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A Morphological Study On Shapes Of Pterion And Its Clinical Importance.

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Background: The pterion is an important anatomical landmark of the skull where the frontal, temporal, parietal and sphenoid bones are articulated. The pterion is the thinnest and the weakest spot of the skull. and can be used as an anatomical landmark of the anterior branch of the middle meningeal artery, lateral sulcus of brain and especially Broca's motor speech area. It is also an important approach point to the sphenoid ridge during optic cancer surgery. Therefore, the position of the pterion is of vital importance in neurosurgery.

Materials and Methods: The present study was conducted to findout the shapes of pterion in adult human dry skulls. 96 adlut dry skull were included for the study. We have observed 192 sides and classified the pterion shapes according to Murphys`s classification in to 4 types namely, sphenoparietal, frontotemporal, stellate and epipteric suture. We have collected the skulls from routine classes of medical, dental and departmental stock also used.

Results: The present study was conducted in 96(192 sides) adult dry skulls, out of 52(104 sides) identified as male skulls and 44(88 sides) found as female skulls. We observed 4 types of pterions in present study that includes Spenoparital, Frontoparietal, Stellate and Epipteric. In males 75(72.11%) sides identifies as spenoparital, 15(14.42%) sides identified as frontoparital, 8(7.69%) sides as stellate and 2(1.92%) as epipteric.

Conclusion: The present study findings may be helpful in practice of forensic medicine, anthropology. The pterion site very important for neurosurgeons as it is site for middle meningeal vessels and important areas of cerebrum like Broca`s area.

Keywords: Pterion, Middle meningeal vessels, Broca`s Area, Cerebrum, Skulls.

Introduction

Pterion is the junction of the frontal, parietal, greater wing of the sphenoid and the squamous part of the temporal bone. According to Murphy`s[1] classification there are four types pterion, that are sphenoparietal, frontotemporal, stellate and epipteric. Floor of the temporal fossa in the skull is formed by greater wing of

sphenoid, frontal bone, parietal bone, and squamous part of the temporal bone, these four bones meet at an H-shaped junction of the sutures termed the pterion. It is covered by scalp superficially and temporalis muscle takes origin from this area and covered by temporalis fascia, as result we can`t neither visible nor palpable from the surface.

The pterion serves as an important anatomical, surgical landmark, and craniometric point. The centre of the pterion is approximately present 3.5 cm behind and 1.5 cm above the frontozygomatic suture. It is surface marked at the meeting point of a thumb behind the frontal process of the zygomatic bone and two fingers above the zygomatic arch. At the position of the pterion the anterior branch of the middle meningeal artery, lateral sulcus of the brain, and Broca's motor speech area are present, due to these structures Clinically, pterion is an important landmark in neurosurgery. Pterion is most fragile point in skull due its less thickness compares to other parts of skull. A trivial blow in this region may rupture the middle meningeal artery. The topographic location of the pterion is important for a neurosurgeon in order to have the most suitable bony aperture to be minimally invasive. Cosmetically also, the pterional approach is favoured for its skin incision being behind the hairline, appropriate size bone flap, and the osteoplastic craniotomy preventing some of the postoperative temporalis atrophy. In the absence of neuronavigational devices to achieve optimum craniotomy, neurosurgeons have to rely on anatomical knowledge of variations in the pterion and the external landmarks around it [2,3,4,5].

Although suboptimal pterion localisation may compromise surgical access and therefore treatment outcome, studies focusing on pterion morphology and surgical anatomy are scarce. Knowledge of pterion location, presence and distribution of sutural bones convergence, the so-called epipteric bones, as well as different types of classified pteria are important to prevent complications when drilling burr pterional holes[6,7]. Any traumatic blow to the pterion presumably causes rupture of the anterior divisions of the middle meningeal vessels causing an epidural haematoma subsequently resulting in compression of cerebral cortex and death unless proper intervention is carried out. Surgical approach via the pterion has been quoted as the most widely implemented approach for the proper management of intracranial anterior circulation aneurysm. This approach has better advantages over the traditional surgical approach with minor tissue damage, lesser brain retraction, a superior cosmetic result and a shorter duration of surgery [8,9]. The present study was conducted to find out different shapes of pterion, the results may be helpful to neurosurgeons, head and neck surgeons, radiologists and anthropologists.

Materials and Methods

The present study conducted with 96(192 sides) adult dry skull, which were collected from departments of Anatomy of multiple medical and dental inistitutions. All the skulls were examined carefully and identified the gender and separated, we found 52(104 sides) skulls as male and sides 44(88 sides) skulls as female[10]. We have observed right and left sides of all the skulls to findout the shapes of pterion. We identified the pterion suture and classified according to Murphy`s classification. According to Murphy[1,8] classification, pterion categorized into four types, namely, sphenoparietal, frontotemporal, stellate and epipteric suture . The sphenoparietal type is the most common suture formed by the articulation of the greater wing of sphenoid bone with parietal bone. The frontotemporal type is a pterional sutural pattern between the frontal and temporal bone. The stellate variety of suture is the site of articulation formed by the fusion of four flat bones, sphenoid, frontal, parietal and temporal bones. The epipteric type of pterion is characterized by the presence of small sutural bones between the sphenoid and parietal bones. The presence of epipteric or sutural bone in the area, can possibly lead to wrong radiological diagnosis and clinical management of fracture in the pterion. The presence of sutural bones could possibly complicate surgical interventions involving burr hole surgeries as their extension may lead to orbital penetration[8][Figure 1, 2]**.**

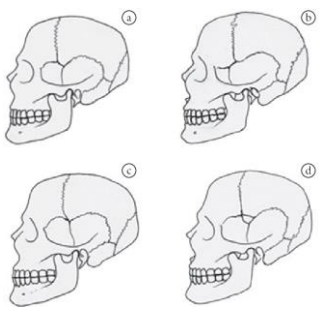

Figure 1. Showing 4 types of pterions a. Spenoparital, b. Frontoparital, C. Stellate and d. Epipteric.[1]

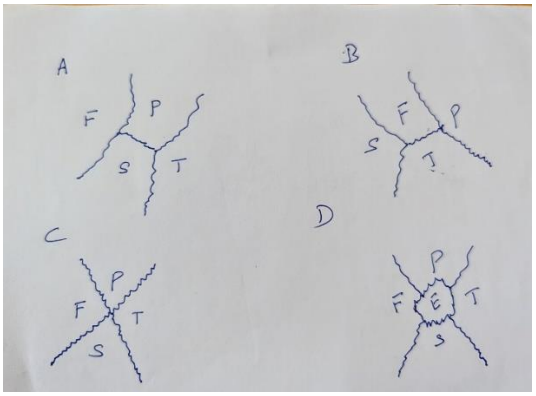

Figure 2. Showing different patterns of Pterion, A. Spenoparital, B. Frontoparietal, C. Stellate and D. Epipteric

Results

The present study was conducted in 96(192 sides) adult dry skulls, out of 52(104 sides) identified as male skulls and 44(88 sides) found as female skulls. We observed 4 types of pterions in present study that includes Spenoparital, Frontoparietal, Stellate and Epipteric. In males 75(72.11%) sides identifies as spenoparital, 15(14.42%) sides identified as frontoparital, 8(7.69%) sides as stellate and 2(1.92%) as epipteric. In females 64(72.72%) sides were identifies as spenoparital, 14(15.90%) sides identified as frontoparital, 9(10.22%) sides as stellate and 1(1.13%) as epipteric. Average spenoparital type was found in 139(72.39%) sides, frontoparital type was found in 29(15.10%), stellate type was found in 17(8.85%) sides and epipteric type was found in 3(1.56%) sides. On right side we found spenoparital type was found in 77(80.20%) sides, frontoparital type was found in 12(12.5%), stellate type was found in 11(11.45%) sides and epipteric type was found in 1(1.04%) sides. On left side we found spenoparital type was found in 62(64.58%) sides, frontoparital type was found in 17(17.70%), stellate type was found in 6(6.25%) sides and epipteric type was found in 2(2.08%) sides. We found major type pterion was spenoparital, following by frontoparital, stellate and epipteric respectively[Figures 3,4,5].

Figure 3. Skull showing the spenoparital type of Pterion

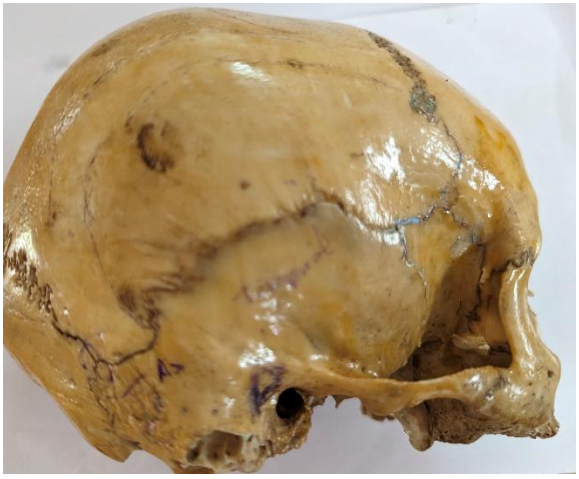

Figure 4. Skull with Forntoparital type of Pterion

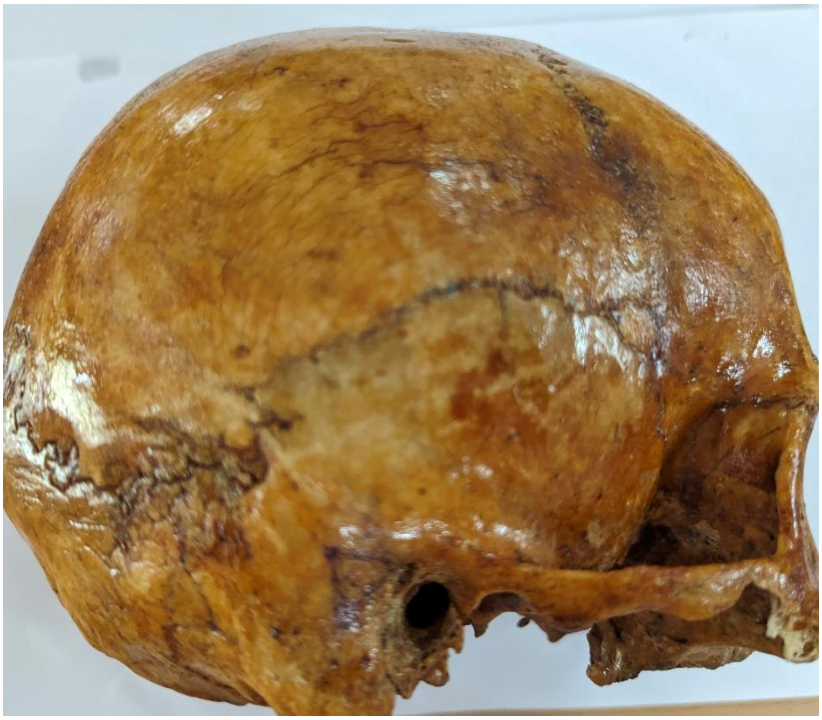

Figure 5. Skull with Epteric type of Pterion

Tabe 1. Showing the distribution of types of pterions.

Types of Pterion				
	SPENOPARITAL	**FRONTOPARITAL**	**STELLATE**	**EPIPTERIC**
MALE (n=104)	75(72.11%)	15(14.42%)	8(7.69%)	2(1.92%)
FEMALE(n=88)	64(72.72%)	14(15.90%)	9(10.22%)	1(1.13%)
TOTAL(n=192)	139(72.39%)	29(15.10%)	17(8.85%)	3(1.56%)
RIGHT(n=96)	77(80.20%)	12(12.5%)	11(11.45%)	1(1.04%)
LEFT(n=96)	62(64.58%)	17(17.70%)	6(6.25%)	2(2.08%)

Discussion

The pterion is an important skull landmark because it is located where the frontal, the great wing of sphenoid, parietal, and squamous parts of the temporal bone junction. The objective of this study was to find out shape of pterion on skulls and to find out the distances between the pterion and some certain anatomic landmarks on neighbouring structures. The landmark for neurosurgical approaches to access brain lesion is the pterion.

In present study we used 96 adult dry skulls and total 192 pterions were observed and found four types of pterions that includes Spenoparital, Frontoparietal, Stellate and Epipteric. Average spenoparital type was found in 139(72.39%) sides, frontoparital type was found in 29(15.10%), stellate type was found in 17(8.85%) sides and epipteric type was found in 3(1.56%) sides. On right side we found spenoparital type was found in 77(80.20%) sides, frontoparital type was found in 12(12.5%), stellate type was found in 11(11.45%) sides and epipteric type was found in 1(1.04%) side. On left side we found spenoparital type was found in 62(64.58%) sides, frontoparital type was found in 17(17.70%), stellate type was found in 6(6.25%) sides and epipteric type was found in 2(2.08%) sides.

The study of Muche A[8] presented, three types of pterion patterns that includes, sphenoparietal, epipteric and stellate. Out of 180 pterions, Sphenoparietal was the most common type with frequency of 152 (84.4%), followed by epipteric 24 (13.3%). Frontotemporal type of pterion was not observed. In all the three identified types of pteria, there was asymmetric distribution. Ersoy M[11] study conducted in Turkey using 300 dried human skulls, in their study they found sphenoparietal type (96%), frontotemporal (3.7%), epipteric (9%) and stellate type (0.2%) and also revealed the existence of an epipteric or wormian bone at the pterion may complicate surgical orientation leading to complication during burr hole surgeries like orbital penetration. The study conducted by Ukoha U[12], on both sides of 56 Nigerian human skulls of unknown sex, reported, all the four types of the pterion were present, that includes sphenoparietal, frontotemporal, stellate, and epipteric. The study showed that the sphenoparietal type was 75% on the right side, 76% on the left side, the frontotemporal type was 19.6% on both sides, the stellate type was 1.8% on the right side and absent on the left side. The epipteric type was 3.6% on both sides. Aksu F[13] study conducted on the skulls of 128 (256 sides) adult West Anatolian people. The results found from this study, the pterion was classified into 4 types: the sphenoparietal, frontotemporal, stellate, or epipteric types. The incidences of types of pterion in the skulls were also found as the sphenoparietal type (85.2%), the epipteric type (8.2%), the stellate type (5.5%), and the frontotemporal type (1.1%). These studies result in accordance with the present study.

Saxena SK[14] study made to study and compare the incidence and variations in the pterion formation in the skulls of 40 Nigerians and 72 Indians. The study concludes: All the three varieties of pterion, sphenoparietal, frontotemporal and stellate are found in both races. The frequency of sphenoparietal pterion is high in both races (Indians 95.3%, Nigerians 84.79%) while the frontotemporal (Indians 3.46%, Nigerians 10.11%) and the stellate (Indians 1.38%, Nigerians 5.06%) pterion are more common in Nigerians. The frequency of epipteric bone is high in Indians (Indians 11.79%, Nigerians 3.79%) and is more commonly associated with sphenoparietal pterion. No epipteric bone is associated with stellate pterion in both races. The difference in the distance of pterion from the zygomatic arch is highly significant between two races on both sides. The difference in the distance of pterion from the frontozygomatic suture is insignificant between the two races. The frequency of "high Pterion" is more in Nigerians on both sides. The frequency of "Backward Pterion" is more in Indians on the right side, whereas little more in Nigerians on the left side. Apinhasmit W[15] study conducted in bilateral sides of 268 adult human Thai dry skulls and Pterion types were classified as sphenoparietal, frontotemporal, epipteric, or stellate. To localize the pterion, linear distances were measured from the centre of the pterion to neighbouring landmarks. The results showed the two most common types of the pterion, the sphenoparietal (81.2%), and the epiteric (17.4%). The study of Oguz O[16] conducted on both sides of 26 Turkish human male skulls, none of which showed any obvious pathology or trauma. The sphenoparietal type of pterion was the most common (96% right side, 79% left side), followed by the frontotemporal (4% right side, 17% left side), and finally the epipteric type (4% left side only). The study of Junhua Li[17] conducted on 250sides of southeastern China adult dry skulls, found the The morphological types of the pterion in the skulls of adults from southeastern China were sphenoparietal suture (SP) (85%), epipteric (12.4%), frontotemporal suture (1.4%), and stellate (1.2%) types. The study conducted in 100 skulls by using Murphy`s classification by Aggarwal N[2] all four types of pterions were observed, sphenoparietal being the most common. No significant gender difference was observed in terms of type and laterality of various pterions. The study by Uabundit N[18], 124 Thai dried skulls were investigated and reported Spheno-parietal type was the most common type (62.1%), followed by epipteric (11.7%), fronto-temporal (5.2%) and stellate (1.2%). Complete synostosis of the pterion suture was present in 18.5% and was only present in males.

Conclusion: The present study concludes sphenoparietal type of suture is the most frequent variety of pterion. Although further studies are needed, morphometric measurements of the pterion could potentially be used for sex estimation which may be useful for forensic and anthropological applications. The findings of this study may, presumably, be useful for the anatomists, neurosurgeons, forensic pathologies and anthropologists.

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