



## Study of Correlation of Morphometric and Radiological Parameters of Hyoid Bone In The Population of Telangana.

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### Abstract

**Background:** The hyoid bone in humans is anatomically positioned in the anterior, upper aspect of the neck and is typically horseshoe-shaped. This bone plays a vital role in forensic studies as an indicator for diagnosing asphyxia deaths due to hanging and strangulation. Since modern facilities have improved the accuracy of measurement and study, present work correlates the morphometric features from the dry cadaveric specimens, as well as scanned images from living hyoid. This will generate useful data for medicolegal and anthropometric uses. This study conducted to correlate the morphometric and radiological parameters of adult hyoid bone in the population of Telangana.

**Material and Methods:** We conducted this study with 40 dried specimens of hyoid bones. We have measured the parameters using vernier caliper and correlated in living using CT scan. In present study we have recorded the parameters like, Length of right greater cornu, Length of left greater cornu, Anteroposterior distance at the middle of body of hyoid bone, Length of Hyoid bone.

**Results:** All the morphometric parameters of hyoid bone correlate with the radiological parameters. There is no significant difference between the dry bone and CT scan measurements in case of length of body of hyoid bone where as there is significant difference between the other three parameters.

**Conclusion:** The findings of this study may be helpful for anthropometry and medicolegal importance and the surgeries in this reason.

**Keyword:** Hyoid Bone, Larynx, Grater cornu, Lesser cornu, Cartilage.

## **Introduction**

Identification is often a difficult task in many of the criminal cases due to the onset of decomposition by the time the dead body was found. Because of the difficulty for facial recognition and the loss of soft tissues in a putrefied body, sex determination has to be done with skeletal remains in many cases [1]. The hyoid bone is a small U-shaped solitary bone situated in the midline of the neck anteriorly at the base of the mandible and posteriorly at the fourth cervical vertebra. Its anatomical position is just superior to the thyroid cartilage. The hyoid bone plays an important role in the functions of speaking, swallowing, prevention of regurgitation, and airway maintenance. Hyoid bone descent occurs concurrently with descent of functionally related structures, namely the larynx and epiglottis. The only bone in the body that is free-floating, the hyoid bone maintains attachment with the mandible, tongue, styloid processes, thyroid cartilage, cricoid cartilage, clavicles, and sternum by ligament and muscle attachments. Hyoid bone anatomy and physiology have been well documented due to the diverse nature of the muscle attachment sites as well as the multiple important functions that the hyoid bone supports. The hyoid bone develops from the branchial arches and the midline mesenchymal condensation between the second and third branchial arch cartilages [3,4]. The hyoid body comes directly from the mesenchymal condensation, the lesser cornua and the stylohyoid ligament derive from the second branchial cartilages, and the greater cornua derive from the third branchial cartilages. The hyoid body and the two greater cornua contain pairs of ossification centers. Ossification in the hyoid body is completed shortly after birth, but fusion in the other two pairs of ossification centers occurs later in life, if at all. Some hyoid bones show a diarthrodial structure, a gap that resembles a synovial cavity in the body/cornua bone articulation. Hyoid is indeed a bone of clinical and forensic significance [5,6].

The hyoid bone consists of a central body, small lesser horns/ cornua and larger greater horns. This horseshoe shaped bone does not articulate to any other bone but connects with the styloid processes of the temporal through the stylohyoid ligaments. The three components of the hyoid each ossify from two centers. Ossification begins during fetal development, but union of the components is highly variable. Fusion of the greater horn to the body is more common in males than females, but rare prior to 20 years of age. Fusion of the greater horn sometimes can be unilateral, especially in females. Adults display a general age progression of fusion but with great variation. Morphology of the adult hyoid also is highly variable and related to body weight. Hyoid morphology displays sex differences and age-related changes. Variation can include bilateral absence of the lesser cornua and abnormal morphology of the body. Detection of traumatic evidence in the structures of the throat is relatively straightforward with skeletonized remains but requires radiography and/or other techniques in the living and in complete and decomposing bodies. In the medical examiner office setting, the usual approach to assess these structures involves simple gross examination, layered dissection and maceration. Routine radiography can detect the most obvious fractures. For better resolution of bone density patterns and improved fracture recognition. Microscopic examination of throat structures can reveal information regarding the timing of trauma [7,8,9,10]. The present study conducted to find anthropometry of hyoid bone and findings may be helpful medicolegal importance and the surgeries in this reason.

## **Material and Methods**

We conducted this study with 40 dried specimens of hyoid bones in department of anatomy, Deccan medical college, Hyderabad. We have measured the parameters using digital vernier caliper and correlated in living using CT scan. In present study we recorded the parameters like, Length of right greater cornu, Length of left greater cornu, Anteroposterior distance at the middle of body of hyoid bone, Length of hyoid bone. We have don statistical analysis and calculated P-value, results expressed in Mean +SD (Figures, 1, 2, 3).

### Results

Parameters	Sample size	Dried bone Mean Value(mm)	Ct scan Mean Value	P- Value
Length of Right Greater cornu	40	31.31+3.59	23.37+1.68	0.00
Length of Left Greater cornu	40	31.24+3.33	24.13+1.91	0.00
Anteroposterior distance in the middle of the hyoid bone	40	2.75+0.55	5.34+0.83	0.00
Length of body of hyoid bone	40	20.46+2.93	21.35+2.10	0.12

All the morphometric parameters of hyoid bone corelate with the radiological parameters. There is no significant difference between the dry bone and CT scan measurements in case of length of body of hyoid bone where as there is significant difference between the other three parameters(Graph 1).

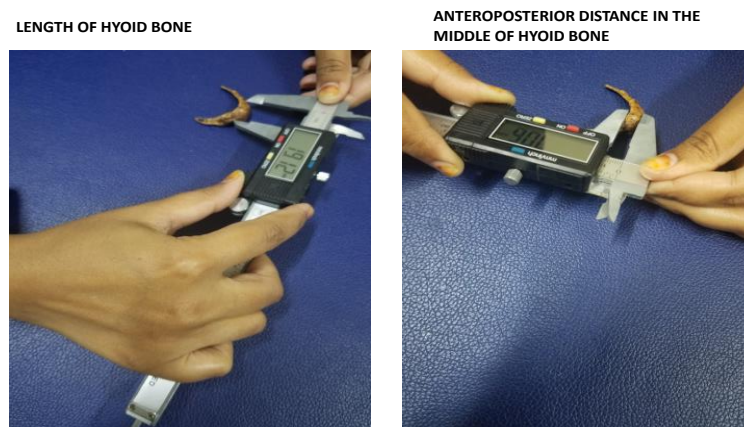


Figure 1. Showing measuring of hyoid bone with digital vernier calipers.

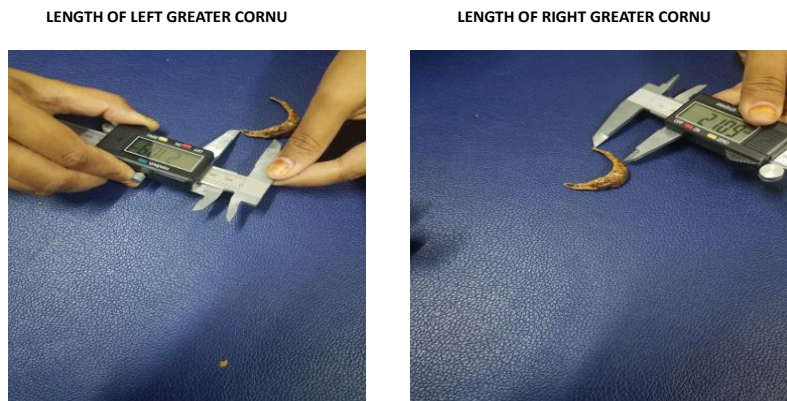


Figure 2. Showing measuring of hyoid bone with digital vernier calipers.

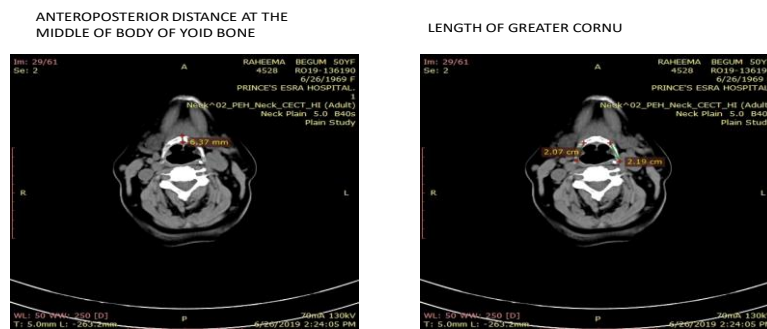
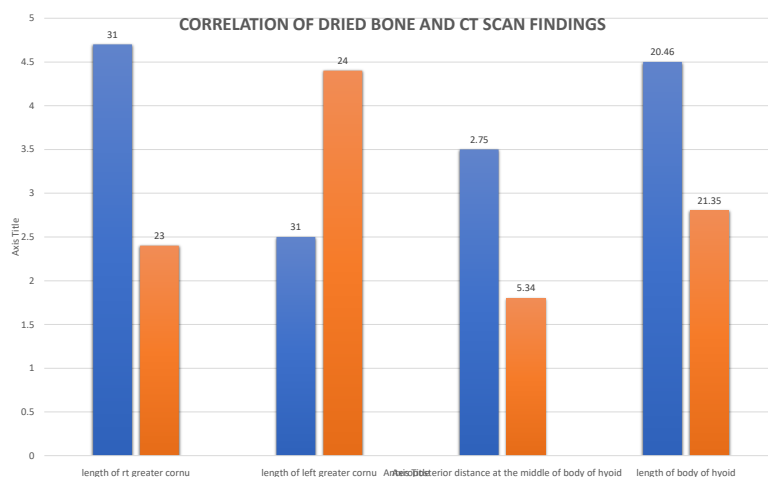


Figure 3. Showing measuring of hyoid bone with CT images.



Graph 1. Showing Correlation between dried none and CT scan findings.

### Discussion

The hyoid bone is a unique structure in the human body. The larynx is an extremely cartilaginous area, except for the sole regional bony structure—the hyoid bone. The hyoid bone is the only bone in humans that does not articulate with any other bone, but only has muscular, ligamentous, and cartilaginous attachments, because of this peculiarity, it has been described as free floating. Given that the vast number of muscles is attached to the hyoid, it is no surprise that the hyoid bone contributes to actions such as mastication and swallowing. Embryologically,

the cartilage of the second pharyngeal arch forms the lesser horn and that of the third pharyngeal arch gives rise to the greater horn. The ventral side of the second and third pharyngeal arches fuses to form the body of the hyoid bone during the fourth week of gestation [11]. In present study we have studied morphometry of hyoid bone in dry bones and CT findings, we measured the length of right greater cornu and it was  $31.31 \pm 3.59$  mm in dry hyoid bone and  $23.37 \pm 1.68$  mm in CT scan measurement. The length of left greater cornu and it was  $31.24 \pm 3.33$  mm in dry hyoid bone and  $24.13 \pm 1.91$  mm in CT scan measurement. The Anteroposterior distance in the middle of the hyoid bone was  $2.75 \pm 0.55$  mm and  $5.34 \pm 0.83$  mm in CT scan. The length of the hyoid bone body was  $20.46 \pm 2.93$  mm in dry bones and  $21.35 \pm 2.10$  mm in CT scan. All the morphometric parameters of hyoid bone correlate with the radiological parameters. There is no significant difference between the dry bone and CT scan measurements in case of length of body of hyoid bone where as there is significant difference between the other three parameters.

In study of Parsons[12] analyzed the hyoid bone from 108 adult cadavers from male adults (53), female adults (28), and children (27). His results showed an average height of 1.2 cm for males (range: 1.0–1.6 cm), and 1.0 cm for females (range: 0.9–1.2 cm). A group of Japanese researchers analyzed 600 hyoid bones (310 males, 290 females) using three-dimensional computed tomography imaging. Their data closely matched with a mean height of 9.4 mm in males (range: 6.3–16.0 mm), and 7.8 mm in females (range: 3.0–8.8 mm)[13]. Fakhry, et al[14] study identified the quantitative measurement of hyoid bone using tools of three-dimensional reconstruction. They conducted the study on 92 bones that were taken from CT scan images of living bodies and 88 bones from cadavers. They were using the metric and morphological analyses for the anatomical and anthropological studies. In metric and morphological analysis, identified the size and relationship of the hyoid bone respectively. In a previous study the hyoid bone was most commonly located at C3 and C2–C3 vertebral level in females (35.7%) and C3 in males (38.5%). No statistically significant difference was found between right and left sides concerning the length and height of the greater horn [15].

The study of Pollanen MS[16] reported there was no linear relationship between the breadth and length dimensions of the bone. Based on qualitative assessment, hyoid bones could be classed as either hyperbolic (55%) or parabolic (45%) in shape. Hyperbolic hyoid bones could be distinguished from hyoid bones with a parabolic configuration on the basis of the metric data although there was considerable overlap in the dimensions of hyoid bones of both configurations. Female hyoid bones tended to be smaller in both dimensions than male hyoid bones. The metric parameters of fractured hyoid bones from 10 cases (8 female, 2 male) of strangulation were compared with the dimensions of hyoid bones in this study. The metric features of the fractured hyoid bones were attributable to the predominance of females in the group of fractured hyoid bones studied, an observation that is anticipated because the majority of strangulations involve female decedents. Monteiro AJ[17] study reported, the mean horn length in males was found to be  $36.3 \pm 3.3$  mm, whereas in females, it measured  $30.6 \pm 1.9$  mm. The mean horn width in males was determined to be  $41.75 \pm 5.1$  mm, while in females, it was  $35.2 \pm 4.5$  mm. Furthermore, the mean body length in males was  $19.3 \pm 2.0$  mm, whereas in females, it measured  $16.4 \pm 1.7$  mm.

## **Conclusion**

Hyoid bone plays a very important role in human body due to which individual can be speech, swallowing, prevention of vomiting etc. It is present at the anterior portion of the neck and

tugged between the mandible and larynx. Hyoid bone is fractured not compulsory in hanging case but it may be fracture in strangulation, throttling and garrotting cases. The present study results may be helpful to clinicians who they perform surgeries in the neck throat region and medico legal practice.

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