Original Article

Morphometric Study of the Asterion in Adult Dry Human Skulls of Nigerian Origin

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Abstract

Background: The asterion, where the temporal, occipital, and parietal bones converge on the posterolateral aspect of the skull, is a critical reference point for surgeons when approaching the structures of the posterior fossa. ***Objective:*** This cross-sectional study wasconducted to assess the linear distances of asterion from various bony landmarks and their proximity to the transverse sinus, as well as to categorizeasterion types based on the presence or absence of suture bone. ***Methods:*** A total of 20 skulls were examined and the type of asterion was determined as type I and type II depending on the presence or absence of sutural bone. The distance from the centre of asterion to tip of the mastoid process and supramastoid process weremeasured. Data were analyzed with Student t-test. ***Results:*** Our data revealed that type II (absence of sutural bones) was commoner than type I (presence of sutural bones)asterion. The asterion was 55.72±2.60 mm from tip of the mastoid process on the right side and 51.07±1.43 mm on the left, p value being statistically significant (P=0.001). The distance of asterionfrom supramastoid crest was 47.16±1.47 mm on the right and 43.80±1.97 mm on the left. P value 0.002 was statistically significant. ***Conclusion:***The asterion is usually located either at or below the level of the transverse sinus, according to the data collected. Neurosurgeons can adopt this knowledge to lessen the danger of posterior fossa surgery.

Keywords: Morphology, asterion, dry human skull, Nigeria

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Introduction

The intersection of the parietal, mastoid, temporal, and occipital bones of the skull, visible in the Norma occipitalis, is called the asterion. In addition, it serves as a critical surgical landmark for the posterior cerebral fossa where the transverse sinus is located.[1]Internally, the transverse and sigmoid cavities and the asterionare firmly connected. The densegroups of neurovascular systems that make up the posterior fossa are concentrated in a tiny space. Owing to the numerous existing venous sinuses, invasive approaches in this area are exceptionally dangerous.[2]

During or after a range of neurosurgical procedures, improper posterior fossa access can bring about a high incidence of bleeding thromboembolism and infection. To avoid accidental injury or to gain access to the intracranial structures, it is necessaryto have a detailed insight of the associations between the numerous surface features on the posterolateral surface of the skull.[3]

The asterionis the major reference point on the posterolateral surface of the skull.[3,4] The goals of this present study were to categorize asterion types based on the presence or absence of suture bone and to estimate the linear distances of the asterions from various bony landmarks, and their proximity to the transverse sinus, which are relevance to thepractices of anthropologists, anatomists, forensic pathologists, and neurosurgeons.

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Methods

Twenty (20) skulls with unknown gender and age available in the Department of Human Anatomy, Achievers University, Owo, Ondo State and Delta State University, Abraka, Nigeria,were used for this study.Only those skulls with no obvious deformity or malformation were selected.

The type of asterion was determined as type I or type II depending on the presence or absence of suture respectively. Type I asterion is one where all three suture are present, whilein type II asterion, there is only one or two are present. The topographical measurements were taken bilaterally using digital vernier calipers with an accuracy of 0.01 mm (Fig. 1). The following distances were measured:

1) AMP: Distance from the centre of the asterion to tip of the mastoid process; and

2) ASC: Distance from the centre of the asterion to supramastoid crest.

Data were expressed as mean±SD. For statistical analysis, unpaired Student's 't'-test was performed. P value <0.05 was considered as statistically significant. All the analyses were done using the SPSS version 23.0 for Windows (SPSS Inc., Chicago, Illinois, USA).

Results

The incidence of type II asterion(absence of sutural bone) was 75.0% and type I (presence of sutural bone) was 25.0% (Table 1, Fig. 2).The bony landmarks of the asterion were calculated. Mean distances from centre of pterion to the tip of mastoid process were 55.72±2.60 (right side) and 51.07±1.43 (left side),asterionto supramastoid crest; 47.16±1.47 (right side) and 3.80±1.97 (left side). In addition, there was a statistically significant difference in the measured parameters between the right and left side (P<0.05)(Table 2). We also observed relationship of the asterion with that transverse sinusand found 60% at the level of the transverse sinus, while 30% below the sinus and 10% above the sinus. (Table 3).

Table 1: Incidence of different type of asterion

Incidence	Frequency	Percentage
Type I	5	25.0
Type II	15	75.0

Table 2: Topographical measurements on dry skull

Parameters	Right (Mean±SD)	Left (Mean±SD)	P value
AMP	55.72±2.60	51.07±1.43	0.001[S]
ASC	47.16±1.47	43.80±1.97	0.002[S]

AMP: Asterion to tip of mastoid process; ASC: Asterion to supramastoidcrest; P value reached from Student's t-test, S=significant.

Figure 1: Measurements on the dry skull- AMP: Mastoid crest (left); ASC: supramastoid crest on right side of posterolateral surface of skull (right).

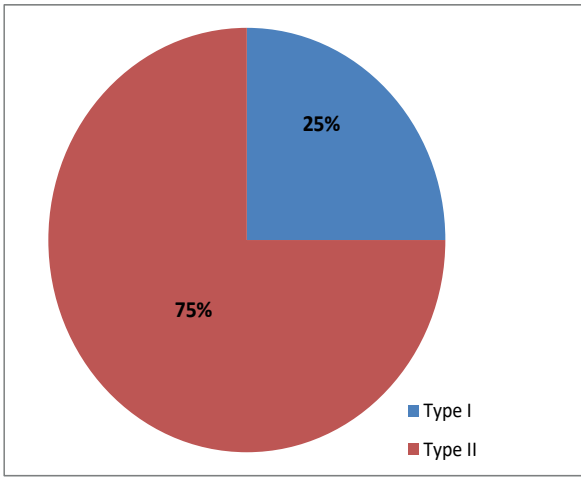

Figure 1: Pie chart showing type I (presence of sutural bone) and type II (absence of sutural bone) asterion (n=20)

Discussion

Type II asterion was more common than type I in all populations tested. The results of the current study are comparable to thestudydone by Berry and Berry,[5]which was done in the Egyptian and Indo-Burmese populations. Indians, Nepalese, Kenyans, Mexicans, and Australians had higher Type I rates than Americans and Turks.[3-12]The mechanism by which suture bone forms is still a matter of debate. Some authors believe that pathogenic elements such as hydrocephalus can contribute to the development of suture bone.[7,8]Others have addressed the role of specific genes such as MSX2 in the development of craniofacial structure.[5]Genetic or environmental factors may account for differences in different ethnic populations as well.[5,6,8,9]

In the present study, we measured the distances on both the left and right side. We observed that the mean on the right was consistently greater than the mean on the left. Our results are in agreement with the studydone by Sinem et al.[10]in a Turkish population.

Leon et al.[11]discovered that in 82.4% of cases the level of the transverse sinus coincides with the asterion.Martinez et al.[12] discovered that this was the case 76.2% of the time. Current analysis shows that the transverse sinus is at the level of the asterion 60% of the time and below it 30%. The drill hole should therefore be placed away from the asterion for posterolateral approaches, ideally posteroinferior (Table 3).

Table 3: Relationship of the asterion with the transverse sinus (TS)

Study	Level of TS (%)	Below TS (%)	Above TS (%)
Martinez et al. (2000)[12]	76.2	23.8	-
Leon et al. (2013)[11]	82.4	12.5	5.1
Present study (2022)	60	30	10

Conclusion

The morphological patterns of asterions in skulls of Nigerian origin are more or less similar to those studies done in the past on different populations. However, the outcome of the current investigation can be comparedto other contemporary methods that are frequently used, such as radiological assessment, whichmight more precisely predict the structure of the asterion and enhance surgical safety and efficacy.

Conflict of interest: None declared.

Ethical Clearance: The study was approved by the Ethical Review Committee of Department of Human Anatomy, Achievers University, Owo, Ondo State, Nigeria and Delta State University, Abraka, Nigeria.

Source of Fund: Nil.

Authors' contribution: All authors were equally involved in data collection, analysis, manuscript preparation, revision and finalization.

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