International Journal of Anatomy and Research,
Int J Anat Res 2017, Vol 5(3.2):4290-94. ISSN 2321-4287
DOI: https://dx.doi.org/10.16965/ijar.2017.313

Original Research Article

INCIDENCE OF TYPES OF PTERION IN SOUTH INDIANS – A STUDY ON CADAVERIC DRY SKULLS

Manjunath Halagatti [1], Channabasanagouda *[2].

[1] Assistant Professor, Department of Anatomy, Koppal Institute of Medical Sciences, Koppal, Karnataka, India.

*[2] Associate Professor, Department of Anatomy, Koppal Institute of Medical Sciences, Koppal, Karnataka, India.

ABSTRACT

Introduction : Pterion is an important landmark in the temporal fossa. It is a significant area for the surface location of anterior branch of middle meningeal artery and stem of lateral sulcus of the cerebrum. Based upon the pattern of articulation of the bones, different varieties of pterion have been encountered. Knowing about the incidence of types of pterion is very important for neurosurgeons, anthropologists, forensic scientists and radiologists.

Materials and methods : Current study was done on 282 dry adult human cadaveric skulls (564 sides), for the incidence of different types of pterion. Types of pterion are – sphenoparietal type, frontotemporal type, stellate type and epipteric type.

Results : Out of the 564 pteria,we have identified 455 sphenoparietal type, 77 frontotemporal type, 17 stellate type and 15 epipteric types. The incidence of different types of pteria have been correlated and compared with the data available from previous studies.

Conclusion : The current study on incidence of types of pterion will add further knowledge to the available data about types of pterion and it will be of immense help for neurosurgeons, orthopedic surgeons, pediatricians, radiologists and anthropologists for proper diagnostic and therapeutic purposes.

KEY WORDS: Pterion, sphenoid, temporal, frontal, meningeal.

Address for Correspondence: Dr. Channabasanagouda (MBBS MD), Associate Professor, Department of Anatomy, Koppal Institute of Medical Sciences, Koppal, Karnataka – 583231
Phone : 09481562274 **E-Mail:** drcbg2007@gmail.com

Access this Article online

Quick Response code

DOI: 10.16965/ijar.2017.313

Web site: International Journal of Anatomy and Research
ISSN 2321-4287
www.ijmhr.org/ijar.htm

Received: 21 June 2017
Peer Review: 21 June 2017
Revised: None

Accepted: 03 Aug 2017
Published (O): 31 Aug 2017
Published (P): 31 Aug 2017

INTRODUCTION

The pterion represents the junction of the frontal, sphenoid, parietal and temporal sutures within the temporal fossa. It marks the position of the frontal branch of middle meningeal artery. Pterion is an important anthropometric landmark. It corresponds to the site of anterolateral fontanelle of the neonatal skull, which closes in the third month after birth [1].

Anteroinferior angle of parietal bone (sphenoid angle), is the meeting place of four bones, with an H shaped suture. Bones which meet here are the squamous part of frontal bone, greater wing of sphenoid bone, anteroinferior angle of parietal bone and the squamous part of temporal bone. This region is called as the pterion. Centre of the pterion is an important landmark for the surgeons, lies about 4cm above the

zygomatic arch and 3.5cm behind the frontozygomatic suture [2]. It is a clinically important area of bone junctions. In greek, pterion means wing. Usually sphenoid and parietal bones meet at the pterion. Less commonly frontal and temporal bones articulate, sometimes all four bones meet at a point [3].

Pterion has got a considerable importance in age and sex determination. It is an important landmark for the location of anterior division of middle meningeal artery, Broca's area and sphenoid ridge [4]. There are various types of pterion depending on the meeting pattern of the bones. Accordingly, Broca [4] has classified the pterion into three types, sphenoparietal type (sphenoid and parietal bones articulate directly), frontotemporal type (frontal and temporal bones articulate) and stellate variety (all the four bones meet at a common point). Murphy [5] added fourth type to the existing three types, which is named as epipteric type, where there will be presence of a sutural bone at the pterion. Two more types were added by Wang [6] these are zygomaticotemporal and zygomaticoparietal types, where the zygomatic bone articulates with temporal and parietal bones respectively. Being an important landmark for the neurosurgeons, pterion has acquired interest by anthropologists and forensic science experts, as there is variation in its pattern in different population groups [7]. The area of pterion is weak, as the bones here are considerably thin. Thus making the pterion vulnerable for fracture. A blunt trauma here may rupture anterior division of middle meningeal artery, resulting in an extradural hematoma [8]. Pterion is important as a craniometric landmark for the location of anterior branch of middle meningeal artery, Broca's area, insula and stem of lateral sulcus. It is a primary area to gain access to sphenoid ridge and the optic canal [9].

Though the pattern of pterion is classically described as an H shaped suture, it is subjected for variant presentations. Knowing the pattern of pterion is of significance for surgical approaches to the underlying structures. This study, on dry adult human skulls adds to the available information about the types of pterion. Further, presence of a sutural bone at the pterion, may complicate neurosurgical and radiological procedures. Thus the current study is significant for neurosurgeons, radiologists, anthropologists and forensic science experts.

MATERIALS AND METHODS

564 sides of 282 dry adult human skulls, irrespective of sex have been studied for the sutural morphology of the pterion. Based upon the observations, pterion is classified into four types [5].

Sphenoparietal type: Greater wing of sphenoid directly articulates with sphenoid angle of parietal bone.

Frontotemporal type: Squamous part of frontal bone directly meets the squamous part of temporal bone.

Stellate type: All the four bones, squamous part of frontal bone, greater wing of sphenoid bone, Sphenoid angle of parietal bone and the squamous part of temporal bone, meet at a common point forming a stellate type suture.

Epipteric type: Presence of a sutual/wormian bone at the pterion

Different types of pteria are noted down in table format. Photographs of the different types of pteria are taken. Results are compared with the previous studies. Importance of this study has been discussed.

Deformed skulls and fractured skulls have been excluded from the study.

Fig. 1: Sphenoparietal type of pterion.

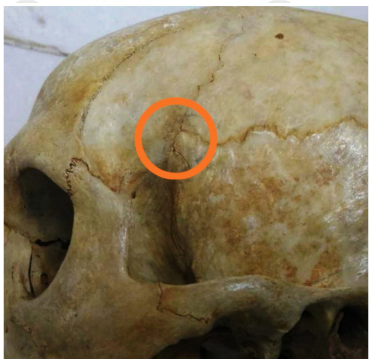

Fig. 2: Frontotemporal type of pterion.

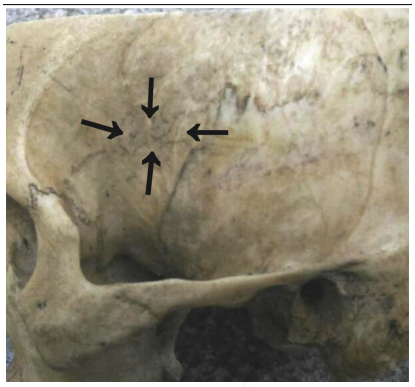

Fig. 3: Stellate type of pterion.

Fig. 4: Epipteric type of pterion.

OBSERVATIONS

Out of the 564 pteria, 455 were sphenoparietal type, 77 were frontotemporal type, 17 were stellate type and 15 were epipteric type. The incidence of different types of pterion has been correlated and mentioned in the following table.

Table 1: Incidence of different types of pteria.

	Incidence of Types of Pterion (percentage)			
	Sphenoparietal type	Frontotemporal type	Stellate type	Epipteric type
Total Incidence (n = 564)	80.53	13.62	3.09	2.62
Right side (n = 282)	46.09	6.01	1.77	2.3
Left side (n = 282)	34.51	7.61	1.23	0.35

The pterion has its own surgical significance, for being an important landmark for locating various intracranial structures. Thus, knowing the pattern/types of pterion is of considerable significance. Previously studies have been done, classifying the pterion into three types [4], four types [5] and six types [6].

The sphenoparietal type is the most common type of pterion reported by many authors in their studies in different population groups. Seema [7] observed 94% of sphenoparietal type, 3% of stellate type, 2% epipteric and 1% frontotemporal type of pteria, in a study on South Indian skulls. We have observed 80.53% of sphenoparietal variety of pterion in 282 skulls (564 sides), accounting for the highest incidence in our study. Right sided sphenoparietal accounted for a slightly more incidence than the left sided one.

Following table shows the comparison between the incidences of types of pterion in different population groups.

Table 2: Comparison of incidence of types of pterion in different population groups.

Author	Population	Incidence of Type of pterion (percentage)			
		Sphenoparital	Frontotemporal	Stellate	Epipteric
Murphy 1956 [5]	Australians	73	7.5	18.5	1
Seema D et al 2013 [7]	South Indians	94	1	3	2
Saxena et al 2003 [9]	Nigerian	84.79	10.11	5.06	-
Saxena et al 2003 [9]	Indian	95.3	3.46	1.38	-
Manjunath et al 1993 [10]	South Indians	93.5	3.52	2.93	17.3
Zalawadia et al 2010 [11]	Western Indians	91.7	2.4	1.2	4.8
Suchit et al 2013 [12]	North Indians	86.25	11.25	2.5	-
Nair et al 2014 [13]	Indians	89.9	2.3	1.9	5.9
Hariprasad et al 2014 [14]	North Indians	89.2	3.3	5	2.5
Pavan et al 2015 [15]	South Indians	72.8	16.4	8.8	2
Present study	South Indians	80.53	13.62	3.09	2.62

Murphy [4], who has classified the pterion into four different types, reported 73% of sphenoparietal type of pterion in Australians. Saxena[9] did a study on Nigerian and Indian skulls and reported 84.79% and 95.3% of sphenoparietal type in respective populations. Manjunath [10] and Zalawadia [11] also reported that the incidence of sphenoparietal type is more than 90%. In our study, we have identified 80.53% of sphenoparietal type of pterion, which is similar to majority of the studies, especially those studies on Indian skulls.

Many authors have opined reasons behind the greater incidence of sphenoparietal type. As per Ashley-Montague [17], sphenoparietal variety of pterion is common in human beings but frontotemporal type is dominant in non-human primates. During evolution, anterosuperior segment of squamous part of temporal bone got detached from it, incorporated into the greater wing of sphenoid, so as to bring about a change from frontotemporal to sphenoparietal type [17].

It is an evolutionary basis and has been shown that growth of bones of calvaria is in coordination with growth of brain and needs an interaction between different tissues in the suture [16]. Increase in brain size in human beings would

have caused morphological changes in the calvaria, due to which greater wing of sphenoid met with the parietal bone [17].

We have observed 13.62% of frontotemporal type and 3.09% of stellate variety of pteria. The frontotemporal variety was slightly more on left side, where as stellate type were slightly more on right side. Saxena [9] reported 10.11% of frontotemporal and 5.06% of stellate types of pteria in Nigerans. Pavan [15] reported 16.4% and 8.8% of frontotemporal and stellate types respectively in a study on South Indian skulls. Manjunath [10] observed 3.52% of frontotemporal type, which is a slightly less incidence compared to other studies. In many of the population groups, frontotemporal type is the second most common type, followed by stellate type. But in a study by Murphy [5] stellate type was the second most common type (18.5%), followed by the frontotemporal type (7.5%). Variations in pteria may be due to the result of combination of genetic and environmental factors [5]. Wang [6] did a study on sutural pattern of rhesus monkeys and concluded that the variations show familial aggregation and are likely to be regulated by genes.

When a sutural bone is present at the pterion, it is called as epipteric type of pterion. Manjunath [10] reported 17.3% of epipteric type and Nair [13] reported 4.8% of epipteric type. Both these studies are on South Indian skulls. Saxena [9] in his study on Nigerian and Indian skulls, did not find any epiptric type of pterion. In our study, incidence of epipteric type of pterion is 2.62%, which is the least among the four varieties of pteria. Among the epipteric type of pteria observed, majority were right sided. Results of our study are almost similar those by Hariprasad [14] and Pavan [15]. Differences in the incidence of types of pteria may be due to the racial characters of various populations.

Sutural bones or wormian bones are small irregular bones, developed due to accessory ossification centres, found along sagittal and lambdoid sutures and at the pterion, lambda and asterion. Some authors opined that the presence of epipteric/wormian bones may be genetic or it may be associated with malformations of the skull and central nervous system anomalies [18,19].

Presence of epipteric bones may give false impression of fractures or fractures may be interpreted for wormian bones, radilogically or clinically, more so when they are at the pterion [20]. Presence of wormian bones at the pterion, may complicate the neurosurgical procedures, like making burr holes [21].

CONCLUSION

We report 80.53% of sphenoparietal type of pterion, which is highest and 2.62% of epipteric type of pterion, which is lowest. Pterion is an important landmark for approaching the cranial cavity. It is one of the standard approach by the neurosurgeons for the lesions in the anterior and middle cranial fossa. A prior knowledge of variants of pterion is significant for pterional approach, especially when a burr hole is planned at this location. The incidence of different types of pterion are of particular interest to anthropologsists, forensic scientists, neurosurg-eons and radiologists. The data displayed by our study, adds on to the previous studies, with comparison between the population groups. Though genetic and racial causes have been implicated in the variation of sutural pattern of pterion, there is a need of further study on correlation between sutural configuration and growth of brain. This data also provides an information for evaluating the causes of variations in pterion and evolution of morphology of pterion.

ACKNOWLEDGEMENTS

Authors are thankful to the Miss Anuradha R for her contribution in this study and also the previous authors from whom we have collected the data.

Conflicts of Interests: **None**

REFERENCES

[1]. Susan Standring. Gray's Anatomy The Anatomical basis of Clinical Practice, 41st Edn . Churchill Livingstone, Elsevier ; 2016. page 409, 410, 419.

[2]. Dutta AK. Essentials of human osteology. 2nd ed. Kokata, India : Current books international; 2005 .page 86, 137.

[3]. Moore, K. L. & Dalley, A. F. Clinical Oriented Anatomy. 5th ed. Philadelphia, Lippincott Williams & Wilkins, 2006. pp.828.

[4]. Broca, P. Instructions craniologiques et craniométriques. Mém. Soc. Anthrop. Paris, 1875 ;2:1-203.

[5]. Murphy, T. The pterion in the Australian aborigine. Am. J. Phys. Anthropol., 1956; 14(2):225-44.
[6]. Wang, Q, Opperman, L. A, Havil L. M, Carlson, D. S. & Dechow, P. C. Inheritance of sutural pattern at the pterion in Rhesus monkey skulls. Anat. Rec. A Discov. Mol. Cell Evol. Biol., 2006;288(10):1042-9.
[7]. Seema D, Dakshayani K.R, Sumanth M.M. A Morphometric Study of Pterion in Adult Human Skulls. International Journal of Recent Trends in Science And Technology. 2013;9:112-115.
[8]. M. Lama, C. Mottolese, C. Alvisi, and A. Riccio, "Middle meningeal artery aneurysm associated with meningioma," Journal of Neurosurgical Sciences 2000;44(1):39-41.
[9]. Saxena R., Bilodi A., Mane S., Kumar A., 2003, Study of pterion in skulls of Awadh area-in and around Lucknow., Kathmandu University Medical Journal, 2003;1(1):32-33.
[10]. Manjunath KY, Thomas IM. Pterion variants and epipteric ossicles in South Indian skulls. J Anat Soc India 1993; 42:85-94.
[11]. Zalawadia DA, Vadgama DJ, Ruparelia DS, Patel DS, Patel DSV. Morphometric Study of Pterion In Dry Skull Of Gujarat Region. NJIRM. 2010; 1(4): 25-29.
[12]. Suchit K, Anurag, Munjal S, Chauhan P, Chaudhary A, Jain SK. Pterion its location and clinical implications- A Study Compared. Journal of Evolution of Medical and Dental Sciences 2013; l2 (25): 4599-4608.
[13]. Nair SK, Singh S, Bankwar V. Sutural morphology of the pterion in dry adult skulls of Uttar Pradesh and Bihar region of Indian subcontinent. Indian Journal of Forensic Medicine & Toxicology 2014; 8 (1):181.
[14]. Hari Prasad, Anshu Mishra, Paramatma Prasad Mishra. Study of Variations of Bony Pattern and Presence of Wormian Bone at Pterion in Dry Adult Skulls. International journal of Biomedical Research, 2014; 5 (11): 168-170
[15]. Pavan P, Shruthi BN, Shaik Hussain Saheb, Henjarappa KS. Morphological Study on Shapes of Pterion. International Journal of Anatomy and Research, 2015;3(4):1555-58.
[16]. KIM, HJ., RICE, DPC., KETTUNEN, PJ. and THESLEFF, I. FGF-, BMP- and Shh-mediated signaling pathways in the regulation of cranial suture morphogenesis and calvarial bone development. *Development,* 1998, vol. 125, no. 7, p. 1241-1251.
[17]. ASHLEY-MONTAGU, MF. The anthropological significance of the pterion in the Primates. American Journal pf Physical Antropology, 1933, vol. 18, no. 2, p. 159-336.
[18]. Pryles CV, Khan AJ. Wormian bones. A marker of CNS abnormality? Am. J. Dis. Child. 1979; 133: 380–382.
[19]. Das S, Suri R, Kapur V. Anatomical observations on os inca and associated cranial deformities. Folia Morphol. (Warsz). 2005; 64: 118–121.
[20]. Nayak S, Soumya KV. Unusual sutural bones at pterion. IJAV 2008;1:19-20
[21]. Ersoy M, Evliyaoglu C, Bozkurt MC, Konuksan B, Tekdemir I, Keskil IS. Epipteric bones in the pterion may be surgical pitfall. Minim Invasive Neurosurg 2003; 46:364–365.

How to cite this article:

Manjunath Halagatti, Channabasanagouda. INCIDENCE OF TYPES OF PTERION IN SOUTH INDIANS – A STUDY ON CADAVERIC DRY SKULLS. Int J Anat Res 2017;5(3.2):4290-4294. **DOI:** 10.16965/ijar.2017.313