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Original Research Article

Study of anatomical variations of pterion in Karnataka population

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ABSTRACT

The Pterion is a point of sutural confluence formed by frontal, parietal, temporal and sphenoid bones. Center of pterion is located 4cms above the midpoint of zygomatic arch and 3.5cms behind the fronto-zygomatic suture. Pterion is a reference landmark for many regions of the brain. Knowledge of various types of pterion is important in neurosurgeries as pterion keyhole approach has several advantages over traditional craniotomy; it has got radiological significance in interpretation of radiographs; in forensic medicine, it has been used for estimation of age and stature; and types of pterion has racial variations, hence it has got anthropological significance. Hence, the present study was taken to assess various types of pterion in South Indian adult human skulls.

Objectives: To classify the types of pterion based on Murphy's classification and compare the right and left sides.

Materials and Methods: The study was conducted on 100 adult dry human skulls collected from Kempegowda Institute of Medical Sciences & Research center, Bangalore. The various types of pterion were noted. All the readings were tabulated and subjected to analysis.

Statistical Analysis: All measurements and frequencies of the data were tabulated. The mean, standard deviation for each of the measurements were assessed. Statistical software SPSS version 16 was used. Right and left side were compared using One-Way ANOVA (Analysis of Variance).

Results: Various types of pterion were observed. Spheno-parietal was the most predominant (78%) type, followed by epipteric (16%), stellate (4%) and fronto-temporal (2%).

Conclusion: The results of the present study can be utilized by neurosurgeons, radiologists, anthropologists and forensic experts. The findings can be used in future for comparing various types of pterion from a different population, race or species altogether.

1. Introduction

Pterion is a point of irregular H-shaped sutural confluence seen in the norma lateralis of skull, formed by the frontal, parietal, temporal and sphenoid bones. Pterion corresponds to the site of the antero-lateral fontanelle of the neonatal skull, which closes in the third month after birth.[1]

It is also known as the sylvian point. Fronto-zygomatic suture and midpoint of zygoma can reliably be used in locating pterion. It is located 4cms above midpoint of zygomatic arch and 3.5cms behind fronto-zygomatic suture.[2] Pterion receives its name from the greek word "Pteron", meaning wing. In greek mythology, Hermes, messenger of the gods, was enabled to fly by winged sandals, and wings on his head which were attached at the

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pterion.

One or more sutural bones appear between the sphenoidal angle of the parietal and the greater wing of the sphenoid known as pterion ossicles or epipteric bones,[2] these sutural bones may be mistaken radiologically for fracture of the skull in the pterion region.[3]

Pterion is an important landmark for anterior branch of middle meningeal artery, broca's motor speech area to the left, insula, lateral cerebral fissure, for the pathologies of optic nerve, orbit, sphenoid ridge and for the anterior circulation aneurysms and tumors.[4]

1.1. Classification

Murphy's classification of pterion include 4 types of pterion namely,

1.2. Types of pterion

1. Spheno-parietal type: Greater wing of sphenoid articulates with the parietal bone to form the letter 'H'.
2. Frontotemporal type: Squamous part of the temporal bone articulates with the frontal bone.
3. Stellate type: Here all bones articulate at a point in the form of letter 'K'.
4. Epipteric type: A sutural bone is lodged between the 4 bones forming the pterion.[5]

2. Objectives of the Study

1. To classify the types of pterion based on Murphy's classification and
2. Compare the right and left sides

3. Materials and Methods

The present study was conducted on 100 adult human skulls collected from the department of Anatomy and Forensic Medicine at Kempegowda Institute of Medical Sciences and from other Medical and Dental colleges in and around Bengaluru.

It is an observational study. All human skulls (irrespective of sex) with intact calvaria, well defined sutures and erupted third molar teeth are considered for study. Damaged skulls, old skulls with obliterated sutures and skulls of newborn, infants and children are excluded

Skulls were observed macroscopically with the naked eye for sutural pattern. Skulls are classified based on Murphy's classification.

Findings of sutural pattern of pterion were noted. Values were recorded separately on right and left sides and compared. Values were also compared with previous studies for their statistical significance.

3.1. Statistical analysis

The data collected in this study were analysed statistically using descriptive statistics like percentages, mean and standard deviation. The statistical analysis was done using SPSS 16.0 software. To compare between right and left sides, One-Way ANOVA (Analysis of Variance) was used.

4. Results

Table 1:

Type of pterion	Percentage of incidence (%)
Sphenoparietal	78
Frontotemporal	02
Stellate	04
Epipteric	16

In the present study, Sphenoparietal was found to be commonest (78%). Frontotemporal was seen in 02%, Stellate type was observed in 04% and epipteric type was seen in 16% of cases. In two skulls, 'two' epipteric bones were noticed. The same type of pterion occurred on both right and left sides in the same individual in 75% of the cases. SP type occurred more bilaterally where as FT, stellate and epipteric types occurred more unilaterally shown in Table 1. In the present study, sphenoparietal and stellate occurred more on right side whereas frontotemporal and epipteric types occurred more on left side shown in Table 2. Two sutural bones at pterional site were noted in two skulls, one on right side and other on left side.(Figure 3)

Table 2: Unilateral and bilateral presentations

Types of Pterion	Total	Bilateral	Unilateral
SP	156	66	24
FT	04	00	04
Stellate	08	01	06
Epipteric	32	08	16

Note: SP – Spheno-parietal, FT – Fronto-temporal

Table 3: Right and left presentations

Types of Pterion	Total number of unilateral type	Right	Left
SP	24	14	10
FT	04	01	03
Stellate	06	04	02
Epipteric	16	06	10

SP – Sphenoparietal, FT – Frontotemporal

5. Discussion

In the present study the occurrence of SP type was 78% which is high when compared to Hussain Saheb et al.,

Table 4:

Study / Population, n (skull) and Sex	Sphenoparital type (%)	Fronto-temporal type (%)	Stellate type (%)	Epipteric type (%)
Oguzetal, 2004, Turkish, n = 26. Male.	88	10	0	02
Mwachaka P.M et al, 2009, Kenyan, n=90, Known gender.	66.7	15.5	11.1	6.7
Ankur Zalwadia et al, 2010, Western Indians, n=42, unknown gender.	91.7	2.4	1.2	4.8
Hussain Saheb et al, 2011, Indians, n=125, Known Gender	69.25	17.35	9.7	3.7
Present Study, 2011, South Indians, n=100, Unknown gender	78	02	04	16

Table 5: Percentage distribution of symmetrical and asymmetrical distribution in different studies

Study / Population	Symmetrical (%)	Asymmetrical (%)
Mwachaka P.M et al, 2009, Kenyan, n=90, Known gender.	78	22
Ankur Zalwadia et al, 2010, Western Indians, n=42, unknown gender.	99	01
Wandee C, et al, 2011, Thailand, n = 268, Known gender.	84.7	15.8
Present Study, 2011, South Indians, n=100, Unknown gender	75	25

Table 6:

Study / Population	Spheno parietal		Fronto-temporal		Stellate pterion		Epipteric	
	Right (%)	Left (%)	Right (%)	Left (%)	Right (%)	Left (%)	Right (%)	Left (%)
Ankur Zalwadia et al, 2010, Western Indians, n=42, unknown gender.	92.9	90.5	2.4	2.4	0	2.4	4.8	4.8
Hussain Saheb et al, 2011, Indians, n=125, Known Gender.	69.25	69.25	11.3	23.4	12.1	7.3	5.2	2.2
Wandee C, et al, 2011, Thailand, n = 268, Known gender.	81.0	81.3	1.5	0.7	0	0.7	17.5	17.2
Present Study, 2011, South Indians, n=100, Unknown gender	58.33	41.67	25	75	66.67	33.33	37.5	62.5

Mwachaka P.M et al. and Oguzetal studies. The high occurrence of SP type could have an evolutionary basis. The SP type of pterion is the dominant form in humans whereas the fronto-temporal type is dominant in non-human primates. In primate evolution, the antero-superior segment of the squamous part of the temporal bone of lower primates become detached from its parent and gets incorporated into the postero-superior angle of the greater wing of the sphenoid bone of humans, thereby changing the pterion pattern from the fronto-temporal type of non-human primates to the spheno-parietal type of humans. Frontotemporal type is least commonly seen in the present study. This is similar to Ankur Zalwadia et al. study but low when compared to Oguzetal, Mwachaka P.M et al. and Hussain Saheb et al. studies. The occurrence of fronto-temporal pterion in man is considered to be atavism due to a natural reversion of a stage in the phylogenetic development of man in which the fronto-temporal type was the normal and constant.

From the present study it was seen that the same type of pterion occurs more bilaterally than unilaterally. This is in agreement with the findings among kenyans but differs with that among turks, where the occurrence of pterionic type varied significantly on the left and right sides. These differences could be due to the different sample sizes used in the study. In the present study, sphenoparietal type was the predominant type. This is in agreement with other studies.

Present study has shown that the same type of pterion occurs more bilaterally than unilaterally. This is in agreement with Wandee C et al., Mwachaka PM et al. and Ankur Zalwadia et al.

Fig. 1: Epipteric type of pterion

Fig. 2: Fronto-temporal type of pterion

Fig. 3: Pterion with two epipteric bones

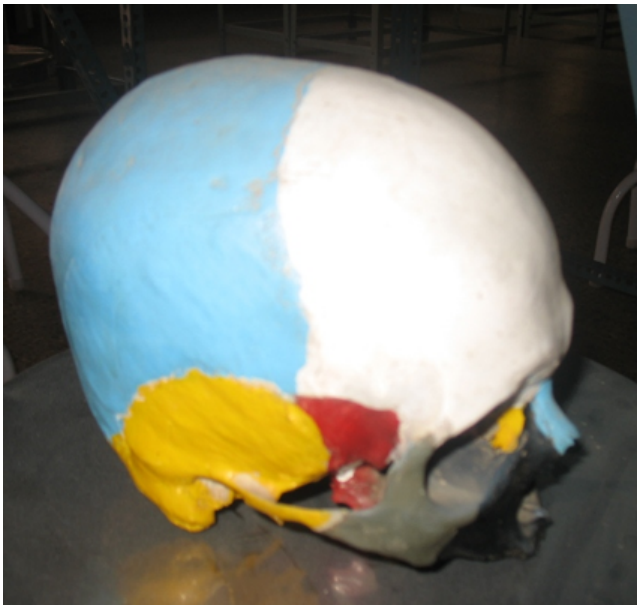

Fig. 4: Stellate type of pterion

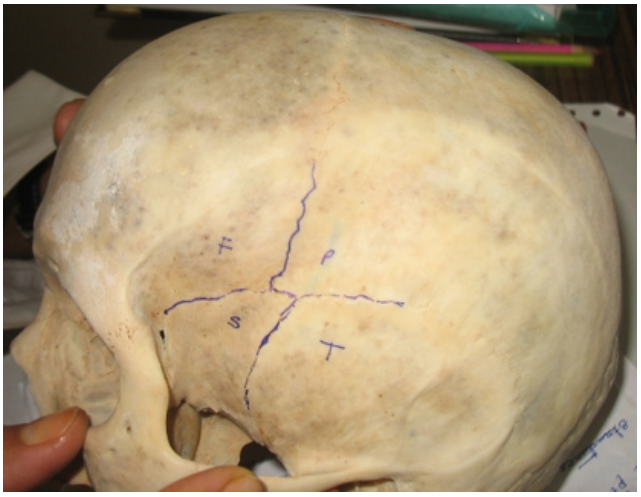

Fig. 5: Speno-parietal type of pterion

6. Conclusion

Spheno-parietal was the most common type observed. Bilateral presentation of this type is more common when compared to unilateral presentation. This type of pterion was present more on right side than left side. Fronto-Temporal was least commonly observed. This type was seen unilaterally only. It was seen more on left side. In Stellate type unilateral presentations were more common than bilateral presentation. This was seen more on right side. Epipteric type was the second most common type observed. This type was seen more commonly on left side. Asymmetrical presentation was more common than symmetrical presentation. The present study has shown no

significant side difference for the types of pterion. Is useful for anthropologists, forensic pathologists, neurosurgeons and maxillofacial surgeons.

7. Source of Funding

None.

8. Conflict of Interest

The author declares no conflict of interest.

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