International Journal of Anatomy and Research,
Int J Anat Res 2016, Vol 4(2):2183-86. ISSN 2321-4287
DOI: http://dx.doi.org/10.16965/ijar.2016.172

Original Research Article

SEXUAL DIMORPHISM WITH THE SHAPE OF HYOID BONE

K. D. V. Santhi Priya *[1], G. Aruna Kumari [2].

*[1] Assistant Professor, Department of Anatomy, Katuri Medical College & Hospital, Guntur, Andhra Pradesh, India.

*[2] Professor, Department of Anatomy, ASRAM Medical College, Eluru, Andhra Pradesh, India.

ABSTRACT

Introduction: Sex determination from skeletal remains is an important task for forensic experts in medicolegal cases.

Aim of the study: The present study was done to know the relationship of sex with the shape of hyoid bone.

Material and methods: A total of 100 hyoid bones, 66 males and 34 females, in different age groups were studied.

Results and discussion: According to the study, hyoid bones were highly polymorphic in shape across the ages in both sexes. In adult males, V shape is more common (36.16 %) when compared to U shaped hyoid bone (35.29%) in adult females.

Conclusion: To be more accurate, the study of hyoid bone alone will be inadequate in sex determination and needs to be considered along with the measurements of other bones of the same individual.

KEY WORDS: Hyoid bone, Cornua, Shape, Sex determination, Anthropometry.

Address for Correspondence: Dr. K. D. V. Santhi Priya, Flat No. 5D, West End, Skyline Apartments, Beside Kankaragunta Flyover, Guntur – 522004, Andhra Pradesh, India. **Mobile no.:** +919885388531 **E-Mail:** drsanthi10@gmail.com

Access this Article online

Quick Response code

DOI: 10.16965/ijar.2016.172

Web site: International Journal of Anatomy and Research
ISSN 2321-4287
www.ijmhr.org/ijar.htm

Received: 11 Mar 2016 Accepted: 04 Mar 2016
Peer Review: 11 Mar 2016 Published (O): 30 Apr 2016
Revised: 24 Mar 2016 Published (P): 30 Apr 2016

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. Determining the sex is important in forensic practice. Studies have been done on establishing the sex from femur, sternum, clavicle, radius, ulna, scapula and others. The present study was conducted to know the relationship of the sex with the shape of the hyoid bone.

Hyoid bone is a 'U' shaped bone suspended from the tips of the stylohyoid ligaments[1]. It lies in the level of the second to third cervical vertebrae and about on a level with the lower margin of the lower jaw when the head is held in the natural position[2]. It has a body, two greater and two lesser horns or cornua [1].

Body (Basihyal) [2], It is Irregular, elongated and quadrilateral. Anterior surface is convex, faces anterosuperiorly and posterior surface is smooth, concave, faces posteroinferiorly, and is separated from epiglottis by thyrohyoid membrane and loose areolar tissue. Geniohyoid is attached to most of the anterior surface

of the body, the medial part of Hyoglossus invades the lateral Geniohyoid area. The lower anterior surface gives attachment to Mylohyoid the line of attachment lying above Sternohyoid medially and Omohyoid laterally. The lowest fibres of Genioglossus, the hyoepiglottic ligament and the thyrohyoid membrane are attached to the rounded superior border. Sternohyoid is attached to the inferior border medially and Omohyoid is attached laterally. Occasionally the medial fibres of Thyrohyoid and, when present,of Levator glandulae thyroideae, are attached along the inferior border [1].

Greater Cornua (cornua majora/ Thyrohyal) [2]: They project backwards from lateral ends of body. They are horizontally flattened, taper posteriorly, and each ends in a tubercle. Middle pharyngeal constrictor and, more laterally, Hyoglossus, are attached along the whole length of the upper surface of each greater cornu. Stylohyoid is attached near the junction of the cornu with the body. Fibrous loop for the Digastric tendon is attached lateral and a little posterior to Hyoglossus. Thyrohyoid membrane is attached to the medial border and Thyrohyoid is attached to the lateral border [1].

Lesser Cornua (cornua minora/ ceratohyal) [2]: These are two small conical projections at the junctions of the body and greater cornua. The Middle pharyngeal constrictors are attached to the posterior and lateral aspects of the lesser cornu. The Stylohyoid ligaments are attached to their apices and are often partly calcified, and the chondroglossi are attached to the medial aspects of their bases[1].

Ossification: Develops from cartilages of 2nd and 3rd pharyngeal arches, lesser cornua from 2nd, greater cornua from third and body from fused ventral ends of both. Chondrification begins in fifth foetal week and is completed in third and fourth months. Ossification proceeds from six centres i.e., a pair for the body and one for each cornu[1]. The body and great cornua may fuse after middle life; the small cornu may join the greater, or in rare cases may fuse with the body [2].

Aims: To establish a method of sex differentiation by the shape of hyoid bone thereby helping the Forensic expert to come to a conclusion.

MATERIALS AND METHODS

A prospective study was conducted in the Department of Anatomy, Guntur Medical College, Guntur, India. 100 hyoid bones collected from autopsied bodies as per the autopsy technique of Otto Saphir [3]. They were cleaned well without soft tissue, taking care to preserve the lesser cornu, and were fixated in 10% formaldehyde solution over 48 hours and thoroughly dried. Later, the shape of the hyoid bone was recognised.

Out of 100 hyoid bones, 66 males and 34 females in age group of 15-75yrs were studied. The sample was divided into different age groups (Table - 1). The damaged hyoid bones, mainly of hanging and strangulation cases, were excluded from the study.

Hyoid bones were classified according to their shape into five types as done by Harjeet and Jit I (1996) [4] as follows

1. Hyperbolic (U shaped) (Fig. 1)
2. Parabolic (V shaped) (Fig. 2)
3. Boat shape (Fig. 3)
4. Horse shoe type (Fig. 4)
5. Deviated type (Fig. 5)

Fig. 1: Hyoid Bones having U shape.

Fig. 2: Hyoid Bones having V shape.

Fig. 3: Hyoid Bones having Boat shape.

Fig. 4: Hyoid Bones having Horse shoe shape.

Fig. 5: Hyoid Bones having Deviated Type.

U Type	V Type	Boat Type	Horse Type	Deviated Type
It is half circle Anteriorly; the greater cornua are almost straight	It is triangular in shape and resembles 'V', body is bent upon itself with convexity forward.	It resembles a boat, the two greater cornua deviate from each other as if opened out	It is half circle anteriorly the greater cornua faces each other.	One greater cornua deviates more than the other making the cornua asymmetrical

U (Hyperbolic) Shape of the hyoid bone, where the width was equal or less than the length. V (Parabolic) Shape of the hyoid bone, where the width was greater than the length.

Table 1: Age wise sample distribution.

Age	Male	Female	Total
0-10	0	0	0
11-20	4	5	9
21-30	6	6	12
31-40	8	10	18
41-50	25	11	36
51-60	17	2	19
61-70	6	0	6
71-80	0	0	0

Table 2: Various Shapes of Hyoid Bone in Males and Females (15-75 Years) with their Percentage.

Shape of hyoid bone	Males	Females	Total
U Type	9 -13.60%	12 -35.29%	21
V Type	24 -36.36%	7 -20.58%	31
Boat Type	7 -10.60%	3 -8.80%	10
Horse Shoe Type	9 -13.63%	5 -14.70%	14
Deviated Type	17 -25.75%	7 -20.58%	24
Total	66	34	100

Table 3: Comparison of Shape of Hyoid Bone of Present Findings with Previous Workers.

S. No	Name of Authors	V Shape Parabolic			U shape Hyperbolic			Boat shape			Horse shoe shape			Deviated shape		
		M (%)	F (%)	Total (%)	M (%)	F (%)	Total (%)	M (%)	F (%)	Total (%)	M (%)	F (%)	Total (%)	M (%)	F (%)	Total (%)
1	Papadopoulos et al (1989) [9]	5.3	5.3	5.4	15.4	21.1	18.3	21.1	31.6	26.4	10.5	31.6	21.1	17.1	10.5	13.8
2	Harjeet and Jit I (1996) [4]	33.5	18	25.8	20.5	33	26.8	14	19	11.5	10.1	12	11.1	22	18	20
3	Present Study	36.6	20.5	28.6	13.6	35.3	24.4	10.6	8.8	9.7	13.6	14.7	14.2	25.8	20.5	23.2

RESULTS AND DISCUSSION

Modern sex determination techniques originated in traditional physical anthropology. Even today, every practitioner's initial assessment of sex is based on a visual gauge of the width of the pubic bone and the subpubic angle or greater sciatic notch. However, since the pelvis is not always available, intact, or 100% diagnostic, more options were needed [5]. The standards from classical studies like those of Pearson and Bell

(1919) [6] on the femur, Borovansky (1936) on the skull, and Washburn's (1948) [7] ischiopubic index are still being used with success. Accuracy rate in Identification of sex from an entire skeleton is highest when compared to the accuracy rate from individual bone. Even with human pelvis alone and skull alone sex can be determined with 95% and 92% accuracy [8] only.

The present study identifies that V shaped hyoid bone is more common (36.16 %) in adult males followed by deviated type (25.72%), and least common is U type (13.6%) (Table 2). In females, U shaped hyoid bone is more common (35.29%) followed by V (20.58%) and deviated type (20.58%) and the least common type among females is boat shaped (8.8%) (Table 2).

The above results were similar with the study of Harjeet and Jit I (1996) [4] and were different from the study of Papadopoulos et al (1989)[9] (Table 3).

According to the study of Koebke and Saternus (1979), parabolic type of hyoid bone is more common in males (40.9%) whereas hyperbolic type is common in females (35%) [10]. According to Papadopoulos et al (1989) their 'U' type corresponds to Hyperbolic and their 'V' type and "Boat" type corresponds to parabolic type of Koebke and Saternus (1979).

Another study by Seham A. Gad El.Hak etal (2007) showed that the hyoid bone shape is related to the parabolic type in both sexes [11].

Apart from shape of hyoid bone, morphometry of hyoid bone [4,12] and fusion of greater cornu with body of hyoid bone [13] were useful in sex determination of individual across different ages.

CONCLUSION

After studying different shapes of hyoid bone, the authors concluded that in males V-type and in females U-type of hyoid bone were the leading types. However, the study of hyoid bone alone will be inadequate in sex determination and needs to be considered along with the measurements of other bones of the same individual for more accuracy.

ACKNOWLEDGEMENTS

Work attributed to Guntur Medical College, Guntur, Andhra Pradesh.

Conflicts of Interests: None

REFERENCES

[1]. Susan Standring et al. Gray's Anatomy-The Anatomical Basis of Clinical Practice, 40th edition, 2008, P: 436.
[2]. J. Ernest Frazer. The Anatomy of The Human Skeleton, 2nd edition, 1920, P: 271-274.
[3]. Otto Saphir. The Text book of Autopsy Diagnosis and Technic, 4th edition, 1958 P: 133.
[4]. Harjeet and Jit I. Shape, size and sexual dimorphism of the hyoid bone in northwest Indians. J. of anatomical society of India 1996. Vol 45 (1) P: 4 -22.
[5]. Mehmet Yasar Iscan. Rise of Forensic Anthropology. American journal of physical anthropology 1988. Vol 31, Issue S9, P: 203–229.
[6]. Pearson K, and Bell J. A study of the long bones of the English skeleton. 1. The femur. Chaps. 1-4 in Draper's Co. Research Mem. University of London. Biom. 1919. Ser.10, P: 225-539.
[7]. Washburn SL. Sex differences in the pubic bone. American. J. Physical Anthropol 1948. 6:199-208.
[8]. Mehmet Yasar Iºcan, Maryna Steyn, MB. CHB. Textbook of The Human Skeleton in Forensic Medicine, 3rd edition; 2013, P: 143.
[9]. Papadopolous et al. The shape of the human hyoid bone and a proposal for an alternative classification. Journal of Anatomy 1989. 166: 249-260.
[10]. Koebke J, Saternus K S. Zur Morphologie does adultion menschlichen Zugenbeins, Zeits chrift fur Rechts medizim 1979.84:7-18.
[11]. Seham A. Gad El.Hak etal. Sexual dimorphism of the hyoid bone. A preliminary study. Mansoura J. Forensic Med. Clin. Toxicol. Jan 2007. Vol. XV (1).
[12]. K.D.V. Santhi Priya, D. Ranzeetha. Determination of Sex from Morphometry of Hyoid Bone. Indian Journal of Clinical Anatomy and Physiology 2015;2(3):157-161
[13]. Miller KWP, Walker PL, O' Hollaran R L – Age and Sex related variation in hyoid bone morphology, Journal Forensic Science 1998. 43(6) : 1138- 1143.

How to cite this article:

K. D. V. Santhi Priya, G. Aruna Kumari. SEXUAL DIMORPHISM WITH THE SHAPE OF HYOID BONE. Int J Anat Res 2016;4(2):2183-2186. **DOI:** 10.16965/ijar.2016.172