

# To Evaluate The Pattern Of Ligature Marks And Their Relationship To Death Mode

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## ABSTRACT

**Aim:** To evaluate the pattern of ligature marks and their relationship to death mode

**Materials and methods:** This research comprised 100 instances. External and internal inspection of the corpse were among the observations made during the autopsy. The ligature material was investigated wherever it was present. The ligature marks were studied by an external examination of the neck. The skin above the ligature mark was transferred to Pathology for histological investigation to determine if the ligature mark was antemortem or postmortem.

**Results:** In the current research, total suspension was seen in 80 instances (80%), compared to 20 cases (20%) with partial suspension. Atypical ligature marks were seen in 85 instances (85%), whereas typical ligature marks were observed in 15 cases (15%). In the current research, soft ligature materials such as lungis, duppattas, sarees, and so on were employed in 55 instances (55%) and hard ligature materials such as nylon rope in 13 cases, electric wire in 5 cases, coir rope in 25 cases, and plastic binder in 2 cases (45%). A running noose with a sliding knot was employed in 56 instances (56%) and a fixed knot in 44 cases (44%). In the current investigation, there was no fracture of the thyroid cartilage in 95 instances (95%) and only 5 cases (5%) had a fracture of the superior horn on the left side of the thyroid cartilage. In the current investigation, no fracture was found in 97 instances (97%) and only three cases (3%) indicated fracture of the greater cornu on the right side of the hyoid bone.

**Conclusion:** History, circumstantial evidence, examination of ligature material, ligature mark characters like a single, interrupted, oblique mark above the level of the thyroid cartilage with slipping of the ligature mark, periligature injuries, and other internal findings on dissection of the neck tissues all pointed to suicide in all of the cases of hanging that were studied.

**Keywords:** ligature marks, death, hanging

## Introduction

Suicide by hanging refers to the act of suspending one's body from a ligature around one's neck, with the weight of the body acting as the constriction.<sup>1</sup> This method is often employed as a last option after previous methods of killing oneself (poisoning, slashing one's throat, etc.) have failed. Anyone at any time might get the idea to hang themselves, and

it is one of the most popular means of self-harm in India.<sup>2</sup> The idea can arrive on its own or as part of a chain of events. More than 8,000 people committed suicide worldwide in 2012, with 1,34,600 of the deaths occurring in India. Of the 1,34,600 suicide deaths in India that year, 41,726 (or 31%) were by hanging. Thus, in 2012, it was determined that suicide by hanging was the second leading cause of death

in India. One of the leading causes of mortality is exposure to pesticides. Expert skill and care is required to determine the cause and manner of death based on the "mark of hanging," which varies based on factors such as the height of the suspension point, the nature and composition of the ligature material used, the victim's weight, the length of time they were suspended, and the objects that came in contact with the ligature material and the skin of their neck. When determining the cause and method of death in a case involving several ligatures around the neck with two or more fixed knots, other injuries to the head, neck, and body may cloud the situation. That's why the ligature mark is so useful in determining what happened to the body. Therefore, it is crucial to investigate the ligature used and any marks left on the body during the autopsy. A ligature leaves a scar in the form of a furrow or groove in the tissue, which is white at first but then becomes yellow or yellowish brown as it dries. Some oozing of blood and serous fluid may be seen on occasion. Time dries the furrow out, giving it a brownish grey colour. When the ligature is thin and the material is dense, the resulting mark is more obvious. Suspension duration is related to the ease with which a ligature mark may be identified. A well-taken shot will highlight the difference between the darker and lighter patches of skin. The process of taking many images at intervals until the autopsy is complete is known as "bracketing" or "colour saturation."<sup>3</sup> In most cases, a single line or mark is discovered. Spiral turns, repeated turns around the neck, or the upward displacement of material after application due to a fall may also result in several markings. The majority of the time, the mark will be oblique and appear above the thyroid cartilage, between the larynx and the chin. The indentation is made facing upward, parallel to the mandibular line, and is unfinished at the rear, leaving only a vague imprint of the knot at the point of suspension (often the mastoid process on one side). When someone is partially hung, a mark may appear on or below their thyroid cartilage. If a ligature is wrapped around a person's neck more than

once, the resulting scar will be oblong and round. Close to the knot, there is an inverted "V" shaped mark.<sup>4</sup>

### **Materials and methods**

The current research was conducted at the Department of Forensic medicine and toxicology. The institutional ethics and research committee approved the study.

This research comprised 100 instances. The police and family provided detailed information on the deceased and the circumstances of death. In some cases, this information was complemented by either a visit to the place of the incident or pictures of the scene of the occurrence. This analysis includes all instances filed with a history of hanging. Decomposed remains with disguised ligature marks were omitted from the research. External and internal inspection of the corpse were among the observations made during the autopsy. The ligature material was investigated wherever it was present. There are two types of ligature materials: hard ligature materials and soft ligature materials. Ropes, metallic chains, and so forth were deemed hard. Soft ligature materials included sarees, dupattas, lungis, and towels, among others. The ligature marks were studied by an external examination of the neck. The skin above the ligature mark was transferred to Pathology for histological investigation to determine if the ligature mark was antemortem or postmortem.

### **Results**

Males accounted for 60 cases (60%) in the sex distribution pattern, whereas females accounted for 40 cases (40%). According to the above data, the age group 25-35 years (45%) has the highest number of hangings in the study population, followed by 35-45 years (25%) and below 25 years (21%) and over 45 years (9%). In the current research, total suspension was seen in 80 instances (80%), compared to 20 cases (20%) with partial suspension. (Table 2) Atypical ligature marks were seen in 85 instances (85%), whereas typical ligature marks were observed in 15 cases (15%). (Table 3) In

the current research, soft ligature materials such as lungi, duppatta, saree, and so on were employed in 55 instances (55%) and hard ligature materials such as nylon rope in 13 cases, electric wire in 5 cases, coir rope in 25 cases, and plastic binder in 2 cases (45%). In the current investigation, the knot was found in 30 cases (30%) in the right occipital area, 22 cases (22%) below the right ear, 21 cases (21%) in the left occipital region, 16 cases (16%) occipital knot, 9 cases (9%) below the left year, and 2 cases (2%) below the chin. (Table 4) A running

noose with a sliding knot was employed in 56 instances (56%) and a fixed knot in 44 cases (44%). In the current investigation, there was no fracture of the thyroid cartilage in 95 instances (95%) and only 5 cases (5%) had a fracture of the superior horn on the left side of the thyroid cartilage. In the current investigation, no fracture was found in 97 instances (97%) and only three cases (3%) indicated fracture of the greater cornu on the right side of the hyoid bone.

**Table 1 Gender and Age distribution of the case**

Gender	Number	Percentage
Male	60	60
Female	40	40
Age in years		
Below 25	21	21
25-35	45	45
35-45	25	25
Above 45	9	9

**Table 2: Degree of Suspension**

Degree of Suspension	Number	Percentage
Partial	20	20
Complete	80	80

**Table 3 : Ligature Mark**

Ligature mark	Number	Percentage
Typical	15	15
Atypical	85	85

**Table 4 : Position of the knot**

Position of the Knot	Number	Percentage
Left occipital	21	21
Below the right ear	22	22
Below the chin	2	2
Below the left ear	9	9
Occipital	16	16
Right occipital	30	30

**Table 5: Fracture of thyroid cartilage**

Fracture of thyroid cartilage	Number	Percentage
Present	5	5
Absent	95	95

## Discussion

The ligature mark in hanging requires a thorough analysis. Inspection, palpation, and internal examination, followed by histological investigation, must be performed in a systematic way. The composition and texture of the ligature material, as well as the kind of hanging (full / partial), play an important role in connecting the results in the individual instances. In the majority of situations, incomplete investigation or the omission of certain minor but significant discoveries results in the generation of incorrect and inconclusive evidence, which leads to confusion.<sup>4</sup>

Males accounted for 60 cases (60%) in the sex distribution pattern, whereas females accounted for 40 cases (40%). According to the above data, the age group 25-35 years (45%) has the highest number of hangings in the study population, followed by 35-45 years (25%) and below 25 years (21%) and over 45 years (9%). Unemployment, love disappointment, marital conflict, financial troubles, dowry harassment, and other circumstances all have an impact on the aforementioned distribution. Similar results were obtained in other researchers' experiments.<sup>5-10</sup> These research were conducted in industrialised nations with abundant work prospects, Westernized culture, and effective government assistance programmes.

In the current research, total suspension was seen in 80 instances (80%), compared to 20 cases (20%) with partial suspension. Atypical ligature marks were seen in 85 instances (85%), whereas typical ligature marks were observed in 15 cases (15%). The observations made above were comparable to those made by other researchers.<sup>11-13</sup> The bulk of the research group was adult persons who had committed suicide, resulting in a higher incidence of complete hangings. The bulk of the abnormal marks were caused by the location of the knot or any intervening item such as clothes, bony protrusion (angle of the jaw), lengthy plaits in Indian women, and the beard. This is in contrast

to the results of previous investigations.<sup>14-16</sup>

The explanation for this was that their research sample was limited to victims of lower age groups who had been victims of either accidental or homicidal hanging. In the current research, soft ligature materials such as lungi, duppatta, saree, and so on were employed in 55 instances (55%) and hard ligature materials such as nylon rope in 13 cases, electric wire in 5 cases, coir rope in 25 cases, and plastic binder in 2 cases (45%). Balabantara et al.<sup>16</sup> found similar results in their experiments. Because the suicidee use widely accessible ligature material. This contradicts the conclusions of Jonathan P. et al.<sup>15</sup> Dog lead, dressing gown cord, electric wire, suit bag webbing, telephone cord, shoes strings, bathrobe belt, and other items were utilised as ligature materials. Running nooses with sliding knots were employed in 56 instances (56%) and fixed knots in 44 cases (44%). Studies done by Slobodan N. et al.<sup>17</sup> and Eisenmenger. W. et al.<sup>18</sup> yielded similar results. In the current research, there was no fracture of the thyroid cartilage in 95 instances (95%) and only 5 cases (5%), there was a fracture of the superior horn on the left side of the thyroid cartilage. The causes include total victim suspension, ossification rising with age beyond 30 years, and pressure over the horns put on the spine due to increased traction. Similar results were obtained in investigations conducted by Slobodan N.,<sup>17</sup> Eisenmenger. W. et al.<sup>18</sup>, and Green H. et al.<sup>19</sup>

In the current investigation, no fracture was found in 97 instances (97%) and only three cases (3%) indicated fracture of the greater cornu on the right side of the hyoid bone. The victim was above the age of 55. The reason for this is because the fracture grows with age, as evidenced in normal and complete hangings, instances with the maximum degree of ligature mark on the back of the neck, increasing time of suspension, and with a thin firm ligature material. Similar results were obtained in investigations conducted by A. Momonchand et al.<sup>7</sup> and Sarangi M.P. et al.<sup>20</sup>

## Conclusion

The normal ligature mark has a portion hanging out, whereas the atypical ligature markings have the whole hanging out. A posterior knot was most often used, and the sliding knot was the most common ligature knot. If a thin and strong or hard ligature material is utilised, a furrow or groove will be left behind as a visible reminder of the ligature's placement. Similarly, a clear ligature mark is often seen in situations of total hanging. Subtle fading of the mark is seen with softer and wider ligature materials.

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