Post Mortem Study Of Injuries to the Internal Neck Structures in Cases of Death Due To Hanging

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Abstracts: Virtually all hangings are suicidal in nature and all ligature strangulations are homicidal in nature. So for the purpose of police investigation differentiation between two is very important and necessary. It is generally said that deaths due to hanging are devoid of any injury to the internal neck structures while in strangulation these injuries are always present. So injuries to the internal neck structures are sometimes used as differentiating factor between hanging and strangulation along with other factors. **Aim:** The aim of this study is to know the prevalence of injuries to the internal neck structures in deaths due to hanging. **Method:** This study was conducted at mortuary of the civil hospital, Ahmadabad in the year 2013. Total 40 cases of deaths due to hanging were randomly selected. **Result:** Out of these 40 cases 26(65%) were male and 14(45%) were female. 22 (55%) cases were showing injuries to the internal neck structures in the form of haemorrhage in to the soft tissues and strap muscles or fracture of superior horn of thyroid cartilage or greater cornue of hyoid bone. However these injuries are mainly found present beneath the ligature mark except some indirect injuries e.g. haemorrhage at the origin of sternomastoid muscle and avulsion fracture of greater cornue of hyoid bone due to over stretching of thyro-hyoid membrane. These injuries in cases of hanging are not extensive as found in cases of death due to strangulation. In one case extension distraction fracture of cervical spine at c3-c4 level was found which very rare finding in suicidal hanging is. **Conclusion:** From the present study it is evident that injuries to the internal neck structures are not very uncommon in the hanging. Though the extent and frequency of injuries are less compare to the ligature strangulation. [Vora P NJIRM 2014; 5(6):68-72]

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Introduction: Hanging is that form of asphyxia which is caused by suspension of the body by a ligature which encircles the neck, the constricting force being the weight of the body or part of it.[1] Virtually all hangings are suicide and all ligature and manual strangulations are homicide.[2] In ligature strangulation, the pressure on the neck is applied by a constricting band that is tightened by a force other than the body weight.[2]

According to the Di Maio[2], in the cases of hanging, injury to the internal structures of neck is exception rather than rule.

Fracture of thyroid cartilage, cricoids cartilage and hyoid bone can only be considered antemortem if there is blood at fracture site. In Di Maio's opinion, blood detectable only microscopically at fracture site is insufficient to prove that fracture of antemortem.[2]

Any substance that is available at the time of the impulse has been used by the suicide as a ligature for hanging. The mark is usually situated above thyroid cartilage between larynx and chin and is directed obliquely upwards following line of mandible and interrupted at the back.[3] On dissection, subcutaneous tissues under ligature mark is usually dry, white, and glistening,-more marked if body has been suspended for a long time. In strangulation subcutaneous tissues under mark are ecchymosed and injuries to muscles of neck are common. While in hanging injuries to muscles of neck are rare.[3]

Fracture cervical spine occurs in judicial hanging and in suicidal hanging where victim jumps from a height and his fall is arrested by sudden jerk of ligature. In few cases the cornu of thyroid cartilage as a result of traction through thyroid ligament, may be fractured, more commonly in old persons. However hyoid bone by direct lateral compression is as a rule rarely fractured.[3]

In the cases of deaths due to hanging, in the neck tissues there may be surprisingly little to find with an absence of laryngeal fracture or strap muscle haemorrhage being common finding, especially if a soft ligature material has been used. However, the literature suggests that an average figure for the incidence of soft tissue haemorrhage would be about 20-30% of cases and for laryngeal fractures approximately 35-45% of cases. Fractures of both hyoid and thyroid may be seen.[4]

Some controversy in the literature exists as to the frequency of the injuries to the hyoid bone and thyroid cartilage in hanging. It is the general consensus of opinion that such laryngeal and hyoid damage are the exception rather than rule and usually limited to older persons who have calcified hyoid bone which may easily crack. Also the length of drop and subsequent jerk may be related to the frequency of fracture, but one can safely say that the proportion of such cases is much smaller than in manual strangulation.[5]

There is considerable difference of opinion about the frequency of hyoid fracture in two types of strangulations e.g. manual and ligature, but it certainly can occur in ligature strangulation mainly in older persons where calcification has taken place and where the constricting pressure of ligature has caused compression beyond the point of elasticity.[5]

Many hyoid bones have an anatomical variant in which there are small joints between greater cornu and body. These can give the impression of excessive mobility and thus false presumption of fracture but careful dissection and absence of any haemorrhage at site of mobility will distinguish two.[5]

In manual or ligature strangulation the main feature being sought is sub mucosal haemorrhage in any position inside larynx but especially immediately beneath the vocal cords.[5]

In India hanging is among the top 5 methods of choice for committing suicide.[6]

In more usual form of hanging i.e. without a drop, local injury is exceptional. The hyoid bone and the thyroid cartilage may sometimes be fractured where they have at times become calcified or rigid. Generally, the pressure in hanging is not sudden or severe enough to cause fracture of these structures. Usually the only appearance revealed by dissection of neck is that of a white band of condensed tissue under the external mark. Polson[7] (1985) reported fracture of hyoid bone in only 25% cases of hanging. In almost twice as many cases thyroid cartilage was found fractured.[7]

In hanging, dissection of neck usually reveals some degree of bruising of connective and muscular tissues in relation to ligature mark. These changes may be relatively slight in certain cases. The hyoid bone may be fractured in hanging. Fracture of laryngeal cartilage and injury to laryngeal mucosa is relatively uncommon. In ligature strangulation dissection of neck usually reveals moderate degree of bruising to connective and muscular tissues but such bruising is not an invariable finding.[8]

Fractures of hyoid bone and thyroid cartilage or of both together are by no means uncommon in hanging. The thyroid cartilage usually fractures at junction of superior horn and lamina and hyoid at or near junction of greater cornu and body. The fractures are usually associated with at least a little haemorrhage but this is not invariable in hanging and absence of haemorrhage does not necessarily means that the body was suspended after death.[9]
In hanging examination of neck at autopsy may not disclose any noteworthy changes in the deep structures. In ligature strangulation injuries which may be found in the neck are hemorrhages between muscles, fracture of thyroid and cricoids cartilages, in other instances there may not be any obvious lesions in neck, the deceased showing only the general signs of asphyxia.[10]

Bruise and at times rupture of muscle fibers of platysma and sternomastoid especially their sternal attachments may be noticed in complete hanging or long drops. The hyoid bone may rarely get fractured at junction of outer third and inner two third or there may be traction fracture through pressure by the ligature on thyro-hyoid ligament with extravasations of blood in and around it.

Fracture of superior horn of thyroid cartilage rarely noticed from pressure on thyro-hyoid ligament.[11] Bruise of subcutaneous tissues and muscles of neck especially underneath the ligature and its knots is noticed more in strangulation than in hanging. The extent of bruising depends upon degree of pressure exerted. Injury of hyoid bone is not commonly noticed here because level of constriction is well below the bony land mark and traction on the thyro-hyoid ligament is negligible. Fracture of thyroid cartilage specially one or both superior horns may be noticed at times. Author comes across only three such cases.[11]

Materials and Methods: This study was conducted at the mortuary of the civil hospital Ahmedabad in the year 2013. Necessary permission and consent have been taken from investigating agency and relatives of the deceased. Total 40 cases of deaths due to hanging were randomly selected for the purpose of this study. Detailed history of the case was taken from the police and relatives of the deceases. After external examination of ligature mark, internal structures of the neck were examined carefully by layer wise dissection. To avoid artefactualhaemorrhage(i.e. Gordon &Prisloo artefact) in neck, brain and visceral organs of the chest were removed before doing the dissection of the neck. Utmost care was taken to avoid artefactual damage to the hyoid bone and thyroid cartilage during their removal. Fractures were first palpated in situ then also confirmed after en block removal of the internal neck structures along with the tongue.

Following Findings Are Recorded:

1.Hemorrhage in soft tissues and strap muscles
2. Fracture of the greater cornu of hyoid bone
3. Fracture of the superior horn of thyroid cartilage
4. Fracture of cervical spine.

Observations:

Table 1: Sex Wise Distribution of Cases

Male	26
Female	14
Total	40

Out of total 40 cases of hanging 26(65%) were males and 14(35%) were females.

Table 2: Age and Sex Wise Distribution of Cases

Age group	Male	Female
0-10	0	0
11-20	0	6
21-30	10	0
31-40	10	4
41-50	4	2
51-60	0	2
>60	2	0
Total	26	14

More than half number of cases are belongs to the young adult age (20 to 40 yrs) group

Table 3: Distribution of Cases According To Haemorrhage in To the Soft Tissues & Strap Muscles Of Neck.

Age group	Male	Female
0-10	0	0
11-20	0	2
21-30	4	0
31-40	2	2
41-50	0	0
51-60	0	2
>60	2	0
Total	8	6

Out of 40 cases of hanging, 14(35%) cases were showing haemorrhage in to the soft tissues and strap muscles of neck.

Table 4: Distribution of Cases According To Presence of Fracture of Thyroid Cartilage And Hyoid Bone

Age group	Fracture of superior horn of thyroid cartilage	Fracture of greater cornu of hyoid bone	Fracture of both hyoid bone and thyroid cartilage	Fracture of cervical spine
0-10	0	0	0	0
11-20	0	0	0	0
21-30	0	0	0	0
31-40	0	0	4	0
41-50	4	0	0	1
51-60	0	1	0	0
>60	0	0	2	0
Total	4	1	6	1

Out of total 40 cases, in 6 cases fracture of both thyroid cartilage and hyoid bone was present, while in 4 cases fracture of only thyroid cartilage was present, and in 1 case fracture of only hyoid bone was present. Fracture of cervical spine was present in one case which is very rare finding in suicidal hanging. So out of total 40 cases, in 11 (27.5%) cases laryngeal fracture was found present.

Table 5: Distribution of Cases According To Nature of Ligature Material

Type of ligature material	Hemorrhage in Soft tissue & strap muscles	Fracture of thyroid cartilage	Fracture of hyoid bone	Fracture of both hyoid bone & thyroid cartilage	Hemorrhage in soft tissue and fracture of both	Fracture of cervical spine
Soft	6	2	1	1	2	1
Hard	4	2	0	1	2	0

Out of total 40 cases, in 30 cases soft ligature material was used and in 10 cases hard ligature material was used. Out of 30 cases of soft ligature material, in 13(43%) cases injury to internal neck structure was present including 1 case of cervical spine fracture.Out of 10 cases of hard ligature material 9(90%) cases were showing injury to the internal neck structures.

Discussion: In the present study 40 cases of death due to hanging were selected randomly to know the prevalence of injuries to the internal neck structures. In the present study 22 (55%) cases were showing injuries to the internal neck structures in the form of ecchymosis(extravasations) in to the soft tissues and strap muscles of the neck, fractures of superior horn of thyroid cartilage, greater horn of hyoid bone and in very rare case cervical spine fracture.

90% cases in which hard ligature material e.g. plastic, nylon or cotton rope was used were showing injury to the internal neck structures. This may indicate the direct relationship between the type of ligature material and possibility of injuries to the internal neck structures. Out of total 30 cases in which soft ligature material was used, only about half (50%) of cases were showing injuries to the internal neck structures.

In one case in which soft ligature material i.e. sari was used by obese woman and location of the knot was at front of neck, extension distraction fracture of c3-c4 through intervertebral disc was present with extensive haemorrhage at the front aspect of cervical spine. Cervical spine fracture is a rare occurrence in the suicidal hanging and found when there is a long drop, obese victim or there is any disease of the cervical spine e.g. osteoarthritis.[2]

Literature suggests that an average figure for the incidence of laryngeal fractures would be approximately 35% to 45%. In the present study incidence of laryngeal fracture was 30% which is slightly lower than the figure mentioned by B.Knight.[4]

Out of total 40 cases, 15% cases fracture of greater cornu of hyoid bone was present along with fracture of superior horn of thyroid cartilage. In one case, only fracture of hyoid bone was present. In all these cases,distal fragments of fractured greater cornu were displaced outwards suggesting the avulsion type caused by stretching of the thyro-hyoid ligament.[11]

In the present study 10%cases were showing fracture of superior horn of thyroid cartilage. All these fractures were occurred at the junction of the superior horn and plate of the thyroid cartilage. Distal fragment was displaced inwards suggesting the compression. Pressure over the thyro-hyoid membrane by the ligature in hanging is appears to be the possible mechanism for this type of fracture.[2, 11]

Literature suggests that an average figure for the incidence of soft tissue haemorrhage would be about 20% to 30%.In the present study, 35% cases were showing haemorrhage in to the soft tissues and strap muscles of neck which is only slightly higher than the figure mentioned by B.Knight.[4]

In the study of hanging cases by Di Maio[2], on examination of internal neck structures, in more than half of cases there are no injuries. Of 83 consecutive hanging examined prospectively only 10 had fracture (12%). Nine showed fractures of thyroid cartilage especially superior horns none fracture of hyoid bone and one a fracture of cervical spine. As per VJM Di Maio[2] this last case involved an obese woman with arthritic changes of cervical vertebrae who stepped off a ladder dropping a short distance before fully suspended. 17 (20.5%) of 83 cases excluding those with fractures, showed haemorrhage in the strap muscles. These findings are almost similar with the present study.[2]

Fractures of hyoid and thyroid were not associated with height of suspension, sex of victim and width of ligature. Likelihood of fracture did increase with age of victim.[2] In the present study, fractures of thyroid and hyoid were present in the victims above 33 years of age which is consistent with the findings of various authors.[2,3,4]

Conclusions: It is mentioned in the various textbooks of the forensic medicine that injuries to the internal neck structures in cases of death due to hanging are exception rather than rule. From the present study it is evident that injuries to the internal neck structures are not very uncommon in the hanging. Though the extent and frequency of injuries are less compare to the ligature strangulation. Frequency of fracture of hyoid bone and thyroid cartilage increases with increase in the age of the victim. From the present study it can be said that chances of these fractures are very less when the age of the victim is less than 30 years. When hard ligature material e.g. plastic, nylon, cotton rope is used, chances of injuries to the internal neck structures are increased.

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