

## A CROSS-SECTIONAL STUDY ON SEXUAL DIMORPHISM IN SHAPE HYOID BONE- A CADAVERIC STUDY IN NORTH INDIAN POPULATION.

<sup>1</sup>Bhavna\*, <sup>2</sup>Sween Walia, <sup>1</sup>Shubhangi Maheshwari,  
<sup>1</sup>Assistant Professor, Gian Sagar Medical College, Banur, India.  
<sup>2</sup>Associate Professor, Gian Sagar Medical College, Banur, India.

Page | 1

### Abstract:

#### Introduction

The hyoid bone is of great forensic importance as its fracture is an acclaimed indicator of strangulation, particularly manual strangulation. Hyoid bone can also be fractured in hanging, automobile accidents, pathological destruction due to tumors, forcible swallowing, muscular pressure, and falls from height. The study aims to examine and classify the shapes of the hyoid bones in a North Indian population, with a specific focus on identifying sexual dimorphism.

#### Material and method

The material for the present study comprised 30 dried Hyoid bones (M: F::15:15). Each hyoid bone was examined as a whole and the shape of the hyoid bones was observed.

#### Results

The commonest type in males was U & D shaped seen in 40% of each while in females the commonest type was H shaped seen in 67% of specimens. The classical type U was seen only in 27% of female subjects.

#### Conclusion

Classical forms of convectional description (Type U &V) are not the most frequent. Type U was seen in 6(40%) male & 2(13.3%) female bones while Type V was seen in none.

#### Recommendation

Forensic experts should consider the shape of the hyoid bone, particularly its sexual dimorphism, during autopsies to improve the accuracy of determining the cause of death in strangulation cases. Additionally, further research with larger sample sizes across different populations is recommended to validate these findings and enhance the understanding of hyoid bone morphology and its forensic implications.

**Keywords:** Hyoid Bone, Strangulation, Forensic, Parabolic.

**Submitted:**2024-05-26 **Accepted:** 2024-06-24

**Corresponding Author:** Bhavna\*

**Email:** [drbhavna29@gmail.com](mailto:drbhavna29@gmail.com)

Assistant Professor, Gian Sagar Medical College, Banur, India.

### INTRODUCTION

The horseshoe-shaped hyoid bone is situated between the thyroid cartilage and the tongue root, and the thyroid membrane connects it to the latter. The word "hyoides," which means "U-shaped" (the Greek letter Upsilon) [1], is where the name of the entity originates. It is a component of the respiratory and digestive systems. It is positioned at the level of the fourth cervical vertebra and uses ligaments and muscles called suprahyoid and infrahyoid to articulate with the surrounding structures. The body and the two larger and two smaller horns make up its three components [2].

Because the hyoid bone's fracture is a well-known sign of strangulation—especially manual strangulation—it is extremely important for forensic purposes. In addition, hanging, car crashes, pathological deterioration from tumors, forced swallowing, pressure from muscles, and falls from heights can break the hyoid bone [3]. The type, extent, and location of the force applied to the victim's neck, the age of the victim, the type of device (ligature or

hand) used to strangle, the anatomical characteristics of the hyoid bone, and the shape of the bone all play a role in the possibility of a hyoid bone fracture.

The type of fracture is determined by the shape of the bone. Whereas parabolic-shaped hyoid bones are more likely to have vertical fractures, hyperbolic-shaped hyoid bones are more likely to have horizontal fractures. Despite the hyoid bone's significant clinical and forensic value, a generally acknowledged morphological classification is unknown. It was previously divided into two categories: parabolic (V-shaped) and hyperbolic (U-shaped). It was later divided into five types: D, B, H, U, and V types [4]. Asymmetry in the skeletal structure and sexual dimorphism exacerbate the challenge of universal morphological classification. The categorization of Papadopoulos et al. (1989) is the most widely accepted classification among all of them (see above) [5]. Thus, the goal of the current study was to categorize hyoid bones according to the structure specified in this categorization.

The study aims to examine and classify the shapes of the hyoid bones in a North Indian population, with a specific focus on identifying sexual dimorphism. This includes analyzing the prevalence of different hyoid bone shapes in male and female cadavers and exploring the forensic implications of these shapes in cases of strangulation.

## Material and methods

### Study design

A cross-sectional study.

### Study setting

The study took place at the Department of Anatomy, Govt. Medical College, Amritsar.

### Participants

The study included 30 participants.

### Bias

There was a chance that bias would arise when the study first started, but it was avoided by giving all participants identical information and hiding the group allocation from the nurses who collected the data.

### Procedure

The material for the present study comprised 30 dried Hyoid bones (M: F::15:15). Bones were labeled from 1-30 with the suffix M(male) or F(female). Each hyoid bone was examined as a whole and the shape of the hyoid bones was observed. The bones were divided into U, V, H, D, and B shapes (vide infra) as described by Papadopoulos et al (1989) [5].

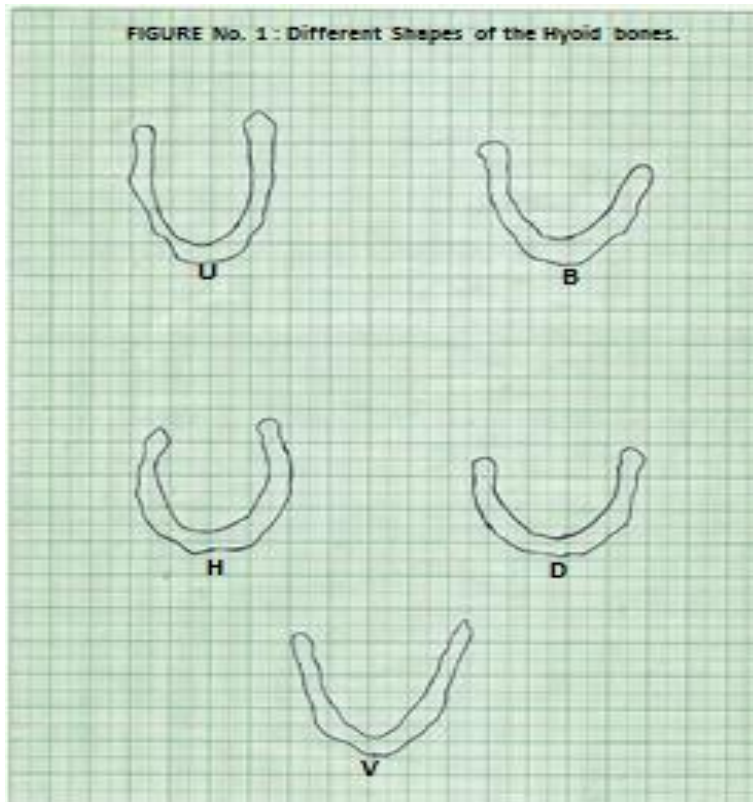
Type U: Bones which were composed of half circle anteriorly and two straight sides, the diameter of the half circle and the transverse diameters posterior to it being approximately equal.

Type V (Triangular, resembling the letter V): The greater transverse diameter of the bone is the base of the triangle.

Type H (Horseshoe): Bones which were composed of half circle anteriorly and two approaching sides posteriorly. The diameter of the half circle is longer than the distance between the tubercles of the greater horns.

Type D (Deviating): The anterior part is a half circle or part of it, but posteriorly, one or both greater horns deviate to one or the other side. The diameter of the half circle may be longer or shorter than the distance between the tubercles of greater horns.

Type B (resembling a transverse section of the boat): It was almost a half-circle, or a part of it, the diameter of which coincides with the major transverse axis.



### Statistical analysis

The data obtained from the study was arranged in a tabulated manner in an Excel sheet and presented as frequencies and percentages.

### Ethical considerations

The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

### RESULTS

Table I shows the number of bones with different shapes in both sexes as observed in the present study.

**TABLE I: Comparing shapes of the Hyoid bone**

Shape of the hyoid bone							
Authors		U shape	H shape	D shape	B shape	V-shape	Total
Papadopoulos et al (1989)	Male	6	4	18	8	2	38
	Female	8	12	4	12	2	38
Present study(2013)	Male	6	1	6	2	none	15
	Female	2	10	2	1	none	15

### Discussion

The findings from the present study indicate that there is a distinct sexual dimorphism in the shape of the hyoid bone in the North Indian population. Specifically, the U and D shapes are the most common in males, each seen in 40% of the male specimens. This suggests that these shapes are more prevalent among men, possibly due to differences in anatomical or functional requirements.

In contrast, the H shape is the most common in females, observed in 67% of the female specimens. This pronounced prevalence of the H shape in females could be linked to different physiological or developmental factors affecting the structure of the hyoid bone between genders. These differences in hyoid bone shapes between males and females have important forensic implications. For instance, the type of hyoid bone shape can influence the likelihood and type of fractures that occur during strangulation. Knowing the prevalent hyoid bone shapes in different genders can assist forensic experts in making more accurate determinations regarding the cause of death in strangulation cases. Additionally, this information could be valuable in anthropological studies and in developing more gender-specific medical treatments or interventions related to the hyoid bone.

As evident from Table I, in the present study the commonest types in males were U & D shaped seen in 40% of each while in females the commonest type was H shaped seen in 67% of specimens. Earlier Papadopoulos et al (1989) found D shape to be commonest in males and H & B shapes in females [5]. So, the results are partially in consonance with them. It is interesting to note that the classical type U was seen only in 27% of subjects and type V was not seen in any of the bones of the present study. This further strengthens the observation by Papadopoulos

et al (1989) that the classical forms of conventional description are not the most frequent.

### Clinical and Forensic Significance

1. As the commonest way of suicide is hanging by the neck, it is considered that the incidence of fracture sustained in hanging directly depends upon the shape and calcification of the hyoid.
2. The specific location of the hyoid fracture in strangulation is determined by the shape of the greater cornu.
3. Horizontal fractures are common in hyperbolic (U) while vertical fractures are frequent in parabolic(V) type.

### Generalizability

The study findings suggest that the distinct hyoid bone shapes between males and females can enhance forensic investigations by providing gender-specific markers, and this understanding can be applied broadly to improve forensic accuracy, anthropological insights, and medical interventions on a larger scale. Further research across diverse populations is recommended to validate and expand these applications.

### CONCLUSION

An interesting finding that was seen in the present study was that classical forms of conventional description (Type U &V) are not the most frequent. Type U was seen in 6(40%) male & 2(13.3%) female bones while Type V was seen in none. On the contrary Type D was seen in 6 (40%) male bones and Type H was seen in 10(66.6%) female bones.

### Limitations

The limitations of this study include a small sample population who were included in this study. Furthermore, the lack of a comparison group also poses a limitation for this study's findings.

### Recommendation

Forensic experts should consider the shape of the hyoid bone, particularly its sexual dimorphism, during autopsies to improve the accuracy of determining the cause of death in strangulation cases. Additionally, further research with larger sample sizes across different populations is recommended to validate these findings and enhance the understanding of hyoid bone morphology and its forensic implications.

### Acknowledgment

We are thankful to the patients; without them, the study could not have been done. We are thankful to the supporting staff of our hospital who were involved in the patient care of the study group.

### Source of funding

No funding was received.

### PUBLISHER DETAILS:

## SJC PUBLISHERS COMPANY LIMITED



**Category:** Non Government & Non profit Organisation

**Contact:** +256 775 434 261 (WhatsApp)

**Email:** [info@sjpublisher.org](mailto:info@sjpublisher.org) or [studentsjournal2020@gmail.com](mailto:studentsjournal2020@gmail.com)

**Website:** <https://sjpublisher.org>

**Location:** Scholar's Summit Nakigalala, P. O. Box 701432, Entebbe Uganda, East Africa

### Conflict of interest

The authors have no competing interests to declare.

### REFERENCES

1. Leksan I, Marcikic M, Nikolic V, Radic R, Selthofer R. Morphological classification and sexual dimorphism of hyoid bone: New Approach. *Coll Antropol* 2005; 29:237-42.
2. O'Halloran RL, Lundy JK. Age and ossification of the hyoid bone: Forensic implications. *J Forensic Sci* 1987; 32(6):1655-9.
3. Pollanen MS, Bulger B, Chiasson DA. The location of hyoid fractures in strangulation was revealed by xeroradiography. *J Forensic Sci* 1995; 40:303-5.
4. Miller KWP, Walker PL, O'Halloran RL. Age and sex-related variation in hyoid bone morphology. *J Forensic Sci* 1998; 43(6):1138-43.
5. Papadopoulos N, Anastopoulou GL, Alvanidou EL. The shape and size of the human hyoid bone and a proposal for an alternative classification. *J Anat* 1989; 163:249-60.