

ORIGINAL RESEARCH

Assessment of Mastoid Parameters for Sexual Differentiation in a known Population: A radiographic study

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Received: 13 July, 2022

Accepted: 21 August, 2022

Abstract

Background: The present study was conducted for evaluating Mastoid Parameters for Sexual Differentiation in a known Population.

Materials & methods: A total of 50 male and 50 female subjects were enrolled. Complete demographic and clinical details of all the subjects was obtained. We analysed lateral radiographs of all the subjects. Three craniometric points were identified on the skull radiographs: (1) porion which is the uppermost point of the external acoustic meatus; (2) mastoidale which is the inferior most point of the mastoid process; and (3) asterion, which is the meeting point of three posterior skull sutures, i.e., lambdoid, occipitomastoid, and parietomastoid. All the measurements were made in Microsoft excel sheet and were subjected to statistical analysis.

Results: Among males, Porion-mastoidale, Mastoidale-asterion, Asterion-porion and Area of mastoid triangle was 34.12 mm, 52.94 mm, 45.89 mm and 691.12 mm² respectively. Among females, Porion-mastoidale, Mastoidale-asterion, Asterion-porion and Area of mastoid triangle was 30.23 mm, 48.69 mm, 41.22 mm and 651.37 mm² respectively. Significant results were obtained while comparing the mastoid variables among males and females.

Conclusion: Radiographic dimensions of the mastoid are potential predictors of sexual morphism.

Key words: Sexual differentiation, Mastoid

Introduction

Study on human skeletal remains for sex determination has been a topic of interest among researchers. Skeletal remains have been used for sexing the individual as bones of the body are last to perish after death, next to enamel of teeth. Almost all bones of the human skeleton show some degree of sexual dimorphism. Sex determination is vital for the identification of an individual. Often fragmentary remains are available for forensic identification making sex determination difficult.^{1,2}

The mastoid region, a fragmentary piece of skull, is ideal for studying sexual dimorphism as it is resistant to damage due to its anatomical position at the base of skull. The skull measurements vary significantly in different ethnic groups and the discrimination models for Indian populations are rare. The mastoid bone is a part of temporal bone of skull that had good part in sex identification.³ Temporal bone has four part- Squamous part, Tympanic part, Petromastoid part and Styloid process. Mastoid process is a conical prominence projecting from the undersurface of mastoid portion of temporal bone, located just behind the external acoustic meatus and lateral to the styloid process. Its

size vary, it is larger in males than in females.^{4 6} Hence; the present study was conducted for evaluating Mastoid Parameters for Sexual Differentiation in a known Population.

Materials & methods

The present study was conducted for evaluating Mastoid Parameters for Sexual Differentiation in a known Population. A total of 50 male and 50 female subjects were enrolled. Complete demographic and clinical details of all the subjects was obtained. We analysed lateral radiographs of all the subjects. Three craniometric points were identified on the skull radiographs: (1) porion which is the uppermost point of the external acoustic meatus; (2) mastoidale which is the inferior most point of the mastoid process; and (3) asterion, which is the meeting point of three posterior skull sutures, i.e., lambdoid, occipitomastoid, and parietomastoid. All the measurements were made in Microsoft excel sheet and were subjected to statistical analysis.

Results

A total of 100 subjects were enrolled. Among them 50 were males and 50 were females. Overall, Porion-mastoidale, Mastoidale-asterion, Asterion-porion and Area of mastoid triangle was 32.56 mm, 50.39 mm, 43.69 mm and 670.36 mm² respectively. Among males, Porion-mastoidale, Mastoidale-asterion, Asterion-porion and Area of mastoid triangle was 34.12 mm, 52.94 mm, 45.89 mm and 691.12 mm² respectively. Among females, Porion-mastoidale, Mastoidale-asterion, Asterion-porion and Area of mastoid triangle was 30.23 mm, 48.69 mm, 41.22 mm and 651.37 mm² respectively. Significant results were obtained while comparing the mastoid variables among males and females.

Table 1: Mastoid variables

Mastoid variables	Mean	SD
Porion-mastoidale (mm)	32.56	2.36
Mastoidale-asterion (mm)	50.39	10.28
Asterion-porion (mm)	43.69	6.21
Area of mastoid triangle (mm ²)	670.36	118.3

Graph 1: Mastoid variables

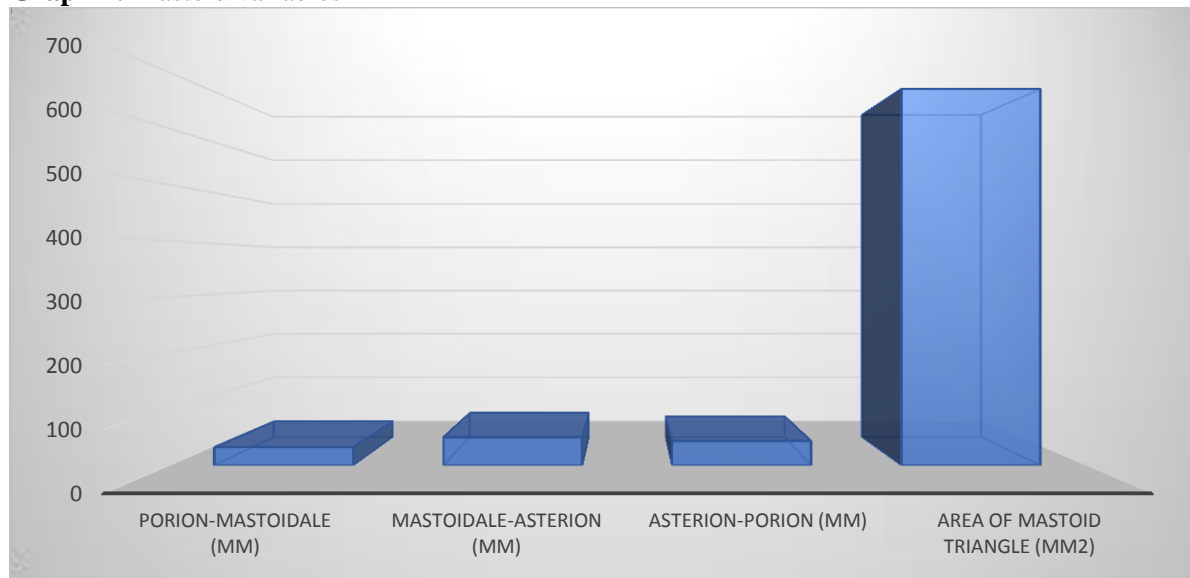
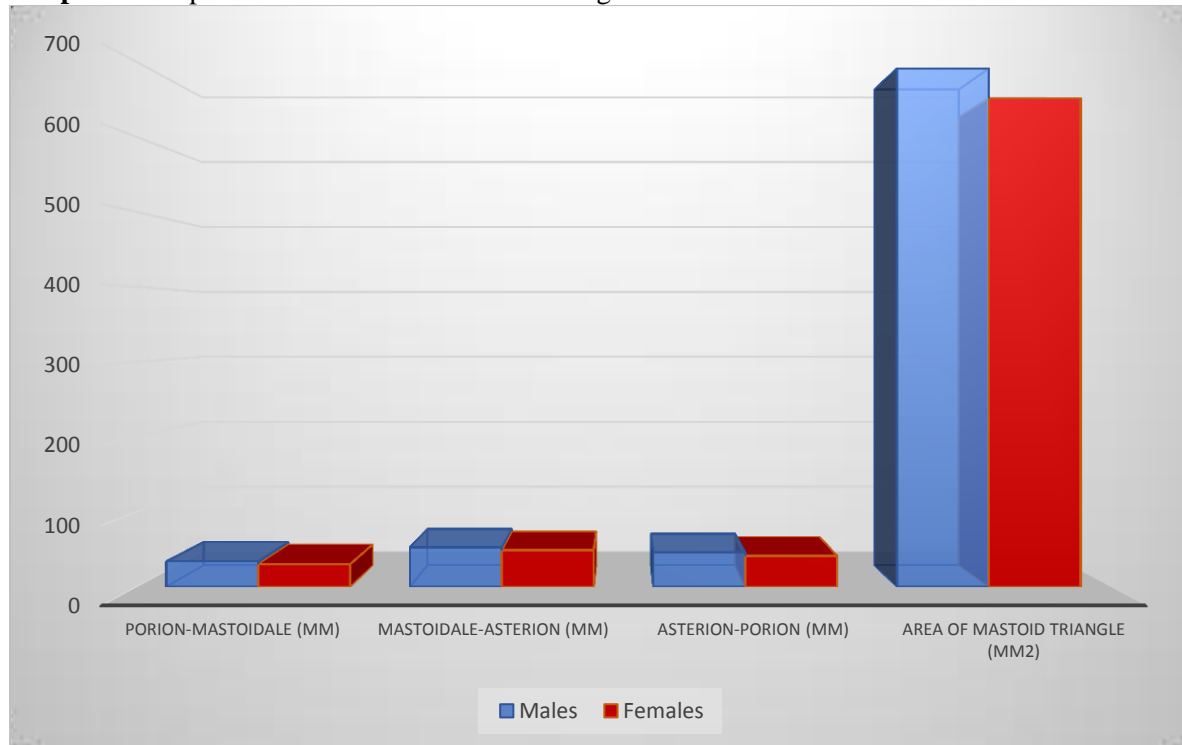


Table 2: Comparison of Mastoid variables among males and females

Mastoid variables	Males	Females	p- value
Porion-mastoidale (mm)	34.12	30.23	0.007*
Mastoidale-asterion (mm)	52.94	48.69	0.018*
Asterion-porion (mm)	45.89	41.22	0.019*
Area of mastoid triangle (mm ²)	691.12	651.37	0.021*

*: Significant

Graph 2: Comparison of Mastoid variables among males and females

Discussion

Study on human skeletal remains for sex determination has been a topic of interest among researchers. Osteometric studies using individual bones exhibiting sexual dimorphism have been reported among different populations. Human evolutionist study sexual dimorphism to understand the etiology of how Homo sapiens came to have less sexual dimorphic features than our ancestors that is the Cro magnun. Bio archaeologist study sexual dimorphism to recreate the demographic profile of our ancestors. Sex is best assessed from the pelvis but it is very often damaged. Skull requires the most frequent sexing in medico legal cases. It appears to be the main reliable bone exhibiting sexually dimorphic traits, because skull has a high resistance to adverse environmental conditions over time, resulting in the greater stability of dimorphic features as compared to other skeletal bony pieces. Mastoid region is one of the most dimorphic traits.⁶⁻⁹ Hence; the present study was conducted for evaluating Mastoid Parameters for Sexual Differentiation in a known Population.

A total of 100 subjects were enrolled. Among them 50 were males and 50 were females. Overall, Porion-mastoidale, Mastoidale-asterion, Asterion-porion and Area of mastoid triangle was 32.56 mm, 50.39 mm, 43.69 mm and 670.36 mm² respectively. Among males, Porion-mastoidale, Mastoidale-asterion, Asterion-porion and Area of mastoid triangle was 34.12 mm, 52.94 mm, 45.89 mm and 691.12 mm² respectively. Our results were in concordance with the results obtained by Passey J et al who also reported similar findings. In their study, one hundred skull lateral radiographs (55 male and 45 female) from the digital archives of a tertiary care teaching institute in Northern India were retrospectively analyzed. All measured parameters were significantly higher in the male group. The porion-mastoidale length was 32.21±2.15 mm in males and 31.66±3.21 mm in females. The mastoidale-asterion length was 50.00±9.75 mm in males and 49.84±6.97 in females. The asterion-porion length was 44.11±6.82 mm in males and 39.72±5.77 mm in females. The area of the mastoid triangle was 690.74±123.35 mm² in males and 570.57±130.0 mm² in females. The area of the mastoid triangle has the highest relative validity (78%).¹⁰

In the present study, among females, Porion-mastoidale, Mastoidale-asterion, Asterion-porion and Area of mastoid triangle was 30.23 mm, 48.69 mm, 41.22 mm and 651.37 mm² respectively. Significant results were obtained while comparing the mastoid variables among males and females.

Similar findings were obtained in a study conducted by Mishra R et al. In their study, authors determined the sex from the cadaveric skull in North Indian population. Their study showed variation in the size of the mastoid process among males and females. On comparing the mastoid parameters in between males and females, mean of mastoid length in males is 28.624 ± 8.99302 and in females is 23.922, mastoid breadth in male was 12.336 and in females 12.389, mastoid A-P diameter in males was 17.360 and in females it was 15.393 & mean of the mastoid size in males was 61.469 ± 1.091 and in females was 10.466. Variation in the size of the mastoid process among males and females was demonstrated in their study.¹¹

In another similar study conducted by Poonia S et al, authors determine the difference in mastoid morphometry between male and female bone for sex differentiation. Material and methods: A descriptive observational study was conducted at Department of Anatomy, SMS Medical College, Jaipur between April- December 2014. Forty dry macerated adult Human skulls of age group above 18-25 yrs of known sex were included in which suture between the basiocciput and basisphenoid were united. Vernier Caliper was used for measurements of Mastoid process in Frankfurt's Plane. Results: Mastoid length was significantly larger in males as compared to females on both sides (p value <0.05). Cut-off of right mastoid length of 32.39mm and left Mastoid length of 31.71mm were highly accurate in differentiating male and female skull.¹²

Conclusion

Radiographic dimensions of the mastoid are potential predictors of sexual morphism. However; further studies are recommended.

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