

Hyoid Bone Fracture in Neck Strangulation: Five Years Meta-Analysis at Tertiary Care Hospital

Muhammad Ashraf Ali, Talha Naeem Cheema, Shahid Khaliq, Altaf Pervez Qasim, Faisal Naeem Cheema

ABSTRACT

Objectives: To find out the hyoid bone fractures in various modalities of compression to the neck i.e. Neck strangulation, Hanging, Garroting and Throttling and to study the socio-demographic characteristics of those victims brought for autopsy. **Study Design:** Cross Sectional Study (Descriptive) **Setting and Duration:** This study was conducted in Autopsy Section of DHQ Hospital Dera Ghazi Khan, Punjab, Pakistan for a period of five years from January, 2013 to December, 2017. **Methodology:** Total 87 medico legal autopsies were labeled as the cases of neck compression & police papers depicted history of strangulation at the level of neck. After careful observation of all related findings of ligature strangulation, throttling and hanging; the hyoid bone was examined in each case. **Results:** Mean age of the victims was 24.16±15.23. Out of 87 cases, 53(60.9%) were male and 34(39.1%) female. According to the police inquest, 52(59.8%) victims belonged to lower socio-economic status while urban area predominance appreciated in 61(70.1%) cases. Modalities of the neck strangulation included 62(71.26%) cases of hanging, 9(10.34%) cases of garroting and 16(18.40%) cases of throttling. Hyoid bone was found fractured in 18(20.7%) cases and out of those, throttling was the most common cause of hyoid bone fracture in 12(75.0%) victims of neck compression. Occupational data revealed 13(72.2%) victims belonged to lower socio-economic status, 3(16.6%) from average socio-economic background while 2(11.1%) belonged to the better economic group. As regards residential status; 10(55.6%) victims were inhabitants of rural areas while 8(44.4%) belonged to the urban setup. **Conclusion:** Fracture of the hyoid bone is rare and attention should be paid towards cases of throttling instead of hanging to find out these lesions during autopsy. Examining doctors overemphasize the importance of hyoid bone & ignore the soft tissue injuries of neck due to faulty dissection techniques. Being a task of immense importance, the autopsy techniques should be improved by arranging practical training under supervision of the experts of Forensic Medicine Department at the regional Medical Colleges.

Keywords: Fracture, Hyoid Bone, Strangulation, Hanging, throttling, Autopsy

Corresponding Author

Dr. Muhammad Ashraf Ali

Associate Professor/HOD Forensic Medicine
Ghazi Khan Medical College, Dera Ghazi Khan
Contact: +92 300-6825456
Email: drmashrafali@gmail.com

Submitted for Publication: 18-01-2018

Accepted for Publication: 20-02-2018

Article Citation: Ali MA, Cheema TN, Khaliq S, Qasim AP, Cheema FN. Hyoid Bone Fracture in Neck Strangulation – Five Years Meta-Analysis at Tertiary Care Hospital. APMC 2018;12(1):4-7.

INTRODUCTION

Compression of neck refers to the cessation of breathing by application of external force on the area of neck. Hyoid bone is usually fractured in majority of homicides caused by neck strangulation. Detection of the hyoid fracture during postmortem examination is relevant to the diagnosis of strangulation.¹ Hyoid is a small bone placed between the root of tongue and thyroid cartilage. It consists of a body, two lesser horns (cornu) and two greater horns (Figure-1). Due to its free floating nature its injury is not very common. However, when fracture is detected during autopsy, it is of great significance in legal aspects. It is well documented that the fracture of hyoid bone is a recognized finding & one of the indication of strangulation (more common in manual strangulation (throttling) than by ligature.² The exact mechanism of fracture is not clear; however hyoid bone may get fractured from direct lateral compression of neck or from indirect violence.³ National violent death reporting system recognizes strangulation as third most common cause of fatal incidents in United States, after firearms and poisoning cases.⁴ In India, strangulation has been reported as fourth most common cause of medicolegal deaths accounting for 16.64% of the cases.⁵ In a local study Qasim et al⁶ also positioned deaths due to

strangulation / asphyxia at fourth number in autopsy relied data. The present study intends to identify various lacunae and challenges encountered while examining such cases. The study encompasses various modalities for strangulation of neck and their association with the fracture of hyoid bone.

Numerous studies have attempted to determine the frequency of hyoid bone fracture in neck strangulation. The study conducted by Kaheri et al⁷ reported 14.7% cases of hyoid bone fracture in victims of neck strangulation whereas 25% cases of hyoid injury were detected by Charoonnate et al⁸ and 68% frequency of hyoid fracture was observed by Nikolic et al.⁹ Fractures occur almost equally on both sides and an insignificant male predominance exists in victims of neck strangulation.¹⁰ Male preponderance of 68.3% to that of 31.7% females has been reported by Singh B et al¹¹ in a recent study conducted in 2017. An increase in deaths due to violent asphyxia had shown that older age groups are usually more vulnerable to hyoid fracture and other neck injuries, possibly due to increasing brittleness of bone and cartilaginous structures.

There is misconception among doctors & law enforcing agencies that hyoid bone fracture is an important finding in cases of suicidal / homicidal hanging. Death in non-judicial

hangings is believed to result from compression of the soft tissues of neck, with obstruction of the vascular supply, loss of consciousness, cerebral anoxia, and finally death. There is a paucity of local studies in this context. Present study is on the basis of difference in material used for the constriction of neck in our country as compared to the other parts of the world. In our country usually a piece of cloth, waistband (kamarband), chadar, dupatta and rarely a rope are used. Dera Ghazi Khan is a far-flung district of Southern Punjab where tribal norms are in vogue. People used to live nomadic life and the incidence of molesting after abduction of both genders cannot be over emphasized. After kidnapping and sexual assaults, victims are murdered by the strangulation of neck, owing to the fear of being recognized afterwards. There is dire need for a study to determine and document the incidence locally. This study will provide a data base for future studies and local hospital policies for postmortem examination.

METHODOLOGY

Study Design: Cross Sectional Study (Descriptive)

Place of Study: DHQ Hospital Dera Ghazi Khan, Punjab, Pakistan

Duration of Study: 5 years from January, 2013 to December, 2017

The study was carried out by perusal of autopsy record at District Headquarter (DHQ) teaching Hospital Dera Ghazi Khan with special emphasis to the cases of neck strangulation documented by police. Socio-demographic profile of the cases having fracture of hyoid bone was tabulated. Findings were recorded in predesigned Performa. Economic status was categorized as Poor (<PKR 10,000 earning/Month), Average (PKR10,000-20,000) and Good (>PKR 20,000/Month earning). Only those cases were included in which deaths could be attributed to the direct mechanical interference at the level of neck leading to asphyxia and ultimately death.

The qualitative data i.e. fracture of hyoid bone was presented as frequency distribution. Mean \pm SD was calculated for age. The effects modifiers minimized by the stratification based on age, gender, socio - economic status, settlement area and chi square test was applied to the effect of these as outcome variable. $P < 0.05$ was taken as significant.

RESULTS

A total of 87 cases were identified having a documented history of Strangulation, reported at DHQ Hospital Dera Ghazi Khan during a span of 5 years i.e. 01-01- 2013 to 31-012-2017. As shown in Table-1 (Socio-demographic Paradigm), majority of the cases were less than 20 years of age and least no of cases were noted between 41 - 50 years of age. Mean age of the cases was a 24.16 ± 15.23 year with a male predominance of 60.9% is present in the study. Majority of the cases belonged to poor socio - economic status (59.8%) and urban suburb settlement (70.1%). Table-2 refers to the stratification of age with various modalities of strangulation, denoting <20 years

being the most common age group for all the modalities of strangulation.

Table 1: Socio-Demographic Paradigm

CATEGORY	NUMBER	PERCENTAGE
Age Group		
< 20	50	57.5
20-30	16	18.4
31-40	8	9.2
41-50	6	6.9
> 50	7	8.0
Total	87	100.0
Mean \pm SD	24.16 \pm 15.23	
Gender		
Male	53	60.9 %
Female	34	39.1 %
Total	87	100.0
Economic Status		
Poor	52	59.8
Average	19	21.8
Good	16	18.4
Total	87	100.0
Settlement Area		
Rural	26	29.9
Urban	61	70.1
Total	87	100.0

Table 2: Modalities of strangulation with Fracture of Hyoid

Age Group	Modalities of Strangulation				Total
	Hanging	Garroting	Throttling		
< 20	32 51.6%	6 66.7%	12 75.0%		50
21-30	13 21.0%	1 11.1%	2 12.5%		16
31-40	8 12.9%	0 0.0%	0 0.0%		8
41-50	6 9.7%	0 0.0%	0 0.0%		6
> 50	3 4.8%	2 22.2%	2 12.5%		7
Total	62 71.3%	9 10.3%	16 18.4%		87 (100.0%)
Chi square = 11.223		df = 8		P value 0.189	

Table 3: Stratification of Age Groups with Fracture of Hyoid

Age Group	Hyoid bone fracture		
	No	Yes	Total
< 20	40 80.0%	10 20.0%	50
20-30	15 93.8%	1 6.2%	16
31-40	7 87.5%	1 12.5%	8
41-50	6 100.0%	0 0.0%	6
> 50	1 14.3%	6 85.7%	7
Total	69 79.3%	18 20.7%	87 100.0%
Chi square = 21.977		df = 4	P value <0.001

Stratification of age with outcome variable is presented in Table-3, showing that fracture of hyoid bone is most common in old age wherein 85.7% of the cases have shown hyoid fractures and the same is presented in relation to the modalities of strangulation in Graph-C. The stratification of modalities of strangulation of neck, 62 cases (71.3%) of hanging, 9 cases (10.3%) of garroting and 16 cases (18.4%) of throttling,

concluded that the most common modality of strangulation amongst 18 cases (20.7%) of hyoid fracture was throttling with 12 cases (66.7%). Distribution of modalities in strangulation of neck and fracture in relation to gender is also revealed in the (Table-4) with a female predominance, having fracture of hyoid bone in 10 cases (29.4%).

Table 4: Modalities of neck strangulation and fracture of Hyoid bone in relation to gender

Modalities	Male		Female		Total	
	Total	Fracture	Total	Fracture	Total	Fracture
Hanging	41	2	21	1	62 (71.3%)	3 (4.8%)
Garroting	5	1	4	2	9 (10.3%)	3 (33.3%)
Throttling	7	5	9	7	16 (18.4%)	12 (75.0%)
Total	53	8 (15.1%)	36	10 (29.4%)	87	18 (20.7%)
Chi square = 39.131	df = 2		P value <0.001			

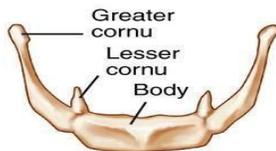


Figure 1: Hyoid Bone

DISCUSSION

The present study included 87 cases, (Table-1) shows the mean age of strangulation of neck is 24.16 with standard deviation ± 15.23 , the standard deviation is consonant with a study conducted by Nicolich et al,⁹ in which the mean age of strangulation of neck was 47.33 having standard deviation ± 17.51 years out of 175 cases. The difference in mean age is due to vulnerability of young females and males due to strong connection between sexual assault and strangulation.

(Table-1) also recognizes 60.9% males and 39.1% females who were succumbed to strangulation of neck which are comparable with the observations of Uzun et al¹⁰ in a study conducted on 761 cases of suicidal hanging; documented the involvement of 537 (70.56%) male and 224 (29.44%) female. Other studies conducted by Vadgama et al¹² reporting predominance of males involving 64% as compared to 34% female and by Qasim AP et al¹³ documented the involvement of 60% males with male to female ratio 3:2 in asphyxial deaths. Increasing number of females in neck strangulations is due to homicidal tendency in male dominating society. This argument of increasing number of females is strengthened by Afridi HK et al¹⁴ showing 85.71% females committing suicide by hanging.

During autopsy of the hanging, strangulation or throttling cases, hyoid bone becomes the most integral part of internal examination. In our study fracture of hyoid bone was established in 20.7% cases. These results are comparable with those of a study carried out by Uzun et al¹⁰ wherein hyoid fractures were reported in 23.26% cases while other studies conducted by Charoonnate et al⁸ and Nikolic et al⁹ demonstrated hyoid

fracture in 25% and 68% cases respectively and Kaheri et al⁷ observed the fracture of hyoid bone in 50% cases of manual strangulation.

As regards modalities of neck strangulation; hanging was recorded as method of choice in 71.3% cases, garroting in 10.3% and throttling was used 18.4% victims as shown in (Table-2). Increased number of throttling cases indicates that in tribal area like DG Khan, children are most commonly molested as observed in this study having 57.5% of the cases below 20 years of age as reflected in (Table-1).

Hyoid bone fractures are usually the result of direct trauma to the neck through manual strangulation (throttling), ligature strangulation (garroting) or hanging, blunt trauma or from projectiles. The literature strongly suggests that hyoid fracture is uniformly rare in infants & children but possibility of fracture increases with advancing adult age. This observation is in complete accord with the present study. Notwithstanding maximum number of cases below 20 years of age (57.5%) noted in present study, fracture of hyoid bone was appreciated in 20.0%. On the other hand it was detected in 85.7% of the cases in old age group i.e. >50 years of age (Table-3)

On autopsy of 53 males, hyoid bone found fractured in 8 cases, while examination of 36 females; revealed hyoid fracture in 10 cases as depicted in (Table-4).

This sway towards female cases in present study deem to be due to male dominating society with the brutal behavior towards females especially in low socioeconomic status. Secondly, frequently available ligature material like dupatta and waistband being the part and parcel of female attire also contribute towards deviation. (Table-4) also shows that fracture of hyoid was found in only 3(4.8%) cases out of 62 victims of hanging, whereas 3(33.3%) victims of garroting exhibited the hyoid fracture out of 9 cases. For throttling, 12(75%) cases demonstrated fracture of hyoid bone out of 16. Poverty and urban settlement indicate that strangulation cases were most common, contributing to 59.8% and 70.1% respectively (Table-1). The same is validated in studies conducted by Singh et al¹⁵ and Rahman MM et al¹⁶. Involvement of 62.5% cases of strangulation reported by Rahman et al connotes to lower socio-economic status, while Singh attributed 66.6% of violent asphyxial deaths to urban areas of northeast Indian Punjab. Economic sufferings also contribute towards the fracture of hyoid bone, as unequivocally presented in Fig-2 and Fig-3, this happens due to overwhelming number of cases in this tier. In present study, of the total 62 cases of hanging only 3(16.7%) sustained fracture of hyoid bone and out of these three cases, fracture of hyoid bone was observed in two cases having age >50 years (Fig-4). Our findings are in contrast with those of Ankur et al¹⁷ as he could not detect any fracture of hyoid bone while examining 320 cases of hanging.

Hyoid bone fracture increases with age above 40 years due to calcification and immobilization of joints. Some authors also claimed that hyoid bone fracture increases with using hard ligature for hanging and strangulation. If a peri-mortem fracture is suspected then the nature of fracture may provide some clues

regarding the force applied. However, since many cases lack a hyoid fracture, the absence of this finding does not exclude strangulation as a cause of death.

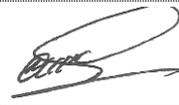
CONCLUSION & RECOMENDATIONS

Fracture of hyoid bone is not necessarily a feature of hanging. It implies to the amount of constricting force inflicted to the neck. There is a common misconception amongst investigating authorities that fracture of hyoid bone is a must in hanging, garroting and throttling. This impression can be rectified by arranging workshops & training sessions for investigating officers as well as public prosecutors. In a country like Pakistan, the doctors conducting autopsies overemphasize the importance of hyoid bone while totally ignoring the soft tissue injuries of the neck due to faulty dissection techniques. This practice should be improved by virtue of their practical training under supervision of Forensic Medicine experts at the regional Medical Colleges.

REFERENCES

- Mukhopadhyay PP. Predictors of hyoid fracture in hanging: Discriminant function analysis of morphometric variables. Leg Med 2010;12(3):113-6.
- Sharma BR, Harish D, Sharma A, Sharma S, Singh H. Injuries to neck structures in deaths due to constriction of neck, with special reference to hanging. J Forensic Leg Med 2008;15:298-305.
- Rutherford BH. Gradwohl. Gradwohl's Leg Med. 1976;3:329.
- Karch DL, Lubell KM, Friday J, Patel N, Williams DD; Centers for Disease Control and Prevention (CDC). Surveillance for violent deaths--National Violent Death Reporting System, 16 states, 2005. MMWR Surveill Summ. 2008 11;57(3):1-45.
- Kumar R. Study of the pattern of homicidal deaths in Varanasi region of India. J Evolution Med Dental Sci. 2013;2(43):8393-418.
- Qasim AP, Ali MA, Baig A; Firearm fatalities in rural setting: Autopsy based study at Tehsil Headquarter Hospital. Med Forum 2016; 27(3):31-5.
- Kaheri GQ, Rikhasor RM, Aziz M, Khichi ZH, Memon MU. Hyoid fractures and strangulation. Med Channel 2001;7:15-8.
- Charoonnate N, Narongchai P, Vongvaivet S. Fractures of the hyoid bone and thyroid cartilage in suicidal hanging. J Med Assoc Thai 2010;93:1211-6.
- Nikolic S, Micic J, Atanasijevic T, Djokic V, Djonic D. Analysis of neck injuries in hanging. Am J Forensic Med Pathol 2003;24:179-82.
- Uzun I, Buyuk Y, Gurpinar K. Suicidal Hanging. Fatalities in Istanbul retrospective analysis of 761 autopsy cases. J Leg Med 2007;14(7):406-9.
- Singh B, Ghosh M, Sangal A, Srivastava AK. A Postmortem medicolegal study of violent asphyxial deaths - An autopsy based study. Int Arch BioMed Clin Res 2017;3(2):104-7.
- Vadgama DK, Manvar PJ, Varu PR, Vaghela RD, Mashru RK. Study of violent asphyxial deaths in Rajkot Region. Ind J Forensic and Community Med 2016;3(4):254-6.
- Qasim AP, Awan ZA, Ansari JA. Critical appraisal of autopsy work. APMC 2016;10(4):194-202.
- Afridi HK, Yousaf M, Mateen A, Malik AR, Aziz K. In Strangulation Deaths: Forensic Significance of Hyoid Bone Fracture. PJMHS 2014; 8(2):376-8.
- Singh A, Singh D. Comparative study of hanging and strangulation cases in north east and northwest regions of Punjab. JPAFMAT 2009;9(1):6-8.
- Rahman MM, Haque M.R, Bose P.K Violent Asphyxial Death: A Study in Dinajpur Medical College, Dinajpur. J Enam Med Col 2013;3(2):91-3
- Ankur P, Rajesh B, Dhaval P, Patel Khushbu P. Study of Violent Asphyxial Death. Int J Medical Toxicology Forensic Medicine. 2013;3(2): 48-57.

AUTHORSHIP AND CONTRIBUTION DECLARATION

AUTHORS	Contribution to The Paper	Signatures
Dr. Muhammad Ashraf Ali Associate Professor/HOD Forensic Medicine Ghazi Khan Medical College, Dera Ghazi Khan	Main author, Study designing, Collection/Processing of data, Preparation of results	
Dr. Talha Naeem Cheema Assistant Professor of Forensic Medicine Quaid-e-Azam Medical College, Bahawalpur	Manuscript designing, Data analysis, Tabulation of results, Discussion & References writing	
Dr. Shahid Khaliq Director Health Services, Bahawalpur Division, Bahawalpur	Co-Author, Designing of charts/Tables Statistical analysis, Comparison & Discussion	
Dr. Altaf Parvez Qasim Professor / HOD Forensic Medicine Sahiwal Medical College, Sahiwal	Review of literature, Manuscript writing Authentication of references, proof reading	
Dr. Faisal Naeem Cheema Medical Officer, BHU Chak Loharan, Tehsil Ahmedpur East, District Bahawalpur	Comparison of results with other studies, Proof reading	