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A cross-sectional study on morphometry of pterion and its relation with middle meningeal artery

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Abstract: Introduction: The frontotemporal type is characterised by a pterional sutural configuration between the frontal and temporal bones. The stellate kind of suture is formed by the fusion of the flat sphenoid, frontal, parietal, and temporal bones.
Methods: The kind of pterion based on sutural pattern was determined using Murphy's classification into sphenoparietal, frontoparietal, stellate, and epipteric kinds on both the left and right sides of each skull. The centre of the circle, which connects the four bones that make up the pterion, is thought to be the centre of the pterion. Distance between the pterion's centre and the external auditory meatus's anterosuperior margin, P-PM: the distance between the pterion's centre and the lateral margin of the optic canal, P-AM.
Results: The current investigation was carried out using 115 dried adult skull bones that were gathered from the central Karnataka region. On the right side, there were 115 pterions, and on the left, there were 115. The most frequent type of pterion was sphenoparietal (82.1%), followed by epipteric (26.1%), stellate (18.6%), and frontotemporal (17.8%).
Conclusions: The findings of this study may be useful for forensic pathologists, neurosurgeons, anatomists, and anthropologists in the region of the population under study.

Keywords: Morphometry; Middle; Meningeal artery; Dry human skulls.

1. Introduction

It is a spherical area that is 4 cm higher than the zygomatic arch and extends about 3.5 cm beyond the frontozygomatic (FZ) suture. The process of cranial suture closure can be used to determine age. It has to do with the anterolateral fontanelle on the neonatal skull, which enables for sculpting of the foetal head as it travels through the birth canal and faster brain growth in the first year of life1 but disappears in less than three months after birth [2]. A thumb's width and two fingers' breadth superior to the zygomatic arch separates Pterion from the frontal process of the zygomatic bone [3].
Sphenoparietal: The parietal bones and the larger wing of the sphenoid are in touch.
Frontotemporal: Direct contact exists between the frontal and temporal bones. Stellate: Direct contact between the frontal and temporal bones.
Frontotemporal: The close closeness of the frontal and temporal bones. Stellate: A single point of articulation for the frontal, parietal, sphenoid, and temporal bones. The four bones that make up the pterion are called epipteric bones because they each have a very little suture.

Pterion-related structures include the left-side Broca's motor speech area, MMA, anterior pole of the insula, lateral (Sylvian) cerebral sulcus, and internal capsule. The development of the skull suture and the emergence of various pterion types may be influenced by genetic and environmental variables. A pterional keyhole approach is used for surgeries on the Broca's area, sphenoid ridge, lesions of the optic canal, cerebral aneurysms, and tumours like lipomas and olfactory meningiomas [7–9]. Keyhole operations cause less brain retraction, less tissue damage, have quicker recovery times, and produce better cosmetic results. The term "pterion" refers to the anterior MMA ramus, and pterional fractures can cause an artery to rupture, leading to

subdural hematomas that, if ignored, can place additional stress on the underlying cerebral cortex and cause issues. Pterion is also known as Sylvian point.

The four forms of pterion identified by Murphy (1956) are the frontotemporal, stellate, epipteric, and sphenoparietal sutures [10]. The sphenoparietal type, which is the most common, is produced when the greater wing of the sphenoid bone articulates with the parietal bone. The frontotemporal type is characterised by a pterional sutural configuration between the frontal and temporal bones. The stellate kind of suture is created by the fusion of the flat sphenoid, frontal, parietal, and temporal bones. The epipteric type of pterion is defined by the presence of small sutural bones between the sphenoid and parietal bones. Due to the presence of epipteric or wormian (sutural) bone in the area, the clinical treatment of a pterion fracture may be wrong. Burr hole operations may be more challenging with sutural bones because their growth may cause ocular penetration [11,12].

2. Materials and Methods

Data collection was done after acquiring the required ethical clearance and permission. The investigation excluded any pathological deformities and damage that would have affected the measures, like a cracked zygomatic arch.

Standards for inclusion and exclusion There were dried, unbroken skulls in the area. Skull bones that were damaged, deformed, had callus formation, or had unossified bones were excluded from the study. The kind of pterion based on sutural pattern was determined using Murphy's classification [5] into sphenoparietal, frontoparietal, stellate, and epipteric kinds on both the left and right sides of each skull. The centre of the circle, which connects the four bones that make up the pterion, is thought to be the centre of the pterion. P-OC stands for the distance between the optic canal's lateral edge and the pterion's centre. P-PM stands for the distance between the pterion's central axis and the external auditory meatus' anterior margin. The association between the pterion point and the MMA was formed by calculating the distance from the pterion to the point closest to the branch of the MMA on the internal aspect.

3. Statistical Analysis

Data were represented using descriptive statistics, frequency, and percentages (mean and standard deviation). The data were analysed using the unpaired t-test. Version 22.0 of the Statistical Package for Social Sciences (SPSS) software was employed. Statistics classify a p-value as significant if it is 0.05 or lower. The significance level for the paired t-test is P0.0001.

4. Results

The current study was performed on 115 dried adult skull bones obtained from central Karnataka region. It involved 115 right and 115 left-sided pterions. The commonest type of pterion observed was sphenoparietal 169 (82.1%) followed by epipteric 26 (11%), stellate 18 (6%) and frontotemporal 17 (5.8%) [Table 1].

Dimensions recorded from the midpoint of the pterion to different bony landmarks are denoted as mean and standard deviations in Table 2.

Table 1. Different types of pterion in adult skull bones

Type of pterion	Total (n=230) n (%)	Side	
		Left (n=115) n (%)	Right (n=115) n (%)
Sphenoparietal	82.1 (169)	86	83
Frontotemporal	5.8 (17)	8	9
Stellate	6 (18)	9	9
Epipteric	11 (26)	12	14

Table 2. Landmarks from the pterion

Landmarks from the pterion	Left-side (n=115)		Right-side (n=115)		t value	p- value
	Mean	SD	Mean	SD		
P-FZ (in mm)	31.41	4.990	31.81	4.701	-0.694	0.488
P-ZA (in mm)	38.90	4.221	39.61	4.603	-1.551	0.123
P-SS (in mm)	49.31	5.281	49.70	5.993	-0.543	0.589
P-PM (in mm)	79.51	5.336	79.90	5.531	-0.554	0.579
P-OC (in mm)	41.81	3.841	43.21	3.351	-1.059	0.294

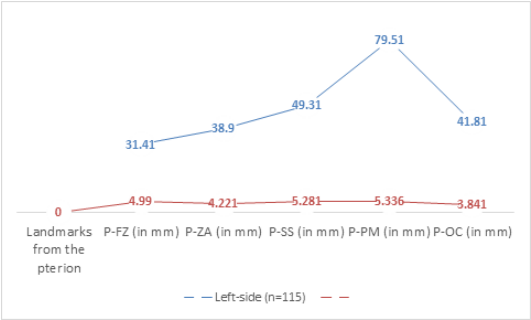

Figure 1. Mean and standard deviations of Dimensions from the midpoint of the pterion

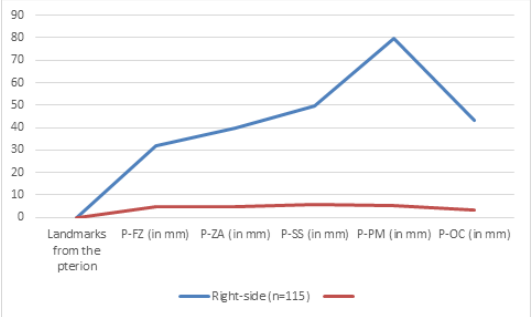

Figure 2. Mean and standard deviations of Dimensions from the midpoint of the pterion

5. Discussion

The fact that the sphenoparietal type of pterion is widespread in bipedal primates may have contributed to its high prevalence in humans. The anteriosuperior part of the squamous component of the temporal bone of lower primates separates from its initial connection and connects to the broader wing of the sphenoid bone at its posteriosuperior angle in humans. In this way, the frontotemporal type of the pterion in nonhuman primates changed into the sphenoparietal type of the pterion in humans. In monkeys, structural changes in the neurocranium brought on by an increase in brain size are what connect the parietal bone with the bigger wing of the sphenoid [13].

For specialists in a variety of medical professions, particularly for neurosurgeons, understanding the pterion sutural patterns and their link to bony landmarks is profoundly useful. The greater incidence of sphenopari is one of this study's key results. Around 23% of sutures are bilateral, while 77% of sutures are unilateral. Moreover, there were statistically significant changes in the central thickness of the skull and the centre distances of the pterion from the FZS, RZA, and inion on the right and left sides of the body.

P-SS (P-EAM): On the left and right sided pterions, the anterosuperior margin of the external auditory meatus was 48.37 mm and 48.73 mm from the pterion's centre, respectively. In Western India, the left and right sides measured 56 mm and 54 mm, respectively. It was also found that the anterosuperior margin of the external auditory meatus aligned with the end of the sylvian fissure and the posterior ramus of the lateral sulcus in the North Indian population. Surgery on the inferior frontal gyrus, sylvian fissure, and superior

temporal gyrus may benefit from this particular value. Iatrogenic injuries are less likely to happen since the main cerebral artery and sylvian veins are situated along this fissure.

P-PM: In this study, the distance from the midpoint of the pterion to the most inferior part of the mastoid process was 78.56 mm on the left side and 78.91 mm on the right, which is comparable to studies conducted in North India (7.93 left and 7.94 right cm) [12] and Western India (80 mm on both sides) [18].

P-OC: The horizontal space between the internal side of the pterion's midpoint and the lateral edge of the optic canal. The current study, which reports 41.84 (left) and 42.23 (right) mm in agreement with another South Indian study, which reported 3.94 and 4.11 cm on the left and right sides, respectively, found no statistically significant difference in any of these parameters between the left and right sided pterions.

6. Conclusion

The findings of this study indicate that the sphenoparietal type of suture is the most typical form of pterion. In the mean measurements between the centre of the pterion and FZS, RZA and inion, and central thickness of the pterion, there was a statistically significant difference between the right and left sides of the skulls. The findings of this study might be useful for forensic pathologists, neurosurgeons, anatomists, and anthropologists in the area of the population under study. Further investigation employing computed tomography, X-ray, and dry human skulls on identified sex, age, and nationality skulls is strongly encouraged, especially on Ethiopian skulls.

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References

[1] Williams, P. L., Warwick, R., Dyson, M., & Bannister, L. H. (1989). Gray's Anatomy (37th ed.). Churchill Livingstone.

[2] Nayak, G., Mohanty, B. B., & Das, S. R. (2017). Morphometric study of pterion and its clinical significance. Asian Journal of Pharmaceutical and Clinical Research, 10(10), 142-144.

[3] Moore, K. L. (1985). Clinically oriented anatomy (2nd ed.). Williams & Wilkins.

[4] Broca, P. (1875). Instructions craniologiques et craniométriques. Mémoires de la Société d'Anthropologie de Paris, 2, 01-203.

[5] Murphy, T. (1956). The pterion in the Australian aborigine. American Journal of Physical Anthropology, 14(2), 225-244.

[6] Modasiya, U. P., & Kanani, S. D. (2018). Study of pterion and asterion in adult human skulls of north Gujarat region. Indian Journal of Clinical Anatomy and Physiology, 5(3), 353-356.

[7] Urzi, F., Iannello, A., Torrisi, A., Foti, P., Mortellaro, N. F., & Cavallaro, M. (2003). Morphological variability of pterion in the human skull. Italian Journal of Anatomy and Embryology, 108, 83-117.

[8] Chao, S. C., Shen, C. C., & Cheng, W. Y. (2008). Microsurgical removal of sylvian fissure lipoma with pterion keyhole approach-case report and review of the literature. Surgical Neurology, 70(1), S1-90.

[9] Hyun, S. J., Hong, S. C., & Kim, J. S. (2010). Side selection of the pterional approach for superiorly projecting anterior communicating artery aneurysms. Journal of Clinical Neuroscience, 17, 592-596.

[10] Murphy, T. (1956). The pterion in Australian aborigine. American Journal of Physical Anthropology, 14, 225-244.

[11] Ersoy, M., Evliyaoglu, C., Bozkurt, M. C., Konuksan, B., Tekdemir, I., & Keskil, I. S. (2003). Epipteric bones in the pterion may be surgical pitfall. Minimally Invasive Neurosurgery, 46, 364-365.

[12] Kamath, V. G., & Hande, M. (2019). Reappraising the neurosurgical significance of the pterion location, morphology, and its relationship to optic canal and sphenoid ridge and neurosurgical implications. Anatomy & Cell Biology, 52(4), 406-413.

[13] Ashley-Montagu, M. F. (1933). The anthropological significance of the pterion in the Primates. American Journal of Physical Anthropology, 18, 159-336.

[14] Yasargil, M. G., Fox, J. L., & Ray, M. W. (1975). The operative approach to aneurysms of the anterior communicating artery. Advances and Technical Standards in Neurosurgery, 2, 113-117.

[15] Nayak, S., & Soumya, K. V. (2008). Unusual sutural bones at pterion. International Journal of Anatomical Variations, 1, 19-20.

[16] Nayak, G., Mohanty, B. B., & Das, R. S. (2017). Morphometric study of pterion and its clinical significance. Asian Journal of Pharmaceutical and Clinical Research, 10(10), 142-144.

[17] Warille, A. A., & Mandloi, R. S. (2016). Measurement of the various identifiable bony landmarks from the centre of pterion in human skulls from Indian Population. International Journal of Health Sciences and Research, 6(2), 133-137.
[18] Desai, S., & Patel, J. (2019). Morphometric study of pterion and its clinical significance. Global Journal for Research Analysis, 8(4), 289-293.
[19] Kalthur, S. G., Vangara, S. V., Kiruba, L., Dsouza, A. S., & Gupta, C. (2017). Metrical and non-metrical study of the pterion in South Indian adult dry skulls with notes on its clinical importance. Marmara Medical Journal, 30, 30-39.