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Original Research Article

Unlocking the Mystries of Asterion Morphology in Skulls of South Indian Origin: Differences and Similarities Across Geographical Areas

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Abstract

Background: Asterion is a craniometric point corresponding to the location of transverse sinus and closely related to transverse sigmoid junction. Asterion is classified as type I and type II based on the presence or absence of wormian bones respectively. Differences in the occurrence of sutural bones among populations could be attributed to racial, geographical, topographical variations, dietary patterns and genetic inheritance.

Aim: To enhance the knowledge of prevelance of types of asterion in Telangana region.

Material and Methods: 100 adult human dry skulls (200 asterions) from different medical colleges of Telangana state were studied and the type of asterion on each side was observed and compared with other geographical areas.

Result : Study revealed a Prevalence of 21% of type I asterion on right side, 19% on left side and 79% of type II asterion on right side and 81% on left side.The total prevalence of type I was 20% and type II was 80%. Further, bilateral incidence of type I was 6% and type II was 69%.

Conclusion: The prevalence of type I asterion ranged from 7.5% to 88.46% and type II asterion 11.56% to 92.5% in different populations, Type II being more common than Type I except for Nepalese and Mexicans. The presence of sutural bones at asterion may complicate the surgical orientation and may be misdiagnosed as fractures of skull bones in medicolegal cases, hence it has important implications in Neuro and Maxillofacial surgeries.

Keywords: Asterion, Type I, Type II, Sutural Bones, Craniometric Point.

Introduction

Asterion is a craniometric point where the parietal, temporal and occipital bones meet at the junction of lambdoid, occipitomastoid and parietomastoid sutures. It corresponds to the location of transverse sinus and is closely related to transverse sigmoid junction [1].It is a surface landmark for posterolateral fontanelle which lies beneath the asterion and closes at the end of 12 months of life. It is also an important surgical landmark for internal approach to posterior cranial fossa and defines the superior limit of bone removal for craniotomy [2,3]. Asterion is classified as type I and type II based on the presence or absence of wormian bones respectively [4]. Wormian bones are accessory bones which vary in

size,shape and number and develop along fontanelle and sutures[5]. Research has shown differences in the occurrence of sutural bones among populations, though the exact mechanism of formation of sutural bones is not completely understood, the differences in its occurrence could be attributed to racial, geographical, topographical variations, dietary patterns and genetic inheritance [6]. Neurosurgeons & Maxillofacial surgeons must be well informed about the presence of sutural bones at asterion as they may complicate the surgical orientation and even be misleading in diagnosis of fracture of skull bones in medicolegal cases.

Aim & Objective

The present study was carried out to enhance the knowledge of prevelance of types of asterion in Indian skulls of Telangana region in order to reduce the complications arising during craniotomies due to the presence of type I asterions causing diagnostic pitfalls in X-rays.

Material and Methods

A total of 100 adult human dry skulls (200 asterions-100 right & 100 left) of unknown age and sex from different medical colleges of Telangana state were studied and the type of asterion on each side was observed. Those with sutural bone were categorised as type I and those without sutural bones were categorised type II Asterion. Classification was done based on previous studies[4,7,8]. Adult skulls with erupted 3rd molar tooth were included in the study. Skulls with previous surgical procedures ,advanced synostosis and fractured skulls were excluded from the study. The collected data has been tabulated and compared with previous studies conducted in different geographical regions.

Result

Study of 100 adult human dried skulls, that is a total of 200 asterions (100 right & 100 left) revealed a Prevalence of 21% of type I asterion on right side and 19% on left side and the prevelance of type II asterion on right side was 79% and left side was 81%.

The total prevalence of type I was 20% and type II was 80%. Further, bilateral incidence of type I was 6% and type II was 69%. (Table 1)

Table 1

ASTERION	RIGHT	RIGHT (%)	LEFT	LEFT (%)	TOTAL	TOTAL (%)	BILATERAL	BILATERAL (%)
TYPE I	21	21%	19	19%	40	20 %	6	6%
TYPE II	79	79%	81	81%	160	80 %	69	69%
TOTAL	100		100		200		75	

Figure 1: Type I Asterion –Presence Of Sutural Bone

Figure 2 : Type Ii Asterion – Absence Of Sutural Bone

Discussion

Asterion is an important landmark for surgical approach to posterior cranial fossa. Researchers have proposed various theories for the occurrence of sutural bones. According to Standring Gray's Anatomy, embryological basis of sutural bones is the appearance of additional ossification centres which may appear in or near sutures[9], according to Hess these bones develop in pathological conditions such as hydrocephalus[10]. Operman *et al* suggested a close relation between developing duramater & calvarial bones[11].Pal & Routal stated that sutural bones develop from

normal processes and are genetically determined[12]. The MSX2 gene which encodes a home domain transcription factor influences the fusion of sutures and is crucial for craniofacial morphogenesis[13]. Various studies in different geographical regions have shown the prevalence of type I asterion ranging from 7.5% to 88.46% and type II asterion ranging from 11.56% to 92.5% as shown in table 2.

Most of the studies have shown that type II asterion is more common than Type I. According to Leon et.al in the study conducted in Mexicans and by Gulam Khan *et al*. in Nepalese type I was more common than type II[8,6]. Such wide variations in the Prevalence could be due to ethnicity, racial variations, genetic and dietary pattern, Topography and environmental aspects.

Table 2: Prevalence of the types of asterion according to studies by various researchers in different regions

Authors	Region	Type -I	Type - II
Berry 1967[14]	North Americans	12%	88%
Berry 1967[14]	South Americans	7.5%	92.5%
Berry 1967[14]	Egyptians	14.4%	85.6%
Berry 1967[14]	Indians - Burma	14.7%	85.3%
Berry 1967[14]	Indians -Punjab	16.9%	83.1%
Kellock & Parsons 1970[15]	Australians	19.8 %	80.2 %
Gumusburun 1997[16]	Turks	9.92 %	90.08%
Mwachaka 2009[7]	Kenyans	20%	80%
Hussain 2011[17]	Indians	23.15 %	76.85%
Rajini Singh 2012[18]	Indians	16.36%	83.64%
Leon 2013[8]	Mexicans	74.4%	25.6%
R Sudha 2013[4]	South Indians	7.6%	92.3%
Pavan 2015[19]	South Indians	19.2%	80.8%
Ahad 2015[20]	South Indians	32%	68%
Priya 2016[21]	Indians -Maharashtra	11.65%	88.33%
Srinivasa Sagar 2017[22]	Indians - Karnataka	20.9%	79%
Vivaan Dutt 2017[23]	Indians	13.46%	86.54%
Modasiya 2018[3]	Indians- Gujrat	8.18%	91.18%
Basnet 2019[24]	Nepalese	24.29%	75.71%
Wirakiat 2021[25]	Thailand	38.8%	61.2%
Gulam Anwer Khan 2022[6]	Nepalese	88.46%	11.56%
Present study	Indians- Telangana	20%	80%

The present study corresponds with the study done by Pavan et.al and Srinivasa Sagar et.al in South Indians and Karnataka region respectively where type II asterion is more common than type I asterion[19,22]. The similarity in the prevalence could be attributed to similar dietary habits, environmental factors and topography. The knowledge of variations in the prevalence of types of asterions in different geographical regions plays a key role during posterior cranial fossa surgeries in order to prevent inadvertent damage to underlying structures. Recent advances in radiology like spiral CT and 3D MRI with fading techniques can be utilised for accurate localisation of asterion and its relation to transverse sigmoid complex in order to reduce the rate of complications[22].

Conclusion

The studies conducted in various geographical regions have showed a wide variation in the prevalence of types of asterion, with type II asterion being more common than type I, in contrast type I was more common than type II in Mexican and Nepalese skulls. In the present study type I asterion with presence of sutural bones was seen in 20% of the skulls which is similar to most of the studies conducted In the South Indian skulls.

The presence of sutural bones at asterion may complicate the surgical orientation and may be misdiagnosed as fractures of skull bones in medicolegal cases, hence Neurosurgeons and maxillofacial surgeons should be aware of the geographical variations of asterion in different populations in order to avoid unnecessary complications during approach to the posterior cranial fossa.

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