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Original Research Article

A STUDY ON SUTURAL MORPHOLOGY OF THE PTERION IN ADULT DRY SKULL IN SOUTH INDIAN ETHNIC GROUP

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ABSTRACT

Introduction: The latest advances in the field of pterional keyhole surgeries make it imperative for a neurosurgeon to understand the sutural morphology of pterion prior to the surgery.

Materials and Methods: The sutural morphology of the pterion was studied bilaterally in 98adult skulls (62 male and 36 female) of south Indian ethnic group. The pterion was classified into four types namely sphenoparietal, frontotemporal, stellate and epipteric and the frequency of each type was observed bilaterally and in either sex and recorded.

Results: Sphenoparietal was observed to be the commonest type of the pterion comprising 81.61%, followed by epipteric and frontotemporal varieties comprising 7.63 and 6.63% respectively and stellate was observed to be the least common variety with 3.55%.

Conclusion: The pterion is an important neurosurgical landmark due to the presence of vital structures beneath it such as the insula, middle meningeal artery, Broca's area, optic nerve and the circle of Willis. It provides lateral access to these structures and enables surgical treatment of vascular aneurysms of circle of Willis, tumours and optic meningiomas. The novel advances in the field of pterional keyhole surgeries increases its significance and a neurosurgeon must essentially understand its sutural morphology prior to surgery.

KEY WORDS: Neurosurgical Implications, Pterion, Pterionic Approach, Sutural Morphology.

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INTRODUCTION

Pterion is an H shaped suture on the lateral aspect of the skull marking the confluence of the frontal bone, the parietal bone, the greater wing of sphenoid and the squamous part of temporal bone representing the neonatal antero-lateral fontanelle [1]. It was Murphy who first classified pterion into four types. The four types

include sphenoparietal, frontotemporal, stellate and epipteric. The sphenoparietal type involves fusion of greater wing of sphenoid and parietal bone, the Frontotemporal type involves fusion of frontal and temporal bones, the stellate type involves fusion of all the four bones which meet at a point and in the Epipteric type a sutural bone is found in the pterion [2]. The position of pterion is marked approximately by a point 3 to 4cm above the midpoint of zygomatic arch and 3 to 4 cm behind frontozygomatic suture [3]. The pterion is a point of immense neurosurgical significance as it provides surgical access to several vital structures such as middle meningeal artery, circle of Willis, insula and Broca's motor speech area in procedures such as trephination for extradural haematoma, treatment of circle of Willis aneurysms and for surgeries involving the insula and the Broca's area [4]. The anterolateral fontanelle can be used for age estimation as it closes 3 months after birth. The position of the pterion also exhibits sexual dimorphism [5]. The Pterional keyhole approach for the treatment of circle of Willis aneurysms is described by several authors [6,7]. The present study analyses the sutural morphology of pterion in south Indian ethnic group. It is essential to understand the sutural morphology of the pterion prior to drilling of the burr hole. The point of surgical drilling has to be precise as an anterior drilling will result in penetration of the orbit. A posterior drilling will move away from the surgical field resulting in ineffective access for instrumentation.

MATERIALS AND METHODS

The study was conducted in the Department of Anatomy in Yenepoya Medical College, Mangalore. The study involved 98 skulls (62 male and 36 female) of south Indian ethnic group. The frequency of each type of pterion was observed bilaterally in all the skulls and recorded. The frequency of each type of pterion in either sex was also observed and recorded.

RESULTS

All four types of pterion were observed and the results were tabulated and compared with the results of previous studies. Sphenoparietal was observed to be the commonest type of pterion comprising 81.61%, followed by epipteric and frontotemporal varieties comprising 7.63% and 6.63% respectively and stellate was observed to be the least common variety with 3.55%. The Sphenoparietal type is shown in figure 1, the frontotemporal type in figure 2, the stellate type in figure 3 and the Epipteric type in figure 4. The frequency of each type of pterion on each side of the skull is shown in table 1. The frequency of each type of pterion in males and females is shown in table 2.

Table 1: Depicts the frequency of each type of pterion on each side of the skull.

Side	Sphenoparietal	Frontotemporal	Stellate	Epipteric
Right (%)	**79.59**	8.16	1.52	10.18
Left(%)	81.63	7.14	2.54	8.16

Table 2: Depicts the frequency of each type of pterion in males and females.

Sex	Sphenoparietal	Frontotemporal	Stellate	Epipteric
Male(%)	83.46	8.87	0	6.94
Female(%)	78.77	3.77	7.94	
Total (%)	81.61	6.63	3.55	7.63

Fig. 1: Depicts the sphenoparietal type.Fig.2 depicts the frontotemporal type.

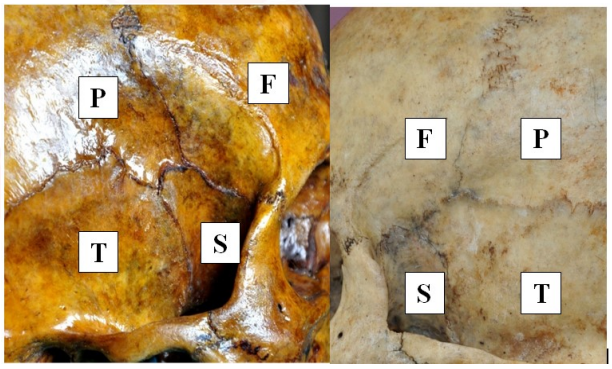
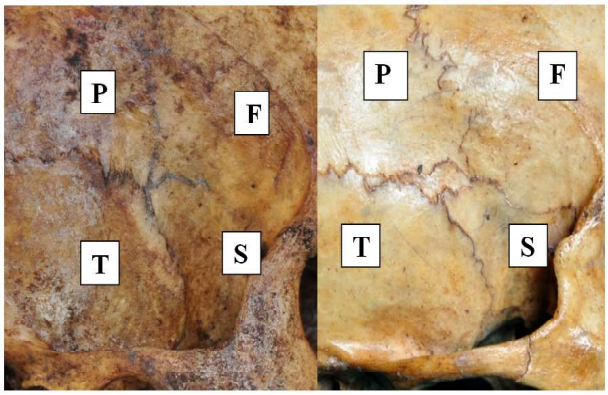


Fig. 2: Represents the stellate type.Fig. 4 depicts the epipteric type.



In the above figures "F" depicts the frontal bone, "T" depicts the squamous part of temporal bone, "S" depicts the greater wing of sphenoid bone and "P" depicts the parietal bone.

DISCUSSION

The sutural morphology of pterion has been studied in diverse ethnic groups by several authors as shown in table 3 [8-13]. Table 3 depicts the comparison of results of the present study with the results of previous studies. When the results were compared it was observed that in all the studies the sphenoparietal type of pterion was the most frequently observed type. The frequency of other types such as frontotemporal, stellate and epipteric varied in different studies. The sutural morphology needs to be understood prior to drilling a burr hole in pterionic keyhole surgeries or while performing a pterional Craniotomy to access and operate on structures that lie beneath it such as the insula, Broca's area, optic nerve and circle of Willis vessels [1]. The sutural morphology is especially significant in case of epipteric variety when a sutural bone present at the site of pterion can confuse the surgeon regarding the point of craniotomy [14].

Table 3: Depicts the comparison of results of the present study to the results of previous studies involving diverse ethnic groups.

Authors	Ethnic Group	Sphenoparietal (%)	Frontotemporal (%)	Stellate (%)	Epipteric (%)
Murphy, 1956 [2]	Australian	73.2	7.7	0.7	18.3
Saxenaet al.,2003 [8]	Indian	87.72	10.01	5.17	0
Oguzet al., 2004 [13]	Turkish	88	10	0	2
Ilknuret al., 2009 [12]	Anatolian	89.2	3.6	3.6	3.6
Apinhasmit et al., 2011 [11]	Thailand	81.2	1.1	0.4	17.4
Saheb et al., 2011 [9]	Indian	69.25	17.35	9.7	3.7
Ukoha et al., 2013 [10]	Nigerian	75.5	19.6	1.83.6	
Adejuwon et al., 2013 [4]	Nigerian	86.1	8.3	5.6	0
Present study, 2015	Indian	81.61	6.63	3.55	7.63

Significance of sutural morphology in neurosurgical procedures: The pterional craniotomy approach to treat vascular aneurysms of circle of Willis and other tumours in the region was popularised by Yasargil in 1967 [14]. A modified subperiosteal craniotomy approach is also described that preserves the temporalis muscle and removes the bone piece around the pterion as a flap which is then replaced with excellent cosmetic results [15]. The recent advances in surgical techniques recommend a keyhole approach that uses a very minute incision on the skin followed by surgical instrumentation that are navigated through the Sylvian fissure so as to access and treat vascular aneurysms of circle of Willis [16]. Moreover, optic meningiomas can also be accessed and surgically treated through the pterion [17,18]. Several authors have suggested that the surgeon needs to be very accurate while drilling the burr hole as its position must be accurate and flawless. This is especially true in case of epipteric variety of pterion where in the surgeon may consider the anterior most point of confluence as the point of drilling and this can result in orbital penetration and injury to orbital contents with loss of vision [19].

CONCLUSION

Pterion is a very important neurosurgical landmark due to the presence of several vital structures beneath it and it provides lateral access to these structures and enables surgical treatment of clinical conditions such as vascular aneurysms of circle of Willis, tumours and meningiomas. Moreover, surgical treatment of extradural hematoma involves trephination where the burr hole is made at the pterion and the intracranial tension is relieved. The recent advances in pterionic keyhole surgeries as a treatment modality for aneurysms makes it imperative for a neurosurgeon to precisely understand the sutural morphology prior to surgery especially in cases with epipteric type.

Conflicts of Interests: None

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