

Symmetry and Isometry of Human Adult Hyoid Bone: A Cadaveric Study in North Indian Population

Abstract

Introduction: Hyoid bone fracture is one of the most integral parts of internal examination during autopsy of hanging, ligature strangulation, or a throttling case. The reasons why some hyoids fracture and others do not may be related to the nature, magnitude, and position of the force applied to the neck, age of victim, nature of instrument (ligature or hand) used to strangle, and intrinsic anatomical features of the hyoid bone, such as rigidity and shape of the bone and symmetry of greater horns. **Materials and Methods:** The material for the present study comprised of 30 dried hyoid bones (M:F: 15:15). Their outline was drawn on the graph paper to study the symmetry and isometry of the bone. **Results:** Forty percent of the hyoids bones were symmetrical, while 60% were asymmetrical. Similarly, the number of anisometric bone is more (86.6%) as compared with isometric bone (13.3%) in both the sexes. **Conclusion:** Hyoid bone is not bilaterally symmetrical bone. The incidence of asymmetrical and anisometric bones is more as compared with symmetrical and isometric bones in both the sexes.

Keywords: Hyoid bone, isometry, symmetry

Introduction

The hyoid bone is a rather neglected structure of the human skeleton which has not been given sufficient attention.^[1] Anatomically, the bone consists of five elements, an unpaired body, and pairs of greater and lesser horns. All elements originate in the cartilaginous tissue of the pharyngeal (also known as branchial) arches. By a generally accepted concept of origin, the lesser horns and superior part of the body above the horizontal ridge are derived from the second, so-called hyoid arch, while the rest of the body and greater horns differentiate from the third pharyngeal arch.^[2]

Observation of hyoid bone fracture is one of the most integral parts of internal examination during autopsy of hanging, ligature strangulation, or a throttling case. Its incidence ranges from 0% to 68% in hanging and is said to be increased with age after 40 years.^[3] The reasons why some hyoids fracture and others do not may be related to the nature, magnitude, and position of the force applied to the neck, age of victim, nature of instrument (ligature or hand) used to strangle, and intrinsic

anatomical features of the hyoid bone, such as rigidity and shape of the bone and symmetry of greater horns.^[4]

The left-right symmetry of hyoid bones corresponds to object symmetry, where a single structure is identical according to a given or selected plane, such as mid-sagittal plane. The matching symmetry, in contrast, is referred to in situations where two separate objects exist as mirror images of each other.^[5] Like most human skeletal structures, the hyoid bone is generally assumed to be bilaterally symmetrical. The evidence of asymmetry in the human hyoid bone has been explored in relation to the individual's sex^[6] and body size.^[7]

On the other hand, the concept of isometry/anisometry deals with the position of tip of greater cornua with respect to each other. If the tips of greater cornua lie in the same coronal plane, the hyoid bone said to be isometric if not so, it is anisometric.^[8]

In the present study, an attempt has been made to find out the incidence of symmetrical/asymmetrical hyoid bones and isometric/anisometric hyoid bones and to correlate the same with its clinical and forensic importance.

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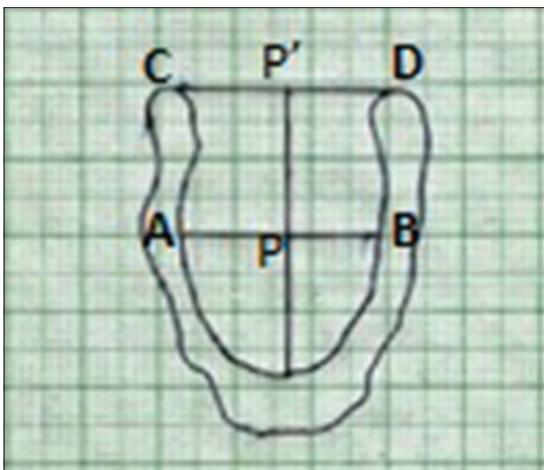


Figure 1: Symmetry of bone

Materials and Methods

The material for the present study comprised 30 dried hyoid bones (M:F: 15:15), made available from Department of Anatomy, Government Medical College, Amritsar. Bones were labeled from 1 to 30 with suffix M(male) or F(female). Each hyoid bone was examined for symmetry/asymmetry and isometry/anisometry.

Symmetry

For determining the symmetry of the hyoid bone, the outline of the bone was drawn on graph paper by pencil. The distal ends of the two greater cornua were joined (CD in Figure 1). Major transverse axis was also drawn (AB in Figure 1). A line was drawn in the mid-sagittal axis of the bone from the posterior surface of the body intersecting the previous lines at points P and P'. If the distance AP = PB, then the bone was labeled as symmetrical bone and if not, it was labeled as asymmetrical.

Isometry

A bone is isometric if the tips of both greater cornua fall in the same coronal plane. If it is not so, the hyoid bone is anisometric. For this, the bone was kept on graph paper with body lying parallel to x-axis, and then a line was drawn touching the tips of the two greater cornua. If it is parallel to x-axis it is isometric, otherwise anisometric. Here, it is worth mentioning that the length of two greater cornua may not be necessarily same in isometric bones (see Figure 2).

Results

Symmetry

In the present study, out of 30 bones, 12 bones were symmetrical and 18 were asymmetrical. A number of asymmetrical bones were more than that of symmetrical bones in both the sexes [Table 1].

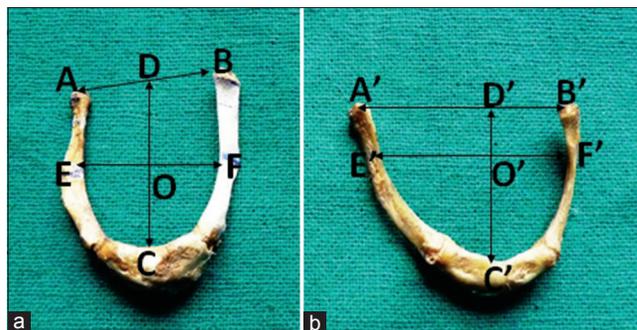


Figure 2: Symmetry and isometry of hyoid bones. (a) Symmetrical but anisometric hyoid bone. (b) asymmetrical but isometric bone

Table 1: Symmetry of hyoid bone

Authors	Sex	Symmetrical	Asymmetrical	Total
Leksan <i>et al.</i> (2005)	Male	33	2	35
	Female	27	8	35
Present study (2013)	Male	6	9	15
	Female	6	9	15

Table 2: Isometry of hyoid bone

Sex	Isometry of hyoid bone		
	Isometrical	Anisometrical	Total
Male	2	13	15
Female	2	13	15

Isometry

In the present study, only 4 bones (13.3%) (2 each in males and females) were isometric rest and 26 bones (86.6%) (13 each in males and females) were anisometric [Table 2].

Discussion

Symmetry

Table 1 compares the incidence symmetry of hyoid bone with the earlier study by Leksan *et al.*^[9] As evident from the table the number of symmetrical bones were more as compared to asymmetrical bones in their study, while in the present study, number of asymmetrical bones were more than that of symmetrical bones. This difference may be attributed to the racial factors. Furthermore, Leksan *et al.*^[9] found the incidence of symmetrical bones to be more in males and asymmetrical to be more in females, while in the present study, no such difference could be seen.

Forensic implication

Pollanen *et al.* found that unilateral fractures of hyoid bone are more common as compared with bilateral ones. This led them to believe that asymmetry of hyoid bone is responsible for determining the location of fractures.^[10] It was further supported by the experimental hyoid distortion studies using interferometry which showed asymmetrical displacement of hyoids under applied loads.^[11]

Isometry

Earlier, Papadopoulos *et al.* found anisometric bones in 59% of their sample. It was though more in our study, but definitely, the incidence of anisometric bones is more as compared with isometric ones.

Summary

To summarize:

1. The incidence of asymmetrical hyoid bones is more as compared with symmetrical bones
2. The incidence of anisometry is more as compared with isometry in the hyoid bones
3. Symmetry/asymmetry and isometry/anisometry of hyoid bones do not depict any sex difference.

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Conflicts of interest

There are no conflicts of interest.

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