

Forensic Analysis of Strangulation and Its Association with Hyoid Bone Fractures.

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ABSTRACT

Introduction: Strangulation a type of asphyxia that results in neck constriction without suspension of body associated with higher incidence fractures of hyoid bone. Strangulation rate differs in various communities and in various geographic areas. A fractured hyoid bone points out homicidal deaths so it carries a greater significance in forensic medicine as an evidence of strangulation in unnatural deaths as this bone is not fractured normally.

Study Objective: To estimate the frequency of strangulation cases in forensic practice and their association with hyoid bone fractures.

Study design, Setting and duration: Exploratory study conducted over 3 years during 2016-2019 at LUMHS Hospital Jamshoro /Hyderabad.

Methodology: The data of 36 unnatural deaths cases due to strangulation was recorded in the form of proforma. Both male and female gender cases were included with age limits of 15 years to 75 years through non-probably sampling. Information regarding biodata, nature, cause and findings were noted in particular hyoid bones were evaluated in terms of symmetry, fusion and fracture. Analysis of data was accomplished using chi-square on SPSS version 22nd.

Results: There were 29(46.03%) male cases out of which 20 (69.0%) had hyoid bone fused while 9 (31%) unfused hyoid there were 34(53.97%) female cases 15 (44.1%) out of which had hyoid bone fused and 19(55.88%) had their hyoid bones unfused (p-value 0.003) Fractures of hyoid bones were seen in 30(47.65%) cases and 33 (52.4%) cases had no hyoids bones fractures. Hyoid bones were symmetric in 26 cases while asymmetric were found in 37 cases (p value 0.0002). Hanging cases were 25(39.68%), garroting cases were 08(12.70%), throttling cases were 9(14.29%) while ligature strangulation cases were 21(33.33%) the difference between fractured and non-fractured cases was significant (p- value 0.01).

Conclusions: There exists significant difference between hyoid bone fractures among various Strangulation modalities, symmetry and fusion of hyoid bones.

Key words: Forensic medicine, Fractured hyoid bone, Symmetric and asymmetric bones.

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Introduction:

Hyoid, a U-shaped bone lies in the neck anteriorly supported by thyroid cartilage while superiorly by the mandible and posteriorly by cervical spine. This bone has no bony articulation and serves to maintain the pharyngeal patency for respiration and swallowing. Direct trauma to this bone is very rare (0.002% to 1%) and its dislocations are even rarer. Injuries to hyoid bone breaks the pharyngeal patency compromising airway and may damage the external carotid artery¹. One-third of the homicides by strangulation get their hyoid bone fractured that helps the postmortem diagnosis of strangulation, young males are more susceptible such fractures than elders and female^{2,3}. Majority of unnatural deaths following asphyxia resulted from neck compression which is also known as strangulation when neck constriction is not associated with body suspension. Fractures of hyoid bone are more frequent in manual

strangulation followed ligature strangulation while these are least observed in hanging. Cases of strangulation differ from community to community and geographical area location around the world. These certain variations have greater significance in neck regional surgeries as well as forensic medicine legal procedures as evidence in strangulation and hanging being associated with the fractures of said bones⁴⁻⁶. This research work aimed at determining the association between the fracture of hyoid bone with fusion, symmetry and different modes of strangulation at LUMHS Hospital Jamshoro /Hyderabad.

Material and Method:

This study was conducted in Department of Forensic Medicine at LUMHS Hospital Jamshoro /Hyderabad. Sindh, Pakistan over 3 years (March 2016 to March 2019). Inclusion criteria were unnatural deaths due to any modality of strangulation while exclusion criteria were cases of firearm and

burns along with other unnatural deaths. After thorough examination and findings 63 cases including hanging, garroting, ligature strangulation or throttling were selected. The dissected hyoid bones were numbered for identification with specific codes and suspended in formalin solution for 72 hours and after washing and drying bones were kept in acetone for another 72 hours for defatting. Data was recorded on proforma and was incorporated in tabular form, analyzed by using SPSS version. Bones were grouped in different categories according to gender, age and mode of strangulation⁷. There were 29 hyoid bones from males while there were 34 bones from females. The examination of bones was carried out for fracture, fusion and symmetry and bones were considered symmetric when the middle of all its transverse diameters falls on the sagittal axis and it was considered asymmetric when deviating to right or left⁸.

Results:

The male proportion in our study was 46.03%(29) out of which 69.0%(20) had their hyoid bone fused whereas the bone was not fused in 31%(9) males, the female proportion was 53.97%(34) with fused cases as 44.1%(15) and unfused hyoid bone cases

were 55.88%(19). The difference between the fractured and non-fractured vs fused and unfused cases was significant with p-value of 0.003 [Table-1]. Fractures of hyoid bones were seen in 30(47.65%) cases and 33 (52.4%) cases had no hyoid bone fractures with symmetric hyoid in 26 cases and asymmetric hyoid in 37 cases, the comparison between fractured and non-fractured symmetric and asymmetric hyoid bones was highly significant with a p-value of 0.0002[Table-2]. Hanging cases were 39.68%(25) out of which 19.05%(12) were fractured and 14.29%(9) were non-fractured, garroting cases were 12.70%(8) with 3.17%(02) fractured hyoid and 9.52%(06) non-fractured hyoid bones, throttling cases were found 14.29%(9) with 12.70%(8) as fractured hyoid cases while 1.59%(01) as non-fractured hyoid bone and the proportion of ligature strangulation was 33.33% (21) in which 19.05%(12) were found fractured hyoid while 14.29%(9) were having non-fractured hyoid bones and the difference between various types of strangulations in terms of fractured and non-fractured hyoid bones was significant statistically with p-value 0.01[Table-3, Fig-2].

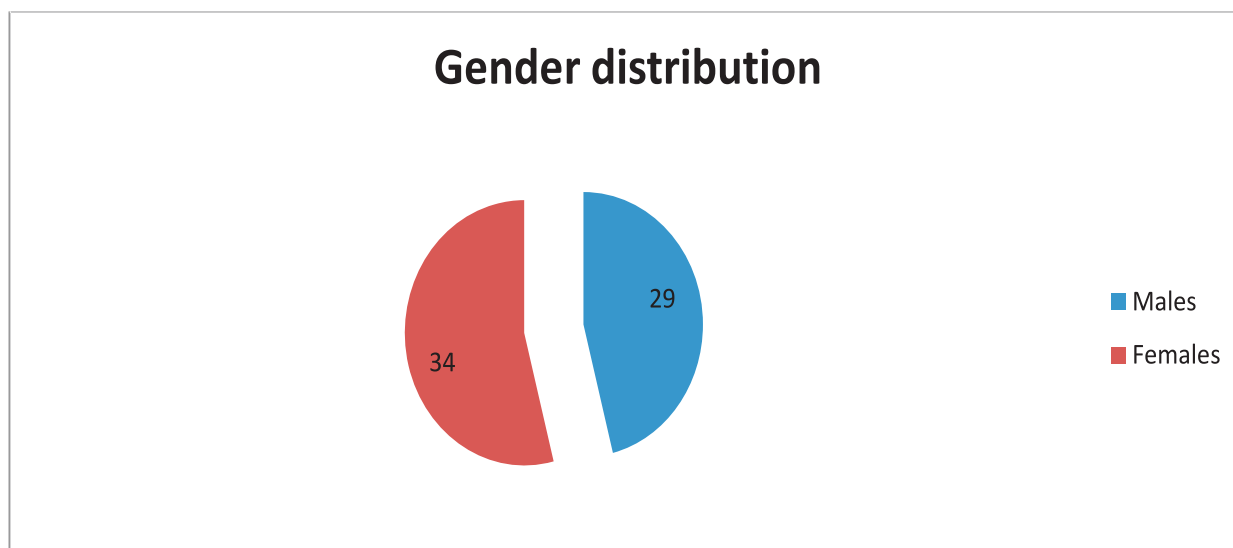


Figure-1: Pie chart of gender distribution

Table-1: Chi-square of fractured and non-fractured cases in fused and unfused hyoid bone

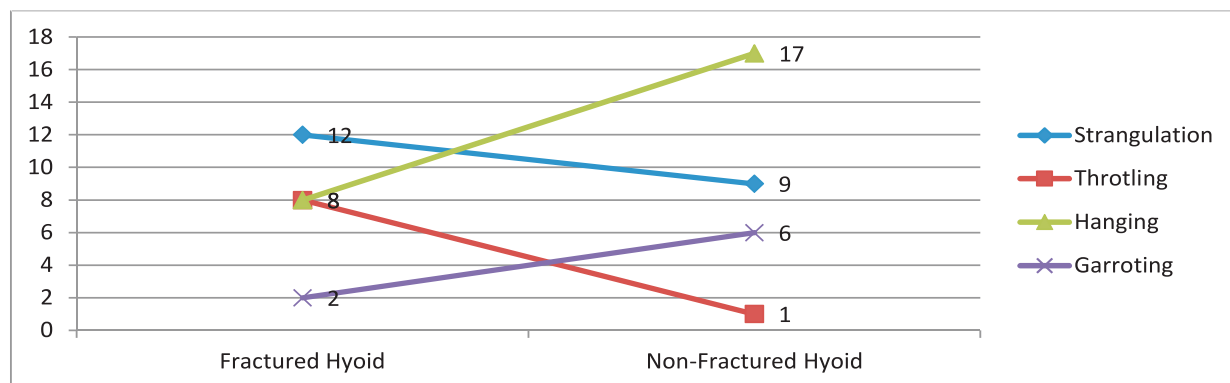
S. No	Parameter	Fractured	Non fractured	Row Total	X ²	P-Value
1.	Fused	23(36.51%)	12(19.05%)	35(55.55%)	8.76	0.003
2.	Non fused	07(11.11%)	21(33.34%)	28(44.45%)		
3.	Column Total	30(47.62%)	33(52.80%)	63(100%)		

Table-2:Chi-square of fractured and non-fractured symmetric and non-symmetric bones

S. No.	Parameters	Fractured Hyoid Bones	Non-Fractured Hyoid bones	Row Total	X ²	P-Value
1.	Symmetric	20(31.75%)	06(9.52%)	26(41.27%)	13.3	0.0002
2.	Non-Symmetric	10(15.87%)	27(42.86%)	37(58.73%)		
3.	Column Total	30(47.62%)	33(52.80%)	63(100%)		

Table-3: Comparison between fractured and non-fractured hyoid bones in various types of strangulation

S. No.	Parameters	Fractured	Non-Fractured	Row Total	X ²	P-Value
1.	Lig. Strangulation	12(19.05%)	09(14.29%)	21(33.33%)	10.99	0.01
2.	Throttling	08(12.70%)	01(1.59%)	9(14.29%)		
3.	Hanging	08(12.70%)	17(26.98%)	25(39.68%)		
4.	Garroting	02(3.17%)	06(9.52%)	08(12.70%)		
5.	Column Total	30(47.62%)	33(52.38%)	63(100%)		

**Figure-2: different patterns of succide****Discussion:**

Fractured hyoid bones very important in forensic proceedings in unnatural death caused strangulation and in others cases where neck structures injuries are suspected. The hyoid fracture is determined through various factors like shape, symmetry, sex, age and its fusion because bone elasticity is lost on complete ossification or calcification, further the material, mode and force applied for strangulation determines the fractures⁷.

Kalyan et al (2018) reported his study findings that 12 bones out of 30 were found symmetrical while 18 bones were found asymmetrical⁸. Leksan et al (2005) showed that the symmetrical bones were more common in males while females had more asymmetrical hyoid bones that is inconsistent with our present findings⁹. Another Indian study by Mukhopadhyay et

al (2006) reported the incidences as 93.1% as symmetrical hyoid bones while 6.9% as asymmetrical hyoids bones that may be attributed to geographical, racial and age factors along with the sample size studied¹⁰. Comparable findings were reported by Harjeet K et al (2010) as complete fusion was reported by them in 38(23%) male cases and 28(33%) in female cases¹¹. The radiology based studies conducted by Bhavana et al (2015) and Dalati et al (2005) on hyoids shows incidence of hyoid bone fusion (body and greater cornua) in 11 males out of 15 while 6 out of 15 females which is consistent with our current results^{12,13}. We found 30 (47.65%) hyoid fractures 18 (62.1%) out of which were males while 12 (35.3%) were females and 33 (52.4%) cases had no fractured hyoid, hanging cases were 8 (26.7%), garroting was 2(6.7%), throttling was 9 (30.0%) while

ligature strangulation cases were 11 (36.7%). These findings were parallel with previous studies conducted by Kulesh Chandekar et al (2015) showing 8 and 4 cases of ligatures strangulation and throttling respectively¹⁴. Whereas Sharma et al (2005) reported 80.7% hanging, 10.3% garroting and 09.0% throttling cases in their study the possible reason of difference may be the sample size and region¹⁵.

CONCLUSIONS:

There exists significant difference between hyoid bone fractures among various Strangulation modalities, symmetry and fusion of hyoid bones.

Conflict of interest:

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