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ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA

Metrical and non-metrical study of the pterion in South Indian adult dry skulls with notes on its clinical importance

Güney Hint yetişkin kuru kafataslarında klinik önemi ile birlikte metrik ve metrik olmayan pterion çalışması

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ABSTRACT

Objectives: The pterional site is important as it lies in close proximity to the middle meningeal artery and on the left side, to Broca's motor speech area. This location is important in surgical approaches to the anterior and middle cranial fossae. This study was conducted to determine the location and type of pterion in a group of South Indian human skulls.

Materials and Methods: The study was conducted on 50 dry adult skulls. The distance from pterion to various bony landmarks were measured on both sides using a vernier caliper. In addition, the pterion was classified depending on bones involved in the articulation, its symmetry and its position in the skull.

Results: In the present study a sphenoparietal type of pterion was the most common (78%). The average distance from the center of the pterion to the frontozygomatic suture was 3.97±0.10 cm, to the zygomatic arch was 3.27±0.06 cm. The average distance from the internal aspect of the center of the pterion to the optic canal was 4.02±0.12 cm, to the sphenoid ridge was 0.97±0.09cm, to the stem of middle meningeal artery was 0.99±0.07cm and to its nearest branches was 0.58±0.12 cm.

Conclusion: These findings will be useful in relating the position of the pterion to several important landmarks in various surgical approaches.

Keywords: Pterion, Pterional approach, Frontozygomatic suture, Middle meningeal artery

ÖZ

Amaç: Pterional bölge, orta meningeal arter ve Broca'nın motor konuşma alanının yakınında bulunduğu için önemli, bir bölgedir. Bu neden ile, anterior ve orta kraniyal fossalara cerrahi yaklaşımlarda bu yer önem taşımaktadır. Bu çalışma, Güney Hint insan kafataslarındaki pterion'un yerini ve türünü belirlemek için yapılmıştır.

Gereçler ve Yöntemler: Çalışma 50 kuru yetişkin kafatasında yürütülmüştür. Pterion'dan çeşitli kemikli noktalara olan uzaklık, her iki tarafta da vernik kaliper kullanılarak ölçülmüştür. Buna ek olarak pterion, kemikler eklemli, simetri ve kafatasındaki konumu itibariyle sınıflandırılmıştır.

Bulgular: Çalışmamızda, sfenoparietal pterion en sık (% 78) rastlanan tip idi. Pterion'un merkezinden frontozigotik dikişe ortalama mesafe 3,97 ± 0,10 cm, zigomatik kemer için 3,27 ± 0,06 cm idi. Ayrıca, pterion'un merkezinden optik kanala içten uzaklık ortalaması 4,02 ± 0,12 cm, sfenoid sırtına 0,77 ± 0,09 cm, orta meningeal artere 0,99 ± 0,07 cm ve en yakın dallarına 0.58 ± 0.12 cm idi.

Sonuç: Bu bulgular, çeşitli cerrahi operasyonlarda pterion'un yerinin tam olarak belirlenmesinde yararlı olacaktır.

Anahtar kelimeler: Pterion, Pterional yaklaşım, Frontozigomatik sütür, Orta meningeal arter

Introduction

The pterion is an irregular 'H' shaped suture present on the lateral aspect of skull where the squamous part of the temporal bone meets the frontal, sphenoid, and parietal bones. In general, the pterion is considered to be located two finger-breadths above the zygomatic arch and a thumb width posterior to the frontal process of the zygomatic bone [1-2].

The pterion forms an important landmark in pathological conditions of many structures that are closely associated with it: including the optic nerve, the orbit, the sphenoidal ridge, the middle cerebral artery, particularly its aneurysms

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and trauma to middle meningeal artery [3-6]. Apart from its importance as a surgical landmark it also can be a guide for determing the age, sex and race in archeological and forensic specimens [7,8]. Metrical and non-metrical studies on the pterion are available in the literature [5,9]. Owing to its variation in metrical and non-metrical parameters with respect to race, gender and geographical distribution, studies on the pterion play a significant role in surgical anatomy. In the present study, we report the variations in types of pterion and its relation to the neighboring anatomical landmarks in adult South Indian dry skulls.

Materials and Methods

In the present study 50 dry adult skulls (37 males, 13 females) were obtained from the Department of Anatomy, Kasturba Medical College, India. The skulls were divided by a cut at the upper part of the cranium about two cm above the supraorbital margin anteriorly and the inion posteriorly. The pterions were classified on the basis of the bones articulating, and their positions as well as their bilateral symmetry. The distance between the pterion and specific identifiable bony landmarks were measured from the external and internal aspects on both sides of the skull, using a vernier caliper as described by Murphy [10].

Classifications of Pterions

a. Based on bones articulating (Figure 1)

1. Sphenoparietal: defined as a sutural pattern where the sphenoid bone articulates with the parietal bone directly.
2. Frontotemporal: defined as a sutural pattern where the frontal bone comes in direct contact with temporal bone.
3. Stellate: characterized by articulation of all four bones, that is sphenoid, parietal, frontal, temporal bones at one point.
4. Epipteric: defined by the presence of small sutural bone between parietal and the sphenoid bone.

Epipteric types were further classified (Figure 2) as described by Ersoy et al. [3]:

a) Os epiptericum proprium – epipteric bones articulates with all constituents of pterion.

b) Os epiptericum triquadrum – a single epipteric bone articulates with three bony constituents of the pterion either anteriorly (Os epiptericum antericus), posteriorly (Os epiptericum posterius), inferiorly (Os epiptericum inferius) or superiorly (Os epiptericum superius).

c) Os epiptericum bilateralum – epipteric bones lie in between two constituents of the pterion.

d) Ossa epipterica – multiple epipteric bones are present in the pterion.

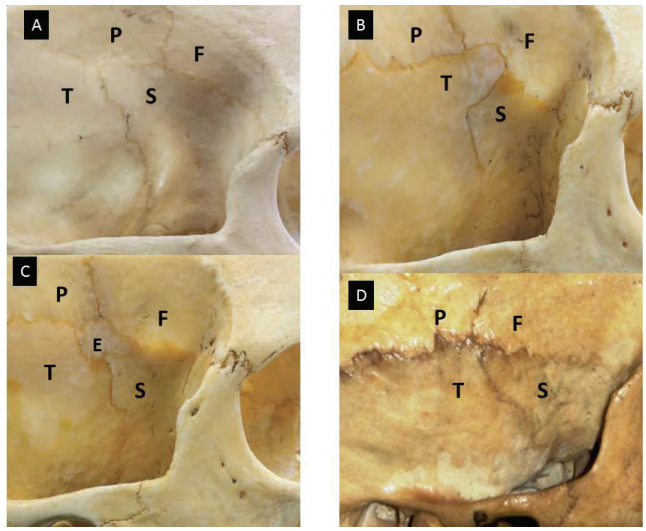

Figure 1: Various types of pterion
A Sphenoparietal **B** Frontotemporal
C Epipteric **D** Stellate

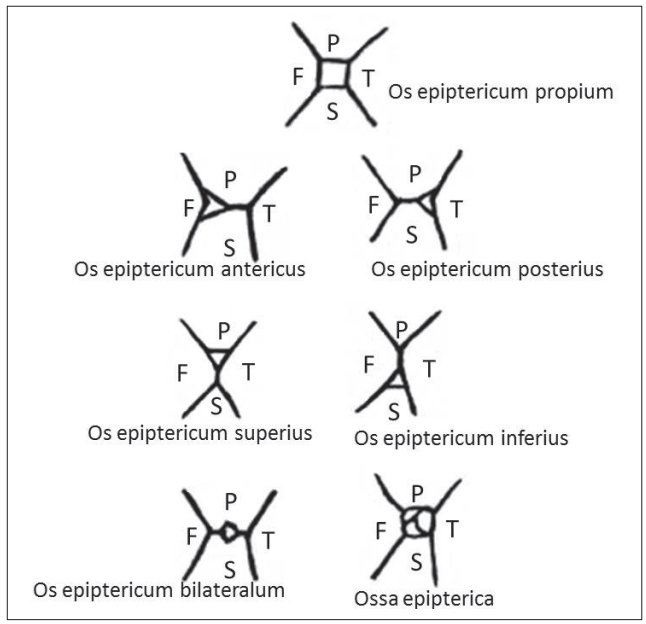

Figure 2: Sub classification of epipteric bones
F = Frontal bone
P = Parietal bone
T = Temporal bone
S = Sphenoid bone

b. Based on symmetry

The pterions were studied in each skull to identify whether they were bilaterally symmetrical. Based on the various articulating bones in the formation of pterion, 16 combinations are possible (four bilaterally symmetrical combinations with the same type on the right and left sides, and 12 bilaterally asymmetrical combinations with different types on the right and left sides [10].

c. Based on position

The pterions were also classified based on their position in the skull as:

1. High pterion - distance >4 cm from the zygomatic arch
2. Low pterion - distance <3.9cm from the zygomatic arch
3. Anterior pterion - distance <3cm from the frontozygomatic suture
4. Posterior pterion - distance >3.1 cm from the frontozygomatic suture.

Metrical parameters

The location of pterion was assessed by drawing a circle with the smallest radius connecting all the four bones involved in the formation of the pterion, the center of which was marked as the center of the pterion (Figure 3).

Measurement from external aspect (Figure 3a)

A = the vertical distance from the center of the pterion to the zygomatic arch

B = the distance from the center of the pterion to the posterolateral aspect of the frontozygomatic fissure

Measurements from internal aspect (Figure 3b)

C= horizontal distance from the center of the pterion to the lateral margin of the optic canal

D = distance from the central of the pterion to the lateral end of the ridge on the lesser wing of the sphenoid

E = distance from the pterion to nearest point of stem of MMA

F = distance from the pterion to nearest point of branch of MMA

The relation of the pterion to the middle meningeal artery (MMA) (Figure 3c)

G = pterion to anterior end of anterior ramus of MMA

H = pterion to posterior end of posterior ramus of MMA

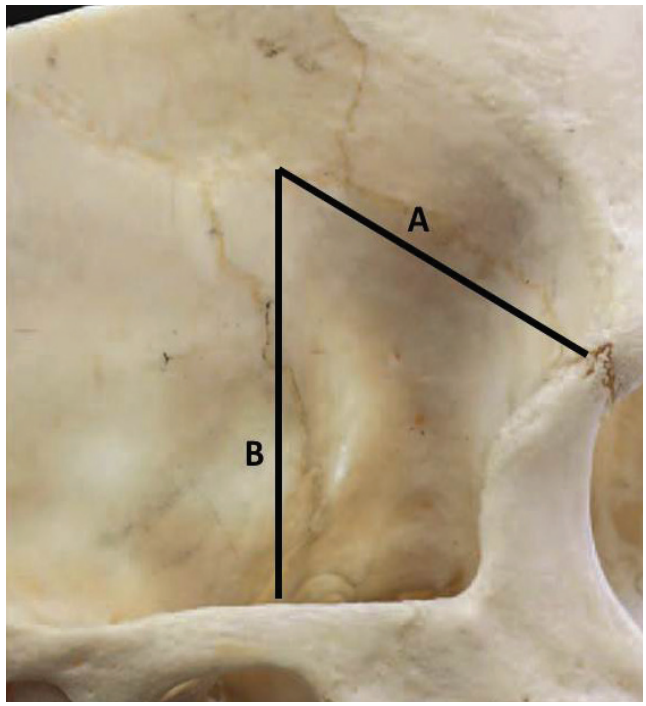

Figure 3a: Measurements taken from external aspect of each skull
A = vertical distance from the center of the pterion to the zygomatic arch
B= distance from the center of the pterion to the frontozygomatic fissure

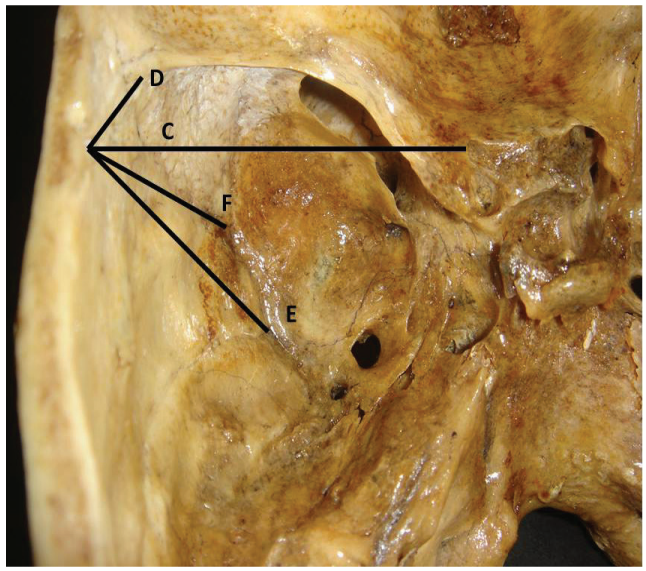

Figure 3b: Measurements taken from internal aspect of each skull
C = horizontal distance from the internal aspect of the center of the pterion to the lateral margin of the optic canal
D = distance from the internal aspect of the center of the pterion to the lateral end of the ridge on the lesser wing of the sphenoid
E = distance from the pterion to the nearest point of the stem of the MMA
F = distance from the pterion to the nearest point of the branch of the MMA

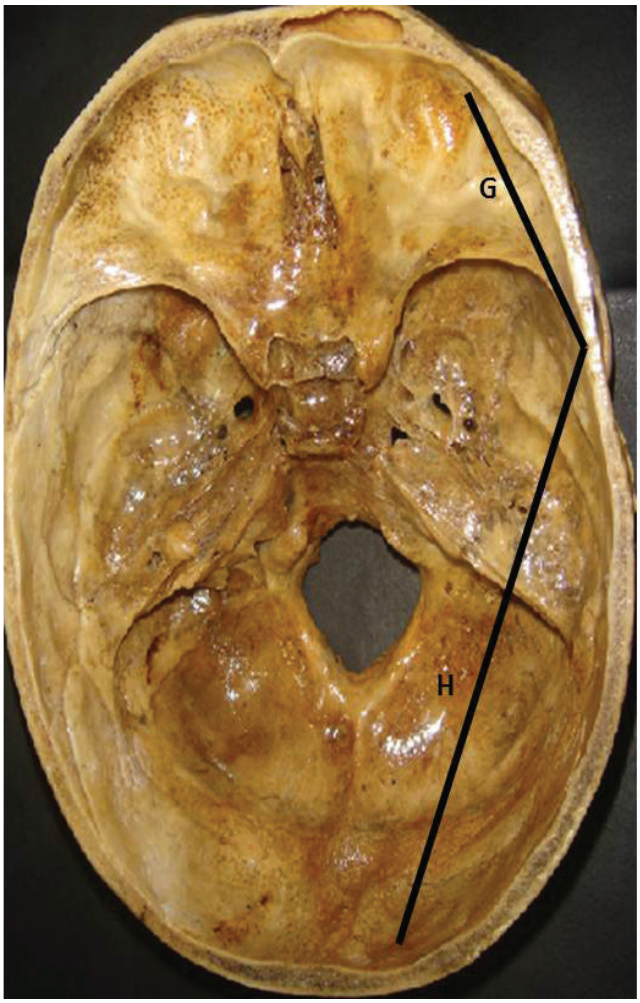

Figure 3c: Relation of the pterion with MMA and its branches this whole thing has to go in figure 3b. plz put it there. and remove it from 3c figure.
G = pterion to anterior end of anterior ramus of MMA
H = pterion to posterior end of posterior ramus of MMA

Statistical analysis

The metrical parameters are represented as mean and standard deviation (SD) of the actual values while the other parameters are expressed in percentages. The incidence of various types of pterions were analysed with the Chi square test using SPSS software.

Results

The present study was carried out on 50 dry adult skulls which were collected from coastal Karnataka. It comprised of 37 male (74%) and 13 female (26%) skulls with mean age of 50.

Classification of the pterion

a. Based on bones articulating

The most common type of pterion observed in the present material was sphenoparietal (78%) followed by epipteric (17%) and frontotemporal (4%) (Table I). The incidence of types of pterion in male and female skulls was similar. Stellate type pterions were least common (1%). Interestingly, it was observed that none of the male skulls had the frontotemporal variety and no female skulls had the stellate variety (Table I).

When epipteric types of pterion were further classified, of 17 skulls with the epipetric type, only three types - os epipterium proprium, os epipterium posterius and os epitericum antero-superius were observed (Table III). The most common type was os epipterium posterius (52.9%) followed by os epiptericum proprium type (42.9%) and os epitericum antero-superius (5.9%) (Figure 4). In addition, the type of pterion was not always bilaterally symmetrical.

b. Based on symmetry

Among 50 skulls analyzed 42 (84%) were bilaterally symmetrical with respect to articulating bones in pterion and remaining 8 skulls (16%) were asymmetrical with respect to articulating bones in the pterion (Table II). In bilaterally symmetrical pterions only sphenoparietal, frontotemporal and epipteric types were observed. In asymmetrical combinations of the 8 (16%) skulls, 7 were an epipteric and sphenoparietal combination and one skull had stellate and a sphenoparietal combination. In male skulls only sphenoparietal (70.27%) and epipteric types (10.81%) were bilaterally symmetrical, while in female skulls only sphenoparietal (69.23%), frontotemporal (15.38%) and epipteric types (7.68%) were bilaterally symmetrical.

c. Based on position

When we classified the pterion based on their position in the skull, 48% were grouped under high and 52% were grouped under low position. The incidence of high and low pterion was similar for the two sides. The pterions at a high position were more common in males (60%) than in females (15.3%) whereas the incidence of low pterion was more in females (84.7%) than in males (40%). When we classified with respect to their distance from the frontozygomatic arch, 27% were anterior and 73% were posterior. On the right and left side of the skull, the incidence of a posterior pterion was

Table I. Types of pterion in adult skulls from the coastal Karnataka region

Types (%)	**Total** (n= 100)	**Side**		**Sex**	
		Right (n= 50)	Left (n=50)	Male (n=74)	Female (n=26)
Sphenoparietal	78[a]	70	86[b]	79.75	73
Frontotemporal	4	4	4	0	15.4
Epipteric	17	24	10	18.9	11.6
Stellate	1	2	0	1.35	0

a: p< 0.001 compared to rest of the types of the pterion; b: p<0.01 compared to the right side

Table II. Symmetry of the pterion in South Indian adult male and female skulls

Types of the pterion		**Total** (n=50)	**Sex**	
Right side	Left side		Male (n=37)	Female (n=13)
Sphenoparietal	Sphenoparietal	70[a]	70.27	69.23
Frontotemporal	Frontotemporal	4	0	15.38[c]
Epipteric	Epipteric	10	10.81	7.69
Stellate	Stellate	0	0	0
Sphenoparietal	Frontotemporal	0	0	0
Sphenoparietal	Epipteric	0	0	0
Sphenoparietal	Stellate	0	0	0
Frontotemporal	Sphenoparietal	0	0	0
Epipteric	Sphenoparietal	14	16.22	7.70
Stellate	Sphenoparietal	2	2.7	0
Frontotemporal	Epipteric	0	0	0
Frontotemporal	Stellate	0	0	0
Epipteric	Frontotemporal	0	0	0
Stellate	Frontotemporal	0	0	0
Epipteric	Stellate	0	0	0
Stellate	Epipteric	0	0	0
Total		100	100	100
Bilaterally symmetrical		84[b]	81.08	92.30[d]
Unilateral occurrence		16	18.92	7.70

Data are expressed as percentage of skulls. a:p< 0.001 compared to rest of the types of pterion; b:p<0.01 compared to unilateral occurrence; c:p<0. 0001 compared to male skulls; d:p<0.05 compared to female skulls

Table III. Incidence of various types of epipteric bones in South Indian adult skulls

Types of epipteric bone (n=17)	**Incidence**
Os epiptericum proprium	7 (41.2%)
Os epiptericum bilateralum	0
Os epiptericum antericus	0
Os epiptericum postericus	9 (52.9%)
Os epiptericum supericus	0
Os epiptericum infericus	0
Ossa epipterica	0
Os epitericum anterosuperius	1 (5.9%)

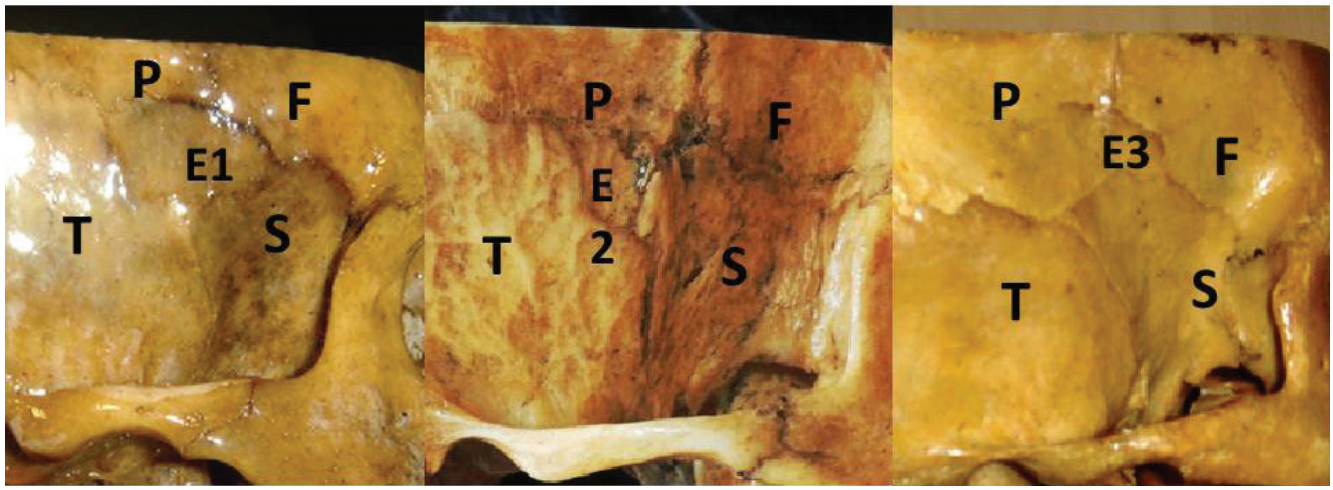

Figure 4: Various types of epipteric bones found in the present study
F = Frontal bone P = Parietal bone T = Temporal bone S = Sphenoid bone
E1 = Os epiptericum proprium E2 = Os epipterium posterius E3 = Os epipterium anterosuperius

three times higher (right 76% and left 70%) than anterior type (right 24% and left 30%). Both males and females had significantly higher incidence of posterior (77.1 V/s 61.6) when compared to anterior ones (22.9 V/s 38.4) (Table IV).

Metrical parameters

The linear measurements taken from the center of the pterion to various internal and external landmarks are represented as mean and standard deviations in Table V. On the external aspect of the skull, zygomatic arch and frontozygomatic suture was at an average distance of 3.97 ± 0.10 cm and 3.27 ± 0.06 cm from the center of the pterion respectively. On the internal aspect of the skull, mean distances measured from the corresponding point of the center of pterion were 4.02 ± 0.12 cm horizontally to the lateral margin of the optic canal and 0.97 ± 0.09 cm to the lateral end of the ridge on the lesser wing of the sphenoid. The mean distance measured from the pterion to the stem of MMA was 0.99 ± 0.07cm and to frontal ramus of MMA was 0.58 ± 0.12 cm. The mean distance from the pterion to the anterior end of frontal ramus was 3.87 ± 0.11 cm and to the posterior end of parietal ramus was 10.13 ± 0.24 cm. There were no statistically significant difference when the right and left sides were compared. When we compared male and female skulls, all the parameters except distance from the pterion to nearest point of branch of MMA and distance from pterion to anterior end of anterior ramus of MMA were not significantly higher in males.

Discussion

Knowledge and understanding of the type and location of the pterion and its relation to surrounding bony landmarks is important in neurosurgery. In addition presence of more than one sutural bone at the pterion is of radiological significance as sutural bones may be mistaken for fractures of the skull in cases of trauma of the pterion.

The observations of the present study indicate that the human skull is not bilaterally symmetrical with respect to the type of pterion. The reasons for the asymmetrical patterns are not known. Therefore, one should be aware of this asymmetry while operating in the region of the pterion especially on the left side as Broca's speech area and middle cerebral artery lie at this point.

In the present study the sphenoparietal type of pterion was the most common type which is in agreement with other studies [9-17] (Table-VI). The high occurrence of the sphenoparietal pterion could have an evolutionary basis [18] as this is the most common type in biped primates such as bonobos and orangutans [19]. It has been shown that the development of calvarial bones is tightly coordinated with the growth of the brain and requires interactions between different tissues in the sutures [20]. Increase in brain size in primates [19] must have caused morphological changes in neurocranium that led to meeting of greater wing of sphenoid and parietal bone.

The incidence of the frontotemporal type of pterion has also been observed to vary in different ethnic groups. In the

Table IV. Classification of the pterion in South Indian adult skulls based on their position

Pterion	Total (n=100)	Right (n=50)	Left (n=50)	Males (n=74)	Females (n=26)
High	33%	40%	26%	41.8%	11.5%[a]
Low	6%	0	3%	8.1%	0
Anterior	17%	12%	22%	3.2%	38%[a]
Posterior	23%	36%	30%	31.0%	7.6%[b]

a:p< 0.00 ; b:p<0.01 compared to male skull

Table V. Linear distance (cm) from the pterion to specific identifiable bony landmarks

Landmarks from the pterion	**Right side** (n= 50)		**Left side** (n= 50)		**Gender**		**Total** (n=100)
	Mean ±SD	Range	Mean ±SD	Range	Male n=74	Female n=26	Mean ±SD
A (Vertical distance from the center of the pterion to the zygomatic arch)	4.05±0.43	3.27-5.40	3.90±0.36	3.03-5.04	4.05±0.10	3.75±0.10	3.975±0.10
B (Distance from the center of the pterion to the posterolateral aspect of the frontozygomatic fissure)	3.32±0.50	2.00-4.37	3.23±0.53	1.64-4.14	3.37±0.06	3.01±0.04	3.27±0.06
C (Horizontal distance from the center of the pterion to the lateral margin of the optic canal)	4.11±0.39	3.24-4.86	3.94±0.48	2.2-4.83	4.11±0.10	3.76±0.15	4.02±0.12
D (Distance from the central of the pterion to the lateral end of the ridge on the lesser wing of the sphenoid)	1.04±0.47	0.33-1.99	0.90±0.39	0.26-1.99	1.01±0.07	0.86±0.17	0.97±0.09
E (Distance from the pterion to nearest point of stem of MMA)	1.05±0.77	0-2.3	0.94±0.86	0-2.2	1.00±0.07	1.00±0.09	0.99±0.07
F (Distance from the pterion to nearest point of branch of MMA)	0.5±0.58	0-2.5	0.67±0.76	0-2.8	0.50±0.03	0.86±0.43	0.58±0.12
G (Distance from the pterion to anterior end of anterior ramus of MMA)	3.95±1.04	1.77-5.49	3.79±1.24	0.29-6.39	3.83±0.11	4.00±0.09	3.87±0.11
H (Distance from the pterion to posterior end of posterior ramus of MMA)	9.96±1.83	1.17-11.8	10.30±1.42	5.60-12.66	10.25±0.07	9.79±0.68	10.13±0.24

present study, the frequency of a frontotemporal type pterion was 4% being closest to that reported in North Indians [9]. Interestingly, in the present study none of the male skulls showed the frontotemporal type, the reason for this could be that the greater wing of the sphenoid in males was broader and hence there was no articulation between the frontal and temporal bones. The stellate type of pterion was observed in a small number of male skulls (1%) specifically on right side. The incidence of this type in the literature varies from 0.6% to 5.17% [10, 12, 21].

Knowledge of epipteric types of pterion is very important for neurosurgeons since it can mislead neurosurgeons during burr hole, as the configuration of the pterion changes depending upon the number, form, extension, and location of the epipteric bones [11]. The incidence of epipteric bones is reported to be high in Indians, Japanese and Australians. Studies in the literature suggest that the incidence varies from 32.4% to 52.9% [13]. In the present study, an epipteric pterion was reported to be dominant on the right side, which has also been observed in Nigerians [11] and more common in males than in females. In skulls which have a variation in the epipteric bone, especially the os epiptericum proprium and os epiptericum anterius varieties, these may mistakably assessed to be at the most anterior margin of pterion and burr hole can then lead to penetration into orbit. [3]. In our study, os epiptericum proprium was most common.

With respect to the type of pterion, the present study showed 5 various combinations with three bilaterally symmetrical and two bilaterally asymmetrical pattern. Murphy [10] in an Australian aboriginal population showed

16 possible combinations whereas Wandee et al. [22] showed nine combinations in a Thai population. The difference in frequency observed in different ethnic groups is probably due to differences in skull shape of these populations or due to genetic and environmental factors [11].

In the present population, we observed the incidence of a posterior positioned pterion unilaterally and according to gender to be the commonest position in contrast to high pterion in a study conducted by Saxena et al. in Indians [12]. Males had high pterion and females had low pterion. The pterion has been reported to lie 4.0 cm above the zygomatic arch and 3.0–3.5 cm behind the frontozygomatic suture [23]. In the present study, the pterion was located 3.97±0.10 cm above the zygomatic arch, and 3.27±0.06 cm behind the frontozygomatic suture (Table II). However, a comparative study of the distance between the center of the pterion and the zygomatic arch and frontozygomatic suture reported some differences between them. (Table VII).

An approach to through the pterion is used in surgeries to treat meningiomas, tumors of the frontal lobe, operations on Broca's area, extradural heamatomas, aneurysms of MMA, the upper basilar complex or petroclival tumors [6, 24-27]. For these the distance between the internal aspect of the pterion and the lateral end of the sphenoid ridge is useful

Table VI. Comparison of the percentage of the pterion types in different populations

Author	Study population	N	Sphenoparietal	Frontotemporal	Epipteric	Stellate
Murphy, 1956 [10]	Australian Aborigines	388	73	7.5	18.5	1
Saxena et al., 1988 [12]	Nigerian	40	87.79	10.11	3.79	5.06
Saxena et al., 1988 [12]	Indian	72	95.3	3.46	11.79	1.38
Matsumura et al., 1991 [13]	Japanese	614	79.1	**2.6**	17.7	0.6
Manjunath et al., 1993 [15]	South Indian	172	93.55	3.52	17.3	2.93
Asala et al., 1996 [11]	Nigerian	212	82.1	23.6	5.7	-
Lee et al., 2001 [16]	Korean	149	76.5	-	40.3	-
Saxena et al., 2003 [4]	North Indian	203	84.72	10.01		5.17
Ersoy et al., 2003 [3]	Turkish	300	87.35	-	8.98	0.2
Oguz et al., 2004 [5]	Turkish	26	88	10	2	-
Mwachaka et al., 2009 [14]	Kenyan	79	66	15.0	12.0	7.0
Ilknur et al., 2009 [17]	Anatolian – Byzantine (13th Century)	16	87.5	6.25	6.25	-
Ilknur et al., 2009 [17]	Anatolian - Contemporary (20th Century)	28	89.2	3.6	3.6	3.6
Zalawadia et al., 2010 [21]	Western Indian	42	91.7	2.4	4.8	1.2
Wandee et al., 2011 [22]	Thai	536	81.2	1.1	17.4	0.4
Present Study, 2013	South Indian	100	78	4	17	1

Table VII. Comparison of linear distance (cm) from the pterion to specific identifiable bony landmarks in different study populations

Authors	Oguz et al., 2004 [5]		Mwachaka et al., 2009 [14]		Ilknur et al., 2009 [17]		Zalawadia et al., 2010 [21]		Present study	
Population	Turkish		Kenyan		Anatolian contemporary (20th century)		Western Indian		South Indian	
Side	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Vertical distance from the center of the pterion to the zygomatic arch	4.05 ±0.39	3.85 ±0.25	3.03 ±3.40	3.03 ±4.30	3.5 ±0.5	3.5 ±0.5	3.73 ±0.51	3.55 ±0.42	4.05 ±0.43	3.90 ±0.36
Distance from the center of the pterion to the posterolateral aspect of the frontozygomatic fissure	3.30 ±0.40	3.44 ±0.39	3.88 ±3.49	3.82 ±3.47	3.8 ±0.4	3.9 ±0.4	3.12 ±0.44	2.97 ±0.33	3.32 ±0.50	3.23 ±0.53
Horizontal distance from the center of the pterion to the lateral margin of the optic canal	4.39 ±0.40	4.36 ±0.40			-	-	4.52 ±0.32	4.37 ±0.23	4.11 ±0.39	3.94 ±0.48
Distance from the center of the pterion to the lateral end of the ridge on the lesser wing of the sphenoid	1.40 ±0.33	1.48 ±0.32			-	-	1.36 ±0.35	1.3 3±0.22	1.04 ±0.47	0.90 ±0.39

information for the operation. In the present study, this distance was 0.97±0.09 cm (Table IV) while this distance in comparison to Turkish, Thais and Western Indian skulls was greater (Table VII). The pterional approach can also be used to access the optic canal [28], where the distance between the internal aspect of the pterion and the lateral margin of the optic canal is a crucial parameter. The mean of this distance in the present study was 4.02±0.12 cm (Table IV) but Thai population had smaller distance of 3.89 ± 3.76 cm.

Accurate knowledge of the location and relations of the pterion is important in particular with respect to the course of the branches of the MMA. In the present study, in 10% cases the stem of MMA was in contact with the pterion whereas in 14% of cases the frontal branch was directly in contact with the pterion. Damage to stem or frontal branch of MMA will hamper the blood supply to the dura mater, periosteum of the bone and bone marrow approximately 3.87±0.11 cm in front of the pterion and approximately 10.13±0.24 cm away from pterion. Hence, during a pterional approach when a burr hole is made this distance should be kept in mind as chances of damaging MMA or its frontal branch may occur.

Conclusion

To conclude, an accurate knowledge of the location of the pterion is important in relation to surgical interventions, particularly with respect to the course of the branches of the middle meningeal artery and to Broca's motor speech area on the left side. The distances between the pterion and the lesser wing of the sphenoid and the optic canal are of practical importance in surgical approaches to these regions via the pterion. Types and the position of the pterion vary among individuals and different racial groups and thus the need for accurate and up-to-date data when performing intracranial surgery guided by recognizable bony landmarks is essential. Therefore, preoperative radiographic assessment (CT images, magnetic resonance radiographs) of the pterion should be confirmed in determining a safe location for performing surgical and microsurgical procedures.

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