



## DETERMINATION OF SEX IN NORTH INDIAN POPULATION USING MASTOIDALE, ASTERION AND PORION (MAP) TRIANGLE

### Anatomy

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### ABSTRACT

**Introduction :** Sex determination is an important part of medicolegal concern in forensic and Anthropological studies for individual identification.

**Objective:** Main aim of this study is to compare postereolateral cranial morphology between male and female skull.

**Material and Method:** A total of 80 adult dry skull (55 male and 25 female) from department of Anatomy in PGIMS, Rohtak were used for study with the help of automate digital Vernier calliper.

The mean, standard deviation, geometric mean, area of MAP triangle and sexual dimorphism ratio were computed and compared between male and females.

**Result:** The male parameters were significantly ( $P < 0.05$ ) higher than female parameters but there is no significant difference in Right and Left side of male and female.

**Conclusion:** The skull is most commonly site for sexual dimorphisms in human Skeleton and MAP Triangle can be additive value in finding the gender determination of unknown skeleton

### KEYWORDS

Skull, mastoidal, asterion, porion.

### INTRODUCTION

Sex is defined as “biological category based upon reproductive attributes and role in sexually reproducing species which consequently may be used in the “classification of individual” into categories based on types of gamete production. There are mainly four available methods of sex determination i.e. morphological, metrical, geometrical morphometrics and molecular. Out of these bone morphology is the oldest and commonly used method and molecular method is recent and benchmark for personal identification. Male and female human skeleton differ both in size and Parameters.

Most reliable bone for sex determination in human skeleton is hip bone (os coxae), followed by skull. Multiple factors or greater numbers of features in each bone are used to determine sex. The sexual dimorphism in the human skull is grossly determined by certain factors like general size, nuchal crest, mastoid process, supraorbital ridges, mental eminence etc.

Saavedra de Paiva et.al and Orish et.al introduced an easy technique for sex determination using temporal and occipital bone respectively. The technique was based on the triangular area calculation obtained between certain fixed points on these bones and suture point. Such types of techniques was used in our study for sexual dimorphism.

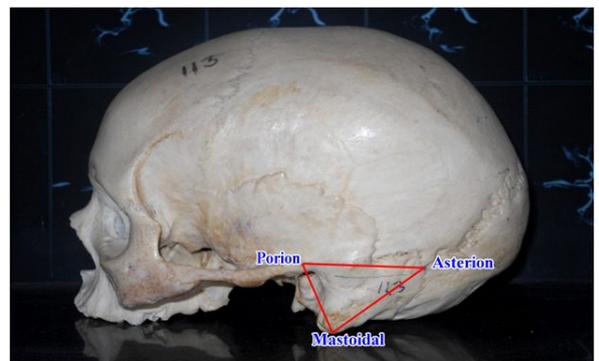
The aim of this study was to develop a sex determination technique using a triangle defined by these points: Mastoidale, Asterion and Porion. The union of these points determines the MAP triangle. The points on the mastoid portion on either side, **MASTOIDALE** [The most inferior point of mastoid process], **ASTERION** [Meeting point of lambdoid, Occipitomastoid and Parietomastoid sutures], and **PORION** [Upper most lateral point of external acoustic meatus pore].

### MATERIAL AND METHODS

This study was done in the Deptt. of Anatomy, Pt. B. D. S PGIMS Rohtak. A total of Eighty skull (55 male and 25 female skull) were taken and studied. All skull were free from damage and deformity and fully ossified. Initial examination of crania was done following the non- metric observation to categories them into male and female category. A digital vernier calliper with a precision of 0.01 mm and marker were used to measure the various length parameters: mastoidale-asterion, asterion-porion, and mastoidale-porion. Union of

these three points determined the MAP triangle. Data was analysed with analytical software. The Area ( $\text{mm}^2$ ) of triangle of both sides was measured using heron's formula. The mean, SD, and other measurements were computed and compared between male and females skull. The skull was kept with Norma- lateralis position facing the observer.

**Figure showing-** Mastoidale, Asterion and Porion .



### OBSERVATIONS

The results are shown in tables 1-2 showing the measurement data of male and female skulls .

**Table 1: showing Male and Female right and left side MAP triangle measurements.**

GROUP	NUMBERS	MEAN AREA	STANDARD DEVIATION
Male Right	55	818.00	112.72
Male Left	55	819.95	116.33
Female Right	25	733.04	123.43
Female Left	25	762.55	146.85

Table no. 1 shows values of male right, male left, female right and female left sided MAP triangle area in the study population. Mean

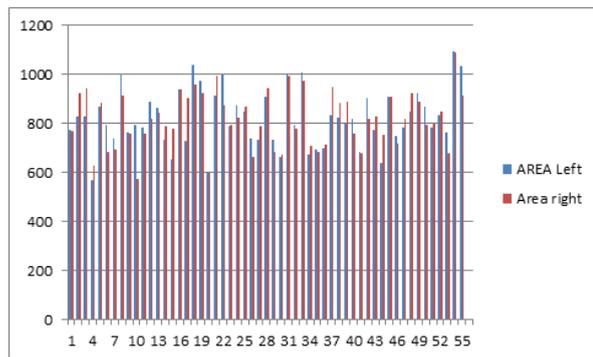
values of male skulls were found significantly high on both sides in comparison to that of female skulls.

**Table 2: showing comparison of Male and Female right and left side measurements using student t-test.**

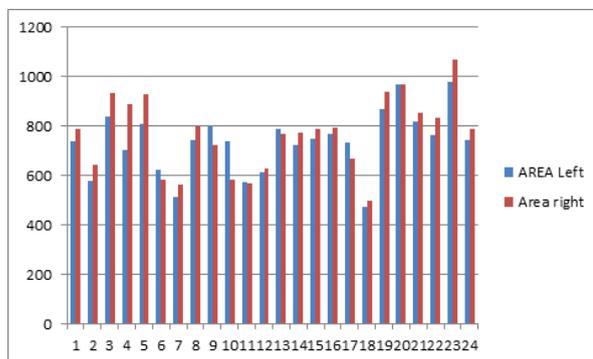
	't'-value	'p' value	Level of significance	Degree of freedom
Male Right side Vs Female Right side	6.802	0.05	significant	98
Male Left side Vs Female Left side	3.231	0.005	Highly significant	98

As per Table no 2, it was found that the student t-test was significant when male right side was compared with female right side as well as when male left side was compared with female left side indicating the importance of mastoid process in sex determination.

**Bar diagram-1: showing comparison of right and left triangular mean area of males**



**Bar diagram-2: showing comparison of right and left triangular mean area of females**



As per the study, there is no significant difference in the values of MAP triangular area of right and left sides in male as well as right and left side's females.

**DISCUSSION**

Accurate determination of sex from the human skull is of great importance to forensic people, anthropologist and anatomists. Studies for sex determination of bones are based on the dimorphism present in majority of human bones. Morphological differences between males and females can be the result of multiple factors which include-Genetic factors, Environmental factors, Nutrition, Physical activity etc. Studies on sexual dimorphism are based on three primary biological differences between males and females including body proportions and architectural differences. Males are generally more robust than females as they generally have more muscle mass and more weight of axial skeleton. Lots of studies have been done for sex determination using skull bone parameters. In our study male right sided MAP triangle area was 818.00 mm<sup>2</sup> and male left side was 819.95mm<sup>2</sup> as compared to study done by Shah S et al in 2013, in which male right and male left were 663.66mm<sup>2</sup> and 662mm<sup>2</sup> respectively. In females area observed was 733mm<sup>2</sup> and 762.55mm<sup>2</sup> on right and left side respectively whereas Shah et al observed 595.9 mm<sup>2</sup> and 589.29 mm<sup>2</sup> respectively.

Mean Area of MAP triangle was higher in males than females and the

difference was statistically significant (<0.05) similar to study done by Shah et al, paiva LA and Segre et al. Studies done by saavedra et al on crania using mastoid triangle parameters on Caucasian skull also showed that total area of mastoid triangle was higher in males than females. Ahmed et al reported sexual dimorphism ratio greater than unity indicating male crania larger in all linear dimensions than female crania which is similar to findings observed in our study.

**CONCLUSION**

According to methodology used in our study following conclusions have been drawn that Sexual dimorphism exists for the evaluated anthropometric measurements. The anthropometric measurement of MAP triangle can be of additive value in determining the gender of unknown human skull. The mean of mastoid dimensions and its triangular area are significantly higher in male as compared to female.

**REFERENCES**

- 1.) I. e. st hoymes and m. y. iscan, "Determination of sex and race: accuracy and assumptions" in reconstruction of life from skeleton, M. Y. Iscan and K.A.R. Kennedy, Eds, PP. 53-94, Wiley-liss, Newyork, NY, USA, 1989.
- 2.) C. N. Orish, B. C. Didia and h. b. fawehinmi "sex determination using Inion -Opistocranium Asterion (IOA) Triangle in Nigerions' skulls" Hindani Publishing Corporation Anatomy research International, vol- 2104, article ID 747239, 15 pages.
- 3.) M Steyn and M.Y Iscon, "sexual dimorphism in the crania and mandibles of south atricon white's" forensic science international, vol. 98, no 1-2, pp 9-16, 1998.
- 4.) A G Deshmukh and D. B Devershi, " comparison of cranial sex determination by univariate and multivariate analysis," journal of the anatomical society at India, vol. 55, no. 2, pp 48-51, 2006.
- 5.) L A Saavedra de paiva and M Segre, "sexing the human skull through the mastoid process," revista do hospital das clinicas. vol 58, no 1 pp 15-20, 2003.
- 6.) G. I. C Suazo, MD Zavando, and R. I Smini, " determination del sexo usando mediciones en el proceso mastoide en craneos brasilenos," international journal of morphology, vol. 26, no. 4, pp. 941-944, 2008.
- 7.) A. A. Ahmed, H. A. Mohammed and M. A. Hassan, "sex dermination from cranial measurements in recent northen sudanex," Bhortoum Medical Journal, vol. 4, no. 1, pp, 539-547, 2011.
- 8.) Shah S, Pratik P "sexing the human skull using the mastoid process" NHL, journal of medical sciences, july, vol2, issue2, 2013.