

Sutural Morphology of the Types of Asterion: A Study on Dry Human Skulls

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Abstract

Introduction: Asterion is the junction of parietal, mastoid part of temporal & occipital bones. It is related to junction of transverse and sigmoid sinuses. Developmentally asterion is the location of posterolateral fontanelle. *Aim:* To study the morphological features of asterion with or without sutural bones in 110 (220 sides) human adult dry skulls. *Material & Methods:* 220 sides of 110 dry adult skull bones of both male & female were studied, for the morphological features of asterion. Depending on the observations, classification is done as type I and type II. *Results:* Incidence noted is 20.9% are type-I and 79% are type-II. *Conclusion:* Presence of sutural bones at the asterion will be of greater significance, during neurosurgical procedures and also during radiological investigations.

Keywords: Asterion; Parietal; Sinus.

Introduction

Asterion is the junction between the lambdoid, parieto-occipital & parieto-mastoid sutures. During linear growth of the skull vault, the bones surrounding the asterion start ossifying, these bones will fuse in the middle of the second year. Sometimes new ossification centres appear as suture bones [1]. Asterion is a surface landmark for the transverse - sigmoid sinus complex [2] and also a surgical landmark for approach to the posterior cranial fossa for the neurosurgeons [3], ENT and Oro-fascio-maxillary surgeons [4].

The surgical importance of the posterior cranial fossa lies in its dense collection of neurovascular structures housed in a small, rigid space. This makes the invasive approach very delicate and prone to accidents or errors in surgery [5,6,7]. The sigmoid sinus is easy to get lacerated during posterior fossa craniotomy, because it is located in a groove in the bone, may be adherent to the bone and is further attached by an emissary vein [4].

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Presence of sutural bones at these points may complicate the surgical orientation leading to pitfalls as exact pinpoint of location cannot be made and burr hole may be smaller to larger which extend from asterion to foramen magnum [8]. Newer spiral CT and MRI 3D image with fading technique are taken to see exact location of asterion in relation to transverse-sigmoid complex & approach to the exact location of the tumour or lesion [9].

Material & Methods

The present study was done in 220 sides of 110 dry adult human adult skulls, procured from the department of Anatomy and Forensic Medicine in KIMS, Koppal, Karnataka. Each skull was observed for the type of asterion, on both the sides, and classified as, Type I Asterion (asterion with sutural bone) and Type II Asterion (asterion without sutural bone). Classification of asterion is done according to previous studies [6,9,10]. Skulls with breakage or advanced synostosis were excluded from the study [11]. Data is collected, in the tabulated form, compared with the previous studies and the significance of the types of asterion has been discussed.

Observations

Out of 220 sides of asterion the Type -I asterion on

right side is 18% & on left side is 23.6%, compared to type-II which is 81.8% on the right side and 76.3% on the left side respectively. Total incidence of type -I

asterion is 20.9% and type-II asterion is 79%. Further, bilateral incidence of type-I asterion is 7.2% and type-II asterion is 67.2%.

Table 1: Incidence of types of asterion

Asterion	Right side	Right side %	Left side	Left side %	Total	Total %	Bilateral	Bilateral %
Type-I	20	18%	26	23.6%	46	20.9%	8	7.2%
Type-II	90	81.8%	84	76.3%	174	79%	74	67.2%
Total	110	-	110	-	220	-	82	-

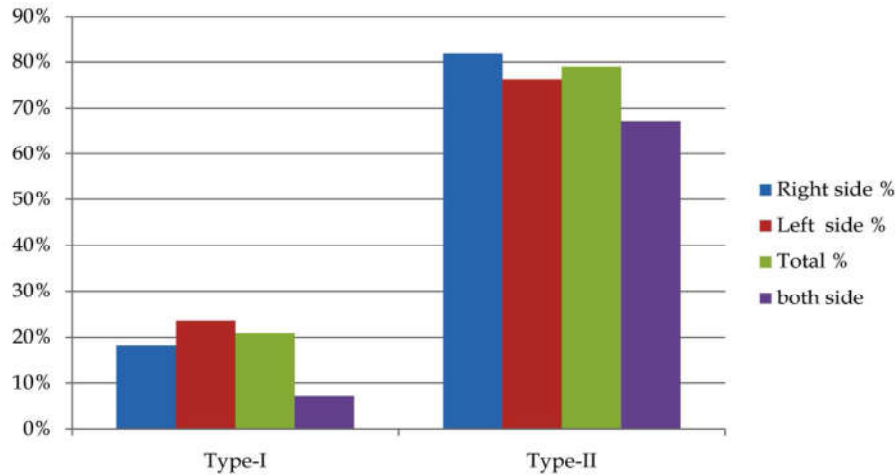


Chart 1: Coloured column chart of Incidence of types of asterion. Incidence of type -I asterion is less than that of type-II

Table 2: Comparison of various studies on asterion in different populations

Population Group	Author & year	No. of Bones	Type-I	Type-II
North americans	Berry ¹² 1967	50	12 %	88 %
South americans	Berry ¹² 1967	53	7.5 %	88 %
Egyptians	Berry ¹² 1967	250	14.4 %	85.6 %
Indians -burma	Berry ¹² 1967	51	14.7 %	85.3 %
Indians-punjab	Berry ¹² 1967	53	16.9 %	83.1 %
Turks	Gumusburun ¹³ 1997	302	9.92 %	90.08 %
Kenyan	Mwachaka ⁶ 2009	79	20 %	80 %
Indians	Hussain ¹⁴ 2011	125	23.15 %	76.85 %
South indian	R Sudha ¹¹ 2013	150	7.6 %	92.3 %
South indian	Pavan ⁷ 2015	250	19.2 %	80.8 %
Indian	Rajani singh ¹⁵ 2012	55	16.36 %	83.64 %
Present study	India (Karnataka)	220	20.9 %	79 %.



Fig. 1: Type 1 sterion (with sutural bone)



Fig. 2: Type 2 asterion (without sutural bone)

Discussion

The mechanism of formation of sutural bone is not fully understood. Some of the authors believe that these bones develop from pathological influences such as hydrocephalus [16]. Some others believe that development of sutural bone is a natural process and is genetically determined [17]. Approach to the asterion itself is difficult due to thick muscles present on it and emissary vein below it [9]. Incidence of type I asterion was 16.36% [15]. The incidence of type-I asterion is nearer to that done by Berry in Indian Punjabi population [12]. Studies done by different researchers revealed that there is racial variation in the incidence of the types of sterion [11-14].

Type -I asterion is less predominant on right side (18%), than left side (23.6%). Whereas, on the right side type-II asterion is 81.8%. On the left side incidence of type-I asterion is 23.6% which is less than type-II (76.3%). When an observation was done on bilateral occurrence, type-I asterion was found on both the sides in 7.2% of the cases and type-II was bilateral is 67.2%. Type-I is predominant on left side & type-II is on right side. The present study is close to the study done in Kenyans [6], Indian Hussain [14]. Our results are almost similar the study done by Pavan et al [7] (Type -I 19.2% and Type -II 80.8%). The differences in the incidence of types of asterion may be attributed to the region, race and population, as it is clearly depicted in Table 2.

Conclusion

Regional wise study of asterion is very important. Predominance of type of asterion, its correlation is significant, which helps neurosurgeons, ENT surgeons, radiologists & oro-facio maxillary surgeon for pre-operative assessment and plan for procedure. Asterion type I was found in 20.9%. Sutural bones, whenever present are of particular significance. Knowledge of sutural bones at the asterion is clinically and surgically significant, during neurosurgical procedures and also during radiological investigations. Our study results are of immense help in the surgical and radiological field for an insight into the types of asterion. This study is also an addition to the previously available data of types of asterion for comparison with population groups.

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