ORIGINAL RESEARCH PAPER
Volume - 13 | Issue - 07 | July - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

# THE LIGATURE MARK CONUNDRUM- SUICIDE OR HOMICIDE?

Forensic Medicine

**Dr. Jitender Pratap Singh** M.D. Forensic Medicine Professor & Head, Dept. of Forensic Medicine Noida International Institute of Medical Sciences (NIIMS) Noida International University, Greater Noida, U.P.

## ABSTRACT

A thorough examination of ligature mark is a key factor to establish the cause of death as suicidal or homicidal. This view-point article is an insight to detailed evaluation of such ligature mark leading to a final impression. The paper also mentions the importance of techniques like basic histological findings, immunohistochemical markers & molecular markers while examining the ligature mark.

## KEYWORDS

Determining the morphological evidence of vitality is essential in order to establish whether a lesion was sustained during life or after death. When there is uncertainty about the difference between a homicidal and suicidal death, it is challenging to situate all vitality criteria within a wide-context.

Particularly in uncommon discoveries, the differential diagnosis between total hanging and partial hanging, strangulation and throttling, constitutes a flotant and obscure limbo. The forensic pathologist is not always certain, over and above which the requirement for immediate investigation and the initial external cadaver examination derails their ability to make a absolute diagnosis. In actuality, uncommon circumstances frequently lead to an incorrect initial reconstruction of the facts, which ignores the possibility of a non-coincident clinical diagnosis. As a result, cooperation between many specialists is still crucial and delicate.

Researchers have not yet found many particular molecular and immunohistochemical markers or legitimate applications for them in the simpler diagnosis of viability in ligature markings, as shown by the literature that we evaluated in our research work [1]. The pathologist's skilled eyes must frame the microscopic findings in a broader perspective in order to reflect the only firmly established criteria. I think this is the only way we can give helpful advice to those who deal with specific problems on a regular basis that need legal assistance and experience.

Even in cases when the examination is only focused on determining whether the death was a suicide or a murder, a thorough exterior examination of the body must be performed before relying even on speculative immunohistochemistry or molecular indicators. In surgical pathology, the macroscopic examination of every organ and every anatomical structure requires the same level of care, backed by the traceability of information useful for subsequent accurate sampling. This should ensure accurate slide preparation for microscopic observation, data interpretation, and final diagnosis.

During the course of a typical workday, we hardly ever read a nice histology report or a good description of a ligature mark/sulcus connected to a ligature. Microscopic facts might occasionally have distinct interpretations depending on how they are distributed among individuals with various constitutional types of asphyxia and in various circumstances influenced by several factors. It is important to note that while the histological criteria in pathological anatomy and forensic pathology even more so—are diagnostic, they must be framed in a general systemic complex that takes into account a variety of factors, including the hanging furrow, the potential for different constitutional types, unusual means of harm, etc.

As a result, the proper placement of the sulcus specimen, its orientation on the corpse, and all the structural features become very important. Determining the precise topography by which the lesion acted is made easier when one understands how the serial histological sample was carried out, particularly in cases where the lesion is atypical or could mimic an act other than hanging. Without a question, meticulous macroscopic inspection is essential to the creation of a quality histology report in a forensic inquiry.

When combined with information, macroscopy and microscopy result in a definitive diagnosis. Relief of the three major diameters (longitudinal, transverse, and deep) and description of the cutaneous and subcutaneous portion's surface, as well as anything that deviates from normal skin, can mean different things for skin samples. For instance, depending on the constitutional type, everything should be reported carefully, particularly when in particular cases, like hanging, few signs of vitality are observed.

More specifically, it is clear that an erythrocyte extravasation will influence minor, partial, and various planes, and may not even be present, if the skin or subcutaneous striated muscle tissue is poorly represented for the normal anatomical site. Additionally, the anterolateral neck region contains more striated muscle tissue than the anterior neck region, which is home to the thyroid and larynx. The latter has thicker muscle with obliquely arranged fibres and higher-calibre vascular structures that are part of the vascular-nerve bundle. It is undoubtedly not always possible to superimpose the identification, location, and quantification of histological vitality results due to the wide variations in the quantitative and structural representation of skin and soft subcutaneous tissues. Additionally, the variety of the pressures applied by the means of injury must be taken into account.

Every diagnosis ought to be placed within a larger framework. Since the sample no longer exists in its totality after processing, everything is crucial and unique and could jeopardise a reliable microscopic and conclusive diagnosis.

Typically, everything is simplified to the so-called "skin sulcus" during regular labour tasks. We forget that, in contrast to some laboratory tests, like the evaluation of cholesterolemia, which is now done using automated devices, pathological diagnosis, which is based on combined macroscopic and microscopic observation on the basis of consolidated objective morphological criteria, requires knowledge and interpretation of the data.

A diagnosis cannot be made with just one data. It is important to draw attention to the differential diagnoses that may exist in the case of violent asphyxia death, particularly between suicidal and homicidal hanging. The vitality results of the sulcus must be taken into account, interpreting them at the sampling site and taking into account the presence or absence of fat, muscles, and other tissues. In addition, the morphological characteristics of other adjacent and/or distant organs, structures, and tissues (such as the thyroid, larynx, lungs, etc.) must be taken into account. **[2-4]**

It is challenging to describe circumstances like the ones where a corpse is discovered partially or completely suspended, touching the ground in a specific position. Since the corpse is not entirely hanged, the difficulty in this instance revolves around the possibility that hanging could be seen as a suicide act **[4]**. This is corroborated by numerous studies that have demonstrated, on a sizable series of hangings: (i) In partial self-suspensions, the ligature mark's appearance can be uncommon; it may not have an upward slope, a complete ligature mark around the neck, or none at all; (ii) During complete or partial suspension, the pressure needed to obstruct the carotid arteries or jugular veins is less than the weight of an average adult head; (iii)

Petechiae and bruising are common in the head and neck region and can affect both the skin and the mucous membranes; they arise when venous pressure above the level of ligature increases, causing vessels to burst and blood to leak into surrounding tissues. Over 50% of victims of suicidal and incomplete hanging may have these symptoms; (iv) Should there be partial suspension, which can result in partial occlusion of the neck or trachea vessels, the victim may grapple, scratch or claw at the ligament, striking adjacent objects, or exhibit seizure-like symptoms; (v) Results from the lungs are crucial for making differential diagnoses. When it comes to incomplete self-suspension, emphysema—a sign of mechanical asphyxia—is regarded as a sign of life because its lung extension assessment is nearly identical to that of drowning **[4-6]**. A thorough histological analysis of every organ is necessary to support or contradict the initial diagnostic theory that the forensic expert determined after the autopsy and inspection.

Thus, the overall anatomical & pathological assessment of a sulcus' vitality is a difficult and complex diagnostic task; in situations where the question is split between homicide and suicide, it needs to be backed up by a wealth of evidence and confirmed in a variety of potential differential diagnoses. Due to the varying intensities of forces applied by the means of injury at different points on the skin, the histological criteria are more discontinuously present in specific and unusual cases, such as partial self-hangings/strangulations; they occasionally assume hesitation or the victim's uncontrollably moving. The vitality indicators in these situations are not quantitatively superimposable; rather, they are less than those seen in complete and usual hangings and in strangulation. In the latter scenario, the force of the injury is applied quickly and violently with a more even and constrained pressure distribution, which frequently results in fractures to the bones or total rupture of the neck vessels **[4]**. It should be mentioned that certain forensic pathology specialists indicate that: in hanging instances, the external pressure varies according on the circumstances and might operate unevenly and at different levels on the neck **[7]**. Widely varying ligatures tend to produce less noticeable ligature marks and, because of their distribution being more of a planar than a pressure load, less severe injuries. Stiff and narrow ligatures produce deeper and sharply demarcated marks and logically produce a more localised force effect against neck structures. Completeness of the body's suspension and the intensity and distribution of the constricting forces can determine a wide range of possible histological findings **[7, 8]**. The type of loop, the elasticity and width of the ligament, and the type of knot can influence the extent and frequency of neck injuries **[9–12]**. However, there is no evidence of a significant correlation between haemorrhages in the muscles (sternocleidomastoid) and any of the parameters, including body weight. As a result, the haemorrhage is still considered non-contributory in quantitative terms. The literature also reports a statistically more significant association between the onset of bleeding and the completeness of body suspension, as well as a significant association between the onset of bleeding and the location of the ligature knot on the neck [13,14].

Based on this concise scientific overview, it is simple to comprehend how each assessment component, when placed in the appropriate context, can aid in the diagnosis of vitality; the standards for this continue to be erythrocytic extravasation, epidermal excoriation, and fragmentation. Rather than using a semi-quantitative or percentage approach to assess the quantity of red blood cells, one should consider the connective tissue and the epithelium's folding towards the sulcus' borders **[15]**. Actually, no research has found a biological or immunohistochemical marker that is the magic bullet or established a percentage or semi-quantitative numerical value (such as low, moderate, or severe) at which the sulcus must be regarded as important.

Retrospective research has documented a plethora of bizarre and inconceivable methods of damage as well as locations where bodies were discovered. According to Tulapunt et al., of 245 cases of hanging, 21 per cent were discovered to be sitting, 4 per cent on their knees, and 1 per cent lying down. Even if they are tiny percentages, they do exist, making them suggestive and helpful in the context of a differential diagnosis strategy. The same authors note that pulmonary oedema, the presence of face bruising, peripheral congestion, and other anatomopathological morphological characteristics of various organs are significant factors that support a diagnosis of partial hanging as opposed to total hanging [15].

Suicidal suspension evaluation is a complicated process that involves integrating various data, conducting a thorough autopsy, and studying various organs. This is particularly true when factors like microfractures are not visible under a microscope or when erythrocyte extravasations affect organs like the thyroid and larynx but are not visible under a microscope.

It has become evident that the diagnostic morphological features of mechanical asphyxia can be identified in the mucous membranes, as described by credible writers, in the lung, which unquestionably serves as an estimate of potential pain, and in several other regions. In fact, it has been noted that while inflammation with activated macrophages is typical of the hypoxia damage that occurs in prolonged asphyxia, and therefore in agony (at least 25 min), emphysema is a sign of vitality in incomplete suicidal hanging, with an evaluation of lung extension nearly equal to that of drowning [16,17].

It is important to note that the ligature mark alone cannot serve as the basis for a differential diagnosis in the interest of justice; in addition, incomplete suicidal hangings may not exhibit this mark.It should also be underlined that, throughout the course of an inspection, only one hypothesis needs to be made, and that hypothesis can then be confirmed, expanded upon, or altered in response to the results of the histological analysis.

**Funding**: This research received no external funding.
**Conflicts of Interest**: NIL

## REFERENCES:

1. Mansueto, G.; Feola, A.; Zangani, P.; Porzio, A.; Carfora, A.; Campobasso, C.P. A Clue on the Skin: A Systematic Review on Immunohistochemical Analyses of the Ligature Mark. Int. J. Environ. Res. Public Health 2022, 19, 2035.
2. Kurtulus, A.; Yonguc, G.N.; Boz, B.; Acar, K. Anatomopathological findings in hangings: A retrospective autopsy study. Med. Sci. Law 2013, 53, 80–84.
3. Uzün, I.; Büyük, Y.; Gürpinar, K. Suicidal hanging: Fatalities in Istanbul retrospective analysis of 761 autopsy cases. J. Forensic Leg. Med. 2007, 14, 406–409.
4. Dean, D.E.; Kohler, L.J.; Sterbenz, G.C.; Gillespie, P.J.; Gonzaga, N.S.; Bauer, L.J.; Looman, K.; Owens, O. Observed characteristics of suicidal hangings: An 11-year retrospective review. J. Forensic Sci. 2012, 57, 1226–1230.
5. Tulapunt, N.; Phanchan, S.; Peonim, V. Hanging Fatalities in Central Bangkok, Thailand: A 13-Year Retrospective Study. Clin. Med. Insights Pathol. 2017, 10, 1179555717692545.
6. Castiglioni, C.; Baumann, P.; Fracasso, T. Acute pulmonary emphysema in death by hanging: A morphometric digital study. Int. J. Legal Med. 2016, 130, 1281–1285.
7. Khokhlov, V.D. Trauma to the hyoid bone and laryngeal cartilages in hanging: Review of forensic research series since 1856. Leg. Med. 2015, 17, 17–23.
8. Russo, M.C.; Verzeletti, A.; Piras, M.; De Ferrari, F. Hanging Deaths: A Retrospective Study Regarding 260 Cases. Am. J. Forensic Med. Pathol. 2016, 37, 141–145.
9. Suárez-Peñaranda, J.M.; Alvarez, T.; Miguéns, X.; Rodríguez-Calvo, M.S.; de Abajo, B.L.; Cortesão, M.; Cordeiro, C.; Vieira, D.N.; Muñoz, J.I. Characterization of lesions in hanging deaths. J. Forensic Sci. 2008, 53, 720–723.
10. Ambade, V.N.; Kolpe, D.; Tumram, N.; Meshram, S.; Pawar, M.; Kukde, H. Characteristic Features of Hanging: A Study in Rural District of Central India. J. Forensic Sci. 2015, 60, 1216–1223.
11. James, R.; Silcocks, P. Suicidal hanging in Cardiff—A 15-year retrospective study. Forensic Sci. Int. 1992, 56, 167–175.
12. Leccia, C.; Alunni, V.; Quatrehomme, G. Suicidal hanging resulting in decapitation: A case report and review of the literature. Forensic Sci. Int. 2017, 279, e10–e13.
13. Zátopková, L.; Janík, M.; Urbanová, P.; Mottlová, J.; Hejna, P. Laryngohyoid fractures in suicidal hanging: A prospective autopsy study with an updated review and critical appraisal. Forensic Sci. Int. 2018, 290, 70–84.
14. Hejna, P.; Zátopková, L. Significance of hemorrhages at the origin of the sternocleidomastoid muscles in hanging. Am. J. Forensic Med. Pathol. 2012, 33, 124–127.
15. Rao, D. An autopsy study of death due to Suicidal Hanging—264 cases. Egypt. J. Forensic Sci. 2016, 6, 248–254.
16. Strunk, T.; Hamacher, D.; Schulz, R.; Brinkmann, B. Reaction patterns of pulmonary macrophages in protracted asphyxiation. Int. J. Legal Med. 2010, 124, 559–568.
17. Gutjahr, E.; Madea, B. Inflammatory reaction patterns of the lung as a response to alveolar hypoxia and their significance for the diagnosis of asphyxiation. Forensic Sci. Int. 2019, 297, 315–325.