

A Study of Ligature Marks in Deaths by Hanging and Ligature Strangulation

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Abstract

Deaths resulting from hanging and ligature strangulation show features amongst which the ligature mark at the neck is considered to be decisive. Hanging is mostly suicidal, while ligature strangulation is mainly homicidal; hence differentiation between the two is necessary. This prospective study was conducted in the department of Forensic Medicine, Dr.B.R.Ambedkar Medical College, Bengaluru, during January to December 2018. During this period, 275 cases of hanging and 10 cases of strangulation were studied. We found that ligature mark was above the level of thyroid cartilage in 80.7% cases of hanging and below the thyroid cartilage in 80% cases of ligature strangulation. The direction of ligature mark was oblique in 91.3% cases of hanging and horizontal in 100% cases of strangulation. Discontinuity of ligature mark was present in 93.09% cases of hanging and absent in 90% cases of strangulation. Single ligature mark was noted in 95.3% hanging cases and 80% strangulation cases. Tissues underneath the mark were pale and dry in all cases of hanging. Extravasation of blood was noted in tissues underneath the mark in 100% cases of ligature strangulation.

Key Words: Hanging, Ligature strangulation, Ligature mark, Oblique, Thyroid cartilage.

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Introduction:

Ligature marks on the neck are found in hanging and ligature strangulation. The ligature mark around the victim's neck constitutes an extremely precious piece of evidence in to arrive at a conclusion as to the cause of death, whether hanging or strangulation. Hanging is that form of asphyxia which is caused by suspension of the body by a ligature which encircles the neck, the constricting force being the weight of the body.¹ In strangulation, the exchange of air between the atmosphere and the lungs

is prevented by way of constriction of the neck by means of ligature material or by some other means, without suspending the body of the victim, where the force of constriction is applied from outside (exogenous in origin) and is not the weight of the body or the head of the victim.²

It is a well-known fact that discontinuity along the course of ligature mark is important criteria while describing ligature mark of hanging or strangulation. Authors have mentioned that hanging mark does not completely encircle the neck.¹⁻⁵ In strangulation, unless the killer is pulling upwards there will be no gap in the mark. However, there can be discontinuity along the course of ligature mark due to interposing clothing, scalp or beard hairs or fingers of the victim in both hanging and strangulation.⁶

Many books on Forensic Medicine have mentioned that hanging mark is situated

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obliquely across the circumference of neck.¹⁻⁵ Where suspension point is low, the pull on the rope is almost at right angle to the axis of the body, so the resulting mark may be horizontal.¹ In strangulation, the mark tends to encircle victim's neck horizontally. However, in strangulation of a victim by using a running noose with the force directed upwards can produce an oblique ligature mark similar to hanging.⁵ Many times there are so many difficulties faced by the forensic personnel in diagnosing ligature mark of hanging and strangulation. In practice, the distinction between the two groups is important because strangulation is usually homicidal and hanging in vast majority is considered to be suicidal. So there is always a necessity to differentiate hanging mark from strangulation mark before giving an opinion, otherwise an error in judgement can convict an innocent or a murderer can go scot free in the society.⁷

Material and Methods:

This prospective study was conducted in the Department of Forensic Medicine, Dr.B.R. Ambedkar Medical College, Bengaluru, Karnataka during January 2018 to December 2018. During this period a total of 285 cases, 275 cases of hanging and 10 cases of ligature strangulation brought by police for medico-legal autopsy were studied with a view to assess the information that a ligature mark can provide in such deaths. History regarding the age and sex of deceased, scene of crime and position of body was collected from the police and relatives. The ligatures if present were photographed in situ and then removed by cutting without untying the knot. The characteristics of ligature mark, like its position over the neck, direction, discontinuity, number of turns and colour were noted down. The neck was examined after removal of the brain and viscera from the chest and abdominal cavities to provide a bloodless field. The neck was opened by a midline incision. Neck structures were

dissected in layers - skin and sub-cutaneous tissue, strap muscles of neck, thyroid gland, trachea and larynx.

Results and Discussion:

A total of 792 medico-legal autopsies were conducted by the department of Forensic medicine, Dr.B.R. Ambedkar Medical College, Bengaluru during the study period, out of which 285 cases were having ligature marks. Out of 285 cases, 275(34.7%) were deaths due to hanging and 10(1.3%) were due to ligature strangulation.

In the present study, out of 275 victims of hanging, 186(68%) were males and 89(32%) were females as shown in Table-1. The male to female ratio was 2.08:1, which is consistent with observations of Momin SG et al⁷ (2:1), Navneet Sharma et al⁸ (2.45:1) and Sharma BR et al⁹ (2.1:1). Males are more active in various activities and customs and hence they are vulnerable for more stress and tension. But in the study of Naiket al¹⁰ female cases account for 62.5%, which is in contrast to the present study.

As shown in Table 1, out of 10 victims of ligature strangulation, 7 were males (70%) and 3 were females (30%). Similar results were observed in study done by Momin SG et al⁷, where male preponderance was seen (71.4%). But in a study done by Tariq N et al¹¹, 63.63% of the victims were females.

Majority of the victims of hanging, 116 out of 275 amounting to 42.2% were between 21 - 30 years followed by 73 cases (26.5%) in 31 - 40 years and least being in the age group of >50 years (5%). Similar findings were observed by Patel JB et al,¹² who found 21 - 30 years of age to be most vulnerable for hanging followed by 11 - 20 years of age.

In ligature strangulation, 40% of the cases were in >50 years' age group followed by 20% cases in 21 - 30 years (Table 1). In a study done by Momin SG et al,⁷ maximum number of cases were seen in 21 - 30 years age group (43%) followed by 31 - 40 years (29%).

Table.1: Age wise & Gender wise distribution of cases.

Age group in years	Hanging (275)				Ligature Strangulation (10)			
	Male	Female	Total	%	Male	Female	Total	%
0 - 10	00	00	00	00	00	01	01	10
11 - 20	22	18	40	14.5	01	00	01	10
21 - 30	66	50	116	42.2	02	00	02	20
31 - 40	57	16	73	26.5	00	01	01	10
41 - 50	27	05	32	11.6	01	00	01	10
> 50	14	00	14	5.09	03	01	04	40
Total	186	89	275	100	07	03	10	100

Table.2: Distribution of cases according to the level of ligature mark.

Level of ligature mark	Hanging		Strangulation	
	Cases	%	Cases	%
Above the thyroid cartilage	222	80.7	00	00
At the level of thyroid cartilage	38	13.8	02	20
Below the thyroid cartilage	15	5.5	08	80
Total	275	100	10	100

It is a well-known fact that the ligature mark of hanging and strangulation are not found at the same level. In hanging, the ligature mark is situated above the level of thyroid cartilage, between the larynx and the chin in 80percent of cases. It may be at the level of cartilage in about fifteen percent and below the cartilage in about five percent cases, especially in partial suspension. In ligature strangulation, the mark is usually about the middle or below the thyroid cartilage.¹

In our study, it was observed that ligature mark was above the level of thyroid cartilage in 222 cases (80.7%), at the level of thyroid cartilage in 38(13.8%) cases and

below the thyroid cartilage in 15(5.5%) cases of hanging. In ligature strangulation, the mark was placed at the level of thyroid cartilage in 20% cases and below the cartilage in 80% cases - Table 2. In a study done by Sunil Kumar Sharma GA et al,¹³ ligature mark was above the level of thyroid cartilage in 96.92% cases and at the level of cartilage in 3.08% cases of hanging. The mark was at the level of thyroid cartilage in 40% cases and below the cartilage in 60% cases of strangulation. In accordance with Table 3, in hanging cases, obliquely placed ligature mark was observed in 251 cases (91.3%) and it was horizontally placed in 24(8.7%) cases. In

all the 10 cases (100%) of strangulation, the direction of ligature mark was horizontal. In a study done by Momin SG et al,⁷ direction of ligature mark was oblique in 90(100%) cases of hanging and transverse in 7(100%) cases of strangulation. But in the study done by Patel JB et al,¹² direction of ligature mark was oblique in 93 cases (96%) of hanging and 2(67%) cases of strangulation. The direction of mark was transverse in 4(4%) cases of hanging and 1(33%) case of strangulation.

Table.3: Showing the direction of ligature mark.

Direction	Hanging		Strangulation	
	Cases	%	Cases	%
Oblique	251	91.3	00	00
Horizontal	24	8.7	10	100
Total	275	100	10	100

Table.4: Showing extent of ligature mark.

Extent of ligature mark	Hanging		Strangulation	
	Cases	%	Cases	%
Complete encircling	19	6.9	09	90
Incomplete encircling	256	93.09	01	10
Total	275	100	10	100

Table.5: Showing number of turns of ligature mark

No of turns	Hanging		Strangulation	
	Cases	%	Cases	%
Single	262	95.3	08	80
Multiple	13	4.7	02	20
Total	275	100	10	100

In 90% cases of strangulation, the ligature mark was completely encircling the neck, while continuous ligature mark in hanging was present only in 6.9% cases (19 out of 275). Ligature mark was incompletely encircling around the neck in 256(93.09%) cases of hanging (Table 4). Sunil Kumar Sharma GA et al¹³ reported 86.67% marks of strangulation to be continuous and in 100% cases of hanging, the ligature mark was incompletely encircling the neck. Discontinuity of the ligature mark was present in 98% cases of hanging and 25% cases of strangulation in a study done by Navneet Sharma et al.⁸

According to table 5, ligature mark was single in 262 cases (95.3%) of hanging and multiple in 13(4.7%) cases. In ligature strangulation, the mark was single in 8(80%) cases and multiple in 2(20%) cases. The ligature mark was single in 100% cases of hanging. 85.71% cases of ligature strangulation in a study by Momin SG et al.⁷

The ligature mark was reddish brown colour in 129 cases of hanging and in 6 cases of strangulation. Parchmentization of ligature mark was seen in 101 cases of hanging and in 4 cases of strangulation. It was pale in 45 cases of hanging. The colour of ligature mark depends mostly on the duration of suspension of the body, nature of ligature materials used and also the time elapsed between death and autopsy.¹⁴ In the study done by Sunil Kumar Sharma GA et al,¹³ the ligature mark was reddish brown in colour in 41.66% cases of hanging and 66.67% cases of strangulation, parchmented in 36.66% hanging cases, pale in 21.66% hanging cases and 33.33% cases of strangulation. In another study done at a tertiary care teaching hospital of western Rajasthan,⁸ reddish brown colour of mark was seen in 23% hanging cases and 50% cases of strangulation, parchmented in 56% cases of hanging and 50% cases of strangulation. The ligature mark was pale in 21% cases of hanging.

As per table 7, the sub-cutaneous tissue and soft tissue underneath the ligature mark was pale and dry in all 275 (100%) cases of hanging and 100% cases of ligature strangulation showed extravasation of blood in underlying soft tissues. The finding is similar to that observed by Momin SG et al⁷ who reported 100% cases of hanging to have pale and dry underlying soft tissues. They also reported the tissues underneath the ligature mark showed extravasation of blood in 100% cases of ligature strangulation.

Table.6: Showing colour/nature of ligature mark.

Colour/Nature	Hanging		Strangulation	
	Cases	%	Cases	%
Reddish-brown	129	46.9	06	60
Parchmentization	101	36.7	04	40
Pale	45	16.4	00	00
Total	275	100	10	100

Table.7: Comparison of tissue underneath the ligature mark.

Tissue underneath the ligature mark	Hanging		Strangulation	
	Cases	%	Cases	%
Pale and dry	275	100	00	00
Extravasation of blood	0	0	10	100
Total	275	100	10	100

Conclusion:

In hanging, the ligature mark was single, found above the level of thyroid cartilage,

oblique in direction and incompletely encircling the neck in maximum number of cases. Obliquity of the ligature mark is the best measure for diagnosis of hanging. Discontinuity of mark is strongly suggestive of hanging. Pale and dry sub-cutaneous tissue is also a finding of hanging. In strangulation, the ligature mark was situated below the level of thyroid cartilage, horizontal in direction and completely encircling the neck in majority of the cases. Extravasation of blood in the tissues underneath the ligature mark is also diagnostic of ligature strangulation.

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