



STUDY OF MORPHOLOGY AND LOCATION OF THE PTERION

Anatomy

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ABSTRACT

Introduction: Pterion is a small area within the temporal fossa which contains the junction of the frontal, greater wing of sphenoid, parietal and temporal sutures. It usually lies 4 cm above the midpoint of the superior border of zygomatic arch and 3.5 cm behind the fronto-zygomatic suture, and marks the anterior branch of the middle meningeal artery and Sylvian point of the brain.

Material and Methods: The present study was carried out on 55 dry skull bones. Both the sides of skulls were studied for the types and position of the pterion. The types of the pterion were noted by looking at the articulation pattern. The measurements were taken from the zygomatico-frontal suture to the center point of pterion (ZF-P) and midpoint of superior border of zygomatic arch to centre of pterion (ZA – P).

Result: The four different types of pterion were found. The most common type is the sphenoparietal (74.54%), and the least common type is stellate (3.63%). The pterion was commonly located 32.06 mm posterior to the zygomaticofrontal suture and 36.87 mm superior to the zygomatic arch.

Conclusion: The knowledge of various types of pterion and its location is very important for clinicians and also helpful to the anatomists, anthropologist and forensic medicine.

KEYWORDS:

Skull, pterion, types, location, suture.

Introduction:

Pterion is a small area within the temporal fossa which contains the junction of the frontal, greater wing of sphenoid, parietal and temporal sutures. It usually lies 4 cm above the midpoint of the superior border of zygomatic arch and 3.5 cm behind the fronto-zygomatic suture. Its position can be estimated roughly by a shallow palpable hollow, approximately 3.5 cm above the center of the zygomatic bone. It is H-shaped. This is an important landmark on the side of the skull because it overlies both the anterior branch of the middle meningeal artery and the lateral (Sylvian) cerebral fissure intracranially (it is also known as Sylvian point). The pterion corresponds to the anterolateral (sphenoidal) fontanelle on the neonatal skull, which disappears about three months after birth^[1].

The pterion is covered by the origin of temporalis muscle and temporalis fascia. Whereas inside the cranium it relates with the many structures like anterior division of middle meningeal vessels, sylvian fissure, area numbers 44 and 45, tip of the lesser wing of sphenoid bone and base of the posterior margin of the orbital plate of frontal bone. This area is very important for surgeons because here the bones are very thin and can easily be broken by the surgeons and neurosurgeons in their clinical work. Most important surgery is done for the drainage of hematoma formed after the accident, where the collection of blood occurs in subdural space, to drain the collected fluid or blood, the burr hole is done at the pterion site. Knowledge of the surface anatomy of the middle meningeal artery is important for accurate positioning of burr hole to evacuate extradural hematoma^[2].

The sutural pattern of the pterion was determined on both the left and right sides of each skull, based on Murphy's classification [3] i.e. the Spheno-parietal (SP), Fronto-temporal (FT), Stellate (ST) and Epipteretic (EP).

The Spheno-parietal (SP) type:

This type of pterion is formed by the direct joining of greater wing of sphenoid with the antero-inferior tip of the parietal bone, preventing the frontal and temporal bones making contact with one another.

The Frontotemporal (FT) type:

This type is a sutural pattern in which the frontal and temporal bones are in direct contact, preventing the sphenoid and parietal bones making contact with one another.

The Stellate (ST) type:

This type is characterized by articulation of the tips of all the four bones (frontal, parietal, temporal and sphenoid) at a point which looks like a star.

The Epipteretic (EP) type:

This type is characterized by presence of a small sutural bone between the four bones articulating at pterion.

Material and Methods:

The present study was carried out on 55 dry skull bones. The skulls were of unknown sex and race. Both the sides of skulls were studied for the types and position of the pterion. Broken and abnormal skulls were excluded. The types of the pterion were noted by looking at the articulation pattern. For measurement of the position of pterion landmark, a point was marked in the center of pterion, second point was marked in the midpoint of the superior border of the zygomatic arch and third point was marked on the anterior margin of the zygomatico-frontal suture. The measurements were taken from the zygomatico-frontal suture to the center point of pterion (ZF-P) and midpoint of superior border of zygomatic arch to center of pterion (ZA – P). The data obtained were compared with those from earlier studies.

Result:

The present study was conducted on 55 dry human skulls (i.e. 110 sides- both right and left sides). The four different types of pterion were found because of difference in the articulation pattern of the four bones with each other. The findings of the present study are shown in Table 1 & Table 2 and are discussed below. The sphenoparietal type (SP) of pterion was observed to be the most common which is found in 74.54% and Stellate type (ST) of pterion was the least common type which is found in 3.63%. The epipteretic (EP) type is found in 14.54% and the

frontotemporal (FT) type in 7.27%. The Mean of the distance between zygomatico-frontal suture and center point of pterion (ZF - P) is 32.27 mm on right side and 31.86 mm on left side. Mean of the distance between midpoint of zygomatic arch and center point of pterion (ZA - P) is 36.63 mm on right side and 37.12 mm on left side.

Table 1: Pterion pattern in different studies

| Studies | Sphenoparietal (SP) type | Epipteric (EP) type | Frontotemporal (FT) type | Stellate (ST) type |
|--------------------------------------|--------------------------|---------------------|--------------------------|--------------------|
| Murphy ^[3] | 73% | 1% | 7.50% | 18.50% |
| Mwachaka et al ^[9] | 66 | 7 | 15 | 12 |
| Saxena ^[10] | 72% | 11.79% | 3.46% | 1.38 |
| Shenoy et al ^[17] | 77.33% | 21.33% | 0 | 1.34% |
| Seema & Mahajan ^[23] | 89 | 12 | 7 | 4 |
| Zalawadia et al ^[24] | 91.7% | 4.8% | 2.4% | 1.2% |
| Praba & Venkatramiah ^[25] | 74 | 14 | 3 | 9 |
| Satpute & Wahane ^[14] | 82.94% | 7.04% | 2.94% | 5.28% |
| Gindha GS et al ^[2] | 72.31% | 23.08% | 4.61% | 0 |
| Present study | 74.54% | 14.54% | 7.27% | 3.63% |

Table 2: The mean (ZF - P) distance and the mean (ZA - P) distance

| Distance in mm | On Right side | On Left side | Total |
|----------------------------|---------------|--------------|----------|
| The mean (ZF - P) distance | 32.27 mm | 31.86 mm | 32.06 mm |
| The mean (ZA - P) distance | 36.63 mm | 37.12 mm | 36.87 mm |

Fig. 1: Pterion Types

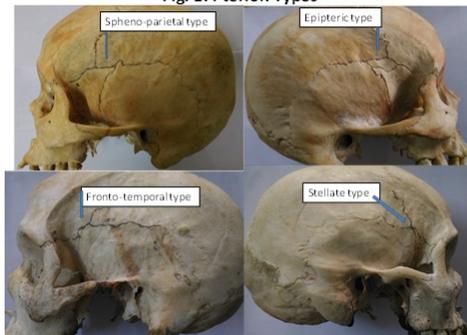
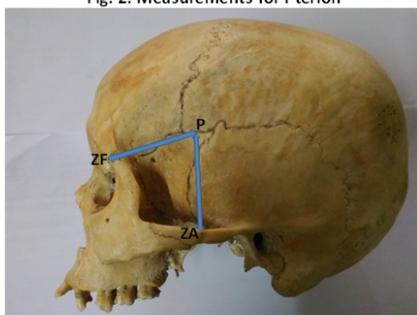


Fig. 2: Measurements for Pterion



Discussion:

The pterion is a point of sutural confluence seen in the norma lateralis of the skull where frontal, parietal, greater wing of sphenoid and temporal bones meet.

Though the actual determinants of the formation of the pterion are unknown, articulation of the cranial bones is thought to be under genetic influence especially the MSX2 gene^[4]. Ethnic and racial variations are thus commonly observed. The fact that the development of the calvarium is tightly coordinated with the growth of the brain may explain the prevalence of frontotemporal pattern of sutures among monkey skulls, unlike humans with larger brains who have a predominantly sphenoparietal pattern of suture^[5,8]. The high occurrence of the sphenoparietal pterion could have an evolutionary

basis^[6]. Sphenoparietal type is the most common type in humans and biped primates such as orangutans^[7].

Four types of pterion have been described by Murphy. He observed that spheno-parietal type (73%) is the most common type; Stellate type is present in 18.5% and fronto-temporal type in 7.5%. The least common type is epipteric type (1%)^[3]. According to Mwachaka et al, Spheno-parietal type is most common occurrence (66%) and least common is epipteric type of pterion (7.0%), (15%) fronto-parietal and (12%) were stellate type of pterion^[9]. In the comparative study conducted by Saxena et al, they observed that 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 %). The presence of epipteric bones may lead to complications in making burr holes at the pterion. The epipteric bone may be mistaken for fracture of skull in case of trauma in the pterion region. 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^[10]. According to Saxena et al^[10], the Indian skulls have more epipteric bones (11.79%) as compared to other population. In the present study epipteric type of pterion is found in 14.54%.

In our present study spheno-parietal type of pterion is the most common type (74.54%). The Stellate type of pterion is the least common type (3.63%). Fronto-temporal type is found in 7.27% and Epipteric type in 14.54%.

In present study the pterion was located 32.06 ± 2.9 mm posterior to the zygomatico-frontal suture (ZF-P distance). Williams et al.^[11] reported that the pterion lies 30 to 35 mm away from the frontozygomatic suture and it is also similar to the Kenyan study which was reported as 30.35 ± 3.61 mm posterior to the frontozygomatic suture. However, there are wide variations as reported by Koreans study 26.8 ± 4.5mm^[12] and Turks study 35 ± 5mm^[13].

In present study the pterion was located 36.87 ± 2.2 mm above the midpoint of the zygomatic arch (ZA-P distance). The ZA-P distance in Koreans study is 36.9 ± 3.8mm^[12] and in Indians study is 38.5mm^[10]. According to Kenyan study^[15] it is 39.31 ± 3.28mm and 37.35 ± 2.97mm in males and females, respectively. This is likely due to the slightly higher arch of the cranium in Africans when compared to the Asians. Standing et al^[16] observed that the pterion lies 3.5 cm behind the zygomatico-frontal suture and 4 cm above the midpoint of the superior border of the zygomatic arch. According to Shenoy et al [17] the pterion was located 29.5 mm posterior to the fronto-zygomatic suture.

A pterional approach has been used in neurosurgery primarily for the treatment of a wide variety of neurosurgical disorders as it provides an opportunity to treat lesions located in several brain structures and areas such as the frontal (anterior) branch of the middle meningeal artery, Broca's motor speech area on the left side, insula, the lateral (Sylvian) cerebral sulcus, internal capsule, for treating lesions of optic canal, orbit, sphenoid ridge and for treating cerebral aneurysms and tumors. Therefore, the anatomical considerations in location and related landmarks of the pterion are useful for surgical approaches through this structure^[18,19,20,21&22].

Conclusion:

As discussed above the knowledge of various types of pterion and its location is very important for radiologist and neurosurgeons in interpretation of x-ray and for surgically correction of fracture. This study will be also helpful to the anatomists, anthropologist and forensic medicine.

The present study was an effort to provide some important anatomical data of pterion in the Indian population. Obtaining more conclusive results demands study of more number of the skulls, as well as carrying out comparative studies between the different regions.

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