

Histo-Morphological Features of Ligature Mark in Hanging - A Descriptive Study

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Abstract

Background: Hanging is the most common method of suicidal death in India. All hangings are suicide, until otherwise it is proved contrary. The ligature mark on the person is the most critical discovery that will guide the investigation. The correlation of external and internal features of ligature mark will help us to establish the critical facts in cases of hanging. **Objectives:** 1. To study various pattern in ligature marks in case of hanging in comparison with age, sex, type of ligature material used, type of hanging, level and colour of ligature mark. 2. To study various histopathological features of skin in ligature mark in cases of hanging. **Materials & Methods:** It is a retrospective descriptive study with a study period of two years from 1 January 2018 to 31 December 2019. All compatible autopsies of hanging received during the study period were included in the study. The records of all the victims died due to hanging were collected from autopsy register maintained by the department of forensic medicine. Haematoxylin and eosin slides were retrieved from department of pathology and reviewed the microscopic findings in hanging cases. The data was entered into Microsoft excel spreadsheet and was analysed. The data was segregated with respect to age, sex, type of ligature material used, morphology and histopathological parameters. **Results:** A total of 79 cases of hanging were studied. Out of which, 57 (72%) were men and majority belong to 31 to 40 years (26.6 %). Most common gross findings were complete hanging (42%), ligature mark above thyroid cartilage (61%) and parchmentization (50%). Common histopathological findings were epidermal thinning (57%), dermal compression (56%), dermal congestion (36%), dermal hemorrhage (17%), inflammatory infiltrate (10%) and adnexal compression (24%). Out of 79 cases of hanging, 57 cases (72.1%) were reported as antemortem, 21 cases (26.6 %) as non-specific and opinion of one case was unable to establish as it did not have epidermis. **Conclusion:** The present study concluded that a detailed evaluation of the gross and histopathological findings of the ligature mark, if undertaken would be more conclusive in establishing the cause and manner of death to aid in the administration of justice.

Keywords: Antemortem, parchmentization, dermal compression, dermal hemorrhage.

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Introduction

Hanging is a form of asphyxia death, which is caused by suspension of the body by a ligature encircling the neck, the constricting force being the weight of body. It is the most common method of suicide in India. [1] According to National Crime Records Bureau more than 1.3 lakh per year die of suicide in India between the year 2018-2019. Out of which suicide by hanging cases comprises 53.6% followed by poison consumption 25.8 %, drowning 5.2% & other methods. [2]

Depending upon the degree of suspension, hanging is divided into - a) Complete Hanging-body is completely suspended without any part touching the ground, b) Partial Hanging-the body is suspended partially, toes or feet touching the ground. [3] The weight of the head, leg, chest & arms act as constricting force in hanging. Depending on the position of knot- a) Typical Hanging-the ligature runs from the midline above the thyroid cartilage symmetrically upward on both sides of the neck to the occipital region & the knot is over the central part of back of neck, b) Atypical Hanging-the knot is anywhere other than on the occiput i.e., on the right or left side or front of the neck. [4]

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In hanging the appreciation of external signs particularly ligature mark plays a vital role. [5] The ligature mark is an important characteristic finding in hanging especially in cases where actual ligature material is not available. [6] The nature of ligature mark depends on material, position of knot and time of suspension of the body. [7] The level, discontinuity and obliquity of ligature mark helps to differentiate hanging from ligature strangulation. [8] Thus, the ligature mark becomes a crucial aid in diagnosis and evaluation of the corpse. Histopathological examination of ligature mark helps in two ways. [9] First, it produces scientific corroboration of circumstantial evidence and gross findings. Secondly, it helps to determine whether changes seen grossly are ante-mortem or post-mortem. [8,9] In the present study, the authors have tried to correlate gross and histopathological features of ligature mark in cases of hanging.

Aims and Objectives

1. To study various pattern in ligature marks in case of hanging in comparison with age, sex, type of ligature material used, type of hanging, level and colour of ligature mark.
2. To study various histopathological features of skin in ligature mark in cases of hanging.

Materials and Methods

Type of study: It is a retrospective descriptive study carried out at department of pathology, Mandya Institute of Medical Sciences.

Study period: The study period was for two years from 1st January 2018 to 31st December 2019.

Sample size: 79

Ethical consideration: Approval was obtained from institutional ethics committee before the commencement of study.

Inclusion criteria: All compatible autopsies of hanging received during the study period were included in the study.

Exclusion criteria:

1. All cases of ligature strangulation
2. Cases without ligature mark
3. Decomposed and burnt bodies

The records of all the victims died due to hanging were collected from autopsy register maintained by the department of forensic medicine. Haematoxylin and eosin slides were retrieved from department of pathology and reviewed the microscopic findings in

hanging cases. The data was entered into Microsoft excel spreadsheet and was analysed. The data was segregated with respect to age, sex, type of ligature material used, morphology and histopathological parameters.

Results

During the two-year study period, a total of 105 autopsies were received at the department of pathology. A total number of 79 cases, which met the inclusion criteria were included in this study. Out of which 57 (72.1%) were male and 22 (27.8%) were females (figure-1). The maximum number of cases were seen in the age group 31 to 40 years - 21 cases (26.6%) followed by 19 cases (24.1%) in 21 to 30 years (Table -1).

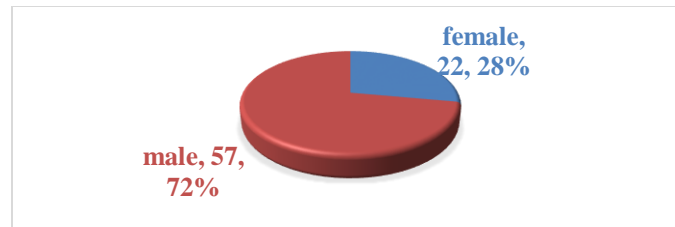


Fig 1: Sex-wise distribution of hanging

Table 1: Age & sex-wise distribution of cases due to hanging

S. No	Age group in years	Male (n) (%)	Female (n) (%)	Total (n) (%)
1.	10-20	04 (5.1)	6 (7.6)	10 (12.7)
2.	21-30	10 (12.7)	9 (11.4)	19 (24.1)
3.	31-40	16 (20.3)	5 (6.3)	21 (26.6)
4.	41-50	15 (19)	1 (1.2)	16 (20.2)
5.	51-60	09 (11.4)	1 (1.2)	10 (12.7)
6.	61-70	03 (3.8)	0	03 (03.8)
7.	Total	57(72.2)	22(27.8)	79 (100)

In Mandya district, maximum no of cases was seen in Pandavapura taluk -19 (24 %) followed by krishnarajpet -15 cases (19%) (Table-2).

Table 2: Taluk wise distribution of cases due to hanging in Mandya district

S. No	Place	No	Percentage
1.	Pandavapura	19	24 %
2.	Krishnarajpet	15	19 %
3.	Mandya	14	17.7%
4.	Srirangapatna	14	17.7%
5.	Nagamangala	08	10.1%
6.	Malavalli	08	10.1%
7.	Maddur	01	1.3 %

Among the various materials used by victims for hanging, rope was commonly used in 48 cases (60.8 %) followed by saree in 17 cases

(21.5%) and dupatta in 8 cases (10.1%). Less commonly used material were wire, towel and shirt (Figure-2).

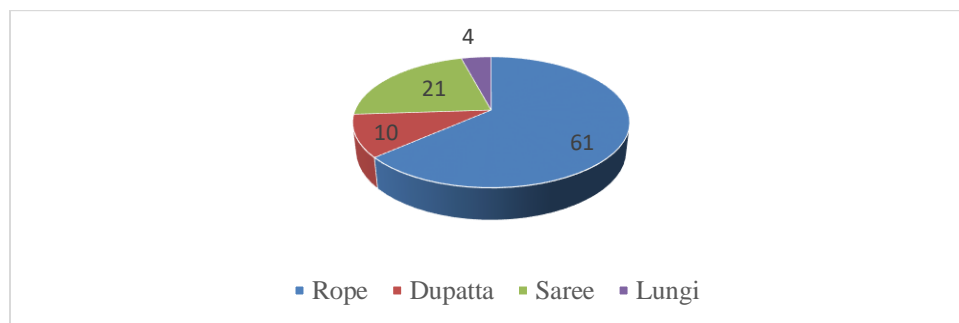


Fig 2: Distribution of cases according to ligature material used in hanging

Complete hanging was seen in 42 cases (53.1%) and partial hanging in 37 cases (47 %). The ligature mark was situated above thyroid cartilage in 61 (77.2 %) cases, at the level of thyroid cartilage in 17 (21.5 %) cases and below thyroid cartilage in 1 (1.2 %) case. The features of the mechanical cutaneous alteration and colour changes

were also collected from the post mortem details. It was found that reddish brown colour of ligature mark was seen in 19 (24 %) cases, it was anaemic pale in 10 (13 %) cases and parchmentation was occurred in 50 (63.2 %) cases (Table-3).

Table 3: Morphological findings of ligature mark

Morphological parameters		No	%
Ligature mark	Complete	42	53%
	Partial	37	47%
Level of ligature mark	Above thyroid cartilage	61	77.2%
	At the level of thyroid cartilage	17	21.5%
	Below the level of thyroid cartilage	01	
Cutaneous alteration	Reddish-brown	19	24%
	Parchmentization	50	63%
	Pale	10	13%

The skin under the ligature mark was also studied histopathologically for the mechanical cutaneous alterations. Epidermal thinning was seen in 57 cases (72.2 %), while both thinning and breakage of skin was seen in only 2 cases (2.53 %). Epidermis was found to be normal in 19 cases (24%). Dermal compression was seen in 56 cases (70.9

%). Dermal congestion was seen in 36 cases (45.5%) and dermal haemorrhage in 17 cases (21.5%). Inflammatory infiltrate of neutrophils and lymphocytes in dermis was seen in 10 cases (12.7 %), while adnexal compression was seen in 24 cases (30.4 %) (Table-4).

Table 4: Histopathological features of ligature mark

Skin parameters		No	%
Epidermis	Thinning	57	72.1
	Thinning & breakage	2	
	Normal	19	24
Dermal compression	Present	56	70.9
	Absent	23	
Dermal congestion	Present	36	45.5
	Absent	43	54.4
Dermal haemorrhage	Present	17	21.5
	Absent	62	78.5
Inflammatory infiltrate	Present	10	12.7
	Absent	69	
Adnexal compression	Present	24	30.4
	Absent	55	

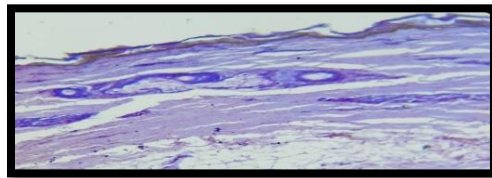


Fig 3: Thinned out epidermis & dermal compression

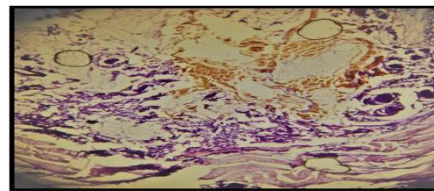


Fig 4: Dermal hemorrhage

Out of 79 cases of hanging, 57 cases (72.1%) were reported as antemortem, 21 cases (26.6 %) as non-specific and one case did not have epidermis. Those cases with only epidermal thinning and dermal compression were reported as non-specific with the following note. The ante-mortem changes in the skin at the site of hanging consists of congestion and dilation of blood vessels, stromal haemorrhage, lymphocytic infiltration and coagulative necrosis of subepithelial collagen fibres. The occurrence of these changes depends on the time taken for death of the individual during hanging and the material used. Presence of these changes will indicate that the injury is antemortem. However, absence of these changes does not rule out antemortem injury, as these changes may not occur if they die within seconds or minutes after hanging.

Discussion

The ligature mark is the most relevant feature of hanging and its characteristics are well known in the literature. [10] In many times, the ligature material is not available during autopsy examination. [11] Hence, the features of the ligature material are not submitted to systematic analysis. [12] Even in our study period, number of cases were excluded because skin under ligature mark was not submitted for histopathological examination. The ligature mark needs detailed and extensive examination in order to come to conclusive diagnosis. Inspection, palpation and external examination followed by histopathological examination have to be carried out in a systematic

manner.[6] In our study period of January 2018 to December 2019, maximum number of cases due to hanging were seen in men 58(72.15%) and the predominate age group was 31-40 years (26.6%). This was consistent with the study conducted by Prasad J et al [7] in the year 2016. The most common material used as ligature material was rope 48(60.7%) followed by saree 17(21.5%). This was consistent with the study conducted by Joshi et al [13] in 2007. The maximum number of cases in Mandya district belonged to Pandavapura taluk 19(24 %) followed by Krishnarajpet 15(19 %). The least number of cases were seen in Maddur taluk. The maximum number of cases showed complete ligature mark 42(53.1%), which was similar to study conducted by Sharma N et al [6] (2014) and Naik et al (2005). Death to complete hanging might be ascribed to firm motive to commit suicide in an individual. [6] The position of ligature mark to thyroid cartilage was studied, in which it showed in maximum number of cases, it was above thyroid cartilage 61 (77.2%). This was in accordance with study conducted by Sharma et al [6] and Prasad et al [7]. According to post-mortem reports parchmentization was found in 63% cases of hanging followed by reddish brown (24%) and anaemic pale (13 %). Both these findings were similar to study conducted by Sharma N et al [6] (2016). The colour of ligature mark depends largely upon the duration of suspension of the body and nature of the ligature material used.[14] The following histopathological features were noted: Epidermal

thinning(72.2%), dermal compression (70.9%), dermal congestion (46%), dermal haemorrhage(21.5%), inflammatory infiltrate (12.7%), adnexal compression (30.4%). Out of 79 cases of hanging, 56 (71%) cases were reported as antemortem, 22 cases were reported as non-specific and one case did not have epidermis. Out of 57 cases reported as antemortem, 46 cases(82.1%) showed epidermal thinning, 52 cases(93.1%) had dermis compression, 30 cases (52.7%) have dermal congestion, 18 cases(31.6%) have dermal haemorrhage, 7 cases (12.3%) have inflammatory infiltrate and 24 cases (42.1%) has adnexal compression. This was in concordance with study conducted by prasad et al. [7]

Conclusion

The present study concluded that an in-depth analysis of the gross and histopathological findings of the ligature mark, if undertaken would be a lot more conclusive in establishing the cause and manner of death and help in administration of justice

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