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Original Article

Study of Suicidal Death due to Hanging in District Prayagraj, U.P.

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ABSTRACT

Hanging is one of the common methods of commiting suicide and it is considered suicide unless contrary is proved. The present study was conducted at the mortuary of Swaroop Rani Nehru Hospital associated with Moti Lal Nehru Medical College Prayagraj (U.P.), from 1st March, 2020 to 28th February, 2021. Total 299 cases of hanging were found in this duration. The different aspects of hanging cases like sex ratio, age group involved, ligature material used, position of knot, features of ligature mark, point of suspension, type of hanging and other Postmortem findings have been discussed in detail in this study.

Keywords: Suicide, Hanging, Ligature mark

INTRODUCTION

Virtually, all hangings are suicidal. Depending on the area of the country and the sex of the victim, hanging is either the second or third most popular method of suicide. People choose to give their life by hanging themselves because it is painless, done in private with grace, need no sophisticated instrument or substance, need no prior preparation or skill and even then it is surest and one of the quickest methods to bring one's death. Being so popular, it is the most frequent medicolegal situation to deal with in suicidal cases. Although hanging is hallmark of suicide, yet possible act of killing sometimes may get benefit of this fact. So, it is mandatory not to take hanging granted for suicide and therefore a forensic pathologist need to be most cautious dealing with them as forensic pathological evidences of homicidal act can easily get missed during autopsy. The situation needs more sincere efforts in dealing these deaths, from the other look likes, as the discriminating features among them are poorly established and mostly circumstance dependent parts of the body. Although pathological features suggestive of hanging are well documented, effects of variable combination of above factors need continuous observation and reporting to enhance their diagnostic and discriminatory values in such deaths. Ligature and position of knot, ligature material, duration of hanging, weight of the body, degree of suspension are in combination produce ligature marks and cause changes in the internal structure of neck and other parts of the body. Although pathological features suggestive of hanging are well documented, effects of variable combination of above factors need continuous

observation and reporting to enhance their diagnostic and discriminatory values in such deaths.

MATERIALS AND METHODS

The study was conducted in the mortuary of Swaroop Rani Nehru Hospital associated with Moti Lal Nehru Medical College Prayagraj (U.P.)

Study design: Descriptive cross-sectional study.

Study period: The present study was conducted between 1st March, 2020 and 28th February, 2021.

Study population: Cases of suicidal hanging deaths coming for medicolegal autopsy.

Sample size: 299 cases.

Inclusion Criteria

Cases with reliable history of suicidal hanging deaths coming for medicolegal autopsy.

Exclusion Criteria

1. Cases not accompanied with reliable and relevant persons for thorough interview, at the time of autopsy.
2. Unidentified bodies.
3. Cases of doubtful manner of death as per history and autopsy findings.
4. Cases with advanced putrefaction or mutilation of bodies

RESULTS

The study was conducted in the mortuary of Swaroop Rani Nehru Hospital associated with Moti Lal Nehru Medical College Prayagraj. A total of 2395 medicolegal autopsies were conducted during the period (1st March, 2020 and 28th February, 2021) of study, of which 17.28% cases of suicidal deaths were recorded. Out of these 414 cases of suicidal deaths, 12.48% cases of suicidal hanging deaths were considered and studied to see various changes in neck structures in deaths.

Table 1 shows that out of total 299 cases of hanging deaths, 152 were males and 147 were females.

Table 2 shows that maximum numbers of cases 35.78% were seen in the age group of 21-30 years followed by 31-40 years of age group 23.74%. The minimum numbers of cases were seen in 61 & above years i.e. 3.67%.

Above Table 3 shows that household clothing was the commonest type of ligature material used for hanging 66.2% cases followed by jute and nylon rope in 27.42%. The materials like newar, belt etc. were found to be used in 4.01% cases and electric wire/cable was used less frequently in 2.34% cases.

Table 1: Distribution of cases according to sex

Hanging	Males	Females
299	152(50.83%)	147(49.17%)

Table 2: Distribution of cases according to age groups

Age group (years)	No. (%)
0-10	0(0.00)
11-20	47(15.71)
21-30	107(35.78)
31-40	71(23.74)
41-50	42(14.04)
51-60	21(7.02)
61 & above	11(3.67)
Total	299(100.00)

Table 3: Frequencies of various types of ligature materials used by victims of hanging

Ligature material	No. (%)
Household clothing	198 (66.22)
Jute & Nylon rope	82(27.42)
Electric wire/cable	7(2.34)
Belt, newar and others	12(4.01)
Total	299(100.00)

Table 4 shows that in 42.81% of cases the knot was located on the right side of the neck and in 34.45% of cases on the left side of the neck. Typical site of the knot was seen only in 15.05% cases.

Table 4: Frequencies of different positions of knot of ligature in cases of hanging

Positions of Knot	No. (%)
On Right side of neck	128 (42.81)
On Left side of neck	103(34.45)
On Occiput/nape of neck	45(15.05)
On Front of neck/below chin	23(7.69)
Total	299(100.00)

Table 5 shows that ligature marks were commonly found incomplete (88.29%) in comparison to fewer complete ligature marks (11.71%). Marks were oblique in the majority of cases 86.96% and horizontal in the rest 13.04%. It is observed from above data that ligature mark was situated above, at the level and below thyroid cartilage in 94.98%, 4.35% and 0.67% cases respectively. Ligature marks were found shallow/deeply grooved in 53.52% of cases, however it was faint/just visible in 37.12% of cases and not visible in 9.36% cases. There was a single turn of ligature mark in 92.30% and multiple in 7.70% of cases respectively.

Parchmentisation of skin beneath ligature, a characteristic feature of ligature mark of hanging was present in 85.28% cases while other features like ecchymosis of margins, patterned ligature mark and periligature injuries found present in 49.16%, 23.75% and 14.38% of cases of hanging respectively.

Table 6 shows a large number of victims had used ceiling fans 41.13% or ceiling hook 38.47% for suspension. However, few victims had used branches of the tree 14.39%. The other used points of suspension were window grill, door handle, iron pole, swing beam collectively constituting 6.01%.

As shown in Table 7, cases are arranged depending on the degree of suspension of bodies as complete hanging in 89.30% and partial hanging in 10.70% of cases. Table 8 shows, bluish discoloration of nails in 78.60% was most consistent followed by subconjunctival hemorrhage

Table 5: Frequencies of various features of ligature mark in cases of hanging

Features of ligature mark	No. (%)
Appearance of ligature mark	
Complete	35(11.71)
Incomplete	264(88.29)
Direction of ligature mark	
Oblique	260(86.96)
Horizontal	39(13.04)
Position on neck	
Above thyroid cartilage	284(94.98)
Over thyroid cartilage	13(4.35)
Below thyroid cartilage	02(0.67)
Indentation of ligature mark	
Shallow or Deeply grooved	160(53.52)
Faint or Just visible	111(37.12)
Not visible	28(9.36)
Number of turns of ligature mark	
Single ligature mark	276(92.30)
Multiple ligature mark	23(7.70)
Characteristics features	
Parchmentisation	255(85.28)
Ecchymosis of margins	147(49.16)
Patterned ligature mark	71(23.75)
Periligature injuries	43(14.38)

Table 6: Frequencies of various point of suspension in cases of hanging (n=299)

Point of Suspension	No. (%)
Ceiling Fan	123(41.13)
Branch of Tree	43(14.39)
Ceiling Rod /Hook	115(38.47)
Others	18(6.01)
Total	299(100.00)

Table 7: Hanging: Type of hanging among male and female victims(n=299)

Type of Hanging	Males No. (%)	Females No. (%)	Total No. (%)
Complete	138(46.15)	129(43.14)	267(89.30)
Partial	14(4.68)	18(6.02)	32(10.70)
Total	152(50.83)	147(49.16)	299(100.00)

Table 8: Hanging: Frequencies of characteristic external autopsy findings among victims

External Postmortem Findings	No. (%)
Bluish discoloration of nails	235(78.60)
Subconjunctival hemorrhage	63(21.07)
Protrusion of tongue	112(37.46)
Seminal discharge	110(36.79)
Faecal/urine discharge	43(14.38)
Dribbling of saliva	212(70.90)
Blood tinged discharge through mouth & nostrils	65(21.74)
Glove and stocking pattern of hypostasis	136(45.48)

21.07%, protrusion of tongue 37.46%, seminal discharge 36.79%, faecal /urine discharge 14.38%, dribbling of saliva 70.90% and blood stained discharge through mouth & nostrils 21.74%.

Table 9 shows that white glistening appearance of the ligature base was most consistent in 92.98% followed by tracheal and laryngeal congestion in 88.62% and 90.63% cases respectively. Other autopsy features like froth of varying nature and regurgitated food particles were observed in 8.70% and 4.68%. Contusions of subcutaneous tissue/ underneath strap muscles observed in 28.76% cases. Injuries to thyroid glands, intimal tear of carotid artery and laryngeal contusions have been observed in 4.68%,17.73% and 2.01% cases respectively. In a lesser number of cases fracture of hyoid bone 4.01% and cervical spinal injuries 4.01% were also observed. The fracture of the tracheal rings was not observed in any of the cases.

Table 9: Hanging: Observations of neck structures (larynx, trachea, hyoid, neck muscles, thyroid and spine) during internal examination

Features	No. (%)
White glistening appearance at ligature base	278(92.98)
Laryngeal Congestion	271(90.63)
Laryngeal Contusion	6(2.01)
Fracture of thyroid cartilage	0(0.0)
Fracture of hyoid	12(4.01)
Tracheal congestion	265(88.62)
Presence of blood mixed froth in trachea	26(8.70)
Presence of regurgitated food in trachea	14(4.68)
Fracture of tracheal rings	0(0.00)
Intimal tear of carotid artery	53(17.73)
Cervical spinal injuries	12(4.01)
Contusion of strap muscles	86(28.76)
Contusion of sternocleidomastoid muscle	28(9.36)
Injury to thyroid gland	14(4.68)
Decapitation of head	00(0.00)

DISCUSSION

Hanging being one of the most common causes, constituted 12.48% of total unnatural death brought to the mortuary for autopsy. Similarly, Baishya and Mahanta [1] reported 11.40% and Jagtap *et al.* [2] reported 12.91% of the deaths due to hanging among reported unnatural deaths.

In the present study incidence of hanging was more in males than females. Out of 299 cases, 50.83% victims were males and 49.16% cases were females.

Maximum numbers of cases 35.78% were seen in the age group of 21-30 years followed by 31-40 years of age group 23.74%. The results of our study is in agreement with most other studies like Muninarayan *et al.* [3]; Udhayabanu *et al.* [4]; Mohanty *et al.* [5]; Bhosle *et al.* [6]; Ahmad *et al.* [7]; Rao [8]. However, Rahim and Das [9] reported a peak of hanging deaths in the age group 11-20 years.

On analyzing the ligature material, it was found that the majority of victims used household clothes 66.22% followed by jute & nylon rope in 27.42% cases. which is similar to findings of other authors like Udhayabanu *et al.* [4] saree 47.74% was the most common ligature material used for hanging, Sonawane *et al.* [10] dupatta as the commonest ligature material used in 46.5% of cases, Ahmad *et al.* [7] dupatta was identified in 41.28% hanging cases.

Results of this study differ from that of Bhosle *et al.* [6] and Pradhan *et al.* [11] in ligature material which was some kind of rope (nylon/rope) in 53.01% and 47.72% cases respectively. It shows that easily available materials were used as a ligature.

In our study 42.81% of cases the knot was located on the right side of the neck and in 34.45% of cases on the left side of the neck. Typical site of the knot was seen only in 15.05% cases.

Similar results have been obtained by Sonawane *et al.* [10] and Ahmad *et al.* [7] in 48.29% and 48.95% cases respectively. Other researchers who came with the same observation are Dekal and Shruthi [12] and Chand *et al.* [13]. Contrary to most studies Baishya and Mahanta [1] and Ambade *et al.* [14] reported the most common position of knot behind the left mastoid in 35.75% in cases of hanging.

Overall, knot was found at atypical positions in 84.95% cases in this study. The same has been observed by Naik *et al.* [15] and Meera and Singh [16] who reported atypical ligature positions in the majority of cases.

In this study ligature marks were found non continuous in 88.29% and continuous in 11.71% of cases of hanging. Similar results obtained by Ahmad *et al.* [7] who reported non continuous mark in 83.27% and continuous mark in 8.71%. Ligature mark of hanging found to be incomplete in majority of previous other studies done by Sharma *et al.* [17] Rao [8] and Saisudheer and Nagaraja [18]. However, studies of Jayprakash and Sreekumari [19] can be called inconsistent with our results as he reported continuous ligature marks in 22% of victims of hanging.

Obliquity of ligature mark is characteristic of hanging observed in 86.96% in our study. Similarly ligature marks were found oblique in majority of cases to Rao [8]; Jayprakash and Sreekumari [19]; Khalkho and Pathak [20]. More so, Patel et al. [21] observed oblique ligature marks in 100% of victims of hanging.

In the present study, the most common position of ligature mark observed was above the level of thyroid cartilage 94.98%. Most common and characteristic, above the thyroid, position of ligature in cases of hanging had also been confirmed previously in studies of Rao [8] 82.58%, Dekal and Shruthi [12] in 84.95%, Mukherjee [22] 80% and Baishya and Mahanta [1] 80% cases above the thyroid cartilage. Rarely in some studies, as conducted by Chand *et al.* [13], position of ligature mark was above thyroid in just over 50% of cases.

Other less frequent positions observed in this study were at thyroid cartilage in 4.35% followed by below the thyroid cartilage in 0.67%. Frequency of ligature position at the level of thyroid cartilage varies among different studies. Chand *et al.* [13] found the place of ligature mark at the level of the thyroid cartilage in 48.07% cases and below the thyroid cartilage in 1.92% cases. Contrary to which, Rao [8] study found ligature mark at the level of thyroid in 10.22% cases and below thyroid in 7.20% cases and Dekal and Shruthi [12] at the level of thyroid in 8.41% cases and below the thyroid cartilage in 6.64%. Ligature mark below the level of thyroid cartilage in significant percent was reported by Davison *et al.* [23] 6.66%, Elfawal and Awad [24] 24.59% and Sharma *et al.* [17] in 93.75% cases the ligature mark was above the level of thyroid cartilage while in 6.25% cases the ligature mark was at the level of thyroid cartilage in hanging deaths.

Prominence of ligature mark usually determined by hardness of ligature material and period of suspension. In our study, the ligature marks were found grooved in

53.52%, faint or just visible in 37.12% cases of hanging. Ligature marks were not clearly visible in 9.36% of cases. Similarly ligature marks were found grooved in studies of Rao [8]; Abouhashem *et al.* [25] and Khalkho and Pathak [20] as 94.31%, 74.24%, 61.1% and 66.28% respectively. Rest of the marks were either faint or not visible in different proportions.

Ligature mark of hanging may show single or multiple turns. However it is usually uncommon to observe more than two loops of ligature mark. In present study most of the ligature marks are found to be of single in number 92.30%. Similar observations have been made in previous studies conducted by Sharma *et al.* [17] in 97.82%, Khalkho and Pathak [20] in 93.02% of hanging.

Features characteristic of hanging like parchmentisation, ecchymosis at margins of ligature mark, patterned ligature mark and periligature injuries are variably in studies depending upon ligature material and period of suspension. In our study these features are observed in 85.28%, 49.16%, 23.75% and14.38% cases respectively.

Parchmentisation was present in 85.28% in our study, Khalkho and Pathak [20] found it in 54.65% cases. Ecchymosis was present in 49.16%, Khalkho and Pathak [20] and Sharma *et al.* [17] in 62.80% and 38.05% cases of hanging. Patterned ligature marks in 23.75% cases, Ahmad *et al.* [7] also found it in 21.95% cases. Periligature injuries in 14.38% cases, Sharma et al. [17] and Abouhashem *et al.* [25] found it in 9.27% and 5.6% of cases of hanging.

The point of suspension is a fixed structure to which ligature is tied to hang. In our study, ceiling fan was the commonest point of suspension in 41.13% cases of hanging followed by ceiling rod/hook in 38.47%. Similar incidences have been reported in a series of studies previously done by Vijayakumari [26]; Khalkho and Pathak [20] where ceiling structures are the commonest point of suspension. However in the study of Ambade *et al.* [14] branches of tree were the commonest point of suspension which in our study, were reported as point of suspension in 14.39% of cases.

Contrary to our study, other structures (hook in the wall/ window grill/door handle/Iron pole/swing beam) were also reported as commonest suspension point in studies of Nowers [27]; Cooke *et al.* [28]; Davison *et al.* [23] and Gunnell *et al.* [29]. Pal *et al.* [30] found iron guider was the commonest ligature point in 23.77% cases followed by ceiling fan in 22.95% and trees in 18.85% cases.

The present study reported complete hanging in 89.30% cases and partial hanging in 10.70% cases. Similarly, other studies have reported nearly 90% cases of hanging as complete as conducted by Patel *et al.* [21]; Vijaynath *et al.* [33]; Naik *et al.* [15]; Dekal and Shruthi [12]; Rao [8], unlike our study, Khalkho and Pathak [20] observed complete hanging in 70.93% and Ambade *et al.* [14] in 67.7% cases. Further lower incidence of complete hanging was reported by Sharma *et al.* [31] and Suárez-Peñaranda *et al.* [32] in 68% and 62.4% cases.

Bluish discoloration of nails in our study, bluish discoloration of nails/mucosa was noticed in 78.60% cases. Our findings are comparable with studies of Sonawane et al. [10] in which cyanosis was present in 79.82% cases, Sonkar *et al.* [34] in 70% cases, Pal *et al.* [30] in 51.63% cases. Quite higher frequencies than our studies have been reported by Sharma *et al.* [17] in 97.07% of hanging cases.

Subconjunctival hemorrhage in our study was present in 21.07% cases. Our study is in agreement with studies conducted by Sonawane et al. [10] and Shrivastava *et al.* [35] who observed subconjunctival hemorrhage in 21% and 22.1% cases respectively. However, lower incidence from our study has been reported by Khalkho and Pathak [20] as 11.63%.

Protrusion of tongue in our study, the protrusion of the tongue was noticed in 37.46% of cases. Our result is comparable with that of Sahoo *et al.* [36] and Sharma *et al.* [17] who observed tongue protrusion in 29.87% and 31.71% cases.

Discharge through natural orifice (Seminal/Faecal/urine discharge) present study on the tip of glans penis in 36.79% cases. Our findings are in agreement with that of Pal *et al.* [30] and Khalkho and Pathak [20] who noticed it in 30.32% and 31.40% cases. While Rawat and Rodrigues [37] who noticed it in 10.89% cases. In our study, faecal/urine discharge was seen in 14.38% cases of hanging. Patel *et al.* [21] noticed discharge of urine/faeces in 13.75% cases. Unlike this study, Rawat and Rodrigues [37] have not found any discharge in any of his cases.

Dribbling of saliva from angle of mouth, pathognomic of antemortem hanging, found in 70.90% cases of our study. Our finding is consistent with studies of Patel *et al.* [21] and Pal *et al.* [30], who observed dribbling of saliva from the angle of mouth of the side opposite to the knot in71.25% cases and 64.75% cases respectively. Grossly decreased values have been reported by Rawat and Rodrigues [37], who observed it in 27.72% of cases. Sahoo *et al.* [36] and Sharma *et al.* [17] observed dried salivary stains from angle of mouth in 39% and 28.29% cases respectively.

Blood tinged discharge through mouth & nostrils, in the present study was present in 21.74% comparable results reported by Sonkar *et al.* [34] and Pal *et al.* [30] in 29.50% and 25% cases respectively. Comparatively, too high values as 71% by Khalkho and Pathak [20] and too low values as1.16% by Shaikh *et al.* [38].

Glove and stocking pattern of hypostasis in 45.48% cases of hanging. Similar observations made by Sahoo *et al.* [36] and Khalkho and Pathak [20] in 67.53% and 68.60% cases of hanging.

White glistening appearance of subcutaneous tissue is observed in 92.98% of cases, similar results has been reported by Sonawane *et al.* [10] and Patel *et al.* [21] who got it in all 100% cases of hanging. Relatively lower incidence of white glistening appearance observed by Sharma *et al.* [17] who reported it in 76.58% cases only followed by Khalkho and Pathak [20] 45.35% cases.

In our study, laryngeal and tracheal congestion was appreciated in 90.63% and 88.62% cases of hanging which is in accordance with Khalkho and Pathak [20] who reported it in 94.19% cases. Ahmad *et al.* [7] also reported tracheal and laryngeal congestion in 95% of hanging.

Injury to neck structures namely strap muscles, sternocleidomastoid, larynx, laryngeal cartilage, tracheal rings, thyroid gland and hyoid bone. These are observed in 0.00%, 0.00% and 4.68% cases of hanging in present study. Similar to our results, Sharma *et al.* [17] and Chowdhury *et al.* [39] found fracture of thyroid cartilage in 0.98% and 2.27% cases of hanging.

In present study, strap muscles are found injured in 28.76% and sternocleidomastoid was found contused in 9.36% of cases of hanging. Similarly, Ahmad *et al.* [7] observed haemorrhage in strap muscles in 28.22% cases of hanging.

In our study 4.01% cases of hanging have shown fracture of hyoid bone, all aged above 40 years. Chowdhury *et al.* [39] found it in 1.89%, Ahmad *et al.* [7] in 14.11% of cases. Rao [8]; Dekal and Shruthi [12]; Chand *et al.* [13] and Shaikh *et al.* [38] study observed the fracture of hyoid bone in 6.06%, 15.48%, 9.5% and 11.63% cases respectively. In a substantial number of studies researchers did not observe fracture of hyoid Khalkho and Pathak [20].

Extreme physical disruption in the form of complete or partial decapitation rarely may occur. No such case was observed in our study.

Horizontal tears in intima of carotid arteries observed in only 17.73% of cases in present study. Our result is similar to previous studies conducted by Hejna et al. [40] who reported it in 16.1%. Contrary to our result Penaranda *et al.* [41] and Jayprakash and Sreekumari [19], observed intimal tears of carotid each in 9.1% of cases. Frequency much higher as 52.20% by Sharma *et al.* [17] to no carotid artery tears by Patel *et al.* [21] is in record.

Variable number of cases in our study had shown presence of blood mixed froth and presence of regurgitated food in Trachea in 8.70% and4.68% cases respectively.

CONCLUSION

Correct interpretation of autopsy findings in a case of hanging is of extreme importance in making a confirmatory diagnosis of death owing to hanging. Our study revealed that the findings vary and could be found in many combinations, sometimes with exceptions to the generally accepted. Awareness of these combinations and the exceptions are of crucial importance in coming to a conclusion in a suspected case of hanging so as to avoid any erroneous opinion.

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