

Morphological Features of Human Mandible

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Research Article

Abstract: Next to pelvis, the skull is the most easily sexable portion of the skeleton. As a component of the skull, mandible shares its own characteristics, but its indices for sex determination are neither as abundant as those of the skull. Mandible is the strongest and largest bone of the skull. It shows various morphological features which may show changes with references to age, sex and race. The present study was undertaken to obtain the information on variation of lingula and coronoid process, distribution of genial tubercles and presence or absence of median pit. The material for this study comprised of a collection of 84 (168 sides) dry adult human mandibles obtained from Bone bank available in the department of Anatomy, Government medical college, Aurangabad. Triangular shaped lingulae were found in 80 (47.67%) sides, truncated in 18 (10.71%) sides, nodular in 47 (27.97%) and assimilated in 23 (13.69%) sides. Triangular lingulae were found bilaterally in 32, truncated in 4, nodular in 19 and assimilated in 8 mandibles. Triangular coronoid process was found more in male bones (62 sides). Pattern of Type II genial tubercle (41 mandibles) was found to be most prevalent. In Summary types of lingula and coronoid process can be used for sexing of mandible.

Key words: mandible, lingula, coronoid process, genial tubercles.

Introduction:

The mandible is the largest, strongest bone in the face. It has a horizontally curved body that is convex forwards, and two broad rami that ascend posteriorly. The rami bear the coronoid and condyloid processes¹. (gray).

The lingula is the tongue shaped bony prominence which overlies the mandibular foramen which leads to the mandibular channel. This channel goes from the ramus to the body, below the alveoli. Since the inferior alveolar nerve enters the mandibular foramen to supply the structures of the lower jaw, the relationship of lingula to the inferior alveolar nerve is of clinical significance to dental surgeons. While performing mandibular osteotomy it is imperative that these vital structures should not be injured. It becomes a necessity to know the morphology of lingula so as

to preserve the important structures during surgical interference of mandible around the lingula region.

Earlier studies described lingual characteristics depending on its location (KIM LEE CHUNG² 1997), its shape and different races (TULI CHOUDHARY ET AL 2000³, DEVI ARNA MANJUNATH⁴ 2003, KOSITBOWORNCHAI⁵ 2007).

Triangular shaped lingulae have been described as the most prevalent type by various leading authors⁶. Different textbooks illustrate truncated⁷, nodular⁸ and assimilated⁹ type.

Researchers analysed the morphological characteristics of the mandibular foramina and lingula and they arrived at a conclusion that such structure variability would account for failure to block the inferior alveolar nerve. (NICHOLSON 1985¹⁰, KEROS KOBLE¹¹ 2001). Hence an attempt has been made to provide more information on lingual morphology.

Coronoid process may be of different size. It may be triangular, hook shaped or rounded. Pattern of genial tubercle varies from bone to bone. Its variable pattern may hide the view of lingual foramina while reading oral radiograph.

Material and Methods:

The present study was undertaken on 84 dry human mandibles. Out of 84 mandibles, 62 belonged to male and 22 belonged to female skeleton. The following parameters were studied.

1. Variations in shapes of lingula

In the present study 84 mandibles were observed on both sides (168 sides) to study any variations in shapes of lingula. Different shapes of lingula were observed such as 1.Triangular 2.Truncated 3.Nodular and 4. assimilated.

A. Triangular: It is with wide base and narrow rounded or pointed apex and apex being directed postero superiorly i.e., towards condyle or towards posterior border.

B. Truncated: It is somewhat quadrangular with superior, inferior and posterior borders.

C. Nodular: Entire lingula except for its apex merged into the ramus.

D. Assimilated: In this type lingula completely incorporated into ramus.

Table 1:- Variation in the shapes of lingual in 84 mandibles (168 Sides)

	Triangular			Truncated			Nodular			Assimilated		
	R	L	T	R	L	T	R	L	T	R	L	T
Male	29	32	61 (36.3%)	7	8	15 (8.92%)	20	9	29 (17.26%)	7	8	15 (8.92%)
Female	13	6	19 (11.3%)	2	1	3 (1.78%)	8	10	18 (10.71%)	3	5	8 (4.76%)



Fig1: Showing Triangular Shaped Lingula



Fig2: Showing Assimilated Shaped Lingula



Fig3: Truncated Shaped Lingula



Fig 4: Nodular Shaped Lingula

The lingula in the adult human mandible

2. Variations in shape of coronoid process

Different shapes of coronoid process studied are triangular, hook shaped and rounded.

	Male	Female	Total
Triangular	70	39	109(65%)
Hook Shaped	30	17	47 (28%)
Rounded	7	5	12 (7%)

Graph No.1;- Types of coronoid process

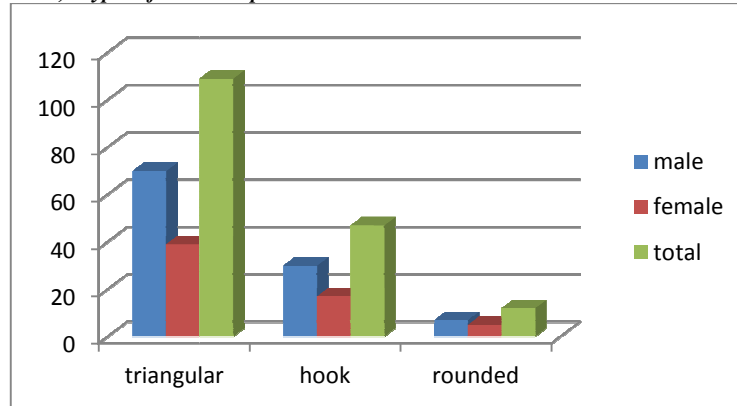


Fig 5: Triangular Coronoid Process



Fig 6: Rounded coronoid Process



Fig 7: Hook shaped coronoid Process

Various shapes of coronoid process

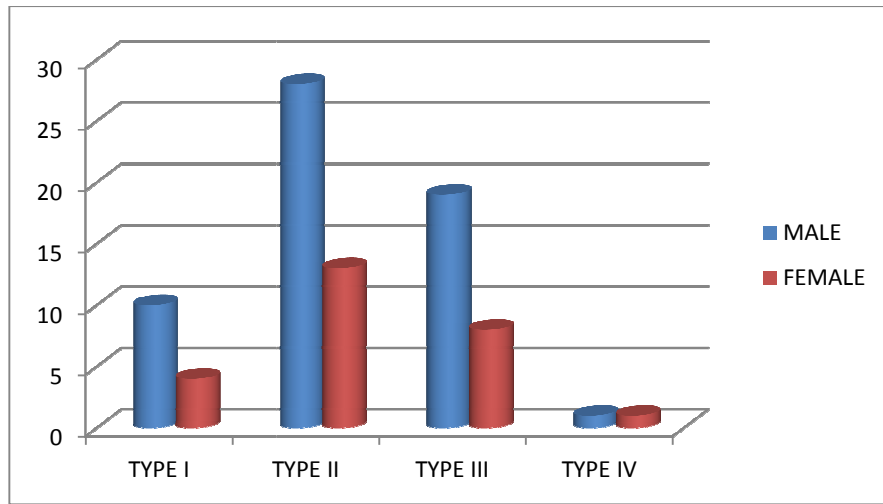
3. Distribution of genial tubercles Depending upon their number and configuration, they are classified as follows.

Table3:- Various Patterns of genial tubercles

Type-I	Four separate genial tubercles upper pair as superior, lower pair as inferior genial tubercles	•• ••
Type-II	Superior genial tubercles of both sides separate while inferior tubercles of both the sides fused to form single crest or tubercle.	•• ▭
Type-III	Superior and inferior genial tubercles of either side fused to form single crest on either side.	▭ ▭
Type-IV	All four genial tubercles fused to form single crest or tubercle	▭

Table 4:- Distribution of Patterns Of Genial Tubercles

	Type I	Type II	Type III	Type IV
Male	10	28	19	1
Female	4	13	8	1
Total	14(16.66%)	41(48.8%)	27(32.14%)	2(2.38%)



Graph No.2:- Distribution and morphology of Genial Tubercles

Observation:

Triangular lingula is most prevalent i.e. (47.67%). It is found more commonly in males(35.43%).The least prevalent type is truncated type (10.71%). Triangular ligulae were found bilaterally in 32 mandibles and unilaterally in 9

bones on right side and in 7 bones on left side. Truncated type was observed bilaterally in only 4 mandibles and unilaterally in 5 bones on right and on left side. Type II genial tubercles (48.8%) were most prevalent, where as Type IV genial tubercles (2.38%), least prevalent.

Table5:- Analysis of shape of lingula

Shapes (168 sides)	Bilateral	Unilateral	
		Right	Left
Triangular(n=80,47.61%)	32	9	7
Truncated (n=18,10.71%)	4	5	5
Nodular (n=47, 27.97%)	19	4	5
Assimilated (n=23, 13.69 %)	8	3	4

Overall triangular type of coronoid process (60%) is more prevalent than rounded

(7%)and hook shaped (28%).Triangular type more prevalent in males (41.66%) than females

(23.21%), also hook shaped process was more prevalent in males (17.85%) than females (10.11%).

Discussion:

Among all the morphological features selected lingulae shows sexual dimorphism. Lingula was described by Johannes-Baptist Spix in 1815 and was therefore named 'Spix's ossicle or spine' (DOBSON, 1962)¹².

Various standard textbooks mention only triangular shaped lingulae. Nicholson (1985)¹⁰ and DuBrul (1988)¹³, however, reported the presence of various shapes but did not provide details about the various types and incidence. Other types of lingulae i.e. truncated⁷ type was described by Hollinshead(1962), nodular⁸ by Berkovitz et al. (1978), and assimilated⁹ type by Morgan et al. (1982).

Table 6 :- Comparison of various studies of lingulae of mandible

AUTHOR	TYPES OF LINGULAE			
	Triangular	Truncated	Nodular	Assimilated
Lopez et al (2010) ¹⁴	41.3%	36.3%	10.5%	11.9%
A Tuli et al (2000) ³	68.5%	15.8%	10.9%	4.8%
Kositbowornchai et al (2007) ⁵	24%	47%	33%	19%
Jansisyanont P et al (2009) ¹⁵	29.9%	46.2%	19.6%	4.3%
Present Study (2012)	47.6%	10.71%	27.97%	13.6%

Triangular type is more prevalent showing its presence in 80 bones (32 bilateral and 16 unilateral). As above table depicts our findings match with Lopez et al (2010)¹⁴ and A Tuli et al (2000)³. In the Thai population the truncated lingula was prevalent, followed by the nodular type, the triangular type and the assimilated type.⁵

About the shape of coronoid process which is classified as triangular, hook and rounded, our study shows triangular in 65%, hook shaped in 28% and rounded in 7%. Over all triangular type is more prevalent in males.

Table7 :- Comparison of various studies of coronoid process of mandible

Types of coronoid process	Triangular	Hook Shaped	Rounded
Tanveer A(2011) ¹⁶	67%	30%	3%
Issac B (2001) ¹⁷	49	27.4	23.6
Vipul et al (2011) ¹⁸	54.17%	24.58%	21.25%
Present study (2012)	65%	28%	7%

Information regarding the morphological shapes of the coronoid process is useful for the maxillofacial surgeon. The coronoid process can be used as an excellent donor graft site for reconstruction of orbital floor deformities (MINTZ et al., 1998)¹⁹.

Genial tubercles are four elevations on the inner surface of body of mandible, provide origin to genioglossi and stylohyoid muscles on either side. They show differential pattern in the form of their shape and size. In the present study four different patterns of genial tubercles were observed. Type II genial tubercle pattern was found in 41 (48.8%) mandibles. Type I was found in 14 (16.66%) and Type III in 27 (32.14%) mandibles. Type IV was the least common found in 2 (2.38%) bones. These differences could be of some racial significance which needs further investigation.

Conclusion:

In the present study various nonmetrical qualitative features of mandible were evaluated. Lingula of mandible is one of the sexually dimorphic feature and can be used effectively in sexing of mandible. Male mandible shows triangular type commonly. Among the various types of coronoid processes, triangular process is the most prevalent. Pattern of genial tubercles should be analysed thoroughly on very large sample of bones for its racial differences.

The above findings are of immense value from anatomical, anthropological and forensic point of view in differentiating the sex of the mandible. Along with other features of the skull known as nonmetric variants these could be used as anthropological markers to assess different populations and races (BERRY, 1975)²⁰.

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