

## Morphometric Study of Pterion in Dry Human Skull Bone in North Indian Population

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### ABSTRACT: -

*Pterion is the bony land mark which lies in the norma lateralis of the skull. It is almost H-shaped which is formed by the articulation of four bones with each other i.e. frontal, parietal, greater wing of sphenoid and temporal bones. The pterion is having a great clinical significance. The present study is done on 65 dry human skull mean 130 pteria of both sides of the skull (right and left sides) are studied. The morphological shapes of the pteria are noted, recorded and photographed. The study of the location of pterion from zygomatic-frontal suture and mid-point of superior border of zygomatic arch is done for the land marking of the pterion superficially in the temporal region. The aim of this study is to compare our study with the standard literature and studies done by other authors for any variations in the study. Out of 130 pteria studied, speno-parietal type of pterion is found in 94 (72.31%) cases, epipteric type in 30 (23.0%) cases, fronto-teporal type in 6 (4.61%) cases and stellate type of pterion is not found in the present study. Mean distance between zygomatico-frontal suture and central point of pterion is found to be (38.71±3.1037) mm on right side and (36.29±3.7307) mm on left side, the mean distance between midpoint of zygomatic arch and center point of pterion is found to be (39±2.5635) mm on right side and (37.00±3.3481) mm on left side. The anatomical variations are important. The epipteric type of pterion sometimes is considered as fractured skull which sometimes create problem neurosurgeons during their surgery. The present study will be helpful for neurosurgeons, anthropologists, forensic medicine and forensic dentologist in their diagnosis and treatment.*

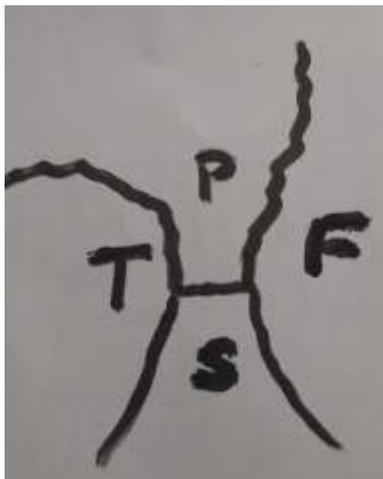
**Key words:** -Temporal fossa, suture, burr hole, haematoma, middle meningeal vessels, zygomatico-frontal suture, zygomatic arch, temporalis muscle. Forensic dentologist.

## INTRODUCTION: -

Pterion is a small area in 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 zygomatico-frontal suture, and marks the anterior branch of the middle meningeal artery and Sylvian point of the brain. 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. 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 for their clinical work. Most important surgery is done for the drainage of haematoma formed after the accident, the collection of blood occurs in subdural space, to drain the collected fluid or blood, the burr hole is done at the pterion site. A Knowledge of the surface anatomy of the middle meningeal artery is also important for accurate positioning of burr hole to evacuate extradural hematoma (Standring, 2011).

Murphy (1956) defined the pterion into four types i.e. the Spheno-parietal (SP), Fronto-temporal (FT), Stellate (ST) and Epipteric (EP).

**The spheno-parietal (SP) type pterion:** - This type of pterion is formed by the direct joining of greater wing of sphenoid with the antero-inferior angle of the parietal bones. Almost all the previous writers have described it as the most common suture (**Figure - I**).



**Figure - I**

**Spheno-parietal type of pterion**



**Figure - II**

**Fronto-temporal type of pterion**

**The fronto-temporal (FT) type of pterion:** - This type of pterion is formed by direct contact between the frontal and temporal bones (**Figure - II**).

**The stellate (ST) type of pterion:** - This type of pterion is formed by joining of the tips of all the four bones which looks like a star (**Figure - III**).

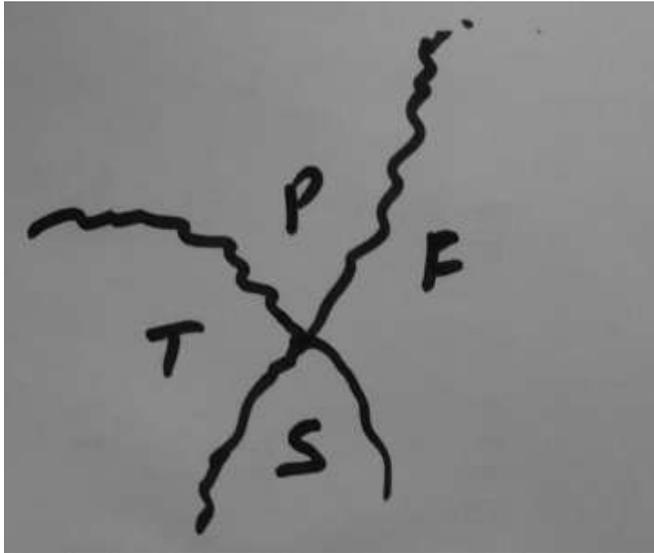


Figure - III

**Stellate type of pterion**



Figure -IV

**Epipteric type of pterion**

(P = Parietal bone) (F = Frontal bone) (T = Temporal bone) (S = Greater wing of sphenoid) (E = Epipteric bone)

**The epipteric (EP) type of pterion:** - This type of Pterion is formed by the presence of a bone in between the sutures of four bones and these are not joining with each other. The bone present is called as sutural, wormian or epipteric bone (**Figure - IV**).

The mechanism of formation of sutural bones is not fully understood. Some authors suggest that these bones develop from pathological influences such as hydrocephalus (Hess, 1946; Finkel, 1971) while others believe that sutural bones develop from normal processes and are genetically determined (Murphy, 1956; Pal and Routal, 1986).

The junction where the frontal, parietal, sphenoid and temporal bones are in close proximity is called pterion. The clinical consequences of skull fracture in this area can be very serious. The bone in this area is particularly thin and overlies the anterior division of the middle meningeal artery, which can tear in a skull fracture in this area, resulting in an extradural hemorrhage (Drake et al. 2010).

The pterion is two fingers breadth superior to the zygomatic arch and a thumb's breadth posterior to the frontal process of the zygomatic bone. A hard blow to the side of the head may fracture the thin bones which can rupture the frontal branch of the middle meningeal vessels crossing the pterion. The resulting in hematoma exerts pressure on the underlying cerebral cortex. An untreated middle meningeal vessels hemorrhage may cause death in a few hours (Moore et al. 2014; Snell, 2012).

One or more pterion ossicles or epipteric bones may appear between the sphenoidal angle of the parietal and the greater wing of the sphenoid. They vary in size but are more or less symmetrical. The sutural bones usually have little morphological significance. However they appear in great number in hydrocephalic skulls and other epigenetic variations in adult crania (Berry and Berry, 1967; and Berry, 1975).

Pterion is the important site for craniotomy which is preferred approach for the lesions located in the anterior branch of middle meningeal artery, sylvian fissure, sellar and parasellar regions, superior orbital fissure, sphenoidal wing, cavernous sinus, orbit, optic nerve, temporal lobe, midbrain and posterior- inferior frontal lobe (Apinhasmit, 2011; Chandana, 2011).

#### **MATERIAL AND METHODS: -**

The present study was done in the Department of Anatomy of Maharishi Markandeshwar Medical College and Hospital, Kumarhatti and District: Solan (Himachal Pradesh) India. The material for the study was 65 dry human skulls which will be collected from the Anatomy department of this college. The skulls were of unknown sex and race. Abnormal and broken skulls were discarded. Both the sides of skulls were studied for the types and position of the pteria. The shape of pteria were noted by looking the articulation of bones forming the sutures. The types of the pteria were noted and recorded. The photographs were taken of all the types of pteria.

For the estimation of pterion land mark, 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 with the help of vernier caliper from the midpoint on the zygomatic arch to the point marked at the centre of the pterion, and from the zygomatico-frontal suture to the point marked in the Centre of the pterion. The measurements were recorded. The present study was compared with the standard literature and studies done by other authors.

#### **OBSERVATIONS: -**

The present study is concluded on 65 dry human skulls. The study is done on 130 sides i.e. both right and left sides of 65 dry human skulls. The formation of pteria by four bones studied carefully and recorded and photographed. The measurements were taken with the help of vernier caliper as described in material and methods and recorded in millimeters. The mean of measurements were taken to estimate land marking of the pterion in the temporal fossa. The present study was compared with the standard literature and the study done by other authors (**Table - 4**).



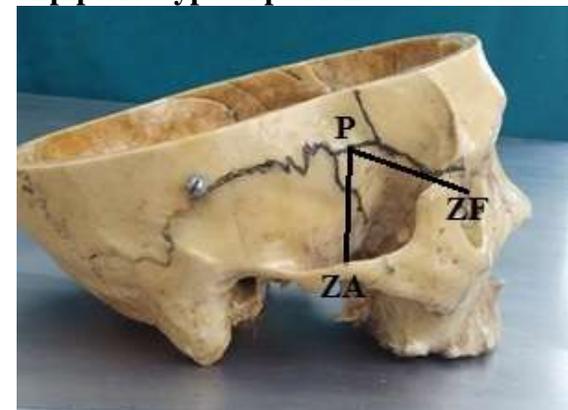
**Photograph-I**  
Spheno-parietal type of pterion



**Photograph-II**  
Epiptereric type of pterion



**Photograph-III**  
Fronto-temporal type of pterion



**Photograph-IV**  
Measurements for pterion

In the present study following are the findings and their percentage shown in the (Table – 1).

**Table - 1 Total number of sides (right and left) studied = 130**

Spheno-parietal type of Pterion		Epiptereric type of pterion		Fronto-temporal type of pterion		Stellate Type of pterion	
No. of pteria	% age	No. of pteria	% age	No. of pteria	% age	No. of pteria	% age
94	72.31	30	23.08	6	4.61	0	0

Highest rate of the type of Pterion is Spheno-parietal type (**Photograph - I**) which is found in 94 cases (72.31%) out of 130 cases and least type of pterion is fronto-temporal type (**Photograph - III**) in which only 6 (4.61%) cases were found out of 130 cases. The epiptereric type (**Photograph - II**) of pterion are found 30 (23.08%) cases in the present study. Mwachaka et al. (2009) reported (69.40%) cases of spheno- parietal type of pterion, Satpute (2015) also reported (82.94%) of cases.

The measurements done from the zygomatico-frontal (ZF - P) suture to the center point of pterion and midpoint of superior border of zygomatic arch (ZA - P) (**Photograph - IV**) for the location of pterion as landmark in the temporal fossa, the mean value of the measurements are given in the (**table - 2 and table - 3**).

**Table - 2** Mean of distance between zygomatico-frontal suture and center point of pterion

Distance in mm	SD	Distance in mm	SD
Right Side		Left side	
38.71	± 3.1037	36.29	± 3.7307

**Table - 3** Mean of distance between midpoint of zygomatic arch and center point of pterion

Right side		Left side	
Distance in mm	SD	Distance in mm	SD
39.00	± 2.5635	37.00	± 3.3481

From the above measurements given in (**Table -2 and Table - 3**) show that (ZF - P) distance is (38.71 ±3.1037 mm) on right side and (36.29±3.7307 mm) on left side. The distance (ZA - P) is (39.00 ±2.5635 mm) on right side and (37.00 ±3.3481 mm) on left side. From these measurement the location of the pterion can be estimated for land marking the pterion.

Standring et al. (2008) described that the pterion lies 4 cm above the midpoint of the superior border of the zygomatic arch and 3.5 cm behind the zygomatico – frontal suture.

Halim (2011) wrote in his book that pterion is neither a visible nor a palpable surface landmark. Its center can be located approximately 3.5 cm behind and 1.5 cm above the fronto-zygomatic suture. Shenoy et al. (2012) described in their study that the pterion was located 2.95 cm posterior to the fronto- zygomatic suture.

## **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 (Williams et al. 1998). Four types of pteria have been described by Murphy (1956). The types of pteria have been shown to exhibit ethnic variations (Murphy, 1956; Oguz et al. 2004).

Murphy (1956) studied 388 pteria and found that (73%) speno-parietal type, (7.5%) fronto-temporal type, (18.5%) stellate type and only (01%) epipteric type of pteria.

Mwachaka et al. (2009) observed that speno-parietal type of pterion is higher in occurrence (66%) and least common is epipteric type of pterion (7.0%), 15% fronto-parietal and 12% were stellate type of pterion. Satpute and Wahane (2015)<sup>14</sup> observed that speno-parietal type of pterion is most common seen in Northern Indians (82.35%) on right side and (83.52%) on left side and average it was (82.94%). Fronto-temporal (2.94%), Stellate (5.29%), epipteric (8.84%) and atypical (1.76%).

The incidence of epipteric bone is high in Indian population. A study done by Saxena et al. (1988) shown that (11.79%) of Indian skulls had epipteric bones. 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. They reported (95.30%) sphe-no-parietal, (10.10%) fronto- temporal type, (11.79%) epipteric type and (1.38%) stellate type of pteria.

Zalawadia et al. (2010) reported that sphe-no-parietal type of pterion is most common seen in Gujarat is (91.7%), epipteric (4.8%) fronto-temporal (2.4%) and stellate (1.2%).

Shenoy et al. (2012) reported in their study out of 150 sides of skulls 116 sides were having sphe-no-parietal type of suture i.e. (77.33%). It is higher in rate as compared to other sutures, like epipteric (21.33%), stellate (1.33%) and fronto-temporal type of suture was not found in their study.

Praba and Venkatramaniah (2012) done their study on 50 dry adult skulls and reported that sphe-no-parietal type of pterion was higher on side (74.0%), epipteric (14.0%), stellate (9.0%) and fronto-temporal was least on side i.e. (3.0%).

Seema and Mahajan (2014) repoted in their study on North Indian population, they found that sphe-no-parietal type of pterion was (82.0%), epipteric type of pterion (9.0%), fronto-temporal type (5.0%), and stellate type (4.0%). Again they reported that higher rate was of sphe-no-parietal and least rate was of stellate type of pterion.

**Table -4 Comparison of the studies of pterion with their present study in % age**

Authers &Year	Spheno-parietal type	Epipteric type	Fronto- temporal type	Stellate type
Murphy (1956)	73.00	01.00	7.50	18.50
Saxana (1988)	72.00	11.79	3.46	1.38
Mwachaka et al.(2009)	66.00	07.00	15.00	12.00
Zalawadia et al. (2010)	91.70	04.80	2.40	1.20
Praba &Venkatramiah (2012)	74.00	14.00	3.00	9.00
Shenoy et al. (2012)	77.33	21.33	----	1.34
Seema and Mahajan (2014)	82.00	9.00	5.00	4.00
Satpute and Wahane (2015)	82.94	8.84	2.94	5.28
Present study(2016)	72.31	23.08	4.61	0

In the present study out of 130 sides of skulls, 94 (72.31%) sides were having sphenoparietal type of pterion. Epipteric type of pterion was found in 30 (23.08%) cases and 6 (4.61%) cases were found to be having frontotemporal type of pterion. No case of stellate type of pterion was found in this study. All the three types of pteria found were bilaterally present.

Saxena et al. (1988) reported that Indian skulls have more epipteric bones as compared to other population. They reported (11.79%) cases in their study, while in the present study epipteric type of pterion is found in 30(23.08%) cases out of 130 cases studied. The present study shows that presence of epipteric bones are more common in Indian population.

### **Conclusion: -**

The pterion is the weakest point of the human skull present in the temporal fossa which is formed by the four bones i.e. parietal, frontal, greater wing of sphenoid and temporal bones. This is most common site for fracture due to presence of thin bones. There are chances of collection of fluid or blood which can cause the compression to the brain substance which can result in the death of the patient. So the burr hole is done to release the compression on the brain substance. The knowledge of various types of pteria are important, especially epipteric type which can be mistaken for fractured bones. In the present study the results of all types of the pteria are almost matching with other studies but the presence of epipteric type of pterion is more as compared to other studies. It shows that epipteric type of pteria are more common in Indian population. The measurements for location of pterion in the temporal fossa will help in the surface marking of pterion. The present study will be helpful to the anatomists, neurosurgeons, anthropologist, forensic medicine and forensic dentistry in their diagnosis and treatment.

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