

Original research article

## Gross and Histopathological Changes in Skin and Subcutaneous Tissues at Ligature Site in Cases of Asphyxial (Hanging) Deaths at IGIMS, Patna

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### Abstract

**Background:** Hanging is one of the common methods of asphyxial deaths. A gross and histopathological changes in skin and subcutaneous Tissues at ligature Site in Cases of asphyxial deaths is helpful in making exact diagnosis of hanging and differentiating it from other form of asphyxia death like strangulation.

**Objective:** To assess the importance of histopathological analysis of tissue underneath the ligature mark in case of hanging.

**Materials and Methods:** The present study was done on medicolegal autopsies conducted at the department of Forensic Medicine and Toxicology, Indira Gandhi Institute of Medical Sciences (IGIMS), Patna from 01.01.2017 to 31.12.2019 to study the gross and histopathological changes in neck structures.

Inclusion Criteria -1. Asphyxial deaths (hanging) coming for medicolegal postmortem examination. Exclusion Criteria -1. Decomposed bodies. 2. Asphyxial cases due to drowning, suffocation.

**Result:** During study period 77 cases were examined for gross and histopathological changes. The gross study revealed that the ligature mark was complete in 24(31.16%) cases. In 71(92.20%) cases, the ligature mark was seen above the level of thyroid cartilage. The subcutaneous area of ligature mark showed microscopically dilated and congested vessels in 65(84.41%) of cases. Thinning of epidermis were seen in 54(70.12%) of the cases, followed by focal fragmentation of epidermis and rolling of epidermis was seen in 25(32.46%) and 17(22.07%) of the cases respectively.

**Conclusion:** In our study, findings in the cases of hanging varied and were found in many combinations. A correct interpretation of meticulous postmortem examination and histopathological finding is necessary to make a confirmatory diagnosis of death owing to hanging.

**Keywords:** Asphyxia, hanging, histopathology, ligature, asphyxial death

## Introduction

In forensic practice, asphyxial deaths are common. The term "asphyxia" literally means "defective aeration of blood" and is used to describe a lack of oxygen. The phrase, however, has been translated from Greek to mean "pulselessness/absence of pulsation." "Asphyxia" is described by Adelson as a physiological and chemical state in which a living body is unable to expel excess carbon dioxide due to a shortage of oxygen available for cell activity [1]. The flow of air into the body is obstructed in mechanical asphyxia by physical impediments such as (a) pressure on exterior of the neck, e.g., hanging and strangulation, (b) obstruction of airways from exterior, e.g., suffocation and smothering, (c) obstruction of airways from interior, e.g., gagging, choking, (d) pressure on the chest, e.g., traumatic asphyxia, and (e) submersion death, e.g., drowning [2]. Death is frequently brought about by a number of anatomical and physiological elements acting in various permutations and combinations, and hypoxia is not the only component involved in hanging and strangulation deaths. The outward features include ligature marks or constricting fingers. Internal findings include soft tissue bruises, blood vessel damage, and clogged lymph nodes in the neck. In some cases, the solid components of the neck, such as the hyoid and larynx, are also affected [3]. Only a handful [3,4] have done histopathological tests on neck tissue to confirm the type and cause of death in these cases.

**Aim:** he present gross and histopathological study of the traumatized/affected tissue and other neck structures (soft tissues) will help in distinguishing the ante-mortem and postmortem aspects and add impetus in making the circumstances and cause of death in violent asphyxia more lucid[5].

## Materials and Methods

The present study was done on medicolegal autopsies conducted at the Department of Forensic Medicine and Toxicology, Indira Gandhi Institute of Medical Sciences (IGIMS), Patna from 01.01.2017 to 31.12.2019 to study the gross and histopathological changes in ligature tissue.

- Study design: Descriptive cross-sectional study.
- Study period: The present study was conducted between 01.01.2017 to 31.12.2019
- Study population: Cases of asphyxial deaths coming for medicolegal postmortem examination.
- Sample size: 77 cases.

## Inclusion Criteria

1. Asphyxial deaths (hanging) coming for medicolegal postmortem examination.

## Exclusion Criteria

1. Decomposed bodies in which ligature tissue cannot be taken
2. Other asphyxia death

Dissection technique: The skull and the chest cavity were opened prior to the detailed dissection of the neck. It provides a comparatively clearer field for the study of neck structures and avoids congestive artefactual hemorrhages in the neck structures. The neck dissection was completed by layer wise inspection starting with subcutaneous tissue and proceeding with muscle layers, vital vessels and other deeper structures in the neck beneath ligature mark. All gross findings were noted and a portion of skin and subcutaneous tissue from the site of ligature mark was excised. The excised specimen was preserved in 10% formalin and subjected for histopathological examination. The sections were stained with hematoxylin and eosin and slides were examined by a panel of pathologists. The final opinion was recorded and findings

were correlated in all the cases for further evaluation. Preliminary data and history were recorded from concern IO and relatives.

### Observations and Results

Observations were made as in terms of gross and histopathological changes at the ligature site. The gross study revealed that the ligature mark was encircling the neck completely in 24(31.16%) cases and incomplete in remaining 53(68.14%) cases, as seen in Table- 1. In 71(92.20%) cases of the study sample, the ligature mark was seen above the level of thyroid cartilage, in 6(7.80%) of the cases, the ligature mark was seen at the level of the thyroid cartilage, as seen in Table- 2. The subcutaneous area of ligature mark showed microscopically dilated and congested vessels in 65(84.41%) of cases. Thinning of epidermis were seen in 54(70.12%) of the cases, followed by focal fragmentation of epidermis and rolling of epidermis was seen in 25(32.46%) and 17(22.07%) of the cases respectively, as seen in Table- 3. Fracture of Hyoid bone was seen in only 10(12.98%) of cases, as seen in Table- 4.

**Table1:Course of ligature mark around the neck**

Type	Complete	Incomplete
Number	24 (31.16%)	53 (68.84%)

**Table 2: Position of ligature mark**

Type	Above Thyroid	Below Thyroid
Number	71(92.20%)	6(07.80%)

**Table 3: Microscopic changes in ligature tissue(n=77)**

1.	Dilated and congested Blood vessels	65(84.41%)
2.	Thinning of epidermis	54(70.12%)
3.	Fragmentation of epidermis	25(32.46%)
4.	Rolling of epidermis	17(22.07%)

**Table 4: Fracture of hyoid bone**

Fracture of hyoid bone	Present	Absent
Number of cases	10(12.98%)	67(87.02%)

### Discussion

The epidermis and dermis are the two primary layers of the skin anatomically [6-8]. The epidermis is made up of a keratinized stratified squamous epithelium that grows continually but desquamates to maintain its regular thickness. The dermis is made up of dense connective tissue that provides the skin with mechanical support, strength, and thickness. Variable levels of adipose tissue are arranged in lobules divided by connective tissue septa in the hypodermis. It is similar to the subcutaneous fascia and is found deep into the dermis [7]. Throughout the body's surface, the thickness of the skin varies from less than 1mm to more than 5mm. The skin on the face and neck is considered thin in comparison to the skin on the palms and soles [7]. When evaluating the nature of stresses on the surface, such as in compressive neck injuries, the anatomical shape of the skin is very important. When the data were analyzed, it was discovered that the bulk of the ligature marks were incomplete 53(68.84 %) and above the level of thyroid cartilage 71(92.20%). Histopathology and microscopy revealed dilated and congested arteries in the dermis 65(84.41%) , as well as epidermal thinning in 54(70.12%) of

the cases. Yadav A and Gupta BM conducted a similar study. In 31% of the instances, the vessels were dilated and congested [9].

Histopathological and microscopic examination of the ligature mark revealed compressive pressures, as shown by epidermal thinning in 54(70.12%) and localized fragmentation of epidermis in 25(32.46%), as well as rolling and layer separation of epidermis in 17(22.07%). In one study, epidermal thinning was seen in 46 percent of cases, followed by localized fragmentation in 35 percent, and rolling in 44 percent of cases [9]. Compression as the causal force is also favoured by the crowding and pushing up of adnexal structures. The term focal fragmentation refers to the epidermis' discontinuity, while rolling refers to the epidermis' enhanced waviness. Adnexal structures such as hair follicles and sebaceous glands are absent from the underlying dermis. The presence of these changes in the skin, either alone or in various permutations and combinations, indicates that the neck has been mechanically compressed. It was also discovered that the microscopic modifications were positive regardless of whether the ligature mark was entire or incomplete, subtle or apparent. The lack of tissue reactivity and congestive changes, on the other hand, cannot be used to prove that the body was hanged after death [10]. The incidence of hyoid bone fracture was found in 10(12.98%), compared to 8.62 percent in Chand et al study [1].

### Conclusions

In our study, findings in cases of hanging varied and were found in many combinations. In these cases, findings varied depending on the type of ligature material used and type of hanging and duration of hanging. The external post-mortem findings are less conclusive than internal post-mortem findings are helpful for making final diagnosis. Hence, the possible findings in a suspected case of hanging must be always anticipated so as to avoid any erroneous opinion. Correct interpretation of such findings and meticulous post-mortem examination is necessary to make a confirmatory diagnosis of death owing to hanging.

The present study also emphasizes the implementation of histopathological examination of skin in all the cases of violent asphyxial death where violent compression of neck took place, as a routine procedure. The present study concludes that a detailed evaluation of the gross and histopathological findings of the neck structures, if undertaken as a routine would be more conclusive in establishing the cause and manner of death to aid the administration of justice.

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