Original Research Paper

Hyoid Bone Fractures in Mechanical Asphyxiation Deaths: A Study at Osmania General Hospital, Hyderabad, India

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Abstract

The fractures of the hyoid bone in the neck are one of the important indicators of any pressure over the neck. The present study includes a huge sample size of mechanical asphyxiation deaths (791 cases) to study the incidence of hyoid bone fractures in hanging, ligature strangulation, and throttling. Fractures of the hyoid bone were noticed in a total of 12 cases, 9 male and 3 female with 33.33% incidence in the 41-50 years age group. Throttling dominated the strangulation group in our study with a share of 42.85%. A total of 6 (5 male, 1 female) cases showed hyoid bone fractures in the strangulation group wherein the predominant incidence is seen in 41-50 years(50%). In our study, right cornu fractures are frequent in hanging and throttling. Except for one outward compression fracture in a hanging instance, all of the fractures identified in our investigation are inward compression fractures. The present study adds to the existing literature that hyoid bone fractures are less common in hanging than throttling and any fracture of hyoid bone is common after the age of 40 years because of calcification.

Keywords: Mechanical Asphyxiation, Hyoid Bone, Hanging, Ligature Strangulation, Throttling.

Introduction

It is quite often alleged by several medico-legal practitioners that, *"framing opinion in asphyxiation deaths is the most asphyxiating aspect of a crime pathologist's practice"*. Mechanical asphyxiation deaths are the bread and butter of an autopsy surgeon's routine work, yet they pose a significant problem at times for pathologists. The fractures of the U-shaped hyoid bone in the neck are one of the important indicators of any pressure over the neck. Mechanical asphyxiation is a form of unnatural death caused by compression and restriction of airways by any means. Nevertheless, the relationship between hyoid bone fractures and mechanical asphyxiation is complex and has always been a source of controversy.

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Our study aims to provide a comprehensive review of hyoid bone fractures in mechanical asphyxiation cases autopsied at Osmania General Hospital for a period of one year. The study data includes the aspects of their prevalence, mechanisms of injury, forensic significance, and potential pitfalls in interpretation. Although several researchers worked on this subject, it has always been and persisting to be a point of contention due to a lack of consensus among the scientific community as to how common is a fracture of the hyoid bone in different forms of mechanical asphyxiation. The findings of this study will contribute to further understanding the role of hyoid bone fractures in ascertaining the cause of death and reducing ambiguity in this domain.

Materials and Methods

The present study was conducted at Osmania General Hospital(OGH), Hyderabad from January to December 2018 for a period of one calendar year. All cases reported for autopsy at our medico-legal center were considered and a purposive sampling model was used to include hanging and strangulation cases from routine autopsy work and expert opinion cases. All cases of drowning, smothering, and burking were excluded. Approval of the institutional ethics committee was obtained before the start of the study.

Results

Out of the 3762 cases reported for autopsy at OGH during the study period, a total of 791 cases belonged to the mechanical asphyxiation group. Further, 577 mechanical asphyxiation cases belonged to the hanging(542, 43.91% Male and 56.01% Female) and strangulation(35, 51.42% Male and 48.57% Female) groups, and 214 belonged to the drowning group. 256 Cases (44.36%), 321(55.64%). Among 48 cases registered for expert opinion during the study period, 35(72.91%), 13 are Females (27.09%).

The age and sex distribution of hanging cases is as follows, 0-10 years (No Cases),11-20 years (8.67% males, 6.47% females), 21-30 years (12.73% males, 28.78% females), 31-40 years(9.96% males, 14.02% females) 41-50 years (7.01% males, 4.59% females), 51-60 years (4.24% males, 2.39% females), 61-70 years (0.92% males, 0.36% females), 71-80 years (0.36% males, 0% females), 81-90 years (No cases).

Amongst hanging cases, the sex distribution of typical hanging is as follows, 3.13% male, 2.21% female, and atypical hanging is 40.77% male, 53.87% female. The incidence of cases according to the position of feet in hanging cases is as follows, complete hanging 42.80% male, 55.90% female, and incomplete hanging or partial hanging, 1.10% male, 0.18% female.

The hyoid bone fractures were present in 12 hanging cases(9 male and 3 female), the age distribution of these fractures is 8.33% in the 21-30 years age group, 25% between 31-40 years, 33.33% between 41-50 years, 16.66% in 51-60 years, 8.33% each in 61-70 and 71-80 years of age groups.

The age and sex distribution of strangulation cases is as follows, 0-10 years (No Cases),11-20 years (No cases), 21-30 years (20% males, 8.57% females), 31-40 years(11.42% males, 25.71% females) 41-50 years (8.57% males, 5.71% females), 51-60 years (8.57% males, 5.71% females), 61-70 years (2.85 % males, 0 % females), 71-80 years (No cases), 81-90 years (2.85 % males, 0 % females).

The profile of strangulation deaths in our study is as follows, 42.85% throttling, 28.57% choking,17.14% ligature strangulation, 8.56% smothering, and 2.85% traumatic asphyxiation.

A total of 6 (5 male, 1 female) cases showed a hyoid bone fracture in the strangulation group of which 16.66% were in the 31-40 years age group, 50% in the 41-50 years age group, and 33.33% in the 51-60 years age group.

The age and sex distribution of hyoid bone-expert opinion cases is as follows, 0-10 years (No Cases),11-20 years (0% males, 2.08% females), 21-30 years (10.41% males, 14.58% females), 31-40 years(29.16% males, 08.33% females) 41-50 years (14.58% males, 0% females), 51-60 years (16.667% males, 2.08% females), 61-70 years (2.08 % males, 0 % females), 71-80 years (No cases), 81-90 years (No cases).

A total of three cases showed hyoid bone fracture amongst cases referred for expert opinion of which 66.66% were in the 41-50 years age group and 33.33% cases were in the 51-60 years age group.

The profile of hyoid bone fractures is as follows in our study, Hanging (right cornu 38.09%, left cornu

19.04%, both 0%), Throttling (right cornu 9.52%, left cornu 4.76%, both 4.76%), Ligature strangulation (right cornu 4.76%, left cornu 0%, both 4.76%), Expert Opinion cases (right cornu 9.52%, left cornu 4.76%, both 0%).

The profile of ligature material used in cases of hanging, ligature strangulation, and expert opinion cases is as follows, bedsheet (13.45% male, 22.31% female), nylon rope (9.88% male, 44.29% female), silk saree (6.47% males, 10.90% females), cotton saree(7.15% male, 13.79% female), lungi (2.04% male, 1.53% female), long towel(4.59% male, 2.04% female), electrical wire(0.51% male, 0% female), belt (0.17% male, 0% female), and trousers (0.68% male, 0% female).

The profile of the type of fractures is as follows, 52.38% of fractures are inward compression fractures in hanging, 19.04% in throttling, 9.52% in ligature strangulation, and 14.28% in expert opinion. 4.76% of fractures are outward compression fractures in hanging.

Among 547 cases of mechanical asphyxiation, the ligature mark on the dead body was above the level of the thyroid cartilage in 483 hanging cases, 3 expert opinion cases, and 1 case of ligature strangulation. The ligature mark is over the thyroid cartilage in 59 hanging cases. The ligature mark is below the level of the thyroid cartilage in one ligature strangulation case.

Discussio

As per our results, 21.02% of our caseload constitutes mechanical asphyxiation cases and the percentage of cases studied for our purpose excluded drowning which amounts to 15.33%. Our results also demonstrate that there is a female (55.64%) predilection in the number of mechanical asphyxiation deaths. Hanging cases are the majority in the study population followed by ligature strangulation. The sex distribution in hanging showed female predilection (56.09%). The sex distribution in strangulation cases showed male preponderance(51.42%). The sex distribution in expert opinion cases also shows a male predilection(72.91%). The highest incidence of hanging cases was noticed in the 21-30 years age group. Throttling turned out to be the most common cause of strangulation in our study constituting 48.25% of all strangulation cases. Hyoid bone fractures were common in the 41-50 years age group in all three categories of hanging, strangulation, and expert opinion cases. Right, cornu fractures are common in hanging and throttling in our study. All the fractures noticed in our study are inward compression fractures except one outward compression fracture in the case of hanging.

In general, for forensic purposes, hyoid bone fractures are of three types, inward compression fractures which are seen in throttling, outward compression fractures seen in hanging and one inward, the other outward compression fractures in hanging[1].The major advantage of the present study is we evaluated hyoid bone fractures in a huge sample size compared to several previous studies. However, primarily, our finding regarding hanging as the most common mechanical asphyxiation death is concordant with several previous researchers. Our study also reported more cases of complete hanging and atypical hanging like Dr. Sharbana Kumar Naik et al[2]. In a study by Dr. P. Chandrasekhar Rao et al[3], the peak age incidence of hanging cases was in the 20-29 years bracket which is similar to our study. Our results regarding the position of the ligature mark in hanging (being above the level of the thyroid cartilage in the majority of the cases) are similar to Sadikhusen G et al[4]. In contrast to findings of no hyoid bone fractures in cases of hanging in a study by Patel Ankur P et al[5], hyoid bone fractures were considerably noticed in cases of hanging more in the 41-50 years age group. The incidence of hyoid bone fractures in hanging varies from 0-68% from author to author. Nevertheless, the increase in fracture rate with age was also noticed in our study similar to Kokatanur et al[6]. In our study, young adults between 21-30 years committed suicide with a cloth material which is concordant with a study conducted in Delhi by Suresh Chand et al[7]. It is advisable to conduct radiography before dissection and histopathological examination after dissection for confirming a fracture of hyoid bone apart from ascertaining the same during gross autopsy as suggested by Abhishek Yadav et al[8].

The left cornu of the hyoid bone fracture was more common in a similar study by Dr.Puttuswamy[9].

However, right cornu fractures are more common in our study. Dr. Amit Yadav[10] also reported that the chances of hyoid bone fractures enormously increase after age 40 which was noticed in our research. A study by Dr. Yogesh prasad shah[11] employed post-mortem radiography to evaluate obscure fractures in mechanical asphyxiation deaths and found an increased frequency of fractures after 40 years in both sexes. The female preponderance of hanging-related deaths in our study is concordant with Muhammad Ashraf Ali et al[12] and Amgain K et al[13]

Recommendations: The authors suggest conducting a meta-analysis to revise the scientific data on hyoid bone fractures in deaths due to mechanical asphyxiation for updating forensic medicine textbooks. This would provide a comprehensive and evidence-based synthesis of existing knowledge.

Conclusion

It is concluded that a detailed examination of the hyoid bone is a must in mechanical asphyxiation cases because of its anatomical position. Fractures of hyoid bones are more common in throttling and hanging cases (predominantly after 40 years of age as calcification increases with age). It is necessary to give due consideration to the question of whether the fracture is antemortem or post-mortem and also injuries of other neck structures before issuing a cause of death in mechanical asphyxiation cases.

Conflicts of interest: None to declare

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