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A Study of Findings in Asphyxial Deaths Due to External Compression of Neck

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Abstract **Original Research Article**

This present study was performed on cases of asphyxial death due to external compression of neck due to hanging and strangulation brought for medicolegal autopsy at mortuary of SRN Hospital, MLN Medical College, Allahabad, and Uttar Pradesh, India. The neck dissection was done as per technique devised by Prinsloo and Gordon [1]. Taking into consideration the importance given to hyoid bone fracture in hanging, strangulation cases by many authors fracture of hyoid bone had been studiedmeticulously Of the total 3322 medicolegal autopsies done at mortuary of S.R.N.Hospital, Allahabad during the period starting July 2011 to June 2012, 82 cases deaths were as a result of external compression of neck, amounting to an incidence of 2.4%. Of all asphyxial deaths hanging accounted for 84.1% of cases while strangulation accounting for 15.8% of cases with ligature strangulation being 30.7% and throttling being 69.2%. Males accounted for maximum number of hanging as well as strangulation cases.hanging was common in 21-30 age group while strangulation was common in 11-20 age group. None of the hanging cases showed hyoid bone fracture while all cases of throttling showed fractured hyoid. Medicolegal autopsy, Asphyxial death, hanging, strangulation.

Keywords: Medicolegal autopsy, Asphyxial death, hanging, strangulation, hyoid bone.

INTRODUCTION

The word Asphyxia is derived from Greek word asphuxia—a, meaning no and sphyxis meaning pulse. In forensic medicine asphyxia means interruption of respiration by mechanical means. External compression of neck is among the common modes leading to asphyxia which includes hanging wherein a body is suspended and the constricting force is weight of body or part of body, Strangulation involves compression of the neck structures by a force other than the body's own weight. The constricting force can be applied by a ligature as in ligature strangulation or by application of hands as in throttling (manual strangulation) or other objects like stick (bansdola), flexed knees (knee bend) and flexed elbows(mugging).

With enough force to impair respiration, the victim will typically lose consciousness within10-15 seconds [2]. Neck having no bony protection is vulnerable to external injury also within its relatively small diameter course the airway, vascular supply to the brain, the spinal cord and other vital nerves, and the cervical vertebral column. External force can injure many of these important structures. The airway is anchored at its superior end by the thyroid cartilage and the hyoid bone anchoring airway at its superior end, are vulnerable to fracture by the external force exerted on the neck. Studies indicate that the thyroid and cricoid cartilage can be broken with static loads of 16 and 21 kg, respectively [3]. The carotid arteries can be compressed against the transverse process of the fourth to sixth cervical vertebrae to obstruct blood flow when static load between 2.5 and 10 kg, depending on the direction of force, is applied to neck[4].

Asphyxial signs like face congestion, petechial haemorrhages are seen on the skin of the face or eyelids, conjunctivae, epiglottis and laryngeal mucosa. The lips, and the mucous membrane of the mouth are blue. Dribbling of saliva is found from the angle of mouth.

Injuries due to external compression of neck are most marked on the neck. In hanging the ligature mark in the neck is the most important sign of death from hanging. The ligature produces a furrow or groove in the tissue which is pale in colour, but later it becomes hard like parchment, due to the drying of abraded skin.

The mark is usually situated above the level of thyroid cartilage, between the larynx and the chin.

Patterned abrasions and contusions of the skin of the anterior neck are more common in strangulations. In ligature strangulation the ligature mark is horizontal and usually below the level of thyroid cartilage, encircling the neck completely with or without overlapping ligature ends. While in throttling Fingernail marks are superficially incised curvilinear abrasions, occurring singly or in sets. The lungs, visceral organs, brain and meninges show congestion in asphyxial deaths which is seen in both strangulation and hanging with varying frequency.

For differentiating hanging and strangulation the hyoid bone has been regarded as the most important integral part of internal examination at the autopsy table the hyoid bone is divided into segments; lateral portions form the greater cornua or horns, which are continuous with the central portion or the body, of the hyoid. The greater cornua and body are separated by various synchrondoses or ossification centers and are associated with variably developed lesser cornua or horns which are found at the site of junction between the body and the greater cornua [5].

AIMS AND OBJECTIVES

The aim is to study diagnostic criteria in asphyxia deaths due to external compression of neck with special reference to hyoid bone fracture in differentiation of hanging and strangulation.

MATERIALS AND METHODS

Medicolegal post-mortem examination and x-ray of neck done at mortuary during a period of one year from July 2011 to July 2012 on deceased dying due to hanging, ligature strangulation and throttling at M.L.N. MEDICAL COLLEGE HOSPITAL AND S.R.N. HOSPITAL ALLAHABAD.

Exclusion: Deaths due to asphyxia other than caused by external neck compression were not included.

RESULT & DISCUSSION

Of the total 3322 post-mortems done during July2011 To June 2012 the number of deaths due to external compression of neck were 82. Of all asphyxial deaths hanging accounted for 84.1% of cases while strangulation accounting for 15.8% of cases (ligature strangulation being 30.7% and throttling being 69.2%).

Table-1: Case distribution according to sex of victims

Type of compression	Male cases	% of male cases	Female cases	% of female cases	Total cases
Hanging	41	59.42	28	40.57	69
strangulation	9	69.23	4	30.76	13
throttling	6	66.66	3	33.33	9
Ligature strangulation	3	75	1	25	4

Over all the incidence of hanging and strangulation was higher in males than in females. In strangulation the incidence of throttling was higher in both sexes and separately, also males had higher incidence of throttling as compared to females Male constituted 59.42% of total 69 hanging cases and 69.23% of total 13 strangulation cases. Females accounted for 40.57% of total 69 hanging cases and 30.76% of total 13 strangulation cases.

Table-2: Incidence of hanging and strangulation in various age groups

Age group	HANGING	% of hanging case	STRANGULATION	% strangulation of cases	THROTTLING	% of throttling cases	Ligature strangulation	% of l.strangulation
0-10	0	0	1	7.6%	1	11.1%	0	0
11-20	9	13.0%	9	69.2%	7	77.7%	2	50%
21-30	30	43.4%	1	7.6%	0	0	1	25%
31-40	18	26.0%	1	7.6%	0	0	1	25%
41-50	8	11.5%	1	7.6%	1	11.1%	0	0
51-60	2	2.0%	0	0	0	0	0	0
61-70	2	2.0%	0	0	0	0	0	0

Age group 11 to 30 constituted more than 70% of total 13 strangulation cases while hanging cases were maximum in the age group of 20 to 40 the incidence being about 70% of total 69 hanging cases while it was lowest in the age group of51-70 yrs.. Specifically maximum incidence of strangulation was in the age group of 11-20 yrs. and hanging in the age group of 21 to 30 yrs. Strangulations were homicidal while all hangings were suicides.

Table-3: Case distribution according to site of occurence

TYPE OF EXTERNAL COMPRESSION	RURAL	% of rural	URBAN	% of urban	total
Hanging	42	60.86	27	39.13	69
strangulation	13	100	0	0	13
Throttling	9	100	0	0	9
Ligature strangulation	4	100	0	0	4

There was a rural/urban variation of cases. Incidence of hanging was higher in rural areas as compared to urban areas. Strangulation cases were observed exclusively from rural areas and throttling outnumbered ligature strangulation cases.

Table-4: Level of constricting force/ligature

LEVEL of ligature	HANGING Total cases	HANGING % of cases	LIGATURE STRANGULATION Total cases	LIGATURE STRANGULATION % OF cases	THROTTLING Total cases	THROTTLING % of cases	TOTAL
ABOVE THYROID CARTILAGE	58	84.5	1	25	6	66.6	65
AT LEVEL OF THYROID CARTILAGE	10	14.49	3	75	3	33.33	16
BELOW THYROID CARTILAGE	1	.01	0	0	0	0	1
total	69		4		9		82

Observations revealed that the level of ligature mark was above thyroid cartilage in majority of observed hanging cases, an incidence of 84.5% was observed while 14.49% of total observed hanging cases had ligature at the level of thyroid cartilage and only 0.01% had ligature mark below the level of thyroid cartilage. In ligature strangulation maximum number of cases had ligature mark lower in the neck. 75% of all ligature strangulation cases showed ligature mark at the level of thyroid and 25% of all ligature strangulation cases had mark below thyroid cartilage. In throttling the level of compression as interpreted by the level of bruise marks had an incidence of 66.66% above thyroid cartilage and 33.33% incidence at the level of thyroid cartilage.

Table-5: Incidence of hyoid bone fracture hanging and strangulation

TYPE OF EXTERNAL COMPRESSION	CASES HAVING HYOID BONE FRACTURE	% OF CASES HAVING HYOID BONE FRACTURE
HANGING	0	0
LIGATURE STRANGULATION	0	0
THROTTLING	9	100%

Fracture of hyoid bone was not found in any of the cases of hanging or Ligature strangulation while it was found in all cases of throttling.

Table-6: Displacement of fractured bone fragment of hyoid bone

TYPE OF EXTERNAL COMPRESSION	CASES HAVING ADDUCTED HYOID BONE FRACTURE	% OF CASES HAVING ADDUCTED HYOID BONE FRACTURE
HANGING	0	0
LIGATURE STRANGULATION	0	0
THROTTLING	9	100%

Fracture of laryngo-hyoid complex is the most essential finding and fracture of hyoid bone, though wrongly, is regarded by many as criteria of differentiating hanging and strangulation. There are many variables that determine whether hyoid bone will fracture in strangulation factors like magnitude of force applied, precise position of application of force, rigidity of hyoid bone and possibly shape of hyoid bone [9].

Some kind of bone or cartilage fracture was observed in 75.3% of hanging cases. The hyoid bone was found fractured in all cases of throttling and was not found in either hanging or ligature strangulation. The fractured segment was displaced in wards in all the cases indicating the force and pressure being applied from sides and directly over the hyoid bone. The results of present study were consistent with the studies of Smith and Fiddes [11]. Practically never fractured in hanging, Mukherjee J.B. [12]. Not found in 500 cases of hanging, Modi J.P. [13]. Fracture is rare in hanging.

Table-7: Site of fracture of hyoid bone

TYPE OF EXTERNAL COMPRESSION	CASES HAVING FRACTURE IN PROXIMAL 2/3 PORTION OF GREATER CORNUA	CASES HAVING FRACTURE IN DISTAL 1/3 PORTION OF GREATER CORNUA	% OF CASES HAVING FRACTURE IN PROXIMAL 2/3 PORTION OF GREATER CORNUA	% OF CASES HAVING FRACTURE IN DISTAL 1/3 PORTION OF GREATER CORNUA
THROTTLING	7	2	77.8%	22.2%

The site of fracture of hyoid bone was greater cornua of hyoid bone in all the fractured hyoid cases. The fracture was at junction of distal 1/3rd and proximal 2/3rd of greater cornua of hyoid bone in 77.77% of observed throttling cases.

The incidence of thyroid cartilage was varied It was absent in throttling cases while only 0.04% of hanging cases had thyroid cartilage fracture. Ligature strangulation had a higher incidence at 33.33%. Fracture of thyroid cartilage is not common. It was noticed in 0.01% cases of total hanging cases observed, while throttling had an incidence of 33.33% of observed throttling cases. Depending on the force of compression there is injury to the underlying structures of neck. Injury to neck muscles was found in 40.75% of hanging cases while in strangulation it was higher for Ligature strangulation and highest in throttling cases. Injury to blood vessels of neck was noted in only10.8% cases of hanging.

The underlying muscles showed bruising and hemorrhage in 40.75% of observed hanging cases, 50% cases of observed ligature strangulation and 66.66% in throttling cases [8]. in their prospective study observed injury to sternocliedo- mastoid muscle in 54% of cases of deaths due to external compression of neck. The intimal injury of blood vessels was noted in 10.8% of cases of hanging in a study [9]. Carotid artery intimal injuries in 9.1% cases, the jugular vein in 2.2% cases [10]. Reported transverse laceration of intimal layers the carotid artery in 16.1% of the cases of hanging.

Table-8: Case distribution according to presence of congestion of visceral organs

TYPE OF EXTERNAL COMPRESSION	**TOTAL CASES HAVING VISCERAL CONGESTION**	**% OF CASAES HAVING VISCERAL CONGESTION**
HANGING	64	92.75%
LIGATURE STRANGULATION	4	100%
THROTTLING	9	100%

Visceral congestion is due to obstructed venous return and capillo- venous congestion. Congestion of viscera was found in 92.75% of hanging cases while the incidence in ligature strangulation and throttling it was 100%.

Table-9: Incidence of other injuries present on body of hanging and strngulation victims

TYPE OF EXTERNAL COMPRESSION	**TOTAL CASE WITH INJURIES**	**% OF CASES HAVING INJURIES**
Hanging	23	33.3%
strangulation	3	75%
throttling	9	100%

Injuries present over other parts of body give an idea about the resistance offered by the deceased. The injuries were noted in 33.3% cases of hanging, it was 75% in ligature strangulation and in throttling cases all cases had some kind of injury over the body.

CONCLUSION

Taking the present study of ``Hyoid bone fracture in cases of asphyxial deaths resulting from constricting force round the neck`` it is concluded that incidence of hyoid bone fracture is almost nil or rare in cases of hanging where the constricting force act on the neck in a sliding or tangential manner. Recent increased reporting of hyoid bone fracture in hanging can be attributed to sensitive diagnostic equipment like CT. However, increasing incidence of hyoid bone fracture after the age of 40 years can be concluded only after taking larger numbers of such cases, which need further continuous study in this regard. In cases of throttling, the hyoid bone is usually fractured, as the constricting force is greater in magnitude over a larger area mostly directly acting upon the hyoid bone itself. Given the importance to the hyoid bone fracture for differentiating hanging and strangulation pre autopsy procedures will minimize the chances of artefacts and improve accuracy of reporting of ante mortem nature of fracture. Use of pre autopsy X-ray or CT, Pre autopsy endoscopic visualization of thyro-hyoid structures and pre autopsy ultrasound examination of neck are some measures which will minimize the error in differentiation of ante mortem nature of fracture. CT scan of neck will also be helpful but there are operational limitations of use of CT scan for this purpose.

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