



## MORPHOMETRIC STUDY OF PTERION AND ITS CLINICAL SIGNIFICANCE.

Dr Shweta Desai\*

Assistant Professor, Dept Of Anatomy, Government Medical College, Surat, Gujarat  
\*Corresponding Author

Dr Jaysree Patel

Assistant Professor Dept Of Anatomy, Government Medical College, Surat, Gujarat.

## ABSTRACT

The pterion is the union of 4 bones of the cranium superior to the zygomatic arch and posterior to the frontozygomatic suture. This study aims to analyze the location and types of pterion in adult Indian skulls. Bilateral sides of 50 adult dry skulls were studied. Certain important anatomic landmarks next to the pterion were determined. They were the zygomatic arch, frontozygomatic suture, zygomatic angle, mastoid process and external acoustic meatus. Sphenoparietal was the most common pterion type (106%) followed by epipteric (12%), frontotemporal (2%) and stellate (2%). The mean distances from the pterion to midpoint of zygomatic arch were  $39 \pm 4$  and  $37 \pm 5$  mm, frontozygomatic suture were  $31 \pm 5$  and  $29 \pm 6$  mm, mastoid process were  $80 \pm 4$  and  $80 \pm 5$  mm, external acoustic meatus were  $56 \pm 4$  and  $54 \pm 4$  mm on right and left sides respectively. In epipteric type of skull the distances from most anterior point of pterion to anterior edge of the lateral wall of orbit were 45 and 47 mm respectively. This information will be of neurosurgical and anthropological importance.

KEYWORDS : Pterion, morphometry, skull

## INTRODUCTION

The pterion is a craniometric point near the sphenoid fontanelle of the skull. It is a point of convergence of the sutures between the frontal, sphenoid, parietal, and squamous temporal bones [1]. There are varied patterns of articulation of these bones and sometimes a small epipteric bone may be present. There are four types of sutural pattern: Sphenoparietal, the sphenoid and parietal bones are in direct contact; frontotemporal, the frontal and temporal bones are in direct contact; stellate, all the four bones meet at a point; and epipteric, where there is a small sutural bone uniting all the bones [2].

The pterion is located superior to the zygomatic arch and posterior to the frontozygomatic suture. This area is known as the weakest part of the skull, yet it overlies the course of the anterior division of the middle meningeal artery [1], thus making it vulnerable to rupture, leading to extradural hematoma in the event of a blunt trauma to the side of the head [3]. In addition, it acts as an important landmark for locating the Broca's motor speech area, anterior pole of the insula, and middle cerebral artery [4]. The "pterional" or lateral approach is occasionally used in operations involving the Broca's motor speech area [5] and repairing aneurysms of the middle cerebral artery [6].

Differences in the exact location of the pterion of both right and left sides have been observed in dry skull. This study is thus of immense benefit to neurosurgical procedures on Indian skull.

## MATERIAL AND METHODS

Fifty dry human skulls from the Department of Anatomy, government medical college, Surat, Gujarat were taken for this study. Fifty adult skulls were selected for the study after exclusion of deformed skulls. Inspection of the pterion was carried out and classified into four types: Sphenoparietal, frontotemporal, stellate and epipteric.

Measurements were taken on both sides of the skull from the pterion to the midpoint of zygomatic arch (PZA), the frontozygomatic suture (PFZS), zygomatic angle (PZAN), pterion to mastoid process (PMP), and pterion to external acoustic meatus (PEAM). In epipteric type of skull the distances from most anterior point of pterion to anterior edge of the lateral wall of orbit (EO) using a manual vernier calipers with an accuracy of 0.01 mm.

**photo1:** Skull showing measurements 1: PZA 2: PFZS 3: PZAN 4: PMP 5: PEAM. **Photo: 2** only in the epipteric type of pterion the mean distance between the most anterior point of pterion and the anterior edge of the lateral wall of the orbit (EO). Means and standard

deviations were generated and compared with other studies.

## OBSERVATION AND RESULTS:

The statistical analysis was carried out and the results have been represented in a tabulated form.

**Table 1: The comparison of the incidences of the types of pterion according to side. (n=50)**

Pterion type	Total	Right	Left
Sphenoparietal	106%	56%	50%
Epipteric	12%	4%	8%
Stellate	2%	2%	0
Frontotemporal	2%	0	2%

So in our study we found most common type of pterion was Sphenoparietal on both side. And least common types were stellate and frontotemporal.

**Table 2: Mean and associated standard deviations of the linear distance in mm between pterion and specific identifiable bony landmarks according to sides.**

	Right (mm)		Left (mm)	
	MEAN	SD	MEAN	SD
PZA	39	4	37	5
PFZS	31	5	29	6
PZAN	38	8	37	6
PMP	80	4	80	5
PEMA	56	4	54	4
EO	45	-	47	-

The means and standard deviations of the various measurements taken from the pterion are presented in Table 2. The mean (SD) distances from the center of the pterion as the right and left sides to the midpoint of the zygomatic arch were  $39 \pm 4$  and  $37 \pm 5$  mm, to the frontozygomatic suture  $31 \pm 5$  and  $29 \pm 6$  mm, to the zygomatic angle  $38 \pm 8$  and  $37 \pm 6$  mm, to the mastoid process  $80 \pm 4$  and  $80 \pm 5$  mm, to the upper border of external acoustic meatus  $56 \pm 4$  and  $54 \pm 4$  mm respectively. In skulls with an epipteric bone variation the mean and SD distance between the most anterior junction of pterion and the anterior edge of lateral wall of the orbit were 45 and 47 mm as the right and left sides respectively. (Table: 2). Skulls when compared right and left sides, no side differences were observed.

## DISCUSSION:

The Sphenoparietal type of pterion was observed to be the most common among the Indian skulls, just as has been reported in different races, for example, Nigerian, Turkish, kenyans [7-9], new zeland, west Antolian [17] and Korean people [15]. second higher

number of type is epipteric in present study ,which is also found similar to Korean [15], New zeland [18] ,west Anatolian [17]and studies done on different parts of Indian people.[16,13,12].we found presence of epipteric type more common on left side which is same as that study on west Anatolian skulls.[17] and in Turkish[8]. Followed by the frontotemporal type which is seen in Indian ,New zeland, Nigerian and Turkish skulls. [7,13,12,18].Lee et.al had not found any frontotemporal type in their study. Though the actual determinants of the formation of the pterion are unknown,

articulation of the cranial bones is thought to be under genetic influence especially the MSX2 gene [10]. Ethnic and racial variations are thus commonly observed. The fact that the development of the calvarium is tightly coordinated with the growth of the brain may explain the prevalence of frontotemporal pattern of sutures among monkey skulls as reported by Wang et al. [11] unlike humans with larger brains who have a predominantly Sphenoparietal pattern of suture.

**Table: 3 comparison of the percentage of pterion in different races.**

Study/population (skull)	Type of pterion, percentage			
	sphenoparietal	frontotemporal	stellate	epipteric
Saxena et.al (7),Nigerian,n=40	87.79	10.11	5.06	3.79
Saxena, et.al(7) ,Indian,n=72	95.3	3.46	1.38	11.79
Manjunath et.al(13), south dian,n=172	93.55	3.52	2.93	17.3
Asala et.al (14),Nigerian,n=212	82.1	23.6	—	5.7
Lee et.al (15),Korean,n=149	76.5	—	—	40.3
Saxena et.al(16),North indian,n=203	87.72	10.01	5.17	0
Oguz et.al(8),Turkish,n=26	88	10	0	2
Mwachaka et.al(9),Kenyan,n=50	66	15	7	12
Zalawadia et.al(12), western Indian, n=42	91.7	2.4	1.2	4.8
Ma et.al (18),newzeland,n=76	78	5	—	16
Funda et.al(17),West antolian people, n=128	85.2	1.1	5.5	8.2
Present study,western Indian people, n=50	106	2	2	12

In Primate evolution, the anterosuperior segment of the squamous part of the temporal bone of lower primates became detached from its parent end incorporated in to the posterosuperior angle of the greater wing of sphenoid bone of human, thereby changing the pterion pattern from the frontotemporal type of nonhuman primates to the Sphenoparietal type of humans.[12].the current study also confirms that the Sphenoparietal type is the most predominant type of the pterion.

## CONCLUSION:

The information obtained from this study useful in planning prior to neurosurgery and recognition of this anatomy may helpful in pterional craniotomy approach. Knowledge of the location and relation of the pterion is important in relation to surgical intervention, particularly of the middle meningeal artery and Broca's motor speech area on the left side. [12]



**Photo1**



**Photo2**



**Photo 3 Sphenoparietal**



**Photo 4 Epipteric**



**Photo 5 Frontotemporal**



**Photo 6 Stellate**

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