

## Study of pterion: Its clinical and morphological aspects

Sowmya S<sup>1,\*</sup>, Meenakshi B<sup>2</sup>, Priya Ranganath<sup>3</sup>

<sup>1</sup>Assistant Professor, <sup>2</sup>Professor, <sup>3</sup>Professor & HOD, Dept. of Anatomy, Bangalore Medical College & Research Institute, Bengaluru, Karnataka

**\*Corresponding Author:**

Email: drsowmyanandan@gmail.com

### Abstract

**Introduction:** Essential precondition for keyhole surgeries are accurate preoperative planning and placement of craniotomy tailored to the individual case. The pterion at temporal fossa is an important surgical landmark for the key hole surgeries to reach the deeper structures of anterior and middle cranial fossa like sylvian point hence broca's area and corresponds to the anterior ramus of middle meningeal artery. Hence precise anatomy and anatomical variation of surgical landmarks helps preventing surgical complications. Also its morphological knowledge is useful for anthropologist and forensic specialists.

**Materials and Method:** The study was done on 50 dry skulls from the Department of Anatomy, Bangalore Medical College and Research Institute, Bangalore.

**Result:** Out of 50 skulls, sphenoparietal type was more observed and stellate type was not observed in this study. The average distance from upper border of middle of zygomatic arch on right side is 4.02 cm and on left side is 3.99 cm and from frontozygomatic suture on right side is 3.42cm and on left side is 33.3cm.

**Conclusion:** The current study reappraises the surface anatomy of pterion, incidence of its various types and hence morphology. This study supporting other studies conducted on Indian population other than some variation in incidence of stellate variety. This study showed incidence of epipteric only on left side, which is a surgical pitfall due to lodging of sutural bone in between sutures. So it suggests a careful approach through pterion on left side.

**Keywords:** Pterion, Zygomatic arch, Fronto zygomatic suture, Epipteric, stellate

### Introduction

An irregularly H-shaped meeting of sutures in the temporal fossa has a horizontal limb the suture between the antero-inferior parietal angle and the apical border of the greater wing of sphenoid. The frontal, sphenoid, parietal and temporal squama are here all close together: a small circular area includes parts of all four and is termed the pterion, whose centre, an important surgical landmark, is on average 4 cm above the zygomatic arch and 3.5 cm behind the frontozygomatic (FZ) suture. Its position can be estimated roughly by a shallow palpable hollow, about 3.5 cm above the centre of the zygoma.<sup>(1)</sup>

Four types of pterion are sphenoparietal (SP) (Fig. 1) type where greater wing of sphenoid articulates with parietal bone to form letter H; Frontotemporal FT type (Fig. 2) where the squamous part of temporal articulates with frontal bone; stellate type where all bones articulate in the form of letter K and epipteric type (Fig. 3) where a sutural bone is lodged between the four bones forming the pterion. Presence of epipteric bone in the pterion may be a surgical pitfall.<sup>(2)</sup> It marks the anterior middle meningeal arterial ramus and the axial position of the lesser wing of sphenoid; the latter is lodged in the stem of the lateral Sylvian cerebral fissure, which has the motor speech area; hence the term Sylvian point.<sup>(1)</sup>

### Material & Method

A crosssectional study was done on fifty dry skulls from the Department of Anatomy, Bangalore Medical

College and Research Institute, Bangalore. The pterion was observed for its formation by different bones and distance of the centre of the horizontal limb of the pterion to the upper border of the middle of the zygomatic arch and to FZ suture was measured using sliding caliper. Mean of each measurements were calculated and statistically evaluated for its significance.

### Observation

Out of 50 skulls, SP type (Fig. 1) was observed in 35 skulls (70%) on right & 42 (84%) on left side, FT (Fig. 2) in 15 skulls (30%) on right & 2 (4%) on left side, epipteric (Fig. 3) in 6 skulls (12%) on left side. SP type was observed more on left side whereas FT was more on right side. Epipteric were observed only on left side. Totally SP type 77%, FT 17%, epipteric 6% and stellate 0% were observed in this study. Different types of pterion and their incidences have compared and tabulated with Indian population and other population (Table 1a & 1b). The average vertical distance from upper border of middle of zygomatic arch to centre of pterion on right side is 4.02 cm and on left side is 3.99 cm. The average horizontal distance from FZ suture to centre of pterion on right side is 3.42cm and on left side is 33.3cm (Table 2).



**Fig. 1: Sphenoparietal type**



**Fig. 2: Frontotemporal type**



**Fig. 3: Epiptereric type**

### Discussion

The importance of pterion is its relation to the Broca's speech area on the left side and surgical intervention relating to pathologies of the sphenoid ridge and optic canal.<sup>(3)</sup> The pterional approach, which

is used in neurosurgery, has been described as the most popular approach.<sup>(4)</sup>

A study showed maximum number of epiptritic type 21.7% on right and 26% on left among 46 dry skulls and 20 cadaveric skulls.<sup>(5)</sup> In another study most occurring type of pterion found to be SP and least incidence of FT (3%) were observed<sup>(6)</sup> which is showing similarity to the study among Turkish.<sup>(7)</sup> Frontotemporal (FT) articulation shows racial variation, probably epigenetic; its incidence varies from almost zero in a British seventeenth century cemetery to 9.8% in Nigerian crania.<sup>(1)</sup> SP type was the most common type (86.1%), followed by FT (8.3%), and stellate (5.6%) with no incidence of epiptritic type in a study conducted in 62 dry human skulls of Nigerian population.<sup>(8)</sup> Author found significant gender variation in occurrence of types of pterion especially in epiptritic type and with more incidence of sp type bilaterally.<sup>(9)</sup> A study in turkish population showed SP88%, FT 10%, epiptritic 2% and no incidence of stellate type.<sup>(7)</sup> In present study SP 77%, FT 17%, epiptritic 6% and no stellate type was observed. Vertical distance from midzygoma and horizontal distance from FZ suture were found to be slightly more on right side compared to left side. Vidarbha region population recorded 82.94% sphenoparietal type, frontotemporal 2.94%, stellate 5.29%, epiptritic or accessory sutural bone 7% was observed. Atypical pterion was observed in 1.76% of skulls. Sphenoparietal type of pterion was found to be predominant type regionally and internationally.<sup>(10)</sup> According to measurements pterion was lying approximately 3.98 cm above the arcus zygomaticus and 3.4 cm behind the frontozygomatic suture. Occurrence of sphenoparietal type pterion was notably higher than the others. This approach also useful to treat aneurysms of the middle cerebral artery or upper basilar complex, and in operations involving petroclival tumors. Moreover this approach has several advantages over traditional craniotomy that including minor tissue damage, less brain retraction, a superior cosmetic result and shorter duration of surgery.<sup>(11)</sup> The distance between the pterion and the lesser wing of the sphenoid bone  $1.40 \pm 0.33$  cm and  $1.48 \pm 0.32$  cm on the right and left sides respectively.<sup>(12)</sup>

**Table 1a: Discussion on formation of pterion among Indian population**

	SP%	FT%	Stellate	Epiptritic
Hussainsaheb et al 2011 <sup>(2)</sup>	69.25	17.31	9.7	7.4
Praba & Venkatramaniah 2012 <sup>(6)</sup>	74	3	9	14
Gupta et al 2014 <sup>(5)</sup>	60.95	6.5	8.7	23.85
Charulatha S <sup>(10)</sup>	82.94	2.94	7	5.29
Present study	77	17	0	6
Total	71.42	9.35	6.88	11.3

**Table 1b: Comparison of Indian population with other population (formation of pterion)**

	SP	FT	Stellate	Epipteric
Oguz et al 2004 (Turkish) <sup>(7)</sup>	88	0	2	10
Mwachaka et al 2009 (Kenyan) <sup>(9)</sup>	66.7	15.5	11.1	6.7
Adejuwon et al 2013 (Nigerian) <sup>(8)</sup>	86	8.5	5.6	0
Indian population (as per study)	71.42	9.35	6.88	11.3

**Table 2: Discussion on distance of pterion to midzygoma & pterion to FZ suture**

	Midzygoma (cm)		FZ suture (cm)	
	R	L	R	L
Oguz et al 2004 (Turkish) <sup>(7)</sup>	4.05	3.85	3.3	3.44
Mwachaka et al (2009) <sup>(9)</sup>	3.888	3.824	3.0	3.035
Adejuwon et al (2013) <sup>(8)</sup>	3.91	3.877	3.1	3.082
Present study	4.02	3.99	3.42	3.33

A good result can be achieved only if surgeon acquires an in-depth knowledge and understanding of the surgical anatomy in area of these tumours. He observed that in epipteric type, there is presence of extra sutural bone among rest of four bones forming pterion which can lead to misinterpretation of centre point, thus leading to various complications like penetration of orbit during surgeries in region of pterion.<sup>(4)</sup>

### Conclusion

The current study reappraises the surface anatomy of pterion, incidence of its various types and hence morphology. This study exhibits population based variation in pattern of formation of pterion by comparing Indian population pattern with other population like Turkish, Kenyan and Nigerian. This study showed more incidence of epipteric type in Indian population. Vertical distance from midzygoma and horizontal distance from FZ suture were found to be slightly more on right side compared to left side. Therefore, its formation and its precise location in relation to other surrounding visible landmarks like zygomatic arch, FZ suture can be very useful for keyhole surgeries in these areas.

### References

1. Standring S: In Gray's Anatomy – the anatomical basis of clinical practice 39<sup>th</sup> edition. Elsevier Churchill Livingstone, Edinburgh, 2005, pp 560, 595, 1912.
2. Hussainsaheb S, Mavishettar GF, Thomas ST, Prasanna LC, Muralidhar P, Magi. A study of sutural morphology of the pterion & asterion among human adult Indian skulls. Biomedical Research 2011,22(1):73-75.
3. Saxena RC, Bilodi AKS, Mane SS, Kumar A. Study of pterion in skulls of Awadh area in & around Lucknow. Kathmandu University Medical Journal 2003,1(1):32-33.

4. Yasargil MG, Fox JL, Ray MW. The operative approach to aneurysms of the anterior communicating artery. Advances & Technical standards in neurosurgery 1975,2:113-170.
5. Gupta R, Sinha MB, Aggarwal A, Gupta T, Kaur H, Sahni D, Garg R. Landmarks for keyhole neurosurgical procedures through pterion. Int J of Healthcare and biomedical research 2014,2(4):168-175.
6. Praba AMA, Venkatramaniah C. Morphometric study of different types of pterion and its relation with middle meningeal artery in dry skulls of Tamilnadu. JPBMS 2012,21(21):1-4.
7. Oguz O, Sanli SG, Bozkir MG, Soames RW. The pterion in Turkish male skulls. Surg Radiol Anat 2004,26:220-224.
8. Adejuwon SA, Olopade FE, Bolaji M. Study of location and morphology of pterion in adult Nigerian skulls. ISRN Anatomy, 2013. 4.
9. Mwachaka PM, Hassanali J, Odula P. Sutural morphology of pterion and asterion among adult Kenyans. Braz J Morphol Sci 2009;26:4-7.
10. Charulata S, Abhilasha W, To Study the Morphology of Pterion in Dry Human Skull in Vidarbha Region, IJSR, 2013,4:2171-73
11. Alper S, Eren Ö, Günes A et al, Morphometric study of pterion, Int J Anat Res 2016,4(1):1954-57.
12. Zalawadia D A, Vadgama D J, Ruparelia D S, Patel D S, Patel D S, V., Morphometric study of pterion in dry skull of Gujarat region. NJIRM. 2010;1:25-9.