

Original Research Paper

Pattern of Ligature Mark in Cases of Compressed Neck in Rajkot Region: A Prospective Study

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Abstract

Ligature mark may be the only evidence available in cases of asphyxial deaths due to either hanging or strangulation. A thorough examination of the ligature mark and analysis of the information provided by it is therefore, a must to arrive at the most probable cause of death and differentiate between hanging and the ligature strangulation. A prospective study was conducted at the Department of Forensic Medicine, P.D.U. Medical College & Hospital, Rajkot from January 2008 to December 2008. During that period out of 2159 cases, 90 cases of hanging and 7 cases of ligature strangulation were selected for the present study. We found that deaths due to hanging constituted 4.17% of the total unnatural deaths subjected to medicolegal autopsy; young adults of the age group 21 to 30 years accounted for the maximum cases 40% and the male: female ratio was 2:1. Chunni (34.44%) was the most common ligature material used. The mark was obliquely placed (100% cases) above thyroid cartilage (80% cases). In all the cases of ligature strangulation the mark was transverse and below the level of thyroid cartilage.

Key Words: Hanging, Ligature strangulation, Ligature mark

Introduction:

Compression of neck is a broad term used for non specific causes of neck pressure which may be sudden. Ligature mark is found in two types of neck compression- (I) Hanging (II) Ligature strangulation. Hanging is a form of death produced by suspension of the body by a ligature round the neck, constricting force being the weight of the body (or apart of the body weight). [1] In India hanging is among the top 5 methods of choice for committing suicide. [2]

Strangulation is a violent form of death which results from constricting the neck by means of a ligature or by any other means without suspension of body. [1] In hanging, ligature material may be any substance that is available at the time of the impulse has been used by the suicides as a ligature. Knot is frequently in the form of a single knot to produce a running noose or fixed by a granny or reef knot, occasionally a simple loop is used. [1] There may be more than one turn around the neck and / or more than one knot imparting corresponding complexity to the mark.

A running noose can tighten at the time of suspension and may then produce a mark which takes a horizontal turn but it is likely to be above the thyroid cartilage. Ligature mark depends on the nature and position of the ligature used, and the time of suspension of body after death. If the ligature is soft, and the ligature removed immediately after death, there may be no mark. Again, the intervention of a thick and long beard or clothes on the neck leads to the formation of a slight mark.

Sometimes, the pattern of the ligature material is impressed on the skin and a characteristic diagonal mark of the strands found when the rope is used. The wide band of cloth when used as a ligature on the bare skin may cause a narrow ligature mark, due to tension lines in the stretched cloth. The mark is a groove or furrow the base is pale, hard leathery and parchment like and margins are red and congested. Ecchymoses and slight abrasions in the groove are rare, but may be found in some cases for instance in judicial hanging.

Usually only one mark is found. Multiple marks may be present due to multiple turns around the neck or upward displacement after application due to fall. The mark is usually situated above thyroid cartilage between larynx and the chin and is directed obliquely, upwards following the line of mandible and interrupted at the back or may show an irregular impression of a knot, reaching the mastoid processes behind the ears towards the point of suspension.

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The mark may be found on or below the thyroid cartilage, especially in case of partial hanging. It may be circular if a ligature is first placed at the nape of neck and then its two ends are brought horizontally forwards and crossed, and carried upwards to the point of suspension from behind the angle of the lower jaw on each side. The mark will be circular and oblique if a ligature is passed round the neck more than once. Near the position of the knot, it is like an inverted "V".

In strangulation, ligature may be applied as one turn around the neck or even less, as homicide have been perpetrated by assailant pulling U shaped ligature against the front and sides of neck, while standing at the back.

Ligature mark is a well defined and slightly depressed mark corresponding roughly to the breadth of the ligature, usually situated low down in the neck below thyroid cartilage and encircling the neck horizontally and completely. The marks are multiple if the ligature is twisted several times round the neck. The mark may be oblique as in hanging if the victim has been dragged by a cord after he has been strangled in recumbent posture or if the victim was sitting and assailant applied a ligature on the neck while standing behind him, thus using the force backwards and upwards. The base of the mark, which is known as a groove or furrow, is usually pale with reddish and ecchymosed margin.

It becomes dry, hard and parchment like, several hours after death, if the skin has been excoriated. The pattern of ligature may also be seen very often, there are abrasions and ecchymoses in the skin and adjacent to marks. In some cases, the mark in the neck may not be present at all, or may be very slight, if the ligature used is soft and if it is removed soon after death. However, it is not necessary that all these differentiating features are present simultaneously in all cases. 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. [3] So there is always a necessity to differentiate hanging mark from strangulation mark before giving an opinion otherwise an error in judgment can convict an innocent or a murderer can go Scot free in the society.

The ligature mark is a vital piece of evidence especially when the killer has taken away the actual ligature. Taking the most important finding i.e. ligature mark into consideration, there are a few points like (1) level (2) continuous/non-continuous (3) oblique/transverse of the ligature mark which differentiate hanging from ligature strangulation.

Many times there are so many difficulties faced in diagnosing ligature mark of hanging and strangulation on many occasions. The author has made an attempt to establish the most reliable factor for differentiating pattern of ligature mark of hanging from ligature mark of strangulation.

Material and Method:

This prospective study was conducted in all cases of death due to hanging and ligature strangulation for the purpose of studying the pattern of ligature mark at the Department of Forensic Medicine, P.D.U. Medical College & Hospital, Rajkot from January 2008 to December 2008. During that period out of 2159 cases, 90 cases of hanging and 7 cases of ligature strangulation were selected for the present study. A detailed history from police and relatives regarding age, sex, socio economical status, marital status, habits, illness (mental / other disease / deformity), previous attempted suicides, suicide note if any etc. were taken. Detailed history from police regarding scene of crime, position of body etc. were taken. Irrespective of information collected, both external and internal post mortem findings were observed meticulously especially the ligature mark. During observation of ligature mark, all the parameters like its site, size, level, number, discontinuity and obliquity were noted.

Observations:

As per Table 1, maximum 39 cases (40.2%) of hanging and ligature strangulation deaths were reported in age group of 21-30 years. Out of 36 cases, 24 (64%) male and 12 (34%) female died due to hanging while 3 case of ligature strangulation equal reported in male.

As per Table 2, Chunni was used as a ligature material in maximum 31 cases (34.44%) of hanging followed by nylon rope in 28 cases (31.1%) of hanging whereas in ligature strangulation cases, ligature material was not known in maximum number 3 cases (42.85%).

In all cases of hanging only one ligature mark was present. The ligature mark was situated above thyroid cartilage in 72 cases (80%) and in 49 cases (54.44%), the length of ligature mark was less than neck circumference. Ligature mark was one in number in 6 cases (85.71%) of ligature strangulation, in all 7 cases (100%) it was situated below thyroid cartilage and the length of ligature mark was equal or less than neck circumference.(Table 3)

In all cases of hanging underlying soft tissues of neck were pale, white and glistening, ligature mark was incompletely encircling the neck in 72 cases (80%) and obliquely present

around the neck all 90 cases (100%) of hanging. In all cases of ligature strangulation underlying soft tissues showed extravasation of blood. The ligature mark was completely encircled and transversely present around the neck in all 7 cases (100%) of ligature strangulation. (Table 4)

Discussion:

In the present study 4.49% cases were declared on autopsy of hanging and strangulation deaths which is similar to study of Sheikh et al. [10] In the present study maximum number of cases 40.2% were reported in the age group 21-30 years, which is consistent with observations of Sheikh et al [10] (42.4%) and Joshi et al [11](44.18%). In present study 66.67% male and 33.33% female cases were observed in hanging, which is consistent with observations of Sheikh et al [10] and Jani et al. [12] Churni as a ligature material was used in 34.44% cases of hanging in the present study. In study by Sharma B R et al [13] commonest ligature material was Churni in 17 cases (30.90%). Number of ligature mark is one in all cases of hanging are similar with observation of Momonchand et al (96.7%). [14]

In present study six case of ligature strangulation where number of ligature mark is one while in one case, number of ligature mark is more than one. Ligature mark was situated above the level of thyroid cartilage in 72 cases (80%) of hanging which is similar with observation of Naik S K (82.94%). [15] In all 7 cases (100%) of ligature strangulation, ligature mark was found below thyroid cartilage.

Out of 90 cases of hanging, in 49 cases (50.51%) the length of ligature mark was less than neck circumference and in all cases of ligature strangulation; length of ligature mark was equal to the neck circumference.

In all 90 cases (100%) of hanging the direction of the ligature mark was oblique which was consistent with the observation by Naik S K. [15] In all 7 cases (100%) of ligature strangulation, the direction of the ligature mark was horizontal which was consistent with observations of Naik S K. [15] Ligature mark was completely encircled in 18 cases (20%) of hanging and in 72 cases (80%) of hanging the ligature mark was incompletely encircled, which was consistent with observations of Naik S K. [15] In all cases of ligature strangulation, the ligature mark was completely encircling the neck. Out of 97 cases of neck compression, in internal appearance of neck underlying soft tissues were pale, white and glistening in 90 cases (100%) of hanging while in 7 cases

(100%) of ligature strangulation it showed extravasations of blood.

It is a well-accepted fact that the ligature mark of hanging and strangulation are not found at same level. Authors have reported that hanging mark is situated higher in the neck usually above the laryngeal prominence. [4-8] Jason P J et al [9] have reported that position of mark of hanging depends on how the device was fixed and the suspension point. Reddy KSN [8] has mentioned that mark of hanging is situated above the level of thyroid cartilage, between larynx and chin in 80% cases. It may be situated at the level of thyroid cartilage in about 15% cases and below the level of thyroid cartilage in about 5% cases, especially in partial suspension. [8] In the present study, it was observed that ligature mark was on or above the level of thyroid cartilage in most cases of hanging. It is also well known fact that discontinuity along the course of the ligature mark is another important criterion while describing ligature mark of hanging or strangulation. Authors have mentioned that hanging mark almost never completely encircles the neck. [4-9] 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. [5]

In the present study, it was noticed that though discontinuity of the mark was a common feature in most cases of hanging still it was missing in 20% cases of hanging. In strangulation deaths, discontinuity of the ligature mark was not present even in a single case.

Observation is incomplete when obliquity along the course of the ligature mark is not noted in cases of hanging and strangulation. Authors have reported that hanging mark is situated obliquely across the circumference of neck. [5-8] 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 almost horizontal. In strangulation, unlike hanging, the mark tends to encircle victim's neck horizontally. However, the mark may be oblique as in hanging, if the victim has been compressed by a cord while in recumbent posture, or if the victim was sitting and the assailant applied the ligature on the neck while standing behind victim, thus using the force backward and upward. [6, 8] Simpson K has opined that the mark of hanging usually rises to a 'peak' pointing the junction of the noose and vertical part of the ligature, this being a distinguish feature from ligature strangulation.

However, exceptions occur if the suspension point is low, a horizontal mark may be produced which can be confused with strangulation. In strangulation, the mark is usually horizontal and will not show any rising peak to a suspension, as do many hanging. Present study revealed that obliquity along the course of ligature mark was a constant feature in all deaths due to hanging. In ligature strangulation; horizontal ligature mark was observed in all cases.

Conclusion:

Obliquity in the course of ligature mark being directed upwards to the knot position is a better criterion for diagnosis of hanging than the factor of discontinuity which may not be present in all cases of hanging. It can be thus concluded that the presence of discontinuity along the course of ligature mark is highly suggestive of hanging but its absence neither rules out hanging nor concludes strangulation. Therefore, based upon the low level of ligature mark and absence of discontinuity, opinion as a case of ligature strangulation should not be given in haste unless obliquity along the course of ligature mark is completely ruled out.

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Table 1: Age & Sex Wise Distribution of Hanging and Ligature Strangulation Deaths

Age grps (yrs)	Type of neck compression				Total (%)
	Hanging		Ligature strangulation		
	M	F	M	F	
0-10	1	0	0	1	2(2.06)
11-20	4	12	0	0	16(16.4)
21-30	24	12	3	0	39(40.2)
31-40	15	4	1	1	21(21.6)
41-50	11	1	0	0	12(12.3)
51-60	5	0	0	0	5(5.15)
>60	0	1	1	0	2(2.06)
Total (%)	60(66.6)	30(33.3)	5(71.4)	2(28.5)	97(100)

Table 2: Distribution of Ligature Material

Type of material	Hanging (%)	Ligature strangulation	Total (%)
Chunni	31 (34.44)	0	31 (31.96)
Nylon rope	28 (31.1)	0	28 (28.87)
Sari	15 (16.66)	0	15 (15.46)
Cotton rope	15 (16.66)	0	15 (15.46)
Shirt	1 (1.11)	0	1 (1.03)
Handkerchief	0	2 (28.57)	2 (2.06)
Metal wire	0	2 (28.57)	2 (2.06)
Not known	0	3 (42.85)	3 (3.09)
Total (%)	90 (92.78)	7 (7.22)	97 (100)

Table 3: Relationship between Numbers, Level & Size of Ligature Mark

Type of Neck compression	Number			Level			Size in relation to neck circumference		
	1	2	3	Above TC	On TC	Below TC	Size<NC	Size= NC	Size >NC
Hanging No. (%)	90(100)	0	0	72(80)	14(15.56)	4(4.44)	49(54.44)	0	41(45.56)
Lig. Strangulation No. (%)	6(85.71)	1(14.28)	0	0	0	7(100)	0	7(100)	0
Total No. (%)	96(98.97)	1(1.03)	0	72(74.22)	14(14.43)	11(11.34)	49(50.51)	7(7.21)	41(42.26)

* TC- Thyroid cartilage, NC- Neck circumference

Table 4: Relationship between Direction, Encirclement and Internal Appearance of Ligature Mark

Type of neck compression	Internal appearance		Encirclement		Direction	
	Pale white	Extravasation of blood	Complete	Incomplete	Transverse	Oblique
Hanging (%)	90 (100)	0	18(20)	72 (80)	0	90(100)
Lig. Strangulation (%)	0	7(100)	7(100)	0	7(100)	0
Total (%)	90 (92.79)	7(7.21)	25(25.77)	72(74.22)	7 (7.21)	90 (92.79)