

AN AUTOPSY STUDY OF LIGATURE MARK IN CASES OF HANGING

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Abstract

Background: Hanging is one of the most common methodologies of committing suicide. The ligature mark in case of hanging leads to important part in the investigation. The correlation of external and internal findings helps to identify the different facts in case of hanging. **Materials and Methods:** The 60 hanging cases were studied with respect to age, gender, circumstances of death, type of ligature material, manner and apparent cause of death as recorded in the Panchanama report. **Result:** The incidence rate of hanging in our study was 5%. The most common age group was between 21 to 30years (37%). Hanging was preferred by males (77%) than females (23%). Nylon rope was used as the most common ligature material (39%). **Conclusion:** Enlightenment of people by educating them is the key in preventing suicidal thoughts. It is further suggested to find out the root cause and psychiatric illness responsible for suicide and design a health care protocol.

INTRODUCTION

Hanging is one of the most common methodologies of committing suicide. The apprehension to hang oneself may be impulsive or progressive. In the present times, majority of autopsies conducted nationwide are of suicides. In India, the suicide by hanging ranked second among the other modalities adopted to commit suicide with 31.5% cases to prove the same in the year 2009. Hanging is the preferred method of suicide along with the consumption of poisons in Maharashtra. The pattern of suicides reported from 35 megacities showed that Hanging (44.5%), Poisoning (20.6%) and Fire/Self-immolation (12.6%) were the predominant means adopted by the suicide victims. The number of deaths due to hanging is augmenting by each passing day in Mumbai.^[1]Cities and towns also harbor hanging as the commonest method of committing suicide. Hanging can be defined as a form of violent asphyxia death which is produced by suspension of the body by a ligature around the neck, where the constricting force is the weight of the body (complete hanging) or part of the weight of the body (partial hanging).^[2]

Depression due to psychological problems, failure in love and studies, loss of near and dear ones, financial problems may play a significant role in a person to hang oneself.^[3]

In this study, all the antemortem phenomenon like ligature mark, damage caused by the ligature to the

neck tissues (both external and internal) are investigated.

MATERIALS AND METHODS

The study was conducted at the post-mortem center attached to a University teaching hospital in Mumbai. The study duration was 2 years, from July 2009 to June 2011. During the specified period, 60 cases were studied with respect to different age groups and gender. The details about the victims regarding the circumstances of death, type of ligature material, manner and apparent cause of death were recorded from police requisition letter and inquest (Panchanama) report. External examination of neck was done with hand lens to correlate the ligature mark findings in relation to material, impression, pattern, color, type of knot, level of ligature and skin changes etc. Y shaped incision was taken to open the body and neck dissection was completed by layer wise. All gross findings were noted and portion of skin and sub cutaneous tissue from the ligature mark was excised and preserved in 10% formalin for histopathological examination. The opinion of the sections by pathologist was recorded.

RESULTS

Incidence of death due to hanging: 1140 autopsies were conducted during the two-year study period

(July 2009 to June 2011), of which 92 (8%) cases were of asphyxial deaths, while the rest 1048 (92%) cases constitute all other cases. In asphyxial deaths, 60 deaths were due to hanging while remaining 32 asphyxial deaths included deaths due to drowning, smothering, choking etc. In present study the incidence of death due to hanging was 5%.

Age and gender wise distribution: In the present study, death due to hanging was not reported below 15 years of age. The youngest victim was 16 years old and oldest was 85 years old. It was also observed that most of the victims 22 (37%) were in the age group 21 to 30 years; of which 16 were males and 06 were females, followed by 14 (24%) in the age group 31 to 40 years. The mean age for male was 37.65 years and for female was 29.64 years. It was observed that most of the victims 77% were males and 23% were females. The male to female proportion was 3.2:1. Details of Age and gender wise distribution of death due to hanging are given in [Table 1].

Occupation: In the present study, it was observed that unemployed (23%) and laborer (23%) constituted highest number of cases each, followed by students. [Figure 1].

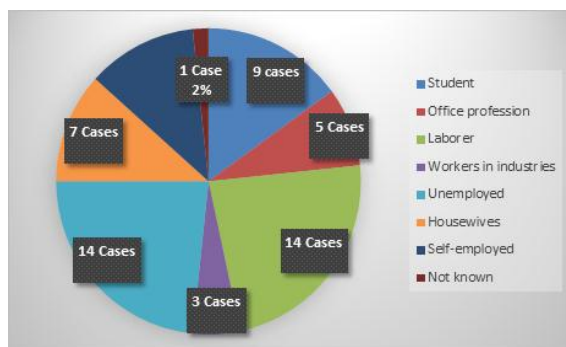


Figure 1: Occupational Status

Dried salivary stains in relation with position of knot in hanging: In the present study, in all cases the position of knot was recorded in which most common position of knot was observed at right side of the neck (62%) followed by left side of the neck (34%) and posterior of the neck (05%) respectively. The dribbling of saliva was noted in the form of dried salivary stains (20%) and was absent in majority (80%) cases. Out of 20% cases, salivary stains were present at right angle of mouth (07%) followed by at left angle of mouth (08%) and at middle of mouth (05%) respectively. It was also observed that there were no dried stains of saliva in cases where the position of knot was over posterior aspect of the neck.

Particulars of ligature mark: In the present study, ligature marks were completely encircling the neck in 07% cases, and it was incompletely encircling the neck of the victim in 93% cases. In majority of

deaths, the ligature mark was present above the level of thyroid cartilage (70%) followed by at the level of thyroid cartilage (20%) and below the thyroid cartilage (10%). The direction of the ligature mark was oblique and upward in all the deaths. The impression of ligature mark was faint in 07% cases, prominent in 48% cases and deep in 52% deaths respectively. The ligature mark was continuous in nature in majority cases i.e. 98% cases. Parchmentization of ligature mark was present in 95% deaths however absent in 05% deaths. Details regarding the particular of ligature marks are given in [Table 2].

Ligature Material: In the present study, the most common ligature material used by victim for hanging was Nylon rope in majority cases (i.e. 42%) and it was mainly preferred by male victims. Dupatta/Odhani were preferred as ligature material in 30% cases and it was mainly preferred by female victims.

Position of knot of ligature: In the present study, it was observed that the position of knot was over occipital region in 5% cases. The knot was present over the right side of neck in 61% cases, of which it was present at right occipital in 56% cases and right mastoid process in 5% cases.

Type of Hanging: Depending on the position of the knot, typical hanging was observed in 3 (5%) cases, whereas, atypical hanging was seen in 57 (95%) cases. Depending on suspension of the body, it was observed that in 50 (83%) cases there was complete hanging and in the remaining 10 (17%) cases there was partial hanging.

Fracture of Throat Skeletons: There were no fractures of hyoid bone, thyroid cartilage, cricoid cartilage or cervical vertebrae in any of the victim in our study.

Histopathological findings of the skin underneath the ligature mark: In our study, it was observed that there was congestion of epidermal and dermal blood vessels in 82% deaths, vascular congestion with hemorrhages in 13% deaths and vascular congestion with disruption of epidermal layer from dermal layer in 17% cases.

Histopathological findings in carotid artery: In our study, it was observed that deaths showed intimal tear, subintimal hemorrhages and disruption of intimal layer from medial layer in histopathology of carotid arteries; however, there were no changes noted in histopathology of carotid arteries in majority cases.

Cause of death: In our study, in majority of cases (97%), the cause of death was given as asphyxia followed by the complication of hanging like bilateral lobar pneumonia with hypoxic encephalopathy and compressive cervical myelopathy with hypoxic brain injury.

Table 1: Age and gender wise distribution of death due to hanging

Age groups (years)	Male		Female		Total	
	Number of cases	%	Number of cases	%	Number of cases	%
0 to10	0	00	0	0	0	0
11 to 20	4	07	4	07	8	13
21 to 30	16	27	6	10	22	37
31 to 40	13	22	1	2	14	24
41 to 50	3	5	1	2	4	07
51 to 60	5	8	2	3	7	12
61 to 70	1	2	0	0	1	2
71 to 80	2	3	0	0	2	3
81 to 90	2	3	0	0	2	3
Total	46	77	14	23	60	100

Table 2: Particulars of Ligature Mark

Particulars of Ligature mark		No.of cases	%
Encircling of Mark around the Neck	Complete	04	07
	Incomplete	56	93
Level of mark at neck	Above the level of thyroid cartilage	42	70
	At the level of thyroid cartilage	12	20
	Below the level of thyroid cartilage	06	10
Direction	Obliquely and upward	60	100
	Transverse and horizontal	00	00
Impression	Faint	04	07
	Prominent	29	48
	Deep	27	52
Continuity	Continuous	59	98
	Intermittent	01	02
Parchmentization	Present	57	95
	Absent	03	05

Table 3: Type of ligature material

Ligature material	Nature of ligature	Male		Female		Total	
		No	%	No	%	No	%
Saree	Soft	05	08	01	02	06	10
Dupatta		07	12	11	18	18	30
Towel		03	05	00	00	03	05
Lungi		05	08	00	00	05	08
Bed-sheet		01	02	00	00	01	02
Nylon rope	Hard	23	39	02	03	25	42
Electrical wire		02	03	00	00	02	03
Total		46	77	14	23	60	100

Table 4: Position of knot of ligature

Position of knot		Number of cases		%	
Posterior (Occipital)		34		05	
Right side	Right occipital	03	37	56	61
	Right mastoid process	03		05	
	Right sub-mental	00		00	
Left side	Left occipital	13	20	22	34
	Left mastoid process	07		12	
	Left sub-mental	00		00	
Anterior (Chin)		00		00	
Total		60		100	

Table 5: Histopathological findings in Skin

Histopathological changes	Number of cases	%
Normal epidermal and dermal tissues with unremarkable changes	11	18
Vascular congestion	49	82
Vascular congestion with hemorrhages	8	13
Vascular congestion with disruption of epidermal layer from dermal layer	10	17

DISCUSSION

In our study, 1140 autopsies were conducted during the two-year study period (July 2009 to June 2011). In asphyxial deaths, 60 deaths were due to hanging, and was studied in detail to ascertain the various causative factors, cause, manner of death and

injuries caused by ligature mark (external and internal) peculiar to hanging. Gross and histopathological changes in skin underneath the ligature mark of hanging and visceral organs were also studied for clinic-pathological correlation. In our study, the incidence of death due to hanging was 5%. In various similar studies, the incidence of

deaths due to hanging was found to be, 8.97% (Saini OP et al), 1.2% (Joshi R et al) which coincides with the present study but there are a few studies like 11.8% (Talukder MA et al) which do not coincide, may be due to different geographical areas, different constitution and life styles of people.^[4-9]

It was observed that most of the victims 22 (37%) were in the age group 21 to 30 years, of which 16 were males and 6 were females. The mean age for male was 37.65 years and for female was 29.64 years. The present study coincides with studies of, National Crime Record Bureau (NCRB - 2009) Saini OP et al, Luck JL et al, Davidson A et al, Elfawal MA et al.^[1,4,10-14]

It was observed that there was male preponderance. The male to female proportion was 3.2:1. It is often observed that men prefer to commit suicide by violent asphyxia (hanging) and women prefer other methods of suicide like burning, drowning, poisoning, etc. rather than hanging. The gender wise distributions of deaths due to hanging in various studies like Elfawal MA et al, Cooke CT et al, Dixit PG et al, and National Crime Record Bureau (NCRB - 2009) showed male preponderance as well.^[12-14]

In the present study, majority deaths due to hanging were observed among married individuals, which coincide with the studies of Sharma BR et al and Saini OP et al.^[4,15-18]

It was observed that unemployed and labourer were constituted highest number of cases 23% each, which coincides with the study of Madni OM et al.^[19] Poverty, alcohol addiction, stress & strain, heavy work load, financial crisis and subsequent frustration could be the reason for suicide.

The manner of death due to hanging was suicidal in all cases in both the genders. All of the cases confirmed as suicide according to the evidences at the scene, investigation reports and autopsy findings. Similar findings were observed in Davidson A et al, Cook CT et al.^[11,13] In majority cases the reason behind hanging was depression and stress which was also observed in the studies of Cook CT.^[13]

The classical signs of asphyxia are visceral congestion, peripheral cyanosis and petechial hemorrhages. These findings coincide with the studies of Luke JL, Dixit PG et al.^[10,14]

In all cases the position of knot was recorded in which most common position of knot was observed at right side of the neck (62%) followed by left side of the neck (34%) and posterior of the neck (05%) respectively. The dribbling of saliva was noted in the form of dried salivary stains (20%) however absent in majority (80%) cases. Out of 20% cases, salivary stains were present at right angle of mouth (07%) followed by at left angle of mouth (08%) and at middle of mouth (05%) respectively. These findings coincide with the study of Vijayanath V et al,^[15] but does not coincide with the study of Saini OP et al.^[4]

The ligature mark is vital evidence of asphyxial deaths. The character of the ligature mark depends on various factors like the nature of the ligature material, weight of the body acting as constricting force and the length of time of suspension. Microscopically, the ligature mark displays the usual characteristics of abrasion showing desquamation and flattening of cells of the epidermis. In the present study, ligature mark was completely encircling the neck in 07% cases, whereas, it was incompletely encircling the neck of the victim in 93% cases. In majority of deaths the ligature mark was present above the level of thyroid cartilage (70%) followed by at the level of thyroid cartilage (20%) and below the thyroid cartilage (10%) respectively. The direction of the ligature mark was oblique and upward in all the deaths. The impression of ligature mark was faint in 07% cases, prominent in 48% cases and deep in 52% deaths respectively. The ligature mark was continuous in nature in majority deaths (98%). Parchmentization of ligature mark was present in 95% deaths. These findings coincide with the studies of Luke JL,^[10] Dixit PG et al,^[14] however, Vijayanath V et al,^[15] observed the ligature mark was above thyroid cartilage in 92.43% cases, over thyroid cartilage in 4.2% cases and below thyroid cartilage in 1 case.

The most common ligature material used by victim for hanging was Nylon rope in majority cases (42%) and it was mainly preferred by male victims. Dupatta/Odhani was preferred as ligature material in 30% cases and it was mainly preferred by female victims. The nature of ligature mark was soft in 55%. The present study coincides with the studies of Luke JL,^[10] Cooke CT et al,^[13] Dixit PG et al,^[14] but does not coincide with studies of Sharma BR et al.^[6] In hanging the commonly used ligature material was nylon rope but it can be any household article or belongings of the victims, which is available at the time of impulse of suicide.^[5] It was observed that the position of knot over occipital region in 05% deaths. The knot was present over right side of neck in 61% victims, of which it was present at right occipital in 56% victims and right mastoid process in 05% victims however knot was observed over left side of neck in 34% victims, of which it was observed at left occipital in 22% victims and left mastoid process in 12% victims. It was also observed that there was no victim with position of knot over anterior of neck. The findings coincide with the study of Saini OP et al, but does not coincide with the study of Nikolic Seta.^[4,17]

Depending on the position of the knot, typical hanging was observed in 3 (5%) cases, whereas, atypical hanging was seen in 57 (95%) cases. Depending on suspension of the body, it was observed that in 50 (83%) cases there was complete hanging and in the remaining 10 (17%) cases there was partial hanging. This coincides with the studies of Elfawal MA et al,^[12] Saini OP et al,^[4] however, this does not coincide with the study of Sharma BR et al.^[18]

Histopathological examination of skin underneath the ligature mark showed normal epidermal and dermal tissues with unremarkable changes in 18% cases. These findings coincide with the study of Yadav A et al.^[16]

It was observed that 8% deaths showed intimal tear, subintimal hemorrhages (7%) and disruption of intimal layer from medial layer (27%) in histopathology of carotid arteries; however, there were no changes noted in histopathology of carotid arteries in 53% deaths. This coincides with the studies of Sharma BR et al but does not coincide with the study of Betz P et al.^[18-20]

CONCLUSION

In present study, there is an increasing frequency of hanging in urban population. In the management of these patients' prompt and rapid transport to hospital is of utmost importance. Enlightenment of people by educating them to burst out the work strain, frustration and emotional instability so that there will be decrease in suicidal thoughts. It is further suggested to find out causes and treat the psychiatric illness which is responsible to suicide.

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