Morphological evaluation of various shapes of asterion and its morphometric localization with reference to cranial co-ordinates

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ABSTRACT

Introduction: The asterion is the point on the skull corresponding to the posterior end of the parietomastoid suture. In human anatomy, the asterion is a visible, so called craniometric, point on the exposed skull, just behind the ear, where three cranial meet: the lambdoid, parieto-mastoid and occipito-mastoid sutures or where three cranial bones meet: parietal bone, occipital bone, and mastoid portion of the temporal bone. **Materials and Methods:** In the present study a total of 70 dry human skull bones of unknown sex and without any gross abnormality were collected from the Department of Anatomy, Saveetha Dental College, Chennai for evaluation. The sutures on the right and left side are noted, photographed, for analysing their shape. With the help of Vernier Calliper and Ruler the location and situation of asterion was measured. **Results:** Different types of asterion were observed, such as Type – I, where a sutural bone was present. And, Type – II was, where sutural bone was not present. There are 15.72% and 84.28% of Type – I asterion in males and 18.57% and 81.43%of Tytpe-II asterion in females, respectively. **Conclusion:** The present study results may be helpful in surgery to the cranium through this craniometrical point and also when interpreting radiological images of fractured skulls. Further, it can also be useful for identification of human male and female skulls in association with other parameters.

Keywords: Asterion, Parietomastoid, lambdoid, occipito-mastoid suture, craniometric point.

INTRODUCTION

Each lateral venous sinus has an inferolateral pathway in the lateral sulcus of the occipital portion that has a small curve with its convexity where the lateral margin of the tentorium is pyramid or petromastoid channel. This channel is in relationship with the mastoid portion where it curves inferiorly and forms an ‘s’ for which reason it is called the sigmoid sinus. It continues towards the jugular foramen where it extends with the bulb of the internal jugular vein. The anatomic points of reference to analyse the topography of the posterolateral surface of the skull are asterion, external occipital protuberance, suprameatal crest, apex of the mastoid process, root of the zygomatic arch, Frankfurt horizontal plane, and the mastoid foramen. These reference points are

of great importance in surgical procedures to locate the site where the initial trepanning will be carried out. The surgical importance of the posterior cranial fossa lies in its dense collection of neurovascular structures housed in a small, rigid space, which makes the invasive approach very delicate and prone to accidents or medical errors in surgery.

Formation of sutural bone can be explained Embryologically, According to Gray's Anatomy, sutural bone develops due to appearance of additional ossification centers which may occur in or near sutures. According to Hess[7], Finkel[8] these bones may be the result of pathological influences such as hydrocephalus. According to the study of Opperman et al [9], there is a close association between developing duramater and calvarial bones. Transplants of sutures in which fetal duramater is left intact, results in continuous fibrous suture between developing vault bones, but in transplants if the fetaldura is removed, bony fusion occurs. This interaction of underlying duramater with the developing calvarial bones has been demonstrated experimentally in rabbit showing that the dura not only promotes the position and maintenance of sutures, but also duramater can re-pattern both the appearance and position of the bones and sutures of the cranial vault after removal of calvaria in the neonate.

According to Murphy, Pal & Routal, sutural bones develop from normal processes and are genetically determined. Although the control of the pattern of articulation of bones forming the pterion and asterion is not known, genetic factors may play some role. The MSX2 gene, which encodes a home domain transcription factor, plays a crucial role in craniofacial morphogenesis by influencing fusion of sutures [12]. The study of asterion morphology may be helpful to neuro and ENT surgeons.

MATERIALS AND METHODS

In the present study a total of 70 dry human skull bones of unknown sex and without any gross abnormality were collected from the Department of Anatomy, Saveetha Dental College, Chennai for evaluation. The sutures on the right and left side are noted, photographed, for analysing their shape. Similar shapes of the sutures were categorized and grouped into a separate type. With the help of Vernier Calliper, the location and situation of asterion on both the sides were measured by marking with three coordinates, such as from mid-point of posterior margin of external auditory meatus, from apex of the mastoid process and from mid-point of external occipital protuberance (Figure - 1).

RESULTS

Different types of asterion were observed, such as Type – I, where a sutural bone was present. And, Type – II was, where the sutural bone was not present. There are 15.72% and 84.28% of Type – I asterion in males and 18.57% and 81.43% of Tytpe-II asterion in females, respectively. All the observed values were shown in Table – 1 and Figure - 2.

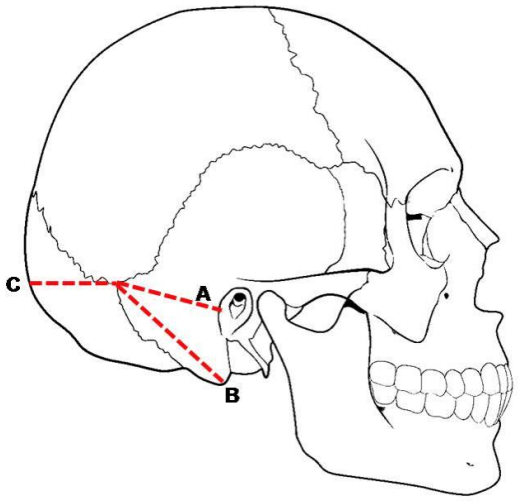

Figure – 1: Showing the location of asterion from mid-point of posterior margin of external auditory meatus (A), from apex of the mastoid process (B) and from mid-point of external occipital protuberance (C).

TYPES OF ASTERION IN MALES AND FEMALES (%)		
TYPE	**MALE**	**FEMALE**
TYPE - I	**11 (15.72%)**	**13 (18.57%)**
TYPE - II	**59 (84.28%)**	**57 (81.43%)**

Table 1: Showing the Types of Asterion in Male and Female in percentage.

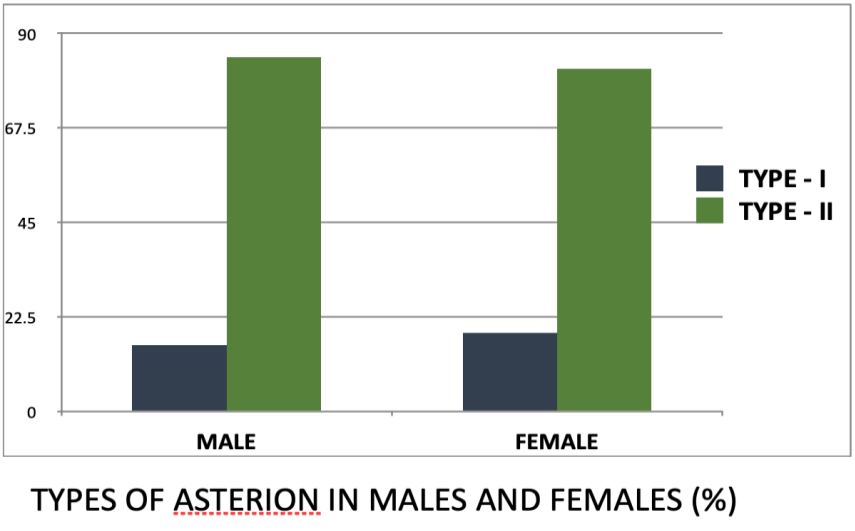

Figure – 2: Showing the percentage of types of Asterion in Male and Female.

DISCUSSION

Our results are in agreement with previous studies, Berry study in 50 North American skulls it was found type I 12% and type II 88%, in 53 south American skulls found that 7.5% as type I and 92.5% as type II, in 250 skulls of Egyptian found type I as 14.4% and 85.6% as Type II, In 51 Indian skulls belongs to Burma region found that type I as 14.7% and type II as 85.3%, in another study by same investigator in Punjab region of Indiain 53 skulls the result was 16.9% as type I and 83.1% as type II [13]. In the study of Gumusburun [14] in 302 Turks, type I was 9.92% and type Ii was 90.8%. In the study of Mwachakam [15] in 79 Kenyans the result was 20% as type I and 80% as type II. In the study of Hussain Saheb et al [16], it was found that 23.15% as type I and 76.85% as type II in 125 skulls. The study of Rajini Singh [17] in 55 Indian skulls was 14.81% as type I and 85.19% as type II. The present study results may be helpful in surgery to the cranium through this craniometrical point and also when interpreting radiological images of fractured skulls. Further, it can also be useful for identification of human male and female skulls in association with other parameters. These results may also be helpful to Anthropologists and forensic experts in their practice.

CONCLUSION

The present study results may be helpful in surgery to the cranium through this craniometrical point and also when interpreting radiological images of fractured skulls. Further, it can also be useful for identification of human male and female skulls in association with other parameters. These results may also helpful to Anthropologists and forensic experts in their practice.

REFERENCES

[1]. Andy C. O. Cheng, Peter W. Lucas, Hunter K. L. Yuen, et al. Surgical Anatomy of the Chinese orbit. Ophthalmic Plastic and Reconstructive Surgery 2007;24(2):136-141.

[2]. Patnaik V.V.G., BalaSangu, SinglaRajan K. Anatomy of the Bony Orbit- Some Applied Aspects. J Anat. Soc. India. 2001;50(1):59-67.

[3]. YongrongJi, ZanqunQian, Yang Dong, et al. Quantitative morphometry of the orbit in Chinese adults based on a three-dimensional reconstruction method. J. Anat 2010; 217:501-506.

[4]. Xing, Song, Victoria Gibbon, Ronald Clarke, and Wu Liu. Geometric morphometric analyses of orbit shape in Asian, African, and European human populations. Anthropological Science 2013; 121(1):1-11.

[5]. Munguti Jeremiah, Mandela Pamela, Butt Fawzia. Sex differences in the cranial and orbital indices for a black Kenyan population. Int. J. Med. Sci 2013;5(2):81-84.

[6]. Ukoha U., Egwu OA., Okafor IJ., et al. Orbital dimensions of adult male nigerians: a direct measurement study using dry skulls. Int J Biol Med Res.2011;2(3):688-690.

[7]. SayeeRajangam, Kulkarni R.N, Lydia Quadrilos, et al. Orbital dimensions. Indian Journal of Anatomy 2012;1:5-10.

[8]. SanjaiSangvichien, KomonBoonkaew, ApornChuncharunee, et al. Sex determination in Thai skulls by using craniometry: Multiple logistic regression analysis. Siriraj Med J 2007;59:216-221.
[9]. JaswinderKaur, SavitaYadav, Zora Singh. Orbital dimensions- A direct measurement study using dry skulls. J. Acad. Indus. Res 2012;1(6):293-295.
[10]. Deepak S. Howale, Jain L. K, KanaklataIyer, et al. Orbital and Nasal indices of Maharastra region: A direct measurement study using dry skulls. International Journal of Current Reasearch 2012;4(8):158-161.
[11]. LekoBankole J, 1Douglas Promise, 2Ukoima H.S, et al. Radiological Assessment of Orbital Dimensions of the Kalabaris and Ikwerres of Rivers State, Nigeria. Afr. J. Biomed. Res 2012;15:197-200.
[12]. Ebeye O.A, Otikpo O. Orbital index in Urhobos of Nigeria. IOSR Journal of Dental and Medical Sciences 2013;8(2):51-53.
[13]. Williams L, Bannister L, Berry, M, Collins P, Dyson, M. & Dussek E. Gray's Anatomy. 38th Ed. Churchill Livingstone, London, 1998.
[14]. Martínez F, Laxague A, Vida L, Prinzo H, Sgarbi N, Soria VR, et al. Anatomía topográfica del asterion. Neurocirugía 2005;16:441-446.
[15]. Bozbuga M, Boran BO, Sahinoglu K. Surface anatomy of the posterolateral cranium regarding the localization of the initial burrhole for a retrosigmoid approach. Neurosurg Rev 2006;29:61- 63.
[16]. Mwachaka PM, Hassanali J, Odula PO. Anatomic position of the asterion in Kenyans for posterolateral surgical approaches to cranial cavity. Clin Anat 2010;23:30-33.
[17]. Tubbs RS, Elton S, Grabb P, Dockery SE, Bartolucci A, Oakes WJ. Analysis of the posterior fossa in children with the Chiari 0 malformation. Neurosurgery 2001;48:1050-1055.
[18]. Standring, S. Sutural bones in bones of skull. In: Gray's anatomy. 39th Ed. Elsevier Churchill Livingstone, New York, 2005. pp.486.
[19]. Hess, L. Ossicula wormiana. Hum. Biol.,1946;18:61- 80.
[20]. Finkel D. I. Wormian bones: a study of environmental stress. Am. J. Phys. Anthropol., 1971;35:278.
[21]. Opperman L. A, Sweeney T. M, Redmon J, Persing, J. A. & Ogle R. C. Tissue interactions with underlying dura mater inhibit osseous obliteration of developing cranial sutures. Dev.Dyn., 1993;198(4):312-22.