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A Descriptive Study of Morphology and Morphometry of Pterion in Dried Adult Skulls

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Abstract:

Background: Pterion is meeting point of parietal, squamotemporal, greater wing of sphenoid and frontal bones . Certain important cranial structures like middle meningeal artery, Sylvian fissure, middle cerebral artery are related to it which make it an important neurosurgical land mark. Stephanion and euryon are other two Craniometric points on the skull. The pterion varies in shape in different skulls. **Aims and objectives**: To assess the different shapes of pterion , to measure the distance of pterion from selected Craniometric points .**Methodology**: Hundred pterions in 50 dry adult skulls of unknown age and gender were studied. Pterion was observed for the shape and pattern of sutures on both sides of each skull and the distance of pterion was measured from the selected Craniometric points (bony land marks) using vernier caliper. Dried intact skulls without any traumatic and pathological defects were included in the study. **Results**: In our present study, the most common pterionic type was sphenoparietal while as stellate type was the least common type. In our present study we observed the location of pterion from the root of zygomatic arch at a mean distance of 34.26± 3.35 mm and 33.70±3.44 mm on right and left sides respectively with a P value of 0.412461 while as it was located at a mean distance of 33. 44±3.59mm and 34.38± 2.87mm respectively from the right and left frontozygomatic sutures with a P value of 0.151906. The mean distance between pterion and stephanion was42.76± 6.60 mm and 42.74± 6.73 mm on right and left sides respectively with a P value of0.98807. The mean distance between pterion to euryon was48.66±9.87 mm and 50.32± 10.92mm on right and left sides respectively with a P value of 0.427416. **Conclusion**: Pterionic location and Sutural pattern is vital for carrying out successful neurosurgical procedures.

Key words: Pterion, frontozygomatic suture, Stephenion, euryon, Craniometric points.

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Introduction:

Pterion, an important craniometric point(land mark) is formed by meeting of four bones in the floor of temporal fossa. Frontal, parietal, squamotemporal and greater wing of sphenoid meet at this point and usually form an H shaped suture[1]. The Sutural patterns vary in different skulls. Four Sutural patterns such as sphenoparietal, frontotemporal, epipetric and stellate have been so far described. The sphenoparietal is the commonest pterionic subtype. These different pterionic subtypes are defined on the basis of direct articulation between particular bones. In sphenoparietal type of pterion, the greater wing of sphenoid and the parietal bones directly articulate with each other. In frontotemporal pterionic subtype, there is direct articulation between frontal bone and squamous part of temporal bone. In stellate pterionic subtype, all the four bones meet forming a cruciate suture. In epipetric pterionic subtype, a Sutural bone is seen between the parietal bone and the greater wing of the sphenoid [2]. Certain intracranial structures such as anterior division of middle meningeal artery and middle meningeal vein, Sylvian fissure, Broca's area of speech, anterior part of insula and middle cerebral artery are related to it which make it an important neurosurgical land mark. The anterior trunk of the middle meningeal artery grooves the anteroinferior angle of parietal bone[3, 4]. Pterion serves an important landmark for certain transcranial approaches for evacuation and management of extradural hematomas, management of aneurysms of middle cerebral artery, excision of tumors of frontal and temporal lobes of cerebrum and management of traumatic neuropathy. Pterionic approach for these procedures provides the advantage of minimum tissue damage and brain retraction, shorter time of the procedure and no unwanted cosmetic results[5]. Developmentally, pterion is the site of anterolateral fontanalle which closes up to 6 months of the post natal period[6]. Stephanion is an important landmark located at the intersection of coronal suture and the superior temporal line. The intersection point of the precentral sulcus and the inferior frontal sulcus lie approximately 5 mm to it[7]. Euryon is another palpable landmark on the skull and is the most prominent eminence on the parietal tuberosity. The distance between the right and left euryons is the maximum transverse diameter of the skull[8]. Since pterion is not palpable in living subjects so its position can be located by measuring its distance from certain palpable surface land marks on the skull.

Aims and Objectives:

1. To assess the Sutural pattern of pterion.
2. To measure the distance of pterion from root of zygomatic arch , frontozygomatic sutuuture, stephanion and euryon.

Materials and methods:

Hundred pterions were studied in 50 dry adult human skulls of unknown gender. Skulls with pathological and traumatic deformities were excluded from the study. The pterion was marked by a circle of minimum diameter including all the four bones meeting at this site. The measurements were taken from the centre of the circle to the selected land marks in the skull. The measurements were taken using stainless steel vernier caliper.

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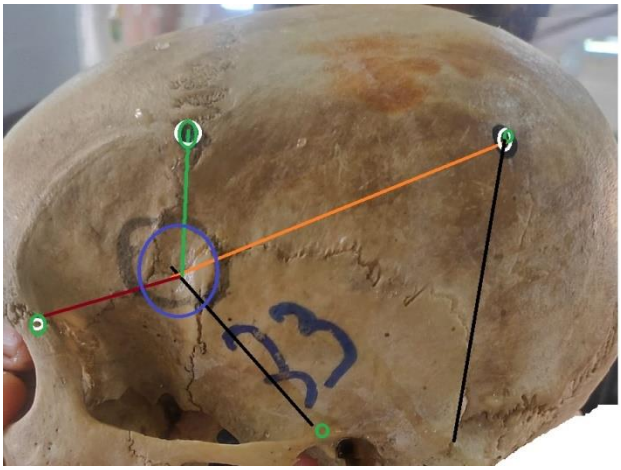

Fig.1: Showing various measurements:

Greeen line= distance from pterion to stephanion.

Red line= distance from pterion to frontozygomatic suture.

Orange line= Distance from pterion to euryon.

Oblique black line= distance from pterion to root of zygotic arch.

Vertical black line= Intersection of this black line with superior temporal line marks the euryon

The measurements were taken by two observers independently and the average of the two was considered for the study. Stephanion was marked at the site of intersection of coronal suture and the superior temporal line. Euryon is marked at the intersection of superior temporal line and a vertical line drawn from the posterior aspect of mastoid process passing through squamous and parietomastoid suture[6]. Statistical analysis was done by using SPSS version 20 statistical software. Comparison of the measurements was done on the two sides by independent t-test and a P value of < 0.05 was considered as significant.

Results:

The present study was conducted in department of anatomy Government medical college Srinagar.50 dry adult skulls of unknown gender were used for the study so a total of 100 pterions (both right and left) were studied. Sphenoparietal type of pterion was most common type while as stellate type was the least common type in our present study (fig 2-5, table 1). The mean distance between pterionic centre and the root of zygomatic arch was 34.26± 3.35 mm and 33.70±3.44 mm on right and left sides respectively with a P value of 0.412461 while the mean distance between pterionic center and frontozygomatic suture on right and left sides were 33.44±3.59mm and 34.38± 2.87mm respectively with a P value of0.151906. The mean distance between center of pterion and staphanion was42.76± 6.60mm and 42.74± 6.73 mm on right and left sides respectively with a P value of0.98807 and the mean

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distance between pterion and euryon was 48.66±9.87mm and 50.32± 10.92mm on right and left sides respectively with a P value of 0.427416(table2).

Table 1 showing the pterion types and their percentage seen in the present study.

Pterion shape/type	**Number percentage**
Sphenoparietal	77/100
Epipetric	15/100
Frontotemporal	7/100
Stellate	1/100

Table 2 showing measurements between pterion and the selected craniometic points(land marks) on the two sides.

Measurement	Right Side in mm Mean±SD	Left Side in mm Mean±SD	P Value (<0.05 is significant)
Pterion to root of zygomatic arch	34.26±3.35mm	33.70±3.44mm	**0.412461**
Pterion to frontozygomatic suture	33.44±3.59mm	34.38±2.87mm	**0.151906**

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Pterion to stephanion	42.76±6.60mm	42.74±6.73mm	**0.98807**
Pterion to euryon	48.66± 9.87mm	50.32±10.92mm	0.427416

Fig.2:Sphenoparietal Pterion

Fig. 3: Stellate Pterion

Fig. 4: Epipetric Pterion . Arrow showing Sutural bone

Fig.5: Frontotemporal Pterion

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Discussion:

The present study was conducted in the deparment of Anatomy Government medical college Srinagar. A total of 100 pterions were studied in 50 adult skulls. The shape of pterion varies in different skulls but the sphenoparietal is the most common type seen. Genetic factors play an important role in determining the shape of pterion as described by **Saheb SH etal 2011[13]** in their study. Msx2 gene located on the long arm of chromosome 5 encodes a protein responsible for craniofacial and limb bud development[16].

Table 3: The percentage of pterion types in different studies

Author	**Pterion type percentage seen**			
	Sphenoparietal	**Frontotemporal**	**Stellate**	**Epipetric**
Ersoy M 2003[10]	96	3.7	0.2	9
Oguz O 2004[11]	88	10	0	2
Saheb sh 2011[13]	77.33	0	1.34	21.33
Sunday AA 2013[14]	86.1	8.3	5.6	0
Ilayperuma 2016[15]	77.04	4.181	o	21.15
Abebe Muche 2021[9]	84.4	0	2.2	13.3
Prasad 2022[20]	81	2.39	3.9	12.5

As is clear from the work of various authors, the sphenoparietal type of pterion is the most common type. Our study is in consistent with the work of the earlier authors[9, 10,11,13,14,15,20]. The work of the earlier authors also reveals that either frontotemporal, stellate or epipetric pterion types were not seen. In our present study we observed all pterion types and stellate type was the least in occurrence(1%). In skulls with epipetric type of pterion difficulty can occur during burhole surgery as it can be mistakenly regarded as the anterior most junction of the bones as burhole at this site may lead to inadvertent orbital peneteration(**Ersoy M 2003**)[10].

Lot of work has been done on the relative position of pterion with respect to different Craniometric points(bony landmarks on skull)[9,11,17,18,19,20]. The measurements vary in different studies and we also see the different values of the distance between frontozygomatic suture to Pterion in different skulls of our study. This variation could be because of genetic and environmental factors.

Table 4: **Distance from pterion to frontozygomatic suture in mm as observed by differen authors**

Author	**Right**	**Left**
Abebe Muche 2021[9]	29.2±0.5	27.5±0.5

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Kanth V 2016[17]	31.0±0.4	30.9±0.4
Mwachaka 2008[18]	30.35±3.5	30.34±4.30
Lee et a 2001l[19]	26.8±4.5	26.8±4.5
Oguzo O et al 2004[11]	33.0±4.00	34.4±3.9
Prasad et al 2022[20]	36.5± 4.3	35.5± 4.3

From the work of various researchers it is also seen that there is variation in the Pterionic position on two sides but the difference is statistically not significant. Our study also shows similar variation on the position of pterion from frontozygomatic suture . The relative position of pterion from root of zygomatic arch was calculated by Abebe Muche but the difference on the two sides was significant. It could be possibly due to racial differences which are influenced by genetic and environmental factors. Our study showed that the difference in the position of pterion relative to root of zygomatic arch on right and left sides is statistically insignificant. In our study we included the study of pterion position with respect to two palpable Craniometric points, stephanion and euryon. We could not find any such study in the literature but we included these two Craniometric points as these two points are fairly palpable in living subjects which can guide us to the location of pterion if the relative position of pterion with respect to these two Craniometric points is known.

Conclusion:

Pterion is an important bony land mark through which burhole craniotomies are done for dealing with the lesions in the region of anterior and middle skull base. Knowledge of location and shape of pterion is important for neurosurgeons to carry out burhole drilling in this region, particularly for surgeons working in centres where the neuronavigation devices are not available. Further the presence of an epipetric bone in the region of pterion poses a risk of anterior burhole drilling which may cause orbital perforation or a posterior drilling may lead to inefficient access to instruments. So while dealing with such procedures, the neurosurgeon must be aware about the presence of the epipetric bone. In our study we selected euryon and stephanion to locate the pterion as these two bony points on the skull are fairly palpable in the living subjects. Unknown gender in the present study was the main limitation.

References:

1. Standring S. Gray's anatomy: The anatomical basis of clinical practice 42nd edition, Churchil Livingstone , London UK.
2. Murphy T. The pterion in the Australian aborigine Am J Phys Anthropol. 1956;14:225–44.
3. Moore KL, Dalley AF. *Clinically oriented anatomy.* 4 ed. Baltimore: Lippincott Williams & Wilkins; 1999. pp. 836–842.
4. Ma S, Baillie LJ, Stringer MD. Reappraising the surface anatomy of the pterion and its relationship to the middle meningeal artery. *Clin Anat.* 2012;25:330–339.
5. Yaargil M, Yaşargil M. Interfascial pterional (frontotem-porosphenoidal) craniotomy: Georg Thieme Verlag. 1984:217–20.
6. Brody J. Lipsett; Vamsi Reddy; Kim Steanson. Anatomy head and neck: Fontanelle. National library of medicine July 24, 2023.

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7. Vigo V, Cornejo K, Nunez L, Abla A, Rubio RR. Immersive surgical anatomy of Craniometric points.Cureus 2020; 12(6): e 8643
8. Roberta Hall, Kenneth Beals, Holm Neumann, Georg Neumann, Gwyn Madden. Landmarks and measurements of skull, introduction to human osteology(Hall et al).
9. Abebe Muche:Position and types of pterion in adult human skulls: A preliminary study. Ethiop J Health Sci. 2021 Jul; 31(4): 875–884.
10. Ersoy M, Evliyaoglu C., Bozkurt MC, Konuksan B, Tekdemir I, Keskil IS. Epipetric pterion may be a surgical pitfall. Invasive neurosurgery 2003;46:364-365.
11. Oguz Oo, Sani SG, Bozkir MG, Soames RW. The pterion in Turkish male skulls. Journal of surgery, radiology and anatomy 2004; 26: 220-224.
12. Roy, Poulami; Deb, Novonil; Kar, Maitreyee; Khatun, Argina. Location and morphological study of pterion: A keyhole landmark for neurosurgical procedures. *Journal of Clinical and Scientific Research* 12(1):p 24-27, Jan–Mar 2023. | *DOI:* 10.4103/jcsr.jcsr_61_22..
13. Saheb SH, Mavishetter GF, Thomas ST, Prasanna LC, Muralidhar P, Magi. A study of sutural morphology of the pterion and asterion among human adult Indian skulls Biomed Res. 2011; 22:73–75.
14. Sunday AA, Fumi EO, Modupe B. Study of location and morphology of pterion in adult Nigerian skulls. ISRN anatomy 2013: 1-4.
15. IIayperuma I, Nanayalkora BG, Palahepitiya KN. Type of pterion in Srilankan skulls. Cylon medical journal 2010; 53: 9-14.
16. MSX2 gene, national library of medicine 2016:1-3.
17. Kanth V, Asif M, Bhat S, Avadhani R. A study on pterion position variations and it's neurosurgical implications. Journal of Anatomical society of India 2016;65(1): 533-539.
18. Mwachaka PM, Hassanali J, Odula PO. Anatomic position of pterion amongKenyans for lateral skull approaches. International journal of morphology 2008;26(4): 931-933.
19. Lee UY, Park DK, Kwon SO, Paik DJ and Han SH. Morphological study of pterion in Korean. Korean journal of Phys. Anthropol. 2001; 14(4): 281-289.
20. Prasad, Mythraeyee; Rout, Sipra. Morphometric and morphological variants of pterion with its clinical importance in South Indian population. National journal of clinical anatomy 2022; 11(2): 84-99.