Mastoid Process: Morphometric Parameters with Correlation to Side and Gender

ABSTRACT The mastoid part is the posterior region of the temporal bone and projects down as the conical mastoid process. It is larger in adult males than in females. Sternocleidomastoid, splenius capitis and longissimus capitis muscles are all attached to its lateral surface. The posterior belly of digastric muscle is attached to a deep mastoid notch on its medial aspect. The occipital artery runs in a shallow occipital groove which lies medial to the mastoid notch.The study was conducted in Department of Anatomy, Pt. B.D. Sharma PGIMS, Rohtak, In year 23-24 on 120 dried human skulls out of which 80 were of males and 40 were of females .The study on the parameters of the mastoid process is important in the determination of sex for forensic purposes and anthropologists. It was concluded in our study that the mean mastoid parameters were more in male skulls than female skulls.

KEWORDS Mastoid process, temporal bone

INTRODUCTION The mastoid part is the posterior region of the temporal bone and projects down as the conical mastoid process. It is larger in adult males than in females. Sternocleidomastoid, splenius capitis and longissimus capitis muscles are all attached to its lateral surface. The posterior belly of digastric muscle is attached to a deep mastoid notch on its medial aspect. The occipital artery runs in a shallow occipital groove which lies medial to the mastoid notch.(StandringS.2005))For many anthropologists, while excavating skeletal remains or in cases of unforeseen disasters, identification of gender is the preliminary task. A major role in the gender identification of skeletal remains may be played by morphometric osteological criteria and lays the foundation for full identification.

MATERIALS AND METHODS The study was conducted in Department of Anatomy, Pt. B.D. Sharma PGIMS, Rohtak, In year 23-24 on 120 dried human skulls out of which 80 were of males and 40 were of females. Skulls with broken temporal bone were excluded from the study. Mastoid process of both right and left sides were studied. Following morphometeric parameters were measured using vernier caliper.

A. Mastoid length: straight distance from mastoidale to the upper rim of root of zygomatic process of temporal bone.

B. Mastoid breadth: the straight distance from posterior end of incisura mastoidea (digastric notch) to the nearest point of posterior border of external auditory meatus.

Asterion– Mastoidale length (AST-MS): the straight distance between asterion and mastoidale (both right and left sides).(Saadia A.2016)

Asterion – Porion length (AST-PO): the straight distance between asterion and porion (both right and left sides). (Saadia A.2016)

Porion – Mastoidale length (PO-MS): the straight distance between porion and mastoidale (right and left side). (Saadia A.2016)

Porion (PO): superior point of external auditory meatus.[2] **Mastoidale (MS):** most inferior point of the mastoid process.[2] **Asterion (AST):** the point where the parietal, temporal and occipital bones meets. (Saadia A.2016)

Figure: 1 Measurement of mastoid length

Figure: 2 Measurement of mastoid breadth

Figure: 3 Measurement of Asterion– Mastoidale length (AST-MS)

Figure: 4 Measurement of Asterion– Porion length (AST-PO)

Figure :5 Measurement of Porion– Mastoidale length (PO-MS)

RESULTS

All the parameters measured, i.e., masoid length ,mastoid breadth,the porion-mastoidale, mastoidale-asterion, asterion-porion length, proved to have a higher value in males as compared to females and the differences were statistically significant for all these parameters

Following observations were made:

Mastoid length: was 31.87± 4.35 mm in males and 29.99± 4.05 mm in female.

Mastoid breadth: was 22.57± 4.10 mm in males and 21.54± 3.55 mm in females.

Asterion– Mastoidale length (AST-MS): was 48.87± 5.40 mm in males and 47.49± 5.09 mm in females.

Asterion– Porion length (AST-PO): was 45.23± 3.33 mm in males and 44.02± 4.26 mm in females.

Porion– Mastoidale length (PO-MS): was 31.60± 3.99 mm in males and 30.18± 3.42 mm in females.

Table-1: Morphometric Parameters of the Mastoid Process of Male and Female Skulls

Parameters (in mm)	Male (n=160)		Female (n=80)		p value
	Mean	± SD	Mean	± SD	
Mastoid Length	31.87	± 4.35	29.99	± 4.05	0.001
Mastoid Breadth	22.57	± 4.10	21.54	± 3.55	0.045
Asterion-Mastoidale	48.87	± 5.40	47.49	± 5.09	0.055
Asterion-Porion	45.23	± 3.33	44.02	± 4.26	0.017
Porion-Mastoidale	31.60	± 3.99	30.18	± 3.42	0.005

Table-2: Morphometric Parameters of the Mastoid Process of both Sides of Male and Female Skulls

Parameters (in mm)	Male (n=80)			Female (n=40)		
	Right	Left	p value	Right	Left	p value
	Mean±SD	Mean±SD		Mean±SD	Mean±SD	
Mastoid Length	32.07±4.53	31.67±4.18	0.563	30.31±4.41	29.68±3.99	0.854
Mastoid Breadth	22.74±4.00	22.42±4.22	0.625	22.07±3.79	21.01±3.26	0.183
Asterion-Mastoidale	48.99±4.98	48.76±5.83	0.795	47.62±5.19	47.37±5.06	0.826
Asterion-Porion	45.60±3.60	44.87±3.03	0.169	44.34±4.45	43.71±4.10	0.511
Porion-Mastoidale	32.14±4.02	31.08±3.91	0.093	30.66±3.52	29.71±3.31	0.219

DISCUSSION

Analysis of the characteristics of the mastoid process is important in the determination of sex for forensic purposes and anthropologists.In the present study, masoid lengh and breadh were more in males than females. When sex-wise analysis was done, the differences were found to be statistically significant but it was not found to be statistically significant on side-wise analysis.(Saadia et al2016)

eported, the mean mastoid length was 3.70±0.11 cm in male and it was 3.07±0.38 cm in female. While (Passey et al 2015) and (Noack 2015)reported lower results in Asian races (mean mastoid length was 2.97 cm in male and 2.45 cm in female).(Saadia et al2016) reported, the mean mastoid breadth was higher in male (2.80±0.24 cm) than in female (2.31±0.29 cm). (Nagaoka et al2008) on Japanese skulls reproted that the mean mastoid breadth was 2.40 ±.25 cm in male and 2.21±.26 cm in female. While (Sumati et al 2010) reported lower results on North Indian skulls, the mean of mastoid breadth was 11.46± 2.7 mm in male and 8.68± 2.59 mm in female.

The mean AST-MS length was 48.87± 5.40 mm in males and 47.49± 5.09 mm in females. It was more in males as compared to the females and showed statistically significant difference. On the left side it was 48.76±5.83 mm in male and 47.37±5.06 mm in female while on the right side it was 48.99± 4.98 mm in male and 47.62± 5.19 mm in female. In a study done by).(Saadia et al 2016) the mean AST-MS length was 5.06±0.28 cm on left side and 5.22±0.31 cm on the right side in male and it was 4.39±0.29 cm on left side and 4.44±0.35 cm on right side in female. (Jain et al2013) on Indian skulls reported that the mean AST-MS length was higher in male (4.92±.80) than in female (4.47±0.72) on both sides. But (Suazo et al 2008)found that the mean AST-MS length was nearly similar in male (5.02±.49) and female (5.01±.51) in Brazilian skulls.The mean AST-PO length was 45.23± 3.33 mm in males and 44.02± 4.26 mm in females. It was more in males as compared to the females and statistically significant difference was observed. On the left side it was 44.87 ± 3.03 mm in male and 43.71± 4.10 mm in female while on

the right side it was 45.60± 3.60 mm in male and 44.34± 4.45 mm in female. (Saadia et al2016) reported mean asterion- porion (AST-PO) length was higher in male (4.66±0.32 cm on left side and 4.56±0.22 cm on right side) than in female (4.26±0.21 cm on left side and 4.23±0.19 cm on right side) on both sides. In another study done by (Jaja et al 2013) on Nigerian skulls in which there was significant difference between male (4.60±0.71 cm) and female (4.30±0.65 cm) in mean of AST-PO length on left side but in present study it was slightly higher in males than females. (Bhaskar et al2013) found that the mean mastoid length was 3.56±0.39 cm in male and 3.05±0.40 cm in female in South Indian skulls.The mean PO-MS length was 31.60± 3.99 mm in males and 30.18± 3.42 mm in females. On the left side it was 31.87± 3.91 mm in male and 29.71±m3.31 mm in female.On the right side it was 32.14± 4.02 mm in male and 30.66± 3.51 cm in female. (Saadia et al2016) reported mean PO-MS length on the left side was 3.25± 0.12 cm in male and 2.63± 0.27 cm in female while on the right side it was 3.29± 0.14 cm in male and 2.76± 0.27 cm in female. In the present study it was more in males as compared to the females and showed statistically significant difference. On comparing with the results of other studies, the present study shows that the parameters of the mastoid process measured can be accountable in medico-legal investigations, and it can be taken as a sex indicator among North Indians.

CONCLUSION

The study on the parameters of the mastoid process is important in the determination of sex for forensic purposes and anthropologists. It was concluded in our study that the mean mastoid parameters were more in male skulls than female skulls.

FUNDING; None

REFRENCES

1. Bhaskar B., Nidugala H, Avadhani R(2013). Mastoid process –Atool for sex determination, an anatomical study in South Indian skulls. IJBR 4(2)106-110.

2.Jaja B.N.,Ajua C.O. and Didia B.C.(2013) Mastoid triangle for sex determination in adult Nigerian Population: a validation study. JFS 58(6):1575-8.

3.Noack T. B.(2015) Sexual dimorphism in the crania in a Norwegian sample.B.A,University of Texas at San Antonio. p.24-28.

4.Nagaoka T., Shizushima A., Sawada J., Tomo S., Hoshino K. and Sato H.(2008) Sex determination using mastoid process measurements: standards for Japanese human skeletons of the medieval and early modern periods. Anthropological Sci. 116:105–113.

5.Passey J, Mishra SR, Singh R, Sushobhana K, Singh S, Sinha P(2015). Sex determination using mastoid process. AJMS;6(6):93-5.

6.Saadia A. Shalaby, Essam M, Eid,Omar A. (2016) Morphometric Study Of Mastoid Canal And Suprameatal Triangle Of Human Egyptian Skull, With Gender Determination. Nature and Science. 14 (4): 67-73.

7.Standring S.(2005)Skull and Mandible In: Standring S(ed.) Gray's Anatomy. The Anatomical basis of clinical practice. 39th edition; Edinburg; Elsevier,. p. 470.

8.Suazo G.I.C., Zavando M.D.A. and Smith R.L.(2008): Sex determination using mastoid process measurements in Brazilian skulls. Int J Morphol. 26:941–944

9.Sumati, Patnaik VVG, and Phatak A.(2010) Determination of sex from mastoid process by discriminant function analysis. JASI;59(2):222-28.

177

178

179

180

181

182

183

184

185

186