

REVIEW ARTICLE

MEDICOLEGAL ASPECTS OF ASPHYXIA WITH REFERENCE TO HANGING

Vidyullatha V. Shetty¹

HOW TO CITE THIS ARTICLE:

Vidyullatha V. Shetty. "Medicolegal Aspects of Asphyxia with Reference to Hanging". Journal of Evidence based Medicine and Healthcare; Volume 1, Issue 11, November 17, 2014; Page: 1463-1470.

ABSTRACT: The asphyxia in legal aspect can be caused by a number of events i.e. hanging, strangulation, suffocation, smothering, choking, electricity shock, etc. Hanging is a form of ligature strangulation in which the force applied to the neck is derived from a gravitational drag of the weight of the body or part of the body. Various mechanism involved in death due to compression of neck in cases of hanging are asphyxia, venous congestion, combined asphyxia and venous congestion, cerebral anaemia, reflex vagal inhibition and fracture or dislocation of the cervical vertebra. Familial support, rehabilitation and treatment of the person are necessary.

KEYWORDS: asphyxia, hanging, medico legal, ligature.

INTRODUCTION: Asphyxia" is a term derived from Greek that literally translates as "stopping of the pulse." This term refers to a multi-etiological set of conditions in which there is inadequate delivery, uptake and/or utilization of oxygen by the body's tissues/cells, often accompanied by carbon dioxide retention.

The asphyxia in legal aspect can be caused by a number of events i.e. hanging, strangulation, suffocation, smothering, choking, electricity shock, etc. Hanging is one of the common methods of committing suicide and it is considered suicidal unless contrary is proved.¹

Strangulation, the deliberate squeezing of the neck, can cut off oxygen to the brain, drowning, where the air in the lungs is replaced by water. The airway can also be blocked when a victim chokes on an object such as a small toy or piece of food. Finally, the airway can also be physically be blocked by hanging, when a person is suspended in the air by a rope or other object wrapped around their throat. Asphyxiation from hanging can occur quickly if the trachea is compressed, or can occur as a result of strangulation if the carotid arteries are compressed.

PATHOPHYSIOLOGY: Various mechanism involved in death due to compression of neck in cases of hanging are asphyxia, venous congestion, combined asphyxia and venous congestion, cerebral anaemia, reflex vagal inhibition and fracture or dislocation of the cervical vertebra.² Blockage or compression of air passages is not necessary to cause death in hanging.³

ASPHYXIA: The constricting force of the ligature, causes compressive narrowing of laryngeal and tracheal lumina, and forces up the root of the tongue against the posterior wall of the pharynx, and folds the epiglottis over the entrance of the larynx to block the airway. Atension of 15 kg on ligature blocks the trachea.

REVIEW ARTICLE

VENOUS CONGESTION: The jugular veins are blocked by the compression of the ligature which results in stoppage of the cerebral circulation, and a rapid rise in venous pressure in the head. This occurs if ligature is made up of broad and soft material, which cannot sink into tissue to any depth. The jugular veins are closed by a tension in the rope of 2kg.

CEREBRAL ANAEMIA: Pressure on the large arteries on the neck produces cerebral anaemia and immediate coma. This occurs with ligature made of thin cord, which sinks deeply into tissues. A tension of 4 to 5kg on ligature blocks carotid arteries, and 20 kg the vertebral arteries.

Reflex vagal inhibition form pressure on the vagal sheath or carotid bodies.

FRACTURE OR DISLOCATION OF THE CERVICAL VERTEBRAE: In the absence of classical signs of asphyxia, even in hangings in which there is complete suspension, the inference must be that death has occurred more rapidly than it takes for such signs to appear, raising the possibility that carotid sinus pressure and neurogenic cardiac arrest has played an important role.⁴

RESTRICTION OF BLOOD FLOW: Restriction of blood flow from and to the brain is typically the major feature in non-judicial hanging or strangulation. There is a significant difference in the amount of force required to occlude the adult airway and cervical blood vessels. Compression of the neck blood vessels is sufficient to cause unconsciousness and death. Thus, unconsciousness and death may occur without significant compromise of the airway.

Neck Structure	Compression Pressure
Jugular veins	4.4 lb
Carotid arteries	5.5-22 lb
Trachea	33 lb
Vertebral arteries	18-66 lb

Table 1: Adult Neck Structures and the Compression Pressures Needed to Cause Unconsciousness and Death⁵

TERMINOLOGY: GENERAL INTRODUCTION TO HANGING: Hanging is a form of ligature strangulation in which the force applied to the neck is derived from a gravitational drag of the weight of the body or part of the body.⁶

Hanging is one of the common methods of committing suicide and it is considered suicidal unless contrary is proved.

The noose compresses the airways, cutting off the supply of oxygen to the lungs. It also compresses the carotid arteries, which carry blood to the brain. Both mechanisms cause asphyxia, in which body and brain are deprived of oxygen. However, asphyxia is not always the cause of death in hanging. In some cases, the pressure on the neck causes vagal inhibition, a reflex that leads to cardiac arrest.

The forensic pathologist has to try to distinguish between hanging and other forms of strangulation and between suicidal, homicidal, and accidental hangings.

REVIEW ARTICLE

To ascertain cause and manner of death in cases of hanging, meticulous examination of ligature mark, neck structure findings and other autopsy findings are much helpful.⁷

The ligature, that is, the material used to make the noose and suspend the victim, usually consists of whatever is at hand.

Some of the commonly used ligature materials are rope, wire, electric cord, saree, veil, lungi, towel, bed sheets etc. Sometimes unusual ligature materials like hand kerchief, belt, shoe laces, hospital dressing bandages can also be used.⁸

The victim may use a fixed knot or a slip knot, the latter being particularly efficient at compressing the airways and blood vessels because it tightens so quickly under gravity.

HANGING CAN BE: COMPLETE HANGING: Some hangings take place from a high point of suspension, where the body swings freely under gravity with the feet off the ground. When the body is completely suspended by a Ligature with full weight acting as constricting force it is termed as Complete Hanging.

PARTIAL HANGING: In partial hanging, the bodies are partially suspended, toes or feet touching the ground, or are in a sitting, kneeling, lying down, prone or any other posture. The weight of the head (5 to 6kg) acts as the constricting force at relatively low point of suspension. The weight of the chest and arms is enough to provide fatal pressure on the neck; suspension of the whole body is not necessary.

TYPICAL HANGING: In typical hanging, the knot is situated over the nape of the neck ligature runs from the midline above the thyroid cartilage symmetrically upward on both sides of the neck to the occipital region while other position of knot is called Atypical Hanging.

INDICATIONS FOR DEATH INVESTIGATION: A medicolegal death investigation is performed to evaluate the cause and manner of a sudden and unexpected death under suspicious circumstances; that may be due to unnatural" causes such as violence or chemical agents; or, that occurs under other statute or regulation defined circumstances.

Deaths involving asphyxia typically fall within the jurisdiction of the medical examiner or coroner and are evaluated using a systematic medicolegal death investigation—examination of the circumstances, scene, and victim.

POST-MORTEM APPEARANCES: EXTERNAL: The ligature mark in the neck is the most important and specific sign of death from hanging. Ligature mark on the neck depends on

COMPOSITION OF LIGATURE:

- Width and multiplicity of ligature.
- The weight of the body suspended and the degree of the suspension.
- The tightness of encircling ligature.
- The length of time body has been suspended.
- Position of the knot.

REVIEW ARTICLE

- Slipping of ligature during suspension.
- Knot.

It is frequently in the form of a simple slip-knot to produce a running noose or fixed by granny or reef-knot; occasionally a simple loop is used. The knot is usually on the right or left side of the neck, ligature usually rising behind the ear to the point of suspension. Sometimes, the knot is in the occipital region and rarely under the chin. After suspension in hanging, the knot is at higher level than the remainder of ligature, the movement of knot being due to the act of suspension. The involvement of another party may be suggested by certain types of knots and nooses. Removal of the noose from the neck is done by cutting the noose away from the knot and tying the cut ends with string or wire.

LIGATURE MARK: The ligature produces a furrow or groove in the tissue which is pale in color, but it later becomes yellowish or brownish yellow and hard like parchment, due to the drying of the slightly abraded skin. The course of the groove depends on whether a fixed or running noose has been used, when the loop is arranged with a fixed knot, the course of the mark is deepest and nearly horizontal on the side opposite to knot, but as the arms of the ligature approach the knot the mark turns upwards towards it. Hanging from a high suspension point leaves diagonal marks on the neck like an inverted V, which does not run around the full circumference of the neck.

The point where the noose meets the vertical part of the rope is pulled up and away from the body and does not leave a mark on the neck. This can be used to distinguish a hanging from a manual strangulation. However, in a hanging from a low suspension point, the marks on the neck tend to be horizontal rather than diagonal and may look more characteristic of a manual strangulation. High hangings are more likely to cause death by vagal inhibition, owing to the sudden pressure on the neck.

The victim tends to be pale in such cases. A low hanging is more likely to lead to asphyxia and there may be some facial congestion and a purple protruding tongue. Asphyxia in hanging is usually related to the compression of the carotid arteries, rather than blockage of the airways. Petechial hemorrhages, caused by blood leaking from capillaries in the eyes owing to the pressure on the neck, are typical of manual strangulation, but not often found in a hanging. Their absence can therefore help distinguish a hanging from other strangulations. The body may also show lividity due to pooling of blood in the legs, forearms, and hands.

INTERNAL: Superficial incision of the groove may show small hemorrhages in the underlying layers of skin, caused by the direct trauma produced by the ligature. The tissues under the mark are dry, white and glistening with occasional ecchymosed in the adjacent muscles. In most cases, there is no bruising of strap muscles or other soft tissues, the muscles of the neck, especially the platysma and sternomastoid are ruptured (5 to 10%), if violence has been considerable. In some cases (5 to 10%), the intimae of the carotid arteries show transverse splits with extravasations of blood in their wall due to stretching and crushing. Opinion varies regarding the frequency of fracture of the hyoid bone. Estimates range from 0 to 60%, but the average is 15 to 20%.

REVIEW ARTICLE

Fractures are rare below 40 years because of the elasticity of the cartilage and mobility of the joints. The frequency of throat skeleton fracture in hanging is more with increasing age of the victim as the bones and cartilages of the neck get calcified, become rigid and brittle, thus more liable to fracture. It is common in persons above 40 years and involves the great horns, at the junction of inner two-thirds and outer one-third. The superior horns of the thyroid may be fractured from pressure on the thyroid ligament in about 40% of cases above 40 years.

Injury to the trachea is unusual. Petechial hemorrhages may be found on the epiglottis, in the larynx and trachea. The trachea is usually congested. The lungs are congested, oedematous, and exude bloody serum on section in cases of constriction occurring at the end of expiration; but they are pale if constriction occurred at the end of inspiration. The abdominal organs are usually congested. The brain is usually normal, but may be pale or congested according to the mode of the death. Subarachnoid effusions are common.

DIAGNOSIS:

- Ligature mark around the neck,
- Presence of abrasions, ecchymoses and redness about the ligature mark,
- Trickling of saliva from the mouth,
- Ecchymoses of the larynx or epiglottis,
- Rupture of the intima of the carotid,
- Post-mortem signs of asphyxia.

Cardinal Sign of Ante-mortem Hanging to Ascertain hanging as a cause of death.

A person may be murdered, and the dead body suspended to simulate suicide. Look for signs of dragging to the place of suspension. When a dead body is suspended, the rope is usually tied first around the neck, and then around the beam, branch of a tree, etc. The beam shows evidence of the rope having moved from below upwards as the body has been pulled up. In true suicidal hanging, the rope moves from above downwards. Further, fibers from the rope may be found on the hands of the victim in suicidal hanging, but not in case of post-mortem hanging. The rope should be examined for presence or absence of any paint similar to one on the beam. In most cases, the internal signs are clearly not those of hanging, although in most cases ligature mark cannot be distinguished. Rarely, for motives of revenge fraud or for some other reason, a victim arranges his suicide to appear to have been a murder.

The body having found suspended is obvious to have a ligature mark round the neck. But the presence alone does not enable to diagnose that death is due to hanging as a similar ligature mark can be found by suspending the body within two hours after death or even after a longer period. Therefore mere presence of a ligature mark does not point to be hanging as the case of death.

MEDICO-LEGAL ASPECT: Whenever a dead body is found to be in a suspended state by a ligature around the neck and brought for post-mortem examination then certain questions to be answered by the medico-legal examiners.

Was the case strangulation, post-mortem suspension or hanging?

REVIEW ARTICLE

IN CASE OF STRANGULATION: The ligature mark in the neck will be continuous, circular and at or below the thyroid cartilage. Injuries to the skin, muscles and deeper tissues, fracture of hyoid bone and laryngeal cartilage are common.

IN CASE OF POST-MORTEM SUSPENSION: There will be sign of cause of death other than by hanging, i.e., blunt trauma to the head, or massive injuries to the vital parts of the body, or some poisons or drugs to be given to the victim resulting of death.

IN CASE OF HANGING: The principal finding for diagnosis is the ligature mark, which is cause by ligature material that has been used.⁹ Was the hanging accidental, suicidal or homicidal? Accidental hangings are uncommon. It may occur during play or when at work in circumstances which were essentially accidental. The most of the victims are children rather than adults. The accidental hanging is related to sexual deviation, where the victims are usually adolescent males, usually found nude or wearing female clothing Homicidal hangings are extremely rare.¹⁰

It is very difficult to hang a well-built individual single-handed unless the victim is over powered by the assailant by some means. It may also be possible of there is a great physical disproportion between assailant and victim or when the victim is under the influence of alcohol or drugs or suffering from a debilitating disease. Homicidal hanging should be suspected when there is sign of violence, the clothing of the deceased is torn or disarranged, and when there are injuries either offensive or defensive. As there was no such sign so this case was not homicidal.

Suicidal hanging is one of the commonest methods of committing suicide. In general hanging is suicidal in nature unless otherwise proved and in this case, the deceased was found hanging by Orna was closed from inside.

Medicolegal evidence should be preserved and subsequently sent or handed over to the investigating authorities for forensic examination and production as evidence in a court of law. Failure to collect, destruction or loss of such an exhibit is punishable under Sec 201 of I. P. C Original copies of all medicolegal documents will be produced whenever asked for in a court of law. The body will be handed over to the civil police. According to Section 174 of Criminal Procedure Code (1973), in all cases of death due to suspected or un-natural causes, police may hold an inquest and send the body to the civil hospital, for post mortem examination for establishing the cause of death.

SOCIAL ASPECT: Treatment and rehabilitation of victims of attempted suicide is an important social aspect. They could be referred to psychotherapist, or to psychiatric centers for expert management by way of psychotherapy or medication.

CONCLUSION: Hanging is a very simple yet highly effective suicide method. It is one of the most commonly used suicide methods and has a high mortality rate. The materials required are easily available, and a wide range of ligatures can be used. Medico-legal analysis of death is performed to ascertain the cause of death. The post-mortem appearances of hanging provide the evidence to ascertain the cause and the nature of death. Familial support, rehabilitation and treatment of the person are necessary.

REVIEW ARTICLE

REFERENCES:

1. Bhosle SH, Batra AK, Kuchewar SV: Violent asphyxial death due to hanging: a prospective study. *Journal of Forensic Medicine, Science and Law*. 2014: 23 (1).
2. Reddy KSN, Murty OP. *The essentials of Forensic Medicine and Toxicology*, Thirty second edition, 2013. p 322-323.
3. DiMaio VJ, DiMaio D. *Forensic Pathology*, 2nd ed, 2001. p 262.
4. James JP, Jones R, Karch SB, Manlove J. *Simpson's Forensic Medicine*, 13th ed, 2011. p 157.
5. Michael AG, MD. *Pathology of Asphyxial Death* Medscape ref, nov 2013
6. Saukko P and Knight B. *Knight's Forensic Pathology*. Third Ed. London: Arnold Publishers; 2004, 352-394.
7. Camps FE. *Gradwohl's Legal Medicine*. Third Ed. Bristol: John Wright & Sons LTD; 1976, 326-336.
8. Dileep Kumar KB, Vedant K, Bheemappa LH. "An Unusual Case of Hanging with Elastic Crepe Bandage: A Case Report". *Journal of Evidence Based Medicine and Healthcare*; 2014 1, (7): 703-708.
9. Knight B *Forensic pathology*, 2nd ed; New York; Arnold; 1996: 375-89.
10. Parikh CK *Parikh's Textbook of Medical Jurisprudence Forensic Medicine and Toxicology*, 6th Edition; New Delhi: CBS publisher's & Distributors' 2007: 340-47.



Figure 1: Ligature furrow



Figure 2

REVIEW ARTICLE

AUTHORS:

1. Vidyullatha V. Shetty

PARTICULARS OF CONTRIBUTORS:

1. Professor, Department of Forensic Medicine, Sri Muthukumaran Medical College Hospital & Research Institute, Chikkarayapuram.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Vidyullatha V. Shetty,
184, 1st Floor, Kumara Nilaya,
Near Guttahalli Circle,
1st Main Road, Sheshadripuram,
Bangalore-20.
E-mail: vidyullatharajesh@rediffmail.com

Date of Submission: 12/10/2014.
Date of Peer Review: 13/10/2014.
Date of Acceptance: 27/10/2014.
Date of Publishing: 17/11/2014.