



Morphometric Study On Pterion And Its Clinical Importance.

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Abstract

Background: The pterion which is the meeting point of the frontal, parietal, greater wing of the sphenoid, and squamous part of temporal bones. The pterion is situated approximately 4 cm above the midpoint of the zygomatic arch and 3.5 cm posterior to the frontozygomatic suture. The anatomical and clinical significance of pterion is it marks the position of the anterior branch of the middle meningeal artery, Broca's area of speech, Sylvian point and anterior pole of the insula. The knowledge of the position the of pterion and the structures deep to it has the utmost importance to burr holes in draining the extradural hematoma caused due to the rupture of branches of middle meningeal arteries. In the neonatal skull, it corresponds to anterolateral fontanelle.

Materials and Methods: The present study conducted with 96 adult dry skull, both sides pterions were measured carefully, the skulls were divided according to gender. The morphometric measurements were carried out by measuring the distance from the centre of the pterion to six different locations of the skull including, anterior aspect of the frontozygomatic suture - PSFZ, the zygomatic angle - PZAN, the zygomatic arch - PZA, Henle's spine- PH, mastoid process of the temporal bone - PMP, external occipital protuberance - PI.

Results: The distance from the center of the pterion to the anterior aspect of the frontozygomatic suture – PSFZ was 35.8+5.3mm, distance from the center of the pterion to the zygomatic angle – PZAN was 40.4+5.35mm, distance from the center of the pterion to the zygomatic arch – PZA 39.85+4.65mm, distance from the center of the pterion to Henle's spine- PH was 61.55+4.25mm, distance from the center of the pterion to the mastoid process of the temporal bone – PMP was 85.7+5.65mm, distance from the center of the pterion to the external occipital protuberance – PI was 131.75+7.3mm.

Conclusion: As pterion is very important point, it is thinner than other parts of skull and deep to it middle meningeal artery and broca's area are present. The present study results may be helpful in practice of neurosurgery, forensic experts and anthropologists.

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Key words: *Zygomatic Arch, Mastoid Process, Meningeal Vessels, H – Shape suture.*

Introduction

Pterion is a neurosurgical landmark located in temporal fossa. Frontal bone, greater wing of sphenoid, squamous part of temporal bone and parietal bone almost meet at a region forming a H shaped structure- pterion. It is a circular area located at around 4 cm higher to zygomatic arch and 3.5 cm behind the frontozygomatic suture. Using cranial suture closure methodology pterion helps in determining age. It relates to the anterolateral fontanelle on neonatal skull and disappears in less than three months after birth. The fontanelles allow shaping of the fetal head while it passes through the birth canal and also help in faster growth of brain in first year of life. Pterion is posterior to the frontal process of the zygomatic bone by a thumb's width and two fingers' breadth superior to the zygomatic arch [1].

The articulation of the cranial bones is thought to be under genetic influence, predominantly MSX2 gene, which is ultimately responsible for the type of pterion and its conformation [3,4]. In infant's skull pterion is site of anterolateral fontanelle. Which closes in about third month post birth. neurosurgeons mark the pterion two fingers superior to the zygomatic arch and a thumb's breadth posterior to the frontal process of the zygomatic bone. The pattern of bone articulation at pterion however can be variable in different individuals. Sometimes a small sutural bone or epipteric bones may be present within any of the sutures forming the pterion. It is an important clinical landmark used by maxillofacial surgeons also. Calvaria is thin at this point and gets fractured easily in head injuries. Pterion is related on the inner side of skull to the anterior branch of middle meningeal artery, the lateral sulcus of brain, and Broca's motor speech area. Any lateral blow on the skull can damage anterior branch of middle meningeal artery resulting in extra dural hematoma. This extra dural hematoma is usually evacuated by creating burr holes on pterional site for decompressing the brain tissue [5,6,7,8]. The present study was conducted to find out the centerpoint of pterion from different landmarks, the findings of this study may be helpful to neurosurgeons.

Materials and Methods

The present study conducted with 96(192 sides) adult dry skull, which were collected from departments of Anatomy and Forensic medicine of multiple medical and dental institutions. 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. The dried skulls were obtained from departments and students were cleaned properly and found the pterion intact and without damage, the dirty and damaged in pterion area, those skulls were excluded from study. Skulls with pathologies such as porotic hyperostosis were also excluded. The morphometric measurements were carried out by measuring the distance from the centre of the pterion to six different locations of the skull including, distance from the center of the pterion to the anterior aspect of the frontozygomatic suture - PSFZ, distance from the center of the pterion to the zygomatic angle - PZAN, distance from the center of the pterion to the zygomatic arch - PZA, distance from the center of the pterion to Henle's spine- PH, distance from the center of the pterion to the mastoid process of the temporal bone - PMP, distance from the center of the pterion to the external occipital protuberance - PI[Figure. 1][9,10,11,12].

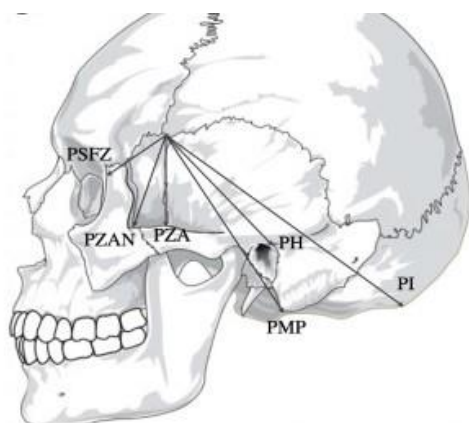


Figure 1. Showing distance of pterion from different landmarks[11]

Results

In present study we have observed the various parameters related to morphometric measurements dealing with distance of pterion from different landmarks. The distance from the center of the pterion to the anterior aspect of the frontozygomatic suture – PSFZ was 35.8+5.3mm in total, right side it was 36.4+6.2mm, left side it was 35.2+4.4mm, distance from the center of the pterion to the zygomatic angle – PZAN was 40.4+5.35mm in total, right side it was 41.2+5.8mm, left side it was 39.6+4.9mm. distance from the center of the pterion to the zygomatic arch – PZA 39.85+4.65mm, right side it was 40.2+5.7mm, left side it was 39.5+3.6mm, distance from the center of the pterion to Henle’s spine- PH was 61.55+4.25mm, right side it was 61.9+3.8mm, left side it was 61.2+4.7mm, distance from the center of the pterion to the mastoid process of the temporal bone – PMP was 85.7+5.65mm, right side it was 86.3+6.2mm, left side it was 85.1+5.1mm, distance from the center of the pterion to the external occipital protuberance – PI was 131.75+7.3mm, right side it was 134.6+8.2mm, left side it was 128.9+6.4mm. The parameters of male and females were measured separately and tabulated [Table. 1].

Distance	Mean+SD(mm)						
	Total	Sex			Side		
		Male	Female	p- Value	Right	Left	P- Value
PSFZ	35.8+5.3	36.7+5.6	35.8+3.4	0.02	36.4+6.2	35.2+4.4	0.003
PZAN	40.4+5.35	40.2+4.6	38.6+5.4	0.26	41.2+5.8	39.6+4.9	<0.01
PZA	39.85+4.65	39.7+3.8	38.8+5.6	0.07	40.2+5.7	39.5+3.6	<0.001
PMP	85.7+5.65	85.9+4.6	83.9+6.2	<0.002	86.3+6.2	85.1+5.1	<0.001
PH	61.55+4.25	62.2+4.6	61.3+5.2	0.08	61.9+3.8	61.2+4.7	0.821
PI	131.75+7.3	134.9+6.1	131.6+5.8	0.002	134.6+8.2	128.9+6.4	0.001
H- WIDTH	10.8+3.9	10.9+3.2	10.1+4.8	0.32	11.2+4.2	10.4+3.6	0.04

Table 1. Showing the distance of Pterion from different land marks according to gender and side(Right and Left).

Discussion

The pterion is a neurosurgical landmark on the lateral aspect of the skull that marks the confluence of the frontal, parietal, greater wing of sphenoid and squamous part of temporal bone converging into an H-shaped suture. This landmark corresponds to the anterolateral fontanelle of the neonatal skull and overlies vital structures of profound clinical significance. The pterion provides access to middle meningeal and middle cerebral vessels, Sylvian fissure, circle of Willis, anterior pole of insula and Broca's area in surgeries such as trephination for extradural haematoma, repair of aneurysms and in surgeries involving these areas. Deeper structures such as the optic nerve and the orbit can also be accessed through the pterion. The pterion position exhibits moderate variation in different ethnic groups and also exhibits sexual dimorphism. The significance of the pterion in neurosurgery is its location, as it overlies vital structures such as the frontal lobe with Broca's area, the temporal lobe, amygdala, hippocampus, insula, Sylvian fissure that provides access to the circle of Willis, optic nerve and chiasm, orbit, superior orbital fissure, supra-sellar and para-sellar regions and pituitary, middle meningeal and middle cerebral vessels, cavernous sinus and the midbrain. The pterional approach is hence, preferred by neurosurgeons in treating vascular aneurysms of circle of Willis and ophthalmic arteries, optic and olfactory meningiomas, cavernous sinus haemangioma, selective amygdalohippocampotomy and large tumours in supra-sellar and para-sellar regions[13].

In present study we have observed the various parameters related to morphometric measurements dealing with distance of pterion from different landmarks. The distance from the center of the pterion to the anterior aspect of the frontozygomatic suture – PSFZ was 35.8+5.3mm in total, right side it was 36.4+6.2mm, left side it was 35.2+4.4mm, in males it was 36.7+5.6mm and in females it was 35.8+3.4mm, distance from the center of the pterion to the zygomatic angle – PZAN was 40.4+5.35mm in total, right side it was 41.2+5.8mm, left side it was 39.6+4.9mm, in males it was 40.2+4.6mm and in females it was 38.6+5.4mm, distance from the center of the pterion to the zygomatic arch – PZA 39.85+4.65mm, right side it was 40.2+5.7mm, left side it was 39.5+3.6mm, in males it was 39.7+3.8mm and in females it was 38.8+5.6mm, distance from the center of the pterion to Henle’s spine- PH was 61.55+4.25mm, right side it was 61.9+3.8mm, left side it was 61.2+4.7mm, in males it was 62.2+4.6mm and in females it was 62.2+4.6mm, distance from the center of the pterion to the mastoid process of the temporal bone – PMP was 85.7+5.65mm, right side it was 86.3+6.2mm, left side it was 85.1+5.1mm, in males it was 85.9+4.6mm and in females it was 83.9+6.2, distance from the center of the pterion to the external occipital protuberance – PI was 131.75+7.3mm, right side it was 134.6+8.2mm, left side it was 128.9+6.4mm, in males it was 134.9+6.1mm and in females it was 134.9+6.1mm.

In a similar study conducted by Chaitra D[14] the mean distance from the midpoint of the zygomatic arch to the center of the pterion is 37.86 ± 2.62 mm and 33.31 ± 1.2 mm in males and females respectively. The mean distance from the midpoint of the frontozygomatic suture and the pterion is 31.10 ± 2.45 mm and 29.04 ± 1.27 mm in males and females respectively. There was a significant difference between the position of pterion of both sexes. The p-value was less than 0.001. The study conducted by Eboh D and Obaroefe M[15] reported there was no significant association between side of the head and pterion type. The mean distance of the pterion to the frontozygomatic suture was 31.56 ± 2.47 mm taking both side together, (left side = 31.08 ± 2.24 mm; right side = 32.06 ± 2.62 mm). The mean distance of the pterion to the midpoint of the zygomatic arch was 39.87 ± 3.16 mm taking both sides together (left side = 39.52 ± 3.32 mm; right side = 40.22 ± 2.98 mm). The mean distance of the pterion to the glabella was 77.51 ± 4.08 mm taking both side together (left side = 76.74 ± 4.27 mm; right side = 78.27 ± 3.77 mm).

According to study of Sunday AA[16], the mean distances from the pterion to the midpoint of zygomatic arch were 39.74 ± 0.505 mm and 39.95 ± 0.657 mm in males and females, respectively, while the distances to the frontozygomatic suture were 31.87 ± 0.642 mm and 30.35 ± 0.836 mm. The vertical position of the pterion was significantly higher in males than females. Bilateral occurrence is statistically insignificant. The study conducted by Uabundit N[11] in 100 dry skulls. The PMP distance, or the distance between the pterion center to the mastoid process of the temporal bone, was significantly longer in males. The PI distance, in other words, the distance from the pterion center to the external occipital protuberance, was also significantly longer in males. Significant differences in the morphometric measurements were found for between sides except for the PH distance and H-width, the present in accordance with this study.

In the study conducted by Sanjay Singh et al[17], reported 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. 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. 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. The study of Francis, T[18] revealed the distance from the center of pterion to posterolateral aspect of frontozygomatic suture as 3.46 ± 0.2 cm and from the center of pterion to the midpoint of the upper border of zygomatic arch as 3.98 ± 0.2 cm.

Conclusion. In present study some of the measurements which deals with distance of centre point of pterion from different landmarks were significant between male and female and sides also. This information may be helpful in neurosurgery practice and anthropologists.

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