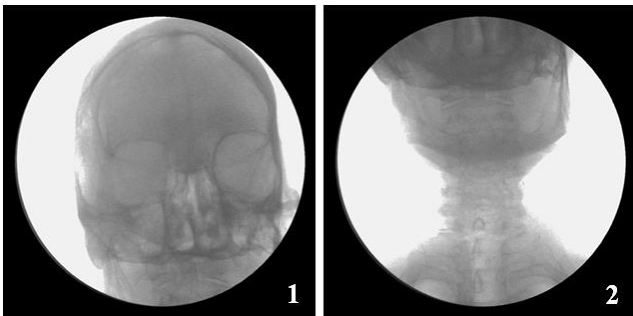


Figure 2. Absence of fractures of the cervical vertebrae

A fracture of the hyoid bone or laryngeal cartilage is observed in approximately 58% of the autopsies [7].

In the Nikolic et al. Series of autopsies, the hyoid bone was fractured in 15% of cases, the thyroid cartilage in 26% and both in 16% of cases [8].

The incidence of these fractures increases with the victims's age, as the neck structures become more fragile [9].

Injuries to the hyoid bone and thyroid cartilage depend on the position of the knot of the ligature, given that these fractures are not observed in case of anterior position of the knot because there is no pressure on the structures.

Injuries to the cervical vertebra, on the other hand, are only observed in 0.8 to 3.6% of cases [10], [11].

The external examination was performed about 3.5 hours after death, and about 3 hours from the discovery of the body, revealed the presence of an area of cutaneous depression at the level of the neck, forming hard sulcus, as well as several ecchymotic-excoriated lesions caused by the impact with the external wall of the house that occurred following the defenestration and peri-mortal convulsive movements.

Specifically, upon closer examination at the level of the cervical region, the following details were observed: an area of ribbon-like skin depression without discontinuity but of variable depth, with a variegated color from reddish to brownish and a parchment consistency, 40 cm in length with characters of vitality (Figure 3).

Regarding the discontinuity of the groove, however, it must be emphasized that despite this occurrence is the most frequent, it may happen that the groove is continuous. This possibility becomes evident in the circumstances in which the lace was wrapped in several coils or, as in the present case, is tightly attached to the skin surface and firmly knotted [10].



Figure 3. Ecchymotic-excoriated lesions and area of ribbon-like skin depression

In addition, it must be emphasized that although it was not possible to identify an area of free discontinuity within the furrow, a variable depth was observed. More precisely, the skin groove started from the right lateral cervical area where it had maximum depth (about 1 cm), was progressively reduced until it reached about 4 cm to the left from the Posterior Median Line (about 0.3 cm), in agreement to the methods of hanging carried out by the victim.

In fact, the victim was found suspended from the external walls of his house with the front surface of the body facing the wall and the knot of the rope placed in correspondence with the left posterolateral cervical area.

In accordance with the circumstantial data, the autopsy confirmed the classic findings of a hanging, revealing the presence of a hard groove upon external examination (Figure 4).

During the autopsy investigation, hemorrhagic infiltrates were found in correspondence with both the base of the tongue and the deep musculature of the latero-cervical regions, as well as the typical lacerations of the intima carotid, more evident on the right, demonstrating the Sign of Amussat [12-14].



Figure 4. Silhouette in motion (red circle) behind the window of the house (09:03:30).

The vitality of these injuries allows us to affirm that these were caused by the compressive action of the lace when the victim was still alive.

The diagnosis of hanging is also supported by the observation of the typical features of death by asphyxiation. In the case in question, these were: presence of petechiae in relation to hypostases, protruded and clenched tongue between the teeth, conjunctival bruises, and by multivisceral stasis as confirmed by histological examination of the brain, lungs, liver and kidneys.

The images taken by the surveillance camera are very useful for reconstructing what happened in a case where there were no witnesses.

In this case, the video footage made it possible to confirm what was found during the necropsy and autopsy, attributing the cause of death to hanging, without the interference of other extrinsic factors: in fact, the video footage shows that the person in question defenestrated himself and committed suicide by hanging.

The dynamics that cause death are essentially attributable to three different pathophysiological mechanisms: asphyxiation, circulatory and nervous.

The asphyxiation mechanism acts by sliding the lace upwards until it stops at the mandibular angle, causing the hyoid bone to move posteriorly and lifting the base of the tongue against the soft palate and pharynx blocking the airways. The circulatory and nervous mechanisms are almost always secondary. The first involves the compression of the great vessels of the neck (carotid and jugular), while the second involves the stretching of the vagus nerve, associated with the stimulation of the skin receptors, with consequent reflex bradycardia leading to cardiac arrest. There is no convergence among the different authors regarding the actual preponderance of one the mechanism over the others. However, there is agreement on the possible competition between them, although to various degrees, depending on the case in question [15], [16], [17], [18], [19].

Despite the great progress made in the field of forensic science in recent years, knowledge on the physiopathology of hanging is scarce.

In fact, the literature relating to the bodily responses that result from hanging is still limited.

In the authoritative book "Spitz" [20], this topic is only addressed briefly: "It has been suggested that consciousness may persist for up to 10 seconds in cases of abrupt cardiopulmonary arrest, because of oxygen already present in brain tissue. However, experience appears to negate this hypothesis with the thought that oxygen is not the sole determining factor in extending awareness, but that simultaneous active and sound blood pressure is also required".

In Di Maio's Forensic pathology, it is reported that "pressure on the neck in the area of the carotid arteries causes unconsciousness in an average of 10 sec" [21].

Di Maio also reports on an old study from 1943 by Rossen et al. [17]. In this study, 85 male volunteers between the ages of 17 and 31 were strangled with a pressure-inflated neck cuff.

The loss of consciousness began in 5 to 11 seconds and was followed by generalized tonic-clonic convulsions [22]. However, studies such as these, despite being extremely incisive and demonstrative from the scientific point of view, are impossible to carry out today due to obvious ethical issues.

Animal studies have also been performed, such as the one by Ikeda et al. relating to the course of respiration and circulation during a hanging carried out on 15 dogs [23].

However, the application of the results to humans from studies on animals can be very questionable.

Of course, there have been various forms of judicial execution based on death by asphyxiation, but these differ greatly from hanging.

In fact, judicial execution causes death mainly through both the fracture-dislocation of the upper cervical vertebrae with resection of the spinal cord and through asphyxiation due to compression of the vascular-nerve structures of the neck [20], [21].

In 1989, a German newspaper reported the case of an autoerotic incident that was a video-recorded hanging [24]. This case involved a 24-year-old man who hanged himself by fixing a noose to the ceiling, then by lowering the seat of the office chair on which he was sitting, he managed to tighten the noose. According to the authors, the victim in the video initially appeared calm, then, he prepared his setting for about 5 minutes and then hanged himself. Loss of consciousness was observed after about 55 seconds, followed by the onset of convulsions for about 6 minutes.

In 2007, the Journal of Forensic Science reported a case [25] describing the sequence of events relating to the respiratory and circulatory systems that result from death by hanging. Specifically, a 37-year-old man fixed one end of the lace to the track system of a garage door and then hanged himself by activating the electronic system to close the garage door using a special remote control. The event was videotaped, which made it possible to identify different phases of agonic movements: initial loss of consciousness, followed by the onset of convulsive movements; then stiffness from decortication and decerebration and, finally, the loss of muscle tone with certain isolated muscle movements. On the other hand, with regards the respiratory system, there was the appearance of increased deep respiratory acts, followed by progressively reduced breaths until they were completely interrupted.

Film analysis

In the case in question, the video surveillance footage portrays the entire building in which the victim lived and from which he defenestrated himself.

The image quality is poor due to the excessive brightness caused by the sunlight contrast on the field of interest, but sufficient to capture all the phases of hanging.

The video footage includes a timepiece that indicates hours, minutes, seconds.

To facilitate images interpretation, only the field of view of our interest was selected, that is, the one including the window located on the external wall of the house from which the victim defenestrated himself. Therefore, simple image processing was carried out based on the enhancement of contrast and the reduction of brightness, to make the sequence of events in question even more evident.

Analysis by the authors:

A moving figure was observed behind the window, which seemed to prepare itself before carrying out the suicide (09:03:30 am and 09:03:40 am).

Subsequently, we observed that previously mentioned figure came out of the window falling along the external wall of the house in question (09:04:43 am and 09:05:11 am)

It remained suspended concluding the hanging (09:06:15 am).

The intense shaking movements of the limbs can be interpreted as desperate attempts to avoid asphyxiation caused by the compression of the lace on the cervical region (time of intense shaking: 09:05:16 am - 09:05:32 am).

Subsequently, the movements became slower, resulting in victim's death by asphyxiation (movement end time: 09:06:15 am) (Figure 5 and 6).



Figure 5. Silhouette in motion (red circle) behind the window of the house (09:03:40).

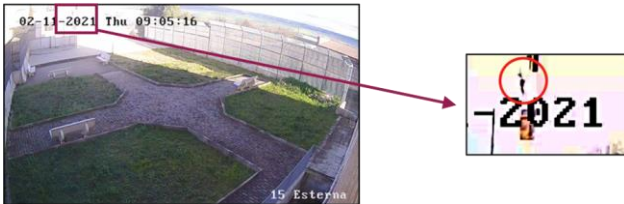


Figure 6. Silhouette suspended (red circle) from a rope, along the external wall of the house (09:05:16 hours).

4. Conclusions

In the case examined by the authors, the images of the video surveillance footage show that the victim was initially affected by movements of intense shaking of the limbs, which in all probability were desperate attempts to avoid the asphyxiation caused by the compression of the lace in correspondence with the cervical region. In fact, the intense agitation appeared between 09:05:16 and 09:05:32, that is, immediately after the subject defenestrated.

Subsequently, the movements became slower, until they stopped with the onset of death by asphyxiation (end time of the movements: 09:06:15).

Although these cases provide very interesting elements for the study and in-depth analysis of the dynamics concerning the respiratory and circulatory system, it cannot be generalized and extended to all cases of deaths by asphyxiation.

Furthermore, several factors can influence and alter the responses of the human organism to asphyxiation, such as: the type of lace (soft or rigid, wide or thin, with or without knots, etc...), the position of the victim (suspended upright, hanging in a sitting position, etc...), the physiognomic characteristics of the victims (age, sex, body composition, etc ...).

However, video-recorded footage can contribute to a better understanding of the pathophysiological mechanisms typical of human hangings.

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