(International Print/Online Journal)

SJIF IMPACT FACTOR: 5.565
PUBMED-National Library of Medicine ID-101739732

ISSN (Print): 2209-2870
ISSN (Online): 2209-2862

International Journal of Medical Science and Current Research (IJMSCR)
Available online at: www.ijmscr.com
Volume 5, Issue 3, Page No: 1054-1060
May-June 2022

IJMSCR

A Morphometric Study Of Pterion In Dry Human Skulls And Its Clinical Significance

Dr. Natarajan Bama[1*], Dr.J. Sreevidya[2], D r. M. K. Punitha Rani[3]

[1]Senior Assistant Professor/ Institute of Anatomy/ Madras Medical College/ Chennai 600 003/ [2] Associate.Professor Institute of Anatomy, Madras Medical College, Chennai-600 003

[3] Senior Assistant Professor/Institute of Anatomy/Madras Medical College/Chennai 600 003

***Corresponding Author:**
Dr. Natarajan Bama

Type of Publication: Original Research Paper
Conflicts of Interest: Nil

Abstract:

Background: The pterion is a point of sutural convergence seen in the Norma lateralis of the skull. It is the meeting point of the frontal, parietal, squamous part of temporal, and greater wing of sphenoid bones of the skull. It is an important neurosurgical landmark to approach the Middle meningeal artery and tumors in brain. The purpose of this study is to find out the prevalence of various sutural patterns of pterion and the location of the point of pterion in relations to various bony landmarks.

Materials And Methods: In the present study, 50 skulls of unknown age and sex were obtained from Institute of Anatomy, Madras Medical College. Pterion was classified based on Murphy's classification as Sphenoparietal, frontotemporal, epiteric and stellate. Two measurements were taken on the external aspect of the skull from the centre of the pterion to determine its location. In case of epiteric type, centre of the circle was drawn by connecting the edges of four bones involved in the formation of pterion and was considered as centre of pterion. One measurement was taken from centre of pterion to the postero-lateral aspect of frontozygomatic suture(P-FZS) and the other was from the centre of the pterion to the midpoint of upper border of the zygomatic arch(P-ZA). The measurements were taken using Vernier calipers.

Results: In the present study, all four types of Pterion were observed. Sphenoparietal type was the most common variety of the Pterion. The distance between centre of Pterion and posterolateral aspect of frontozygomatic suture was found to be 2.88±0.495cm on the right side and 2.83±0.467cm on the left side. The distance between the centre of pterion and the midpoint of upper border of the zygomatic arch was found to be 3.76±0.355cm on the right and 3.61±0.405cm on the left sides.

Conclusion: The bone in this area is particularly thin and overlies the anterior division of the middle meningeal artery, which can be torn by skull fractures, resulting in extradural hematoma. The study will be helpful to Neurosurgeons, Anthropologists, Neurologists, Forensic experts.

Keywords: Frontozygomatic suture; Zygomatica arch ; Middle meningeal artery; Neurosurgeons; Sutures

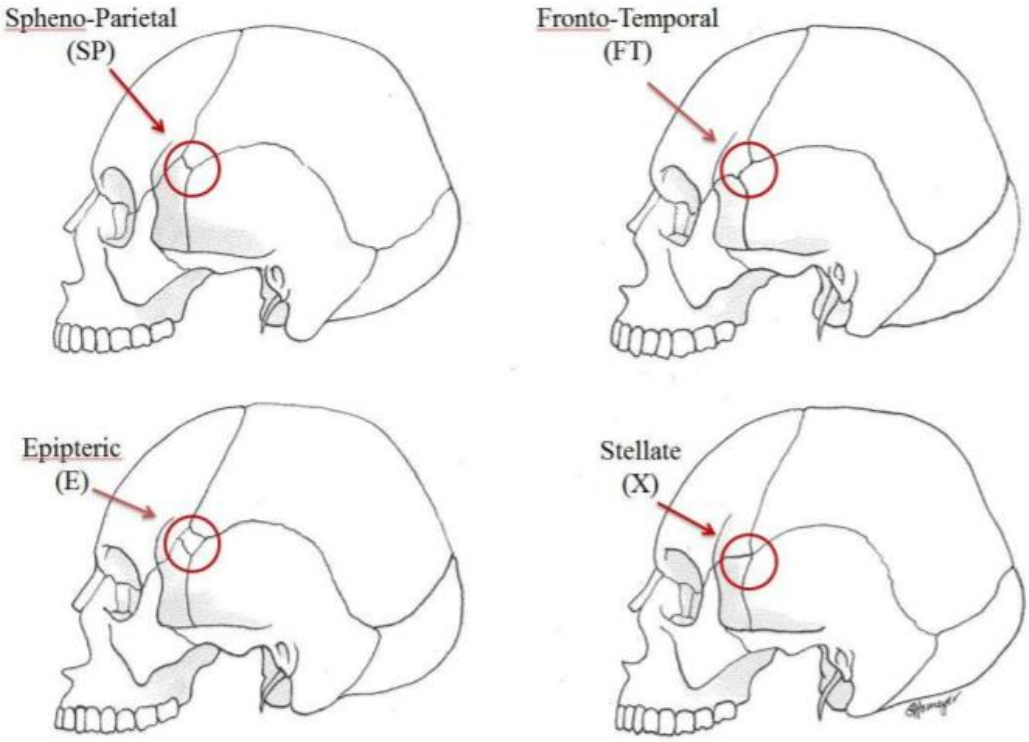
Introduction

Pterion is the sutural convergence of the frontal, parietal, greater wing of sphenoid, and squamous part of temporal bones of the skull. Pterion means Wing. It has a horizontal limb that lies between the antero inferior angle of parietal bone and tip of the greater wing of sphenoid bone. Its centre lies 4cm above the zygomatic arch and 3.5 cm behind the fronto-zygomatic suture.

In 1875, the Pterion was classified into 3 types by Broca as Sphenoparietal, frontotemporal and stellate. Later in 1956, Murphy classified the Pterion into four types- sphenoparietal, fronto temporal, epipteric and stellate. The Sphenoparietal type of suture lies between greater wing of sphenoid and anteroinferior angle of parietal bone, while the frontotemporal type of suture lies between the squamous part of the frontal bone and the squamous part of temporal bone.

In the stellate type, all the four bones meet at a common point and the epipteric type represents the presence of a sutural bone between the four bones forming the pterion.

Murphy's classification:



The Pterion corresponds to the site of anterolateral fontanelle of the neonatal skull which closes by 3 months of age. It exhibits variations in the pattern of fusion of constituent bones. It is an important neurosurgical landmark for various structures like the anterior branch of middle meningeal artery, Sylvian point, Broca's area and anterior pole of insula. It gains significance in cases of tumours involving the inferior aspect of frontal lobe. orbit and optic nerve pathologies and aneurysms in anterior cerebral circulation. The anatomical location of the Pterion is helpful for the neurosurgeons while performing minimal invasive procedures to evacuate Extradural hemorrhage. The sutural patterns of pterion are of interest mainly to anthropologists & forensic experts. This is useful for age & sex determination in forensic department.[1][2][3][4]

Aim Of The Study

The objective of the study is to

i. Identify the various sutural patterns of Pterion based on Murphy's classification.

ii. Determine the location of the point of Pterion in relation to two bony landmarks - Frontozygomatic suture and midpoint of upper border of Zygomatic arch.

Materials And Methods

In the present study, 50 adult dry human skulls of unknown age and sex were obtained from the Institute of Anatomy, Madras Medical College. The study was conducted between March 2020 and March 2021. Damaged skulls, skulls of newborn, infants, children and very old skulls with obliterated sutures were excluded from the study.

The sutural pattern of the Pterion was observed in both sides of the skull, based on Murphy's classification (Sphenoparietal, frontotemporal, stellate, epipteric).

Volume 5, Issue 3; May-June 2022; Page No 1054-1060

Measurements were taken on the external aspect of the skull from the centre of the Pterion to specific bony landmarks to determine its location. One measurement was taken from centre of Pterion to the postero-lateral aspect of FrontoZygomatic Suture(P-FZS) and the other was from the centre of the Pterion to the midpoint of upper border of the Zygomatic Arch(P-ZA). The measurements were taken using vernier calipers. In case of epipteric type of sutural pattern of pterion, a circle was drawn by connecting the edges of four bones involved in the formation of Pterion and the centre of the circle was considered as centre of pterion.

Observation

The Table1 shows all sutural patterns of Pterion that were observed on the right side of skulls in the present study. The most predominant variety was Sphenoparietal variety followed by the epipteric & frontotemporal varieties. Stellate variety of sutural pattern was observed the least.

Out of 50 skulls, sphenoparietal type of sutural pattern of pterion was found in 37 skulls on the right side .Epipteric & frontotemporal types were found in 5 skulls each on the right side &stellate in 3 skulls on the right side.

The Table2 shows all sutural patterns of Pterion that were observed on the left side of skulls in the present study. The most predominant variety was Sphenoparietal variety followed by the epipteric& stellate variety. Frontotemporal variety of sutural pattern was observed the least.

Out of 50 skulls, sphenoparietal type of sutural pattern of pterion was found in 33 skulls on the left side. Epipteric type of pterion was found in 10 skulls followed by stellate type in 4 skulls & frontotemporal type in 3 skulls on the left side.

On comparison of the sutural pattern on both sides of the skull (50 skulls), 60% skulls had sphenoparietal sutural pattern on both sides. Only 8% skulls had epipteric type on both sides, 6% s and 4% had frontotemporal type and stellate type on both sides respectively (Table 3).

In this study, mixed sutural patterns were also reported. About 14% of skulls had combination of sphenoparietal and epipteric type of pterion on either side. Only 4% of skulls had combination of sphenoparietal and stellate type on either side, 2% of skulls had combination of sphenoparietal and frontotemporal type on either side, 2% of skulls had combination of frontotemporal and stellate on either side respectively (Table 4).

Discussion

Among the various studies reported in table 5, it is noted that, the most common type of sutural pattern of pterion is sphenoparietal. In the present study also, sphenoparietal (70%) is the commonest sutural pattern of pterion. The incidence of sphenoparietal type of pterion coincides with the Praba et al[11] & Pavan et al. The values are higher in Manjunath et al(93.5%)[7], Saxena et al(95.3%)[6]& Zalawadia et a l(91.7%)[9] compared to our findings. The incidence of epipteric type of pterion in present study is 10% which is closer to Praba et al. The incidence of epipteric type is higher in Manjunath et al (17.3%). The various studies showed that there are different sutural patterns of pterion noted among various geographical populations. These variations can be attributed to a combination of both environmental & genetic factors.

According to the present study, pterion is lying approximately 2.88+/-0.49 cm on right side , 2.83+/-0.46 cm on left side above & behind the frontozygomatic sutures (Table 6) . The present study correlated with the Ukoha et al [12] & Walulker et al [14].

Table 7 shows that, in the present study, the distance from centre of pterion to midpoint of the upper border of the zygomatic arch is 3.76+/-0.35 cm on right side and 3.61+/-0.40 on left side. The findings of present study are closer to the findings of Walulker et al[14],Ukoha et al[12], &Seema et al[13] .The findings in other studies were slightly higher than the present study.

Conclusion

Development of cranial vault is closely related with the growth of brain and requires interaction between different tissues within the sutures.

The knowledge of sutural pattern is important. In epipteric variety of pterion, burr holes placed over the anterior junction for evacuation of extradural hematoma may cause inadvertent penetration of orbit.

Volume 5, Issue 3; May-June 2022; Page No 1054-1060

The sutural types give clue towards the volume of brain. The prevalence of Frontotemporal type of pterion is common in monkeys which have small brains compared to humans with larger brain where sphenoparietal type is predominant.

The gene responsible for the articulation of cranial bones in pterion is MSX2(on 5q35.2), a gene of homeobox family involved in cranial suture morphogenesis. Variations in the sutural pattern of pterion may be due to environmental or genetic factors.

The anatomical knowledge of location & bony relations of the pterion is important in neurosurgery. Access to pterion, either alone or in combination with other approaches is used for minimally invasive procedures in neurosurgical cases.

The present findings concerning pterion and its localization was readily obtained from the examination of normal dry skulls and should be used as approximate measurements. The observations obtained from our study will be useful in planning various neurosurgical procedures and a sound knowledge of this anatomy will be useful in performing safer craniotomy. Preoperative radiographic assessment (CT, MRI) of the pterion helps surgeons in determining a safe location for performing neurosurgical procedures. The pterion is used as an important landmark for determination of age & sex. Hence, it plays a vital role in anthropological & forensic research.

Acknowledgements:

We are thankful to the Director, Institute of Anatomy, Madras Medical College, Chennai for providing us the necessary facilities to conduct the study. We are also thankful to the technical staff of the Institute of Anatomy for their kind cooperation.

References:

1. Strandring S, Ellis H, Healy JC, Johnson D. Gray's anatomy, 39th edn. Elsevier Churchill Livingstone, London, 2005;442-471.
2. Romanes GJ. Cunningham's textbook of anatomy, 12th ed. Oxford:Oxford University Press;1981:109.
3. Dutta AK. Essentials of human osteology. 2nd ed, Kolkata, India:Current books international;2005. page 86,137.
4. Moore,K.L. & Dalley,A.F. Clinical Orientated Anatomy.5th ed. Philadelphia, Lippincott Williams & Wilkins,2006. page.828.
5. Murphy, T. The Pterion in the Australian aborigine. Am. J. Phys.Anthropol.1956;14(2):225-244.
6. Saxena RC, Bilodi AKS, Mane SS, Kumar A. Study of pterion in skulls of awath area-in and around Lucknow. Kathmandu Univ Med J 2003;1:32-33.
7. Manjunath Halagatti, Channabasanagouda. Incidence of types of pterion in south Indians-A Study on Cadaveric Dry Skulls. Int J Anat Res 2017;5(3.2):4290-94.
8. Bhargavi C, Vasudha S. Kishan K Pterion:A sight for Neurosurgical Approach. Int J Biomed Res 2011;2:588-94
9. Zalawadia DA, Vadgama DJ, Ruparelia DS, Patel DS, Patel DSV. Morphometric Study of Pterion in Dry Skull of Gujarat Region. NJIRM.2010;1(4):25-29.
10. Alper Sindel, Eren Ogut, Gunes Aytac, Nurenttin Oguz, Muazaffer Sindel. Morphometric study of pterion, Int J Anat Res 2016;4(1):1954-57.
11. A Mary Antony Praba, C. Venkatramaniah. Morphometric study of different types of pterion and its relation with middle meningeal artery in dry skulls of Tamilnadu.J Pharm Biomed Sci.2012;21(04).
12. U Ukoha, CK Oranusi, JI Okafor, OO Udemezue, AE Anyabolu, TC Nwamarachi. Anatomic study of the pterion in Nigerian dry human skulls. Nigerian Journal Of Clinical Practice.2013;16(3).
13. Seema D, Dakshayani K.R., Sumanth M.M.. A Morphometric study of Pterion in Adult Human Skulls.IJRTST.2013;9(1).
14. Walulkar S, Dehankar R, Walulkar M, Ksheersagar DD. Pterion formation and its variations in human skull in Vidarbha region.J Cont Med A Dent.2016;4(2).

Volume 5, Issue 3; May-June 2022; Page No 1054-1060

Tables

Table 1: Sutural Pattern Of Pterion On The Right Side

S. No.	Sutural pattern	No of skulls(50)	Percentage
1	Sphenoparietal	37	74
2	Epipteric	5	10
3	Frontotemporal	5	10
4	Stellate	3	6

Table 2: Sutural Pattern Of Pterion On The Left Side

S. No.	Sutural pattern	No of skulls(50)	Percentage
1	Sphenoparietal	33	66
2	Epipteric	10	20
3	Stellate	4	8
4	Frontotemporal	3	6

Table 3: Comparison Of Sutural Pattern Of Pterion Observed On Both Sides

S. No.	Sutural pattern of pterion	No of skulls (50)	Percentage
1	Spheno parietal on both sides	30	60
2	Epipteric on both sides	4	8
3	Fronto temporal on both sides	3	6
4	Stellate on both sides	2	4
5	Spheno parietal and Epipteric	7	14
6	Sphenoparietal and Fronto temporal	1	2
7	Spheno parietal and Stellate	2	4
8	Fronto temporal and Stellate	1	2

Table 4: Mean And Associated SD Of The Distance From Pterion To Specific Identifiable Bony Landmarks

DISTANCE	RIGHT SIDE (N-50)	LEFT SIDE (N-50)
	Mean ± SD (cm)	Mean ± SD (cm)
P-FZ*	2.88 ± 0.495	2.83 ± 0.467
P-ZA#	3.76 ± 0.355	3.61 ± 0.405

* **P-FZ -** centre of Pterion to the postero-lateral aspect of frontozygomatic suture
# **P-ZA-** the centre of Pterion to the midpoint of upper border of the zygomatic arch

Volume 5, Issue 3; May-June 2022; Page No 1054-1060

Table 5: Comparison Of Incidence Of Types Of Pterions In Different Studies

Study (No. of Skulls)	Type of Pterion			
	SPHENOPARIETAL (%)	EPIPTERIC (%)	FRONTO-TEMPORAL (%)	STELLATE (%)
Murphy et al.(54)	73	1	7.5	18.5
Manjunath et al., (172)	80.67	13.62	3.09	2.62
Saxena et al., (203)	95.3	-	3.4	1.3
Zalawadia et al., (42)	91.6	4.8	2.4	1.2
Praba et al., (50)	74	14	3	9
Pavan et al	72.8	2	16.4	8.8
Present study (50)	70	15	8	7

TABLE 6: COMPARISON OF DISTANCE OF CENTRE OF PTERION To FRONTOZYGOMATIC Suture (P-Fz)

S.NO	STUDY	P-FZ	
		Right side (in cm)	Left side (in cm)
1	Zalawadia et al (2010)	3.73±0.51	3.55±0.42
2	Bhargavi et al (2011)	3.93±0.37	3.8±0.4
3	Ukoha et al (2013)	2.74±0.07	2.74±0.06
4	Seema et al (2014)	3.1±0.44	3.4±0.40
5	Walulker et al (2016)	2.72±0.6	2.70±0.5
6	Nayak et al (2017)	3.48±0.21	3.41±0.16
7	**Present study**	**2.88 ± 0.49**	**2.83 ± 0.46**

Volume 5, Issue 3; May-June 2022; Page No 1054-1060

Table 7: Distance Between The Centre Of Pterion And The Midpoint Of Upper Border Of Zygomatic Arch (P-Za)

S.NO	STUDY	P-ZA	
		Right side (in cm)	Left side (in cm)
1	Zalawadia et al (2010)	3.12±0.44	2.97±0.33
2	Bhargavi et al (2011)	4.52±0.32	4.4±0.35
3	Ukoha et al (2013)	4.02±0.05	4.01±0.03
4	Seema et al (2014)	4.1±0.45	4.4±0.32
5	Walulker et al (2016)	4.01±0.5	3.92±0.3
6	Nayak et al (2017)	4.01±0.19	3.94±0.20
7	**Present study**	**3.76 ± 0.35**	**3.61 ± 0.40**

Volume 5, Issue 3; May-June 2022; Page No 1054-1060