ORIGINAL ARTICLE

Pterion formation and its variations in Human Skull in Vidarbha Region

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Abstract

Introduction*: The study aims to analyze for the location and types of pterion in adult skulls of Vidarbha region of Maharashtra.* ***Materials & Methods****: Study was performed on 350 adult human skulls. The pterion types were classified and linear distances from the center of the pterion to the frontozygomatic suture and the midpoint of the zygomatic arch were measured.* ***Result:*** *Four types of pterion i.e sphenoparietal, frontotemporal, stellate and epipteric, were observed. Sphenoparietal was common pterion type (82.2%) followed by frontotemporal (9%), stellate (3.7%), and epipteric types (5%). The mean distances from the pterion to frontozygomatic suture were 2.72±0.6 mm and 2.70±0.5 mm on right and left side respectively, while the distances to the midpoint of zygomatic arch were 4.01±0.5 mm and 3.92±0.3 mm.* ***Conclusion****: The study has shown incidence of various types of Pterion. The sphenoparietal variety is predominant type of Pterion in this region.*

Keywords: *Sphenoparietal pterion, frontotemporal pterion, stellate pterion, epipteric pterion*

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Introduction

Pterion is defined as an H-shaped small circular area formed by the junction of four bones: frontal, parietal, temporal and sphenoid on normalateralis of the skull. It lies approximately 4.0 cm above the zygomatic arch and 3.5 cm behind frontozygomatic arch. The pterion is located superior to the zygomatic arch and posterior to the frontozygomatic suture. This is the weakest part the skull, yet it overlies the course of anterior division of the middle meningeal artery, thus making it vulnerable to ruptured, leading to extradural hematoma in the event of a blunt trauma to the side of the head. In the addition, it acts as an important landmark for locating the Broca's motor speech area, anterior pole of the insula, the lateral (Sylvian) cerebral fissure and anterior division middle cerebral artery.

Sutural patterns or bony articulations within the region of the pterion have been generalized into different types by various anthropological and clinical studies [1]. The pterion was first classified into three type (sphenoparietal, frontotemporal and stellate) by Broca [16]. Subsequently, four types (sphenoparietal, frontotemporal, stellate and epipteric) were defined as by Murphy [4].

Little or no study on the pterion has been done in Vidarbha region of Maharashtra. Differences in the exact location of the pterion have been observed among different races, and this could be due to genetic or environmental influences affecting the craniometric indices of human skull.

Materials and Methods

Present study was carried out on 350 dry adult skulls (700 sides of skulls) of unknown sex from department of anatomy at N K P Salve Institute of Medical sciences and research center, Nagpur and other medical colleges in Vidarbha region of Maharashtra by examining the pterion and its sutural articulations with frontal, parietal, sphenoid and temporal bones and also anatomical variations. Eruption the third molar was used to identify the adult skulls.

The sutural patterns of the pterion were studied on both sides according to the classification of Murphy [4]. The frequency of the various types of pterion namely, sphenoparietal, frontotemporal, epipteric and stellate were observed on both sides of the skull and recorded.

A circle of smallest radius was drawn connecting the four bones involved in the formation of the pterion, the center of which was taken as the center of pterion. Specific measurements were taken on both sides of 350 human adult skulls(700 sides of skulls) of unknown sex with a Mannual digital vernier caliper with an accuracy of 0.1mm: the distances between the pterion and specific indefinable bony landmarks.

Figure 1 side view of a dry human skull showing the center of pterion (P), distance from center of pterion (P) to frontozygomatic suture (FZS), and distance from center of pterion (P) to midpoint of zygogomatic arch (ZA).

Figure-1: Measurement of Pterion

These were:

1.P-FZS –Distance from center of pterion to the posterolateral aspect of the frontozygomatic suture.

2.P–ZA–Vertical distance from center of pterion to midpoint of superior border of zygometric arch.

The measurements were taken by one observer and repeated and the average taken as the final measurement. Data obtained were analyzed using Epi Info ® software. Means and standard deviations were generated and compared using the Student's t- test for assessment of side.

Results

In the present study, four types of pterion, i.e. sphenoparietal, frontoparietal, stellate and epipteric, were observed, as shown in Fig. 2.

Figure-2: Types of pterion (left to right): sphenoparietal, frontotemporal, stellate,epipteric

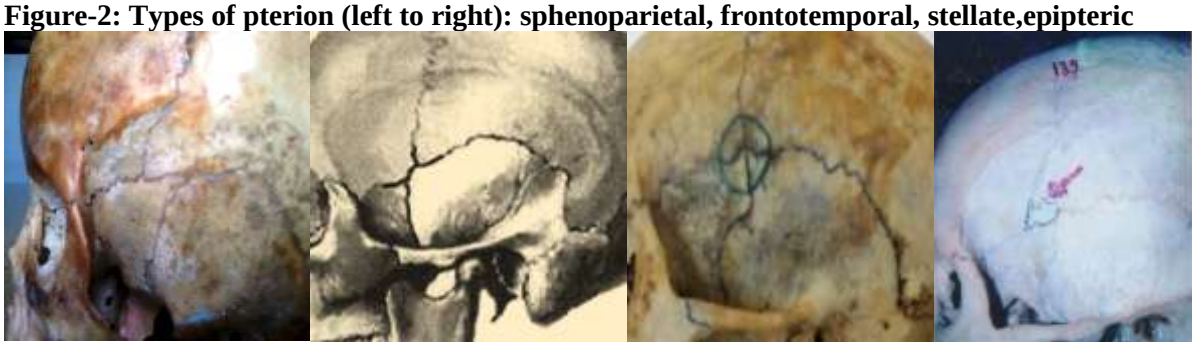

Table-1:The frequency of pterion types observed on the right and left sides of the skull.

Pterion type & percentage	No. of Pterion	Right side (N=350)	Left side (N=350)
Sphenoparietal (82.2%)	576	274	302
Frontotemporal (9%)	63	43	20
Stellate (3.7%)	26	15	11
Epipteric (5%)	35	23	12

All the four types of pterion were seen in the studied human adult skulls as shown in Table 1

and the different types of pterion sutural patterns. The sphenoparietal type was the most common type (82.2%), followed by the frontotemporal (9%), epipteric (5%) and stellate type (3.7%).

Then the data were compared among different populations, the percentage of types of pterion was found to be as given in Table –2 Percentage distribution of types of pterion in different populations. The means and standard deviation of the various measurements taken from the pterion are presented in Table. 3. The distance of the pterion posterion to the frontozygomatic suture and superior to the midpoint of the zygomatic arch was compared between the left and right side of all the skulls.

Table-2: Comparison among different populations; sphenoparietal(A), frontoparietal(B), stellate(C) and epipteric(D)

Different Studied populations	A	B	C	D
Saxena et al.[4], 1988,Nigerian, 40, unknown sex	84.79	10.11	5.06	3.79
Saxena et al,[4]. 1988, Indian, n=72, unknown sex	95.3	3.46	1.38	11.79
Manjunath et al.[5], 1993, Indian, n=172, unknown sex	93.55	3.52	2.93	17.3
Asala et al., 1996 [6], Nigerian, n=212, unknown sex	82.1	23.6	–	5.7
Lee et al., 2001[7], Korean, n= 149 , unknown sex	76.5	-	-	4.3
Saxena et al., 2003 [8], Indian, n=203, both sex	84.72	10.01	5.17	0
Oguz et al., 2004[9], Turkish, n=26, male	88	10	0	2
Mwachaka et .al.[10] Keniya n=50 both sexes	66	15	7	12
Zalawadia 2009[11] Indian n=42	91.7	2.4	1.2	4.8
Hussain 2011[12] Indian n=125	69.25	17.35	9.7	3,7
Aksu et al, 2014 West Antolian People, n = 128	85.5	1.1	5.5	8.2
Seema et al, 2014 North Indian Papulation	89	7	4	12
Present Study n=350 both sexes	82.2	9	3.7	5

Table-3: The distance of the pterion posterior to the frontozygomatic suture and superior to the midpoint of the zygomatic arch

Distance, mm	Right side (N=350)(in mm)	Left side (N=350)(in mm)
P-FZ(mm)	27.2±0.6	27.0±0.5
P-ZA(mm)	40.1±0.5	39.2±0.3

Table-4: Comparison of pterion position from frontozygomatic suture and zygomatric arch

Author	Center of pterion to frontozygomatic suture (cm)		Center of pterion to midpoint of zygomatic arc (cm)	
	Right side	Left side	Right side	Left side
Ahuja et al. (1971)	2.70	2.80	3.50	3.50
Zalawadia et al.(2010)	3.73±0.5	3.55±0.44	3.12±0.44	2.97±0.33
Seema et al,(2014)	3.1±0.44	3.4±0.40	4.1±0.45	4.4±0.32
Aksu et al,(2014)	3.18	3.14	4.0	3.98
Present study	2.72±0.6	2.70±0.5	4.01±0.5	3.92±0.3

Discussion

In the present study four types ot pterion were noted. They were sphenoparietal in 82.2% of cases, frontotemporal in 9% of cases, stellate in 3.7% cases and epipteric in 5% cases. Sphenoparietal type is most common in the present study as in Asiatic Indians (95.1%) (10), North Indians (87.72%) (14), South Indians (93.55) (13) and 93.48% in North Indians (19) but is low in Koreans (76.5%) (8) and Kenyans (66%) (11). Present study showed 9% incidence of frontotemporal variety which is lower than Kenyans (11) and Papuan (41.4%) (3) but comparable to some study (10) (10.11%). Epipteric bones were found in 5% of cases of skulls. The incidence was more in Nigerians (23.6%) (10) and Australians (18.5%) (3).

It is well known that the morphological configuration of the sutural junctions of the bones associated with pterion varies significantly in humans. Previous studies of the configuration of sutural articulation patterns associated with the pterion have focused

principally on variation, classification, presence of epipteric bones, and associated cranial measurements and indexes [14,15]. Population-based differences suggest that various genetic variations in humans underlie the different sutural patterns of the pterion [15]. Murphy[4] reported that variations of the pterion are likely a result of a combination of environmental and genetic factors. Asala and Mbajiorgu [2] concluded that these variations are "epigenetic". Wang et al. examined variations in sutural patterns at the pterion in rhesus monkey predigrees and stated that the variants show familial aggregation, likely regulated by genes (6). However, contributions of developmental or environmental factors to the observed variations at the pterion region remain to be investigated.According to previous studies, the sphenoparietal type of pterion is the dominant form in humans whereas the frontotemporal type is dominant in nonhuman primates [16, 4, 17, 18, 6, 19, 9].

There were no significant side variations in the distance from the midpoint of pterion to the frontozygomatic suture and midpoint of zygomatic arch among all the skulls; hence the landmarks can be used to locate the pterion irrespective of the side. This information is of great importance for neurosurgical operations in regions where neuron navigation equipments are not available and for anthropological identification of Nigerian skulls.

Conclusion

The study has shown incidence of various types of Pterion and sphenoparietal variety was of predominant type of Pterion.The distinctive characteristics of the pterion observed in different populations, racial groups and species result from differences in skull formation. Knowledge of the location and relations of the pterion is important in relation to surgical intervention, particularly with respect to the course of the branches of the middle meningeal artery and Broca's motor speech area on left side of the skulls. The detailed knowledge of position of this important landmark in Vidarbha Region of Maharashtra of India that will help the surgeons for planning and success of surgery in relation to anatomic variable topographic cranial point.

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