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Original Research Article

Variations in the Position of Pterion in Tamil Nadu Crania

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Abstract

Background: The variations of the position of the pterion in the crania are common factor because it represents, anthropological and anatomical significant but it has surgical important as middle meningeal artery lies below the pterion and more prone to get injury leads extradural hematoma

Method: 45 (forty-five) non-pathological adult crania were studied. Linear distances were measured from the central point of pterion to PZT and PFZ. The measurement was carried out by a digital vernier calliper.

Results: All four types of pterion were observed. The spheno-parietal being the most common. The mean values of distance between the pterion and PZT and PFZ have a significant p-value ($p < 0.001$).

Conclusion: Present morphometric study will be useful for neurosurgeons, radiologists, anthropologists, and anatomists because variations in morphometric values of mesoderm-origin derivatives are quite common.

Keywords: Digital Vernier Caliper, Spheno-Parietal Pterion, Burrhole, Epipetric Bone.

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Introduction

The word "pterion" was coined by Broca in 1875, derived from “pteron” which means "wing." The pterion is a bony landmark on the lateral aspect of the skull that marks the junction of the squamous part of the frontal bone [1]. Sphenoidal angle of the parietal bone, and squamous part of the temporal bone. These bones converge to form an english alphabet H-shaped suture. The pterion in cranial anatomy is the weakest point on the skull and is vulnerable to injury in traumatic events. This intersection also carries clinical importance owing to its proximity to key neuro vascular structures, most notably the middle meningeal artery that courses directly beneath this area [2].

The pterion corresponds to the site of the anterolateral fontanelles of the neonatal skull, which closes in the 3rd month after birth. The joints of the cranial vault are sutural joints that ossify in membranes. A sutural bone is sometimes present at the pterion. This bone is called the pterion ossicle, epipteric bone, or flower bone [3]. Variations in the position of the pterion have evolutionary landmarks. It is revealed that bones of the cranial vault, especially the norma lateralis. The greater wing of the sphenoid and parietal bone prevent the temporal and frontal bones from articulating at pterion. Hence, variations in the articulation at the junction of the pterion suture has different pattern of suture [4]. During the trauma at Norma lateralis, the pterion is more prone to getting fractured and leads to an extradural haematoma beneath the pterion. Hence, an attempt is made to study the different pattern and location of the pterion. And it’s various positions and its distance to zygomatic bone.

Material and Method

45 (forty-five) adult male skulls available in the anatomy and forensic and toxicology departments, Indira Medical College and Hospital, VGR Nagar, Pandur, Tiruvallur, Tamil Nadu-631203, were studied. Were selected for study.

Exclusion Criteria: Pathological, broken skulls were excluded from the study.

Method: The selected adult skull was put in an anatomical position. The sutural pattern of the pterion was carefully studied using Murphy's classification. Pterion was classified into four types.

1. Sphenoparietal Type (SP): greater wing of sphenoid articulates with parietal bone to form letter H shaped suture (Fig A).
2. Frontotemporal Type (FT): Frontal and squamous part of temporal bones are in direct contact (Fig B).
3. Stellate Type(S): Characterized by the articulation of frontal, parietal temporal and

sphenoid bone at a point to form letter X or K (Fig C)

4. Epipteric Type: Defined by the presence of small sutural bone that articulates with bones of pterion (Fig D).

The linear distances of the pterion to the most anterolateral point on the frontozygomatic suture (P-FZ) and pterion to superolateral point on zygomaticotemporal suture (P-ZT) were measured with a digital vernier caliper (Kawasaki Company, Japan).

The duration of study was from June 2025 to May 2026.

Statistical Analysis: Linear measurement distances were measured (in mm) from the pterion to P-ZT, PFZ, (please clarify this) mean values between both P-ZT and P-FZ on both sides were compared with a t-test, and significant values were noted. The statistical analysis was carried out using SPSS software.

Observation and Results

Table 1: Linear distance (mm) from pterion to the points on suture

- Distance between centres of pterion to Sup. lat. P-ZT suture: linear range was on right suture 3.34-4.83 and mean value was 3.95 (± 1.02), on left the range was 2.72-4.54 and mean value was 3.83 (±0.3), total range was 2.72 (±4.83) and value was 3.90 (±1.1).
- Distance between centre of pterion to ant lat. P-FZ suture on right side the range was 2.63-4.72 and mean value was 3.72 (±0.5), on left side the range was 2.40-4.92, the mean value 3.62 (±0.9). The total range was 2.40-4.92, the mean value was 3.66 (±1.7).

Table 2: Comparison of mean value distance between centre of pterion to Sup. lat. surface P-ZT suture and distance between centre of pterion to P-FZ suture.

- In P-ZT – To centre of pterion 3.95 (±0.8) right side, 3.83 (±0.3) left side, t test was 2.23 and $p<0.001$ (p value is highly significant).
- In P-FZ to centre of pterion 3.72 (±0.2) right side, 3.62 (±0.1), left side, t test was 3.00 and $p<0.001$(p value is highly significant).

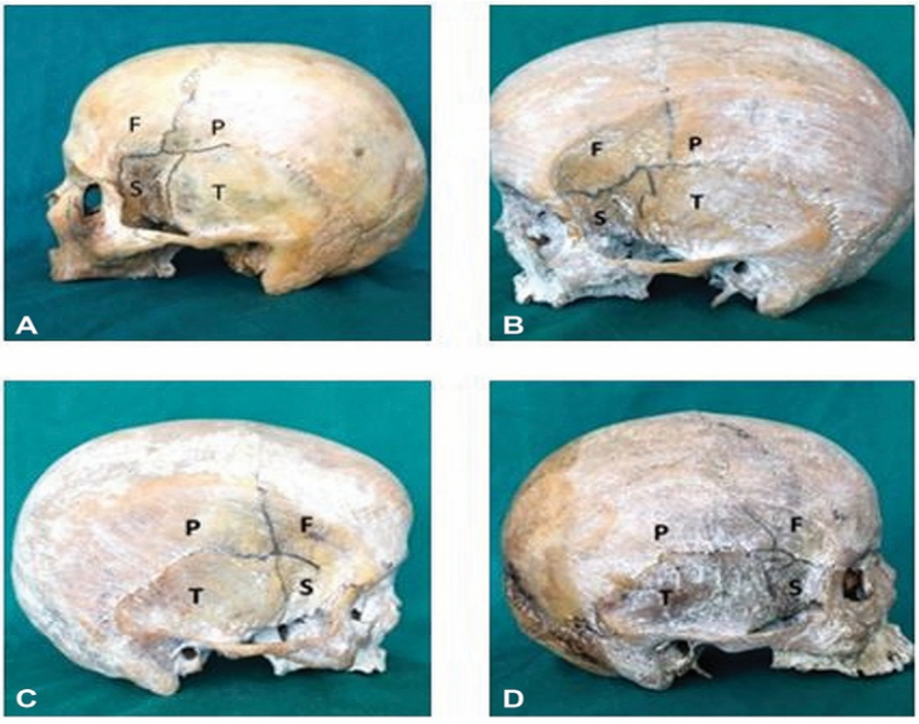

Figure 1: Various types of pterions as per Murphy's classification. (A) Aphenoparietal, (B) Frontotemporal, (C) Stellate, (D) Epipteric.

Table 1: Linear distance (mm) from pterion to the points on suture

Distance (mm)	Right side (N=45)		Left side (N=45)		Total 95	
	Range	Mean (±SD)	Range	Mean (±SD)	Range	Mean (±SD)
Distance between centres of pterion to sup. lat. PZT suture	3.34-4.83	3.96 (±1.02)	2.72-4.54	3.83 (±0.3)	2.72-4.83	3.90 (±1.1)
Distance between centres of pterion to sup. lat. PFZ suture	2.63-4.72	3.72 (±0.5)	2.40-4.92	3.62 (±0.9)	2.40-4.92	3.66 (±1.7)

PFZ → Point on Fronto Zygomatic PZT → Point on zygomatico temporal

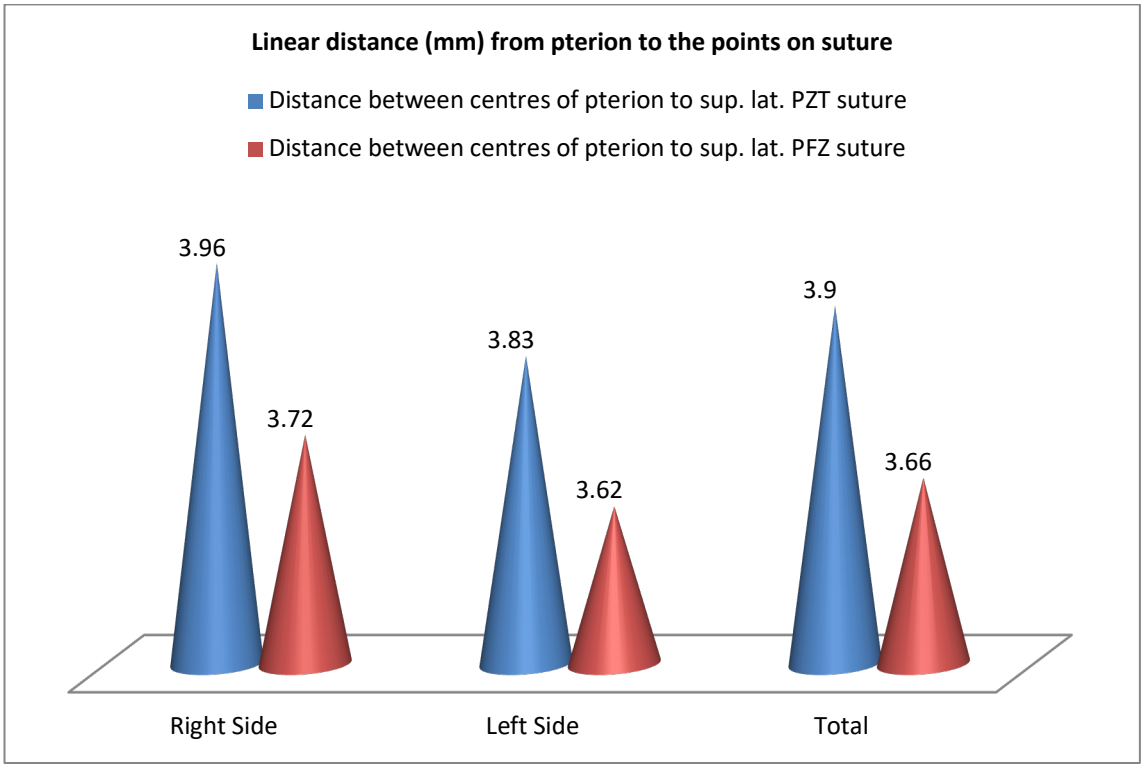

Figure 2: Linear distance (mm) from pterion to the points on suture

Table 2: Comparison of Mean value distance between centre of pterion to superolateral, PZT suture and distance between pterion to PFZ suture

Right side Mean value	Left side Mean value	t test	p value
3.95 (±0.8) PZT pterion	3.83 (±0.3)	2.23	P<0.001
3.72 (±0.2) PFZ pterion	3.62 (±0.1)	3.00	P<0.001

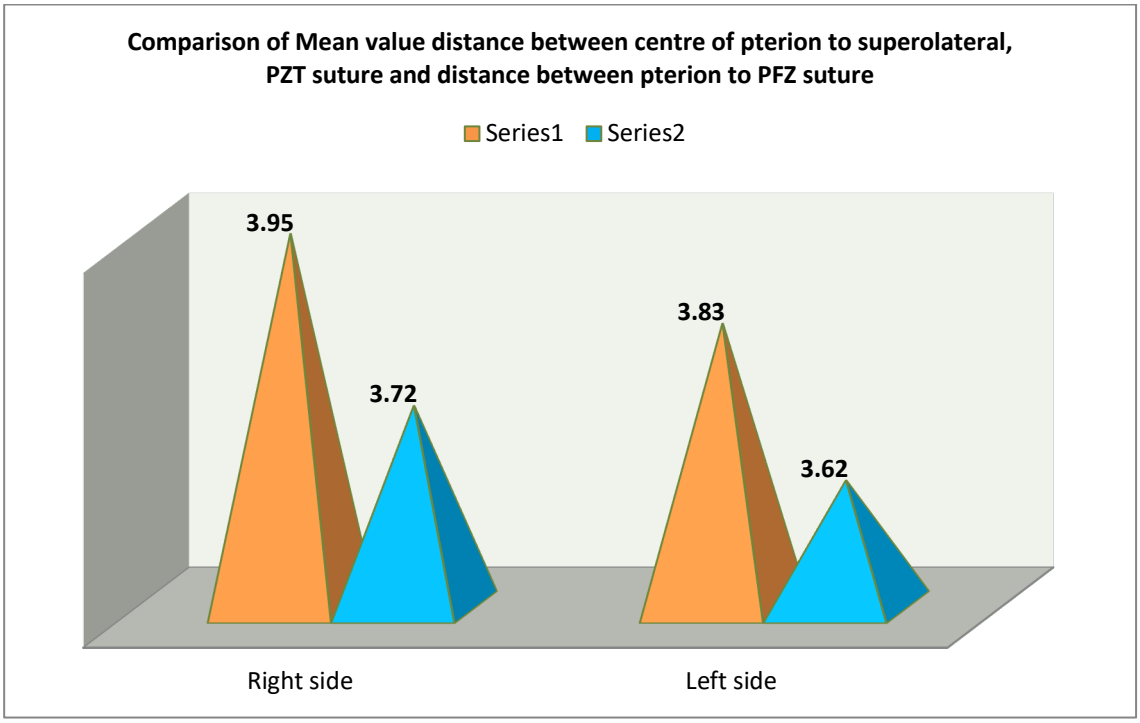

Figure 3: Comparison of Mean value distance between centre of pterion to superolateral, PZT suture and distance between pterion to PFZ suture

Discussion

A present study of variations in the position of the pterion in Tamil Nadu crania. The linear distance (mm) from the pterion to P-ZT (point on Fronto zygomatic temporal. The range on the right side was 3.34-4.83, and on the left side, the range was 2.72-4.54. The mean value on the right side is 3.95 (±1.02) and on the left side is 3.90 (±1.10). Distance between the centres of pterion to P-FZ (point on Front Zygomatic). The range on the right is 2.63-4.72, and on the left side, it is 2.40-4.92. The mean value on the right side is 3.72 (±0.5), and on the left side is 3.66 (±1.7) (Table 1). The comparison of distance between the centre of the pterion to P-ZT on the right and left sides had a significant p value ($p<0.001$). Similarly, the comparison of distance between the centre of pterion to P-FZ between the right and left sides has a significant p-value ($p<0.001$) (Table 2) (Figure 1). These findings are more or less in agreement with previous studies [5,6,7]. These variations could be the skeleton or crania of an individual adapted to its owner's way of life. The role of landmarks in the positioning of burr holes in relation to the pterion is crucial for neurosurgeons as they have been developing the surgical approaches, attempting to achieve maximal surgical exposure with minimal brain retraction during the removal of extradural haematoma procedures [8]. There are many factors known to influence and modify the course of bone development, such as deprivation of raw materials and vitamins, hormonal imbalances and abnormal bio-mechanical situations.

The exact determination of the sutural pattern formed by the articulation of cranial bones is not fully understood. It is reported that MSX2 (on 5935.2), a gene of the homeobox family, may have some role in the determination of sutual pattern [9]. The sutural patterns of pterion also indicate the volume of the brain, as the development of the calvarium is tightly coordinated with the type of brain since the cranial sutures undergo a series of morphological changes from birth till childhood owing to the growth of the brain.

All these factors or hypotheses regarding variations of position in the pterion could be due to ethnical and racial factors, as the cranial index varies in sexes, regions and races, adopting the environmental factors and diverse ethnic factors. There is abundant evidence showing that bones can undergo changes in it's shape and function in response to nutritional and environmental changes [10].

Normal growth of the bone is dependent on the anterior pituitary, which stimulates cell division in cartilaginous growth plates at the end of the bones. The sex hormones and hormones of the adrenal cortex antagonise the actions of growth hormones and thyroxine and bring about the normal cessation of growth in adolescence [11]. The capacity and articulations of membranous bones depend on intrinsic properties of periosteal tissues and not on the chemical variations. The process of ossification is associated with the appearance of a local enzyme called 'phosphatase'. Moreover, nutrition plays a vital role in the development of bones, as vitamin A controls the activity distribution and coordination of the osteoblastic and osteoclastic activity to the sites where it is normally found, and the reaction is often very intense in nature [12].

Summary and Conclusion

The present study of the identification of variations in the position of the pterion in Tamil Nadu crania is very important to the neurosurgeon because accurate localization of the pterion and understanding of the various morphological types are essential for the neurosurgeon; improper drilling can result in orbital penetration or injury to underlying neurovascular structures. These significant values and ranges between the central point of the pterion and the P-FZ suture and P-ZT sutures have surgical, radiological, anthropological, and anatomical significance because morphometrical study of mesodermal derivates are uncertain.

Limitation of study: Owing to remote location of research centre, small number of crania, lack of latest techniques, we have limited findings and results.

This research work was approved by the ethical committee of Indira Medical College and hospital, VGR Nagar, pandur, Tiruvallur, Tamil Nadu-631203.

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