

## A DESCRIPTIVE STUDY ON GROSS INTERNAL AND EXTERNAL NECK FINDINGS IN CASES OF HANGING – AN AUTOPSY-BASED STUDY

Reshma A A<sup>1</sup>, Renju Raveendran<sup>2</sup>

<sup>1</sup>Assistant Professor, Department of Forensic Medicine, Sree Uthradam Thirunal Academy of Medical Sciences, Vattapara, Trivandrum, Kerala, India

<sup>2</sup>Professor, Department of Forensic Medicine, Government Medical College, Trivandrum, Kerala, India

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**Corresponding Author:**

**Dr. Reshma A. A.**  
Email: reshmaaa75@gmail.com

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### ABSTRACT

**Background:** Hanging is a form of mechanical asphyxia in which death is caused by the suspension of the body by a ligature that encircles the neck, the constricting force being the weight of the body. Although most of the cases are suicidal, hanging can be homicidal or accidental, and always causes suspicion among relatives and investigating officers. Controversy arises when the victim is a child and in partial hanging cases, where postmortem suspension is suspected. Hence, the autopsy findings play a crucial role in determining the cause of death as hanging. The present study aimed to identify the gross external and internal findings in cases of hanging. **Materials and Methods:** It is a descriptive study done on 257 cases of hanging deaths in the Department of Forensic Medicine, Government Medical College, Kottayam. Autopsies were done by En masse removal of thoracic and abdominal organs, and the flap dissection of the neck region was performed at the end, after removal of the Cranial Structures. **Result:** The most preferred ligature material was plastic rope (49.02%), followed by lungi (17.12%). Vertical salivary dribble mark, a characteristic finding of suicidal hanging, was seen in (36.57%) cases. Fracture of the hyoid bone was seen in (2.72%) cases, and thyroid cartilage in (3.89%) cases. **Conclusion:** A keen external examination is mandatory before proceeding towards the dissection of the dead body in hanging cases during post-mortem examination. Atypical features such as infiltration of the sternocleidomastoid muscle and fracture of thyroid cartilage were found in a good number of cases, the number being more than the classic textbook descriptions.

## INTRODUCTION

In India, hanging is the second most common method of suicide after poisoning. Over the past 30 years, the incidence of suicide by hanging has increased, especially among young adults.<sup>[1]</sup> Hanging is a form of mechanical asphyxia in which death is caused by the suspension of the body by a ligature that encircles the neck, the constricting force being the weight of the body.<sup>[2]</sup> Depending on the degree of suspension, hanging can be classified into complete and partial hanging. Most hangings are self-suspensions. That may be carried out by a wide variety of methods, but a typical method of self-suspension is to attach a thin rope to a high point such as a ceiling beam or fan. The lower end is formed into either a fixed loop or a slipknot, which is placed around the neck while the one intending suicide stands on a chair or other support. On jumping off or kicking away the support, the victim is then suspended with all or most of his weight upon the rope.<sup>[3]</sup> Although most of the cases

are suicidal, hanging can be homicidal or accidental, and always causes suspicion among relatives and investigating officers. The accidental hanging can only be established by comparing the autopsy results with the survey of the circumstances and the examination of the scene of death. Controversy arises when the victim is a child and in partial hanging cases and when postmortem suspension is suspected. Thus, the autopsy findings play a crucial role in determining the cause of death as hanging. Hence, the present study is aimed to determine the gross external and internal findings that are pathognomonic for hanging.

## MATERIALS AND METHODS

A descriptive study was conducted on 257 cases of known hanging deaths in the Department of Forensic Medicine, Government Medical College, Kottayam, over a 15-month period from January 2018 to March 2019, after obtaining approval from the institutional

review board (IRB NO- 180/2017 dated 4/1/2018). All cases of hanging, except decomposed hanging cases, were included in the study. The inquest reports were scrutinized, and information regarding the history of the incident and the manner of death was gathered from the police records and relatives of the deceased. The ligature material that was brought along with the body was examined. The external injuries in the neck, especially the ligature mark was examined in detail. In situ dissection of the neck structures was carried out after removing the thoracoabdominal and cranial contents. The lower attachments of sternocleidomastoid muscles were specially examined for injuries, before separating the sternoclavicular joints. The subcutaneous tissue and muscles and the other structures of the neck were inspected and reflected layer by layer. The lobes of the thyroid gland were examined, and thyroid and cricoid cartilages and hyoid bone were palpated, removed, dissected, and examined carefully for injuries. Carotid arteries were opened in situ using fine scissors with blunt tips, and injuries, if any, were noted. The details that are obtained in each case were recorded in the pre-designed proforma. The data were entered into Microsoft Excel, and further statistical analysis was done using SPSS software.

## RESULTS

In the present study, the following findings were obtained:

- The most common type of hanging was partial hanging (59.53%) cases.
- The most preferred point of suspension by the victims was the beam of the roof (66.92%) cases.
- Plastic rope (49.02%) was the most frequently used ligature material.
- In most of the victims, the ligature mark was seen above the level of thyroid cartilage (95.72%) cases.
- Ligature mark was obliquely placed in 250 (97.28%) cases.
- The most common site of the knot was found to be on the left side (73.54%) of cases.
- Vertical salivary dribble mark was seen in 36.57% cases.
- Infiltration of blood in the sternocleidomastoid muscle was seen in 18.68 % cases.
- Other neck muscle injuries were seen in 2.72 % cases.
- Fracture of the hyoid bone was present in 2.72% cases.
- Fracture of thyroid cartilage was present in 3.89% cases.
- Combined laryngo-hyoid fractures were seen only in one case.
- Fracture of cervical vertebrae was present only in 2.72% cases.
- Tear in the intima of the carotid artery was present in 1.56% cases.

**Table 1: Distribution of study population according to the type of ligature material**

Sl. No	Ligature material	No of cases	Percent
1	DUPPATA	34	13.22
2	PLASTIC ROPE	126	49.02
3	SARI	20	7.78
4	BEDSHEET	18	7.00
5	WIRE	2	0.77
6	LUNGI	44	17.12
7	COIR ROPE	5	1.94
8	TOWEL	8	3.11
	Total	257	100

**Table 2: Distribution of study population according to Point of attachment of ligature**

Sl. No	Point of attachment of ligature	No. Of cases	Percent
1	OPEN(TREE)	43	16.73
2	CEILING ROD	172	66.92
3	CEILING FAN	27	10.50
4	OTHER	15	5.83
	TOTAL	257	100

**Table 3: Distribution of study population according to the position of knot**

Sl. No	Position of knot	No. Of cases	Percent
1	RIGHT SIDE	62	73.54
2	LEFT SIDE	189	24.12
3	OCCIPUT	6	2.33
	TOTAL	257	100

**Table 4: Distribution of study population according to the infiltration of blood in the sternocleidomastoid muscle**

Sl. No	Infiltration of blood in SCM muscle	No. Of cases	Percent
1	PRESENT	48	18.68
2	ABSENT	209	81.32
	TOTAL	257	100

**Table 5: Distribution of study population according to fracture of the hyoid bone**

Sl. No	Fracture of hyoid bone	No. Of cases	Percent
1	PRESENT	7	2.72
2	ABSENT	250	97.28
	TOTAL	257	100

## DISCUSSION

In the current study, more than half of the cases were of partial hanging (59.53%), and the remaining (40.46%) were complete hanging. This finding conforms with the well-accepted fact that partial hanging is mostly suicidal. Similar findings were obtained in the study conducted by Pradhan et al in Nepal Medical College where (56.81%) cases were of partial hanging.<sup>[4]</sup> Most of the deceased in the study population preferred the beam of the roof (66.92%) as the point of suspension, followed by the tree (16.73%), ceiling fan (10.50%), and other points of suspension, like window, shower pipe, etc., were used by (5.83%) cases. This was contradictory to the studies done by Dhul et al in the Punjab population, where most of the victims preferred the ceiling fan as a point of suspension, followed by beam of the roof. While comparing the ligature materials, plastic rope was most preferred for hanging (49.02%). Lungi was used in (17.12%) cases followed by dupatta (13.22%), sari (7.78%), bed sheet (7%) and towel in (3.11%) cases. Other ligature materials included coir rope (1.94%), and electric wire in (0.77%) cases. Similar findings were observed in the studies conducted by Pradhan et al where plastic rope was the commonly used ligature material, followed by dupatta, sari, bedsheets, etc.<sup>[4]</sup> The traditional culture influences the method of choice of ligature and the victim uses whatever material is easily available in the house or nearby during the particular time. The rope was mostly used for hanging because it is cheap, convenient, and easily available in almost every household in India.<sup>[6]</sup>

In the current study, it has been found that in (95.72%) cases the level of ligature mark was above the thyroid cartilage, below the thyroid cartilage in (0.78%) cases, and over the thyroid cartilage in (3.5%) cases. This was in accordance with the study done by Nivin et al. in the South Kerala population.<sup>[7]</sup> The ligature mark in the neck is the principal external sign of hanging. Ligature mark was obliquely placed in 250 (97.28%) cases and horizontally placed in 7 cases (2.72%). Similar findings were obtained in the study done by Pal et al in the North Indian population and Nivin et al in the South Kerala population.<sup>[6,7]</sup> On examination of the position of the knot, in most cases the knot was present on the left side of the neck 189 (73.54%) cases, right side of the neck in 62 (24.13%) cases, and over the centre of the occipital region in 6 (2.33%) cases. Similar findings were obtained in the study conducted by Nivin et al in the South Kerala population.<sup>[7]</sup> Vertical salivary dribble mark is one of the definite sign of antemortem hanging, and was found in 36.57% of cases in this study. Which is in

conformity with the study conducted by Nivin et al in the South Kerala population.<sup>[7]</sup>

On internal examination, infiltration of blood in the sternocleidomastoid muscle was seen in 18.68% cases and was absent in 81.32% cases; this is consistent with the study done at Trivandrum Medical College by Sharija et al.<sup>[8]</sup> This was in contradiction to the studies done by Dinesh et al., where 70.83% cases showed infiltration of blood in the sternocleidomastoid muscle.<sup>[9]</sup> In the present survey, other neck muscle injuries were seen in 2.72% cases and were absent in 97.28% cases, which is comparable to the study done at Manipur, India, where 2.38% cases showed neck muscle injuries.<sup>[10]</sup> Fracture of hyoid bone was present in 2.72% cases and was absent in 97.28% cases, which is consistent with the study done at Trivandrum Medical College by Sharija et al where 2.7% cases showed fracture of hyoid bone.<sup>[8]</sup> Meanwhile in a study done on frequency of hanging deaths in Lucknow, India 2008-2012 by Shiuli et al on 1180 cases no hyoid bone fracture was recorded which is in accordance with few other national studies.<sup>[11]</sup> Fracture of superior horn of thyroid cartilage was present in 3.89%. Which is almost in conformity with the study done at Trivandrum Medical College by Sharija et al where 5.3% cases showed fracture of superior horn of thyroid cartilage.<sup>8</sup> Factors influencing are age (significantly more frequent in individuals older than 30 years), location of the knot, location of the ligature, and length of ligature. It may also occur due to indirect force, i.e. caused by stretching of thyroid ligament and thyroid membrane.<sup>[12]</sup> Fracture of both thyroid and hyoid bone was seen in a single case out of 257 cases. This was in accordance with the studies done by Zacharia et al done at the Department of forensic medicine, Govt Medical College, Kozhikode.<sup>[13]</sup> Fractures of the superior thyroid horn were the most common type of laryngo-hyoid fracture in hanging victims. Isolated fracture of the greater horn of the hyoid bone was the second most frequently identified fracture, followed by combined thyrohyoid fracture. This is in confirmation with the study done by Godin et al.<sup>[14]</sup> Fracture of cervical vertebrae was present only in 2.72% cases. Which is in agreement with the study done at Trivandrum Medical College by Sharija et al where 1.6% of hanging cases showed fracture of the cervical vertebrae.<sup>[8]</sup> Fracture of the cervical vertebrae are unusual in hanging, but when they occur, they tend to be similar to the judicial type of hanging in which the body falls some distance after suspension.<sup>[15]</sup> Fractures of neck skeleton were noted in persons older than 38 years in the present study. This may be due to calcification and fragility of bony structures in the later years of life, as stated by Spitz and

Fischer.<sup>[16]</sup> In the present study tear in intima of carotid artery was present only in 1.56% cases, which was in agreement with the observations of Sharija et al were carotid intimal tear was noticed in 1.1% of cases.<sup>8</sup> Which may be due to the pressure exerted from opposite sides by the ligature material.<sup>[12]</sup>

## CONCLUSION

A keen external examination is mandatory before proceeding towards the dissection of the dead body in hanging cases during post-mortem examination. Certain important objectives of autopsy may be achieved from such external study, like manner, time since death, position of body, type of suspension, ante-mortem or post-mortem nature, type of ligature material used etc. Thus, a meticulous external examination of the body facilitates opinion formation in hanging deaths. Atypical features such as infiltrations into the muscles and fracture of thyroid cartilage were found in a good number of cases, the number being more than the classic textbook descriptions. This could have been due to the peculiarity in the nature of ligature material, individual variations in its application on the neck, and trauma inflicted by the rough handling of the victims with persisting heartbeat while taking them down from their suspended position, causing antemortem bruising and other injuries.

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