

**Study of Ligature Mark Patterns in Hanging Cases: An Original Research Article**

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Conflicts of Interest: Nil.

Abstract

Postmortem External examination of ligature mark plays a vital role in case of hanging deaths. This study was conducted to know the pattern of ligature mark in various types of hanging among autopsies conducted at the mortuary, attached to Government Medical College, Baroda during one year of duration from October 2013 to September 2014. In this descriptive, prospective, observational type of study, demography profile of victim, manner of death and the ligature mark with reference to their site, level, number, discontinuity, obliquity, type of material and internal appearance. Hanging constituted 101 cases of 2315 autopsies (4.36 %). Male outnumbered female in total autopsies conducted related to the hanging. The third and fourth decades males are dominating our study. Finance related problems were the commonest motive for suicide. Among female victims, the majority composed of adolescents and young adults. Most common easily available materials used as ligature materials in hanging were soft materials like dupatta, Saree, dhoti, turban, bed sheet. This study thus suggests that object used for ligature depends on accessibility to the object. The most frequent level of the ligature mark over the neck

in our study was over and above the laryngeal prominence, accounting for 99 % cases. Out of 101 cases of hanging studied, only 03 cases of Hyoid bone fracture (2.97%) were noticed. Complete hanging was seen in 43 cases and partial hanging in 58 cases. Typical ligature mark seen among 49 cases and atypical ligature mark in 58 cases. Oblique ligature mark was noted in 95 % of cases. The ligature mark was non-continuous in 91% of cases. Horizontal ligature marks were noted in some of cases of partial hanging. A careful examination of neck in suicidal hanging cases is of great importance in ascertaining the ante-mortem character of lesion and to exclude the possibility of homicide.

Keywords: Asphyxia, Fracture, Hanging, Hyoid, Ligature mark, Suicide.

Introduction

Hanging is death due to violent asphyxia, caused by suspension of the body by a ligature around the neck region, the constricting force being the weight of the body.¹ The mode of death in hanging cases is almost always suicide or accident, rarely homicide.² Hanging is the most common method of committing suicide, followed by fall from height, firearm (in men), and toxic substance

(in women).³⁻⁵ Hanging usually produces painless and rapid death and can occur even with partial suspension.⁴ When the body is found completely suspended from above, it is called complete hanging; if some part of the body touches the ground, it is called incomplete or partial hanging.⁶ There are a number of mechanisms by which hanging produces death. These include stretching of the carotid complex, causing a reflex of cardiac inhibition, venous, and arterial occlusion; airway obstruction; disruption of the spinal cord; and so on.⁷ Despite being a prominent cause of suicidal deaths in India, particularly among young adults, there are hardly any statistics available on its epidemiology in a pan-Indian scenario. The published data on injury patterns, clinical aspects and management is also limited. While conducting autopsy on ligature asphyxial deaths, autopsy surgeon often comes across cases when the only principle external sign present is the ligature mark on the neck. Ligature mark is a pressure mark underneath the ligature present on the neck region, found in either Hanging or Ligature strangulation. In India, hanging is the second most common method of committing suicide; first being the Poisoning. The appearance of ligature mark may be variable depending upon the type of hanging, type of material used etc. Postmortem External examination of deceased particularly the appearance of ligature mark plays a vital role in case of hanging deaths.

Material & Methods

This study was conducted to know the pattern of ligature mark in various types of hanging among autopsies conducted at S.S.G. Hospital mortuary, attached to Government Medical College, Baroda, during one year of duration from October 2013 to September 2014. In this descriptive observational type of study, demography profile of victim, manner of death and the ligature mark with reference to their site, level, number, discontinuity,

obliquity, type of material and internal appearance. The findings/ data were recorded on a specially designed Performa and tabulated using SPSS version 15. In some of the instances, this information was supplemented by either, visit to scene of occurrence or from the photographs of scene of occurrence. Ethical clearance was obtained from the College Ethical Committee.

Results & Discussion

During the one year study period, total 2315 autopsies done at SSGH hospital mortuary, out of which 101 (4.36%) cases of hanging deaths were noted.

Table 1:

Incidence of hanging deaths during the study period

Cases	No.	Percent
Hanging	101	4.36
Others	2214	95.63
Total	2315	100

TABLE 2- Hanging cases -Age & Sex distribution chart.

Age in years	Total no. of Cases	Number of cases (Males)	Number of cases Females (%)
1-10	01	00 (0%)	01 (02.95%)
11-20	19	10 (14.9%)	09 (26.45%)
21-30	34	20(29.85%)	14 (41.20%)
31-40	29	20 (29.85%)	09 (26.45%)
41-50	07	06 (08.95%)	01 (02.95%)
51-60	10	10(14.9%)	00(00%)
61-70	01	01(01.5%)	00(00%)
71-80	00	00(00%)	00(00%)
Total	101	67(66.33%)	34 (33.67)

The above table clearly shows that age group of 20-40 years are most vulnerable to commit suicide by hanging. This was similar to study done by Sadikhusen G et al.⁸ and B.R Sharma et al.⁹ The youngest victim in this study was 15 year male and the eldest was 72 year female. Male to female ratio was 2:1; this frequency is consistent with the study by Sadikhusen G et.al⁸ Naik SKK, Patil DY¹⁰ and most of the other studies state male preponderance.

Ligature Mark Findings

Type of suspension

Complete hanging accounted for 43 (42.50%) cases, rest of the 58(57.5 %) cases were partial hanging in the present study. Similar findings were observed by Narayan AK¹¹, though in most studies complete suspension was more common.

TABLE 3- Type of suspension in hanging cases

Type of suspension	Frequency
Partial	58 (57.5%)
Complete	43(42.5%)

Type of ligature mark

Atypical hanging was seen in 49 (48.5%) cases and 52 (51.5%) cases were of typical hanging corroborating with findings of study by Sharma BR, Sing VP, Harish D⁹, Narayan AK¹¹, Saini OP, Saini PK, Jain R, Mathur PN¹², Sharma BR, Harish D, Sharma A, Sharma S, Singh H.¹³

No. of ligature marks: In 97 no. of cases there was only one ligature mark and in 4 cases there were more than one turns of the mark.

Direction of ligature mark

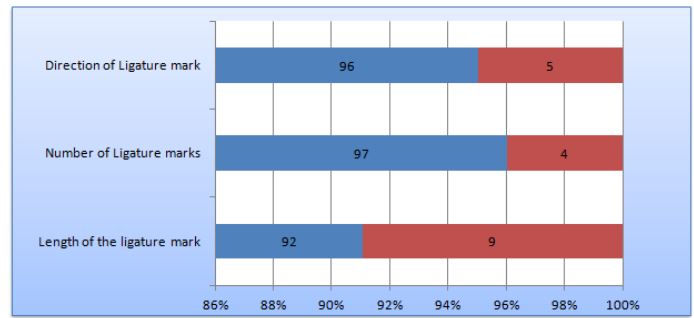
In 96 no. of cases the ligature mark was oblique and in 5 cases a transverse ligature mark was found. Among the 5 transverse ligature mark cases 4 were partial hanging cases.

Length (completeness) of the ligature mark

Out of 101 cases in 92 cases the mark was incomplete and 09 cases it was complete.

Graph: 1.

Chart Depicting Number, length and Direction of Ligature mark.



Position of knot

TABLE 4. Distribution of position of knot in hanging cases.

Position of knot	Frequency
Occipital region	52
Right side	16
Left side	32
Below Chin	01
Total	101

Out of 101 cases, 32 (31.68%) cases showed knot placed on left side followed by 16 (15.84%) cases of knot placed on the right side, and over the occipital in 52 (51.5%) cases, under the chin in 1 (4.76%) cases. Similar observations were made in studies by Saini OP, Saini PK, Jain R, Mathur PN¹², Selvakumar C.¹⁴

Level of ligature mark

The most frequent level of the ligature mark over the neck in our study was over and above the laryngeal prominence (OALP) accounting for 100 (99 %) cases and below the laryngeal prominence (BLP) was accounting for only one case (1%). The following studies are similar to our study Gordon I, Shapiro. H.A¹⁵, Naik S.K¹⁶.

Ligature material

The soft ligature material was the commonly used one 69 (68.3%) compared to hard ligature material which accounts for 32 % (31.7%) of cases. The soft ligature material was the commonly used one 69 (68.3%) compared to hard ligature material which accounts for 32 (31.7%) of cases which is consistent with the study by

Narayan AK¹¹, Sharma BR, Harish D, Singh VP, Singh P¹³, Mohammed Ziyauddin G Saiyed, Kamesh A Modi¹⁷, and Mohammed Musaib M. Shaikh, H. J. Chotaliya¹⁸.

Neck structure fractures

Out of 101 cases of hanging studied, 03 cases of Hyoid bone fracture (2.97%) was noticed (in which 2cases showed fracture of right greater horn of hyoid bone and 1 case had left greater horn and body junction. Among the three cases of Hyoid bone two were partial hanging and one case was of complete hanging. All fractures were in male patients and were of age 24, 45 and 38 years. Ligature material used was nylon rope in 2 cases and dupatta in one case. Two cases were atypical hanging and one case was a typical hanging. Similar findings were seen by Narayan AK¹¹, Saini OP, Saini PK, Jain R, Mathur PN¹² Selvakumar¹⁴, Shrabana Kumar Naik, D Y Patil¹⁶. The other neck structures including Thyroid and cricoid cartilage did not show any fracture. Only one Case of cervical spine fracture (C3-C4 fractured) with spinal cord contusion was seen.

TABLE 5:
Fracture and injuries of various Neck structures in hanging cases.

Neck structure	Frequency	Total Number of cases	Percent
Hyoid bone	03	101	2.95%
Thyroid cartilage	08	101	7.9%
Cricoid cartilage	00	101	00
Carotid intimal tear	01	101	0.9%
Cervical spine fracture	01	101	0.9%
Strap muscles	03	101	2.95%

Conclusion

Hanging constituted 101 cases of out of 2315 autopsies (4.36 %) conducted in study period. Males outnumbered females and finance related problems were the commonest motive for suicide. The third and fourth decades males outnumbered others whereas fourth and seventh decade had minimal cases. There was preponderance of males in the study group (66.34%) majority of them being young

age (21-30 yrs).Among females (33.66%) the major group was composed of adolescents and young adults. Most common easily available materials used as ligature materials in Hanging were Soft materials such as Dupatta(40.5%), saree (15.85%), dhoti, turban, bed sheet(chaddar), leggings and so on were used as ligature by 68.3% of victims and hard materials such as coir rope, plastic rope, cable wire, and so on were used by 31.7% of victims. This reflects the easy availability of dupatta(veil) sari, and dothi. This is one of the reasons for more number of partial hanging in the present study as soft ligature materials tend to stretch because of the body weight. This study thus suggests that object used for ligature depends on accessibility to the object. All these cases happened in peridomestic areas like bed room, drawing room, bathroom, work places, kitchen, and trees in the backyard - when the deceased was lonely at home. Similar observation had been made by others too. This is obvious that if cases of hanging have to be saved they have to be released within minutes and this is possible only when somebody is there around. This chance is not there if hanging is attempted in a lonely place.

Complete hanging was seen in 43 cases and partial hanging in 58 cases. Typical ligature mark seen among 49 cases and atypical ligature mark in 58 cases. Oblique ligature mark was noted in 95 % of cases. The ligature mark was non-continuous in 91% of cases. Horizontal ligature marks were noted in cases of partial hanging. There were 51.5% cases of typical hanging and 48.5% atypical hanging. Fracture of hyoid bone at their greater horns was seen in 2.9% and thyroid cartilage in 7.9% of cases. Cervical vertebrae fracture noted in 1% case. Haemorrhage in strap muscle fibers was seen in 3 %, and carotid intimal tear was seen in 1% of cases. Neck skeleton injuries were noted in persons older than 38

years. The 'classical signs' of asphyxia were not present in all the cases.

The reason for the predominant partial hanging is that the point of suspension chosen by the suicide is normally one which is within easy reach, with or without the aid of some kind of platform, e.g., a chair, stool, or table. A majority of the victims choose a point of suspension which permits hanging from the standing posture, with feet, or at least the toes, on the ground, also low socioeconomic status leads to low ceiling house and the material used for hanging also matters.

Studies mention neck structure fractures ranging from 0 to 75% but the present study reports lower fracture rate of 2.97%. The reason for this kind of high incidence in the literature may be prolonged suspension leads to post-mortem fracture, improper dissection technique, and lack of uniformity in interpreting the fracture. Thus retrospective studies in this respect are not at all reliable.

Our study stresses that injury to neck structures in case of hanging is very rare and this has to be brought in to the notice of the law enforcing authority to wipe away the misconception they have. A careful examination of neck in suicidal hanging cases is of great importance in ascertaining the ante-mortem character of lesion and to exclude the possibility of homicide.

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