

Morphological Characteristics of Human Mandible: A Guide for Sexing of Mandible

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Abstract

Background: Mandible being largest and strongest bone of skull, having various morphological features may show changes with reference to age, sex and race. The study of various morphological features of mandible can be useful to determine age, sex and race of the individual in various medico-legal cases as well as in other anthropological studies. **Materials and Methods:** The study was carried out on 110 dry mandibles (free from pathological or traumatic damages, Edentulous and bones with absorbed alveolar margins were also excluded from the study). The parameters studied were shape of lingula and coronoid process, distribution of genial tubercles and angle of mandible. **Observations:** Triangular shape of lingula was found to be the most common both in males & females and assimilated type as least common. Triangular coronoid process was most common in males (64.22 %) and hook like coronoid process is commonest in females (41.67%). **Discussion:** Locating the exact location of lingula plays an immense role in anesthetic surgical block of inferior alveolar nerve. Triangular lingula are the commonest in our study and most of other studies also. The coronoid process can be used as an excellent donor graft site for reconstruction of orbital floor deformities. So its shape carry monumental role for reconstructive maxillofacial surgeries like orbital floor repair. The above mentioned parameters of mandible plays substantial role in sexing of the mandible.

Keywords: Morphological; Medico-Legal; Masticatory; Edentulous.

Introduction

Second to pelvis, the skull is the most easily sexable portion of the skeleton [1]. Mandible being a part of it contributes greatly to the same. Mandible being largest and strongest bone of skull, having various morphological features may show changes with reference to age, sex and race [2]. It also shows morphological change according to the age [3]. Morphological changes like alteration in size and

shape of certain bony process of mandible like lingula, genial tubercles and coronoid process etc play an important role in the determination of sex [2]. So the study of various morphological features of mandible can be useful to determine age, sex and race of the individual in various medico-legal cases as well as in other anthropological studies.

Dimorphism of mandible is reflected in its shape and size. As the mandible is considered as the last skull bone that stops growing, it is quite sensitive to the adolescent growth spurt. The stages of mandibular development, growth rates and its duration are distinctly different in both sexes so this bone is particularly useful in differentiating between sexes. Additionally, masticatory forces applied are different for males and females, which influence the shape of the mandibular ramus [4]. Kumar and Lokanadham [5] studied mandible using 22 parameters, out of which six parameters can be used to determine sex in nearly 75% cases.

Humphrey [6] stated that differences between the sexes are more marked in the mandibular ramus

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compared to the mandibular body. Literature also shows that some studies had been performed, but very few of these have used the parameters that can be comparable to each other. So this study was carried out with the aim of studying the some of the parameters of mandible that can be helpful in forensic and anthropological studies.

Methodology

The present study was carried out on 110 dry mandibles present in the museum of Anatomy department of our Medical College. Out of 110 mandibles, 67 belonged to male and 43 were female mandibles. The studied bones were free from pathological or traumatic damages. Edentulous and bones with absorbed alveolar margins were also excluded from the study.

The following parameters were observed and studied.

Shape of Lingula

Study of 110 mandibles showed 220 lingula. The variations in shapes of Lingula were observed. The different shapes observed were triangular, truncated, nodular and assimilated (absorbed).

Shape of Coronoid Process

The shapes of various coronoid processes were noted as triangular, rounded or hook like.

Distribution of Genial Tubercles

The number of genial tubercles was noted. The arrangement of these tubercles on posterior aspect of mentum was described into four categories.

Category I: Four separate genial tubercles- upper pair as superior and lower pair as inferior genial tubercles

Category II: Superior genial tubercles of both sides are separate while inferior tubercles of both the sides fused to form single crest or tubercle.

Category III: Superior and inferior genial tubercles of either side fused to form single crest on either side.

Category IV: All four genial tubercles fused together to form single crest or tubercle

Angle of Mandible (Gonial angle)

The gonial angle in mandibular bones was measured as the angle formed by the base of the mandible and the posterior border of the ramus by the scale of protractor, which is placed over the angle of mandible in such a way that the base of the protractor coincides with the base of the mandible. The angle was recorded in degrees.

Observations

The data collected regarding the lingula of mandible is summarized in the table 1.

The various shapes of coronoid processes of mandible are triangular, rounded or hook like. Table 2 shows the data of shapes of coronoid process in males and females.

Table 1: Shapes of 220 Lingula of 110 mandibles in males and females

	Triangular			Truncated			Nodular			Assimilated		
	Right	Left	Total	Right	Left	Total	Right	Left	Total	Right	Left	Total
Male	30	32	62	5	8	13	17	23	40	10	9	19
Female	20	28	48	3	6	9	14	13	27	2	0	2
Total	50	60	110	8	14	22	31	36	67	12	9	21

Table 2: Gender wise distribution of shapes of coronoid process

	Male	Female	Total
Triangular	70 (64.22%)	39 (35.78%)	109
Rounded	30 (63.83%)	17 (36.17%)	47
Hook like	07 (58.33%)	05 (41.67%)	12

Table 3: Gender wise distribution of arrangement of genial tubercles

	Category I	Category II	Category III	Category IV
Males	12	17	24	14
Females	7	23	8	5
Total	19 (17.27%)	40 (36.36%)	32 (29.10%)	19 (17.27%)

Table 3 shows that large percentage falls in Category III where Superior and inferior genial tubercles of either side are fused to form single crest on either side.

Discussion

Pearson has pioneered stature estimation early in 19th and 20th century. In the last quarter of the previous century researchers had done such studies on large populations. Deviation and eventual use of generalized equation is a task accomplished by Steele [7].

Lingula was described by Johannes-Baptist Spix in year 1815 and was therefore also labeled as "Spix's ossicle or spine" (DOBSON, 1962) [1]. Different morphological shapes of lingula were first classified by Tuli et al [8] into triangular, truncated, nodular and assimilated types in adult Indian human mandibles [9]. We observed triangular as most common shape of lingula and truncated as the least common shaped lingula in both males and females. Khan and Sharieff [10] also recorded triangular lingula as commonest shape. Finding the exact location of lingula plays in immense role in anesthetic surgical block of inferior alveolar nerve. Variation in its shape or less frequently, its absence may create difficulty in such nerve blocks. We found that triangular shaped lingula are commonest variety in males (64.22%) and hook like lingula are commonest in females (41.67%). Nirmale et al [1] (2012) found triangular lingula commonly in males (35.43%).

Information regarding the various morphological shapes of the coronoid process is useful for the maxillofacial surgeon [1]. The coronoid process can be used as an excellent donor graft site for reconstruction of orbital floor deformities (Mintz et al, 1998) [11].

Genial tubercles are four projections on posterior surface of mentum which give origin to paired genioglossus and stylohyoid muscles of corresponding sides. Four different categories of arrangement of genial tubercles are noted in observations. Category II (Superior genial tubercles of both sides are separate while inferior tubercles of both the sides fused to form single crest or tubercle) seems to be most common variety (36.36%). Nirmale

et al also noted that type II variety is the commonest and type IV as the least common.

Thus the above presented data can be very useful for sexing of human mandible. Out of the four parameters of mandible studied, lingula is most important while determining the sex of individual.

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