

## A Study on the Polymorphism of the Hyoid Bone in Relation with Sexual Dimorphism

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### ABSTRACT

**Background & Objective:** Sex determination from skeletal remains is an important task for forensic experts in medico-legal cases. The present study was done to develop the statistical relationship of sexual polymorphism with the shape of the hyoid bone. **Material and Methods:** This is an observational study of a total of 100 hyoid bones, 50 males and 50 females, in different age groups were studied. **Results:** 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%) when compared to U-shaped hyoid bone (34%) 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 the other bones of the same individual.

**Key-words:** Hyoid bone, Cornua, Shape, Sex determination, Anthropometry.

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### INTRODUCTION

Identification is very difficult after the onset of decomposition. 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. 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 statistical 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.<sup>1</sup> 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.<sup>2</sup> It has a body, two greater and two lesser horns or cornua. Body is irregular, elongated and quadrilateral having anterior surface convex, faces antero-superiorly and posterior surface smooth, concave, faces postero-inferiorly. Greater cornua (cornua majora/ Thyrohyal) project backwards from lateral ends of the body. They are horizontally flattened, taper posteriorly and each ends in a tubercle. Lesser Cornua (cornua minora/ ceratohyal) are two small conical projections at the junctions of the body and greater cornua.<sup>2</sup> Ossification of lesser cornua occurs from 2<sup>nd</sup>, greater cornua from third and body from fused

ventral ends of both. Chondrification begins in a fifth foetal week and is completed in third and fourth months. Ossification proceeds from six centers, i.e. a pair for the body and one for each cornu.<sup>1</sup> 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.<sup>2</sup>

## MATERIALS AND METHODS

This prospective study was conducted in the Department of Anatomy and the Department of Forensic Medicine, J.L.N. Medical College, Ajmer, Rajasthan after taking the due permission from the Institutional Ethical Committee. Total 100 hyoid bones, including 50 males and 50 females were collected from autopsied bodies as per the autopsy technique from Otto Saphir.<sup>3</sup> All the cases in which hyoid bone is damaged were excluded from the study with the cases in which the victims were either below 15 yrs or above 75 yrs were excluded from the present study. After removal of the hyoid bone from the dead body, it was cleaned well and removal of soft tissues done, taking care to preserve the lesser cornu. The hyoid bones fixated in 10% formaldehyde solution over 48 hours and then thoroughly dried in air. Later, the shape of the hyoid bone was analyzed to establish their sexual dimorphism. The present study can be useful to the Anatomist and Forensic Pathologists to determine the sex in skeletal remains. Out of 100 hyoid bones, 50 males and 50 females in the age group of 15-75yrs were studied. Hyoid bones were classified according to their shape into five types as done by Harjeet and Jit<sup>4</sup>

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

## RESULTS & DISCUSSION:

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.<sup>5</sup> The standards from classical studies like those of Pearson and Bell<sup>6</sup> on the femur, Borovansky (1936) on the skull, and Washburn's<sup>7</sup> ischiopubic index are still being used with success. The 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 only.<sup>8</sup> The present study identifies that V shaped hyoid bone is more common (36%) in adult males followed by deviated type (26%), and least common is U type (14%) (Table 3). In females, U shaped hyoid bone is more common (34%) followed by deviated type, (22%) then Vshaped (20.%) and the least common type among females is boat shaped (8%) (Table 3). The above results were similar to the study of Harjeet and Jit<sup>4</sup> and were different from the study of Papadopoulos et al.<sup>9</sup> According to the study of Koebke and Saturnus,<sup>10</sup> parabolic type of the hyoid bone is more common in males (40.9%) whereas hyperbolic type is common in females (35%). According to

Papadopoulos et al their 'U' type corresponds to Hyperbolic and their 'V' type and "Boat" type correspond to parabolic type of Koebke and Saturnus. Another study done by Seham and Gad et al<sup>11</sup> showed that the hyoid bone shape is related to the parabolic type in both

sexes. Apart from the shape of hyoid bone, morphometry of hyoid bone<sup>4,12</sup> and fusion of greater cornua with the body of hyoid bone<sup>13</sup> were useful in sex determination of the individual across different ages.

**Table 1: Various shapes of Hyoid Bones**

U Type	V Type	Boat Type	Horse Shoe Type	Deviated Type
It is a 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 Type V Type Boat Type Horse Type  
Deviated Type: 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 2: Age wise sample distribution.**

Age	Male	Female	Total
0-10	0	0	0
15-20	3	5	8
21-30	5	6	11
31-40	7	10	17
41-50	20	17	37
51-60	10	8	18
61-70	5	4	9
71-80	0	0	0

**Table 3: Various Shapes of Hyoid Bone in Males and Females (15-75 Years) with their Percentage.**

Shape of Hyoid bone	Male	Female	Total
U shape	7 (14%)	17 (34%)	24
V shape	18 (36.%)	10 (20.%)	28
Boat Shape	5 (10.%)	4 (8.0%)	9
Horse Shoe type	7 (14%)	8 (16%)	15
Deviate	13 (26%)	11 (22%)	24
<b>Total</b>	<b>50</b>	<b>50</b>	<b>100</b>

**Table 4: Comparison of Shape of Hyoid Bone of Present Findings with Previous Workers.**

Name of Authors	V shape parabolic			U shape Hyperbolic			Boat shaped			Horse Shoe type			Deviated		
	M %	F %	Total %	M %	F %	Total %	M %	F %	Total %	M %	F %	Total %	M %	F %	Total (%)
Papadopoulos et al (1989) <sup>9</sup>	5.3	5.3	5.4	1.54	21.1	18.3	2.11	3.16	26.4	10.5	31.6	21.1	17.1	10.5	13.8
Harjeet and Jit I (1996) <sup>4</sup>	33.5	18	25.8	20.5	33	26.8	14	19	11.5	10.1	12	11.1	22	18	20
Present Study	36	20	28	14	34	24	10	8	9	14	16	15	26	22	24

**Conflicts of Interest** : None.

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