Original Research Article

Study of injuries to neck structures in cases of hanging in Trichy district

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International Archives of Integrated Medicine, Vol. 8, Issue 6, June, 2021.
Available online at http://iaimjournal.com/
ISSN: 2394-0026 (P) **ISSN: 2394-0034 (O)**
Received on: 08-06-2021 **Accepted on:** 14-06-2021
Source of support: Nil **Conflict of interest:** None declared.
How to cite this article: R. Chandra Sekar. Study of injuries to neck structures in cases of hanging in Trichy district. IAIM, 2021; 8(6): 55-61.

Abstract

Background: Deaths due to hanging are common among suicides. Various studies in the forensic literature have reported considerable differences in the frequency of hyoid bone or thyroid cartilage fractures and injuries to the musculature and the vasculature of the neck. Some important reasons to which these variations could be attributed include lack of a common method for examination of neck structures, varying degrees of thoroughness in examining the neck structures, and lack of seriousness in the documentation of the findings (like cases of hanging are almost always suicidal) thus affecting the results of retrospective studies.
Aim of the study: To find out, the most common and most reliable criteria of neck injury, to say, that it is an ante-mortem hanging.
Materials and methods: This prospective study was conducted in the Institute of Forensic Medicine, Department Of Forensic Medicine, K.A.P. Viswanatham Government Medical College, Tiruchirappalli from August 2019 to July 2020. Only cases in which thehistory and scene of crime examination report given by police and relatives of the deceased are suggestive of ante-mortem hanging were included. 63 cases of deaths due to hanging, which was subjected to medico-legal Autopsy, were the subjects of this study.
Results: The age ranged from 13 years to 72 years. In 57 cases (90%), ligature mark was seen above the thyroid cartilage and in only 6 cases (10%) it was seen over and above the thyroid cartilage. 19 cases (30%) were typical hanging and 44 cases (70%) were atypical. Only in one case, the knot was below the chin. Out of 63 cases, carotid intimal tear and rupture/contusion to sternomastoid and other strap muscles was the commonest internal neck structure injury that was seen in 19 cases (30%) and 18 cases (29%) respectively. Hyoid bone fracture and thyroid cartilage fracture were seen in only one case (2%). Fracture of the cricoid cartilage and cervical vertebral fracture was not seen in any cases (0%).

Conclusion: According to the present study hanging is more common in young adults mostly suicidal in nature. Congestion of the face is the most significant external feature in hanging while tonsillar hemorrhage is a significant internal feature.

Key words

Hanging, Asphyxia, External neck injury, Internal neck injury, Ligature mark.

Introduction

Hanging remains to be one of the common methods of committing suicide. Homicidal and accidental hanging is rare. Hence all cases of hanging are considered suicidal until the contrary is proved [1]. Because of the above, postmortem suspension of the body may be resorted to masking the crime. So, a careful forensic examination is of great importance, to ascertain the ante-mortem character of the lesion and also to exclude the possibility of murder dissimulation [2]. There is no specific gold standard to distinguish between ante-mortem hanging and Postmortem hanging. However, presence of vertical salivary dribble mark from the dependent angle of the mouth [3]. The phenomenon of Le facies sympathetic, presence of Petechial hemorrhages, Hyperaemia and ecchymosis of margins of ligature mark are considered as features of ante-mortem hanging. But obvious salivary dribble marks could be detected only in 56% of cases [4]. A meticulous examination of the body right at the scene of hanging, that too, before removing the clothes and apparels can give the real prevalence of it. Le facie sympathetic is very rare, i.e., as low as 1% as observed in different studies [5]. Although petechial hemorrhages commonly occur in cases of ante-mortem hanging, they are not diagnostic of ante-mortem hanging and they occur in various asphyxial and non-asphyxial deaths. And it is also equally important to note that petechiae may be absent in rapid death due to vagal stimulation in hanging [6]. So, petechial hemorrhages cannot be taken as a specific feature of ante-mortem hanging. Furthermore, the ligature mark, which is considered the principal external sign of hanging, is mainly a postmortem phenomenon. So, it is very much necessary to look for any injury to inner neck structures, that is quiet frequent than the above, which cannot be artificially produced and which also indicates ligature mark intravital to establish the ante-mortem hanging [7, 8].

Materials and methods

This prospective study was conducted in the Department of Forensic Medicine, K.A.P. Viswanatham Government Medical College, Tiruchirappalli from August 2019 to July 2020. Only cases in which the history and scene of crime examination report given by police and relatives of the deceased were suggestive of ante-mortem hanging were included. 63 cases of deaths due to hanging, which was subjected to medico-legal autopsy, were included of this study. All cases with, external neck injuries other than the ligature mark, other external injuries suggestive of homicide, and cases with postmortem intervals of more than 24 hours to avoid artifacts of decomposition were excluded. A complete perusal of all the records was done before medico-legal autopsy, which is a routine protocol in all cases. After identification of the body, a careful search for any external injuries, dribbling of saliva, signs of asphyxia like bluish discoloration of fingernails, petechial hemorrhages, signs of sphincter relaxation, Le-facie sympathetic, pattern and also any distribution of hypostasis extent of rigor mortis developed, etc. were looked for. A detailed study of the Ligature mark was done. Finally, a meticulous dissection of the neck was done by a step-by-step layer-wise reflection of the tissues after the thoracic organs and the brain had been removed. This allowed the blood in the neck to drain away, providing for a cleaner dissection field. The neck was extended by keeping a wooden block under the shoulder. With a midline incision, the skin and subcutaneous tissue were

reflected off the underlying anterior cervical strap muscles along the fascial plane. The manubrium sternum was left intact at the beginning of the autopsy when the rib cage was removed so that the inferior attachments of the anterior cervical strap muscles remain unaltered. After cutting the inferior attachments of the muscles, each muscle was examined anteriorly and posteriorly for contusion or rupture and then reflected superiorly. Now the carotid sheath was identified and opened to view the internal jugular vein and the carotid artery. With gentle dissection carotid artery was separated and dissected out on both sides from its origin till high up in the neck or few centimeters above its bifurcation. Then, it was opened by cutting it longitudinally with small scissors with blunt tips from below upwards and examined for transverse carotid intimal tears, extravasation of blood, or ruptures. Now the thyroid glands were examined in situ and then removed to study the underlying tracheal rings. Reflection of the trachea towards the face allowed for the visualization of trauma to the prevertebral musculature and fascia. Next, the tongue, larynx, and upper trachea were removed as a whole by inserting the scalpel blade over the body of the hyoid bone and into the floor of the mouth. Then the scalpel blade was directed downward along with each greater horn of the hyoid bone, cutting the pharyngeal tissues until the anterior surface of the cervical vertebrae is seen. Then gentle traction was applied to the larynx while dissecting it from the rest of the neck structures. The hyoid bone, thyroid cartilage, and cricoid cartilage were separated from ligaments and soft tissues and examined for areas of blood extravasation and fracture. The cervical vertebra was examined for any fractures, dislocations with areas of extravasation. All the positive and negative findings were documented and photographed.

Results

Table – 1 shows age-wise distribution of 63 cases of deaths due to hanging. The age ranged from 13 years to 72 years. The age group, 20-30 years, accounted for the maximum number of cases, 24 cases (38%), followed by the age group 30-40 years, 18 cases (29%). Extremes of age, i.e., age less than 20 years, comprised 9 cases (14%) and more than 60 years, 2 cases (3%) of victims each. The incidence among males was 56% which comprised 35 cases and among females was 44% which comprised 28 cases respectively.

Table – 1: Age wise distribution of deaths due to hanging.

Age (years)	No. of cases	Percentage
<20	9	14%
20-30	24	38%
30-40	18	29%
40-50	6	10%
>=50	6	10%
Total	63	100%

Table – 2: Ligature material used.

Material used	No. of cases	Percentage
Nylon saree	19	30%
Nylon dupatta	14	22%
Nylon rope	12	19%
Coir rope	9	14%
Cotton lungi	3	5%
Cotton bed sheet	5	8%
Cotton saree	1	2%

Table – 3: Type of hanging.

Type of hanging	No. of cases	Percentage
Complete	40	63%
Partial	23	37%

Table – 4: Position of ligature mark.

Position of ligature mark	No. ofcases	Percentage
Above thyroid cartilage	57	90%
Over and above thyroid cartilage	6	10%

Table – 2 shows the incidence of ligature material used in 63 deaths due to hanging. Nylon

saree was the most common ligature material that was used in 19 cases (39%), the next common being the nylon dupatta in 14 cases (22%) and nylon rope in 12 cases (19%). Rarely used material was cotton lungi in 3cases (5%) and cotton saree in only one case (2%). So most commonly used ligature material was the commonly available household soft material, i.e., nylon saree, dupatta, and rope.

Table – 5: Position of knot.

Position of knot	No. of cases	Percentage
Left side of the neck	36	57%
Back of neck	19	30%
Right side of neck	7	11%
Below the chin	1	2%

Table – 6: Incidence of neck structures injury in case ofhanging.

Injuries	Present		Absent	
	No.	%	No.	%
Rupture /contusion of sternomastoid and other strap muscles of neck	18	29%	45	71%
Carotid intimal tear	19	30%	44	70%
# Hyoid bone	1	2%	62	98%
# Thyroid cartilage	1	2%	62	98%
# Cricoid cartilage	0	0%	63	100%
# Cervical vertebra	0	0%	63	100%

Table – 7: Relationship of position of knot with injuries.

7.1: Sternomastoid rupture

	Present		Absent	
	No.	%	No.	%
Back of neck	7	37%	12	63%
Below the chin	0	0%	1	100%
Left side of the neck	10	28%	26	72%
Right side of neck	1	14%	6	86%

7.2: Carotid intimal tear

	Present		Absent	
	No.	%	No.	%
Back of neck	8	42%	11	58%
Below the chin	1	100%	0	0%
Left side of the neck	9	25%	27	75%
Right side of neck	1	14%	6	86%

7.3 Fracture of hyoid bone

	Present		Absent	
	No.	%	No.	%
Back of neck	1	5%	18	95%
Below the chin	0	0%	1	100%
Left side of the neck	0	0%	36	100%
Right side of neck	0	0%	7	100%

7.4 Fracture of thyroid cartilage				
	Present		Absent	
	No.	%	No.	%
Back of neck	1	5%	19	100%
Below the chin	0	0%	1	100%
Left side of the neck	0	0%	36	100%
Right side of neck	0	0%	7	100%

7.5 Fracture of cricoid cartilage and cervicalvertebra				
	Present		Absent	
	No.	%	No.	%
Back of neck	0	0%	19	100%
Below the chin	0	0%	1	100%
Left side of the neck	0	0%	36	100%
Right side of neck	0	0%	7	100%

Table – 3 shows the incidence of complete and partial hanging in this study of 63 deaths due to hanging. Overall, 40 cases (63%) were complete hanging and 23 cases (37%) were partial hanging. So the incidence of, complete hanging is twice thatof partial hanging.

Table - 4 shows the incidence of, ligature mark position over the neck in this study. In 57cases (90%) it was seen above the thyroid cartilage and in only 6cases (10%) it was seen over and above the thyroid cartilage.

Table – 5 shows the incidence of the position of the knot in this study. 19 cases (30%) were typical hanging and 44 cases (70%) were atypical. Only in one case, the knot was below the chin.

Table – 6 shows the incidence of internal neck structure injuries in case 63 deaths due to hanging. Out of 63 cases, carotid intimal tear and rupture/contusion to sternomastoid and other strap muscles was the commonest internal neck structure injury that was seen in 19 cases (30%) and 18 cases (29%) respectively. Hyoid bone fracture and thyroid cartilage fracture were seen in only one case (2%). Fracture of the cricoid cartilage and cervical vertebral fracture was not seen in any cases (0%).

The incidence of injury to sternomastoid or other neck muscles were more common when the position of the knot was on the left side of the neck, seen in 10 cases (28%) and to the back of the neck, seen in 7 cases (37%), respectively. It was not seen when the knot was below the chin. Carotid intimal tear was seen in all positions of the knot. But it was more common when it was on the left side of the neck and to the back. Fracture of hyoid bone and thyroid cartilage was seen when the knot position was to the back of the neck, 1 case (5%). Fracture of the cricoid cartilage and cervical vertebra was not seen in any knot position (**Table – 7.1 to 7.5**).

Discussion

Hanging remains to be one of the common methods of committing suicide. It is particularly a lethal method of suicide with an estimated fatality rate of over 70%. In contrast to an overdose, there is little opportunity to change one's mind as death generally occurs rapidly after suspension [9]. The last 30 years have seen an increase in hanging suicides, particularly amongst young males all over the world. In this study, deaths due to hanging were seen from 13 years to 72 years of age. Maximum incidence being in the age group of 20 -30 years, 24 cases (38%), followed by the age group 30-40 years, 18 cases (29%). Extremes of age, less than 20 years, comprised 9 cases (14%) and more than 60 years,

2 cases (3%) of victims each, whereas, in a study done by Green H, et al. young adults of the age group of 21-30 years accounted for 46%, which is almost similar to the present study. Any substance available at hand is used as ligature material. The most commonly used ligature material in both sexes in this study is nylon saree 19cases (30%), next to being nylon dupatta 14 cases (22%) and nylon rope 12 cases (19%) [10]. The most common ligature points that were used were beams, hooks, and ceiling fans [11]. A ligature mark was seen in all the 63 cases of deaths due to hanging. It crossed the midline of the front of the neck above the thyroid cartilage in 57 cases (90%) and over and above the thyroid cartilage in 6 cases (10%), whereas in a retrospective study done by Keith L Moore, et al. wherein the ligature mark was placed above thyroid cartilage in 85% of cases [12]. Khokhlov VD, et al. has mentioned that the mark of hanging is situated above the level of the thyroid cartilage, between the larynx and chin in 80% of cases. It may be situated at the level of the thyroid cartilage in about 15% of cases and below the level of the thyroid cartilage in about 5% of cases, especially in partial suspension. In the present study, the knot was located on the left side of the neck in 36 cases (57%), to the back of the neck in 19cases (30%), and the right side of the neck in 7cases (11%). In only one case the knot was placed below the chin (2%) [13]. Out of 63 cases, the carotid intimal tear was seen in 19 cases (30%), and rupture/contusion to the sternomastoid and other strap muscles was seen in 18 cases (29%). These two criteria were the commonest internal neck structure injury observed in this present study. Hyoid bone fracture and thyroid cartilage fracture were seen in only one case (2%) [14]. Fracture of cricoid cartilage and fracture and dislocation of cervical vertebral was not seen in any cases (0%). The carotid intimal tear was seen in 5 to 10% of hanging cases as per various studies. Injury to blood vessels was seen in only 6cases (9%), injury to the sternomastoid and other neck muscles was seen in 28 cases (42%), a hyoid bone fracture in 10cases (15%), and thyroid cartilage fracture in 8 cases (12%).In the present study, the incidence of carotid intimal tear is on the higher side when compared to other studies. Carotid intimal tear was commonly seen in the age group of 40- 50 years, i.e., around 67% of cases [15], the lowest being in the age group of below 20 years (11%) of age. Hyoid bone fracture and thyroid cartilage fracture were seen in one case (17%) in the age group of 40-50 years. Cricoid cartilage and fracture and dislocation of the cervical vertebra were not seen in any cases (0%) [16]. So injury to strap muscles of the neck is more likely to be seen in complete hanging than in partial hanging. In the present study, the carotid intimal tear was more common in complete hanging, 14 cases (35%). In partial hanging, it was seen in only 5 cases (22%) [17]. In our study more common in complete hanging, 6cases, and partial hanging, it was seen in only 2cases. So, the carotid intimal tear is more common in complete hanging in both studies. Fracture of hyoid bone and thyroid cartilage was seen in only complete hanging, 1 case (3%). Fracture of the cricoid cartilage and cervical vertebra was not seen in cases of both complete or partial hanging [18, 19, 20].

Conclusion

Most of the deaths due to hanging were in the age group of 20-30 years (38%). Incidence of hanging was slightly more in males (56%) when compared to females. Most common type of hanging is complete hanging (63%) and the commonest position of knot is to the left side of the neck (57%). In the present study, the commonest internal neck structure injury is the carotid intimal tear (30%), the next common being rupture/contusion to the sternomastoid and other strap muscles of the neck (29%). The injury to the sternomastoid and other strap muscles of the neck are more common in the age group of 40-50 years. Fracture to the cricoid cartilage and cervical vertebra was not seen in many cases. All the neck structure injuries are common in completehanging.

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