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Original Research Article

MORPHOMETRIC STUDY OF NASAL BONE AND PIRIFORM APERTURE IN HUMAN DRY SKULL OF SOUTH INDIAN ORIGIN

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ABSTRACT

Background: Nasal bone and piriform aperture shows racial and geographical differences because of variable climate.

Aim: the aim of this study was to evaluate the dimensions (maximal width and length), the size and the shape of the piriform aperture (PA) and nasal bone in South Indian adult.

Materials and Methods: In this observational study, dimension of piriform aperture and nasal bone were measured using digital Vernier Calipers after assessing landmarks around the piriform aperture on the norma frontalis in Frankfurt plane in 51 skull of South Indian origin.

Results: The mean height of the piriform aperture between male and female showed significance this has correlated well with the previously data acquired from human skulls. The present study findings were similar to most of Indian skulls having platyrhine type of piriform aperture (triangular to oval shape with piriform aperture index of 0.79. The Mean length and width of nasal bone did not show sexual dimorphism.

Conclusion: the analysis of size and shape of the piriform aperture showed the existence of a significant sexual dimorphism. These results encourage us to go further with functional and imaging correlations. This study will also be helpful in forensic research, anthropology and plastic surgery.

KEY WORDS: Nose, Dimension, Sexual Dimorphism.

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INTRODUCTION

The nasal bone and piriform aperture (PA) together form the nose. Its morphology varies depending on the ethinicity and gender. The two nasal bones articulate in the midline to form the internasal suture. Superiorly both nasal bone articulate with the frontal bone and forms the fronto-nasal suture. Nasion is the point of intersection between internasal and frontonasal suture. The piriform aperture is an anatomical structure formed by several bones that are part of the face. It usually has a pear-shape appearance, anatomically formed in its upper portion by the nasal bone, palatal process of the

maxilla inferiorly and laterally by the frontal process of the maxilla. There is racial and geographical difference in the shape of the nose and the nasal aperture owing to climatic variation. This variation is necessary in order to adapt to the physiological and functional need of climate. These changes occur with respect to external nasal morphology, orientation of nasal bone and piriform aperture and in the mucosa lining the internal passages[1]. The knowledge of the morphometric measurements of nasal bone and piriform aperture is of relevance for performing a surgical procedure such as rhinoplasty, osteotomies and plastic reconstructions. Studies have shown that surgical and traumatic alterations of the piriform aperture may alter the respiratory mechanics[2]. Their form and size may also serve as a basis for anthropological studies of a specific population, related to ethnicity [3]. The present study was undertaken to determine the size, shape and sexual dimorphism of the nasal bones and piriform aperture in a population of South Indian skulls and to compare the data obtained with those reported in other populations.

MATERIALS AND METHODS

51 adult dry skulls of were collected from the Department of Anatomy of Sree Balaji Medical College & Hospital. All measurements were taken using digital Vernier caliper accurate up to 0.001 mm. Nasion and anterior nasal spine were marked. Then nasomaxillary and internasal sutures were traced. Using landmarks defined by Hwang et al.[5], measurements of piriform aperture (PA) and nasal bone were taken using digital Vernier calipers, Maximum height at the midline of (PA), width of (PA) at the upper and lower end, nasal bone length, nasal bone width and piriform aperture index (PAI) . The nasal bones were classified according to their shape, using the descriptions of Hwang et al. depicted in [Fig-1] [5].

All data collected were thoroughly screened and entered into Ms excel spread sheets and analysis was carried out. Differences in male and female skull were recorded and the mean calculated. The calculated mean was analyzed using SPSS statistical software. Sex determination of skull is required to assess sexual dimorphism. So, the sex of skull was determined based on the following features. The male skull is more robust and the female is more gracile. The female fore head is higher, more vertical and more rounded than the male, and there is a clear retention of the frontal eminences in the female.

A male skull has thicker and more rounded orbital margins, pronounced supra orbital ridges and often a well defined glabella that occupies the midline above the root of the nose. The temporal lines are more pronounced in the male and the supramastoid crest generally extends posterior to the external auditory meatus. The sites of muscle attachment on the skull are more prominent in male skull especially the mastoid process, nuchal and temporal lines when compared to that of female skull. [11]. On the basis of above characteristics the sex distribution was 26 male and 25 female skulls.

Fig. 1: Classification of Nasal bone according to shape as per Hwang et al.[5]

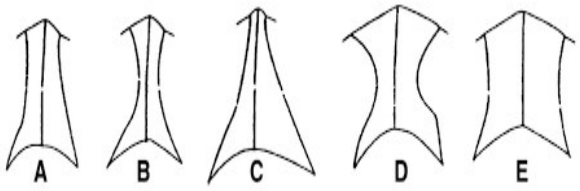

Fig. 2: Classification of nasal bone according to shape (Hwang et al.[5])and percentage distribution.

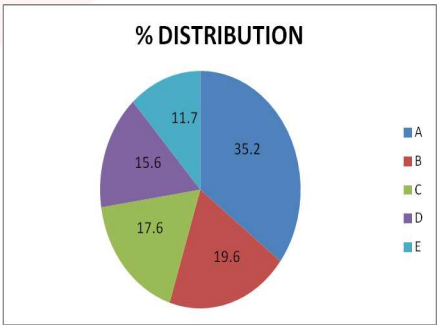

Fig. 3: Graphical representation of parameters between Male and Female.

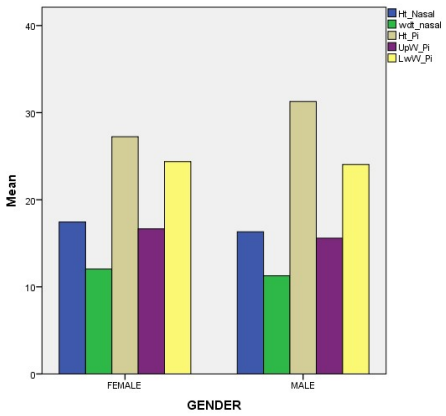

Table 1: Comparison of parameters between Male and Female.

S.No	Parameters	Male (mean)	Female (mean)	P value
1	Height of Nasal bone	16.3 ±1.9	17.4 ± 2.3	0.066
2	Width of nasal bone	11.3 ± 1.6	12.05 ±1.7	0.091
3	Height of Piriform aperture	31.2 ± 1.3	27.2 ±1.3	0.000*
4	Upper Width of Piriform aperture	15.6 ± 2.4	16.6 ± 2.8	0.152
5	Lower Width of Piriform aperture	24.03 ±1.4	24.4 ± 2.3	0.523

Table 2: paired Samples statistics.

parameters	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig. (2-tailed)
Nasal height	1.374	0.247	1.878 1.869	49 45.945	0.066 0.068
Nasal width	0.002	0.963	1.725 1.723	49 48.556	0.091 0.091
Height of piriform aperture	0.05	0.823	-10.76 -10.762	49 48.956	0 0
Upper width of piriform aperture	0.513	0.477	1.457 1.452	49 47.252	0.152 0.153
Lower width of piriform aperture	8.3	0.006	0.644 0.638	49 39.356	0.523 0.527

Table 3: Classification of Piriform Aperture (PA) based on shape and piriform aperture index by Boyan et al. [4].

Type	Shape of PA	PAI	No. Of Skull	Percentage	Male	Female
I	Long and Narrow	0.49 – 0.60	1	1.9	0	1
II	Triangular	0.61 – 0.70	7	13.72	4	3
III	Triangular to Oval	0.71 - 0.80	23	45.09	12	11
IV	Tending to Roundness	0.81 – 0.90	20	39.21	10	10

DISCUSSION

The data pertaining to the nasal bone and piriform aperture is important especially, in preoperative evaluation of anatomy will ensure better performance and good outcome during surgery. The size and the shape of the nasal bones and piriform aperture shows racial differences these characteristics can be used in anthropologic classification. It has been noted that nasal bone type A (45%) is predominant in North Indian population, followed by Type C (20%), Type D and E and least Type E Adil Asghar, et al.[12].

Hwang (2005) found predominance of Type B (52.3%) Nasal type in Korean population followed by Type A (43.2%) and Type D (4.5%) [4]. Lang and Baumeister (1982) found that German population has Predominance of Type A (68.3%) nasal bone followed by B, D, E. and C [7]. It was determined in the Chinese skull and identified Type A 47.5% and Type B 52.5% nasal bone [8]. Prado (2011) shows predominance of Type A (28.6%) followed by Type B (16.2%) Type C (7%) few Type D & E [9] in present study among South Indian skulls it has been found type A to be predominate (35.2%) followed by type B (19.6%) type C (17.6%) , type D (15.6%) and type E (11.7%) this correlates with previous studies . In present study length and width of nasal bone was 16.3± 1.9 and 11.3 ±1.6 mm in male and 17.4± 2.3 and 12.05 ± 1.7 mm in female. Hwang measured the length and width of nasal bone in Korean origin 25.9±3.8mm & 9.2±2.4mm in male and 24.5±3.7mm &8.8±2.6mm in female [4]. Lang worked on German origin and found mean nasal length and width 24.9±3.2 & 13±2.4 respectively [7]. Karadag et al., studied 80 Anatolian patients and reported the mean nasal bone length of 30.6 mm in males and 29.01 mm in females [2].No study showed significant sexual differences.

Mean height of PA is 31.3 mm male and 27.24 mm in female indicating a significant higher value in male. The mean height of the PA (36.3 mm) observed in Boyan et al., (2007) study was larger than that reported by Ofodile (25.8mm Ashanti; 31.4mm Austrians; 28.6mm American Indians; and 28.2mm black Americans) and Hwang et al., (30.1mm males and 28.0mm females in Korean population) [3,4,10].

Moreddu studied on French population by 3-d CT reconstruction method and found mean PA Height as 32.54 mm (±2.70) in females and 36.35 mm (±3.07) in males. The nasal aperture was longer at the maximal length in the Indian group in comparison with Chinese and white groups [13]. Maximum width of PA (Male & Female mm p=). Moreddu et al., also measured mean PA Width as 24.00 mm (±1.77) in females and 25.32 mm (±1.86) in males. The total width of the nasal aperture was assessed in 80 men and Women, using healthy individuals measurement, obtained by CT scans. The mean width was suggested to be 21.9 +/- 2.1 mm in men and 21.0 +/- 2.2mm in women [14]. According to Adil Asghar, et al, the Indian population falls in platyrhinian and hyperplatyrhinians. This can be explained as an adaptation to extreme climate of India which is hot and cold requiring

more surface area and volume of nasal passage along with more turbulency by soft tissue changes for appropriate conditioning. So, excess soft tissue changes needs wider and circular PA.

With respect to shape of the piriform aperture, in Boyan study type II was predominant (51.8%), followed by type I (25.0%) and then types IV and III with similar frequency (12.5% and 10.7%, respectively) [3]. According to Ofodile, the shape of the piriform aperture was oval (equivalent to types III and IV) in Ashanti, triangular (type II) in Austrians and American Indians, and varied from oval to triangular in black Americans (type III) [10]. It was observed that the most common was the type I (pear - 39.1 %) and the less common were type III (diamond - 0.0 %), type II (inverted heart - 1.6 %) and type IV (inverted heart - 3.1 %) [15]. In the present study shape of piriform aperture was triangular to oval 45.09% of skulls followed by tending to roundness in 39.21% of skulls this distribution is similar to studies done on skulls of North Indian population [12] and similar to previous studies.

CONCLUSION

From the present study, the mean height of the piriform aperture was higher in the male sex compared to the female with significant difference. The width of piriform shows an equal average for both sexes. The results obtained in this study showed the importance of the morphological knowledge of the piriform aperture. As the skeletal structure of human face is influenced by environmental factors specific standards of assessment must be drawn and applied to particular population under consideration. Thus the present study may be useful for anthropologist, forensic researchers, otorhinologist and plastic surgeons.

Conflicts of Interests: None

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