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Original Research Article

Pterion topography in dry human skulls: A comprehensive institutional analysis from Kashmir valley, Northern India

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ABSTRACT

Introduction: The pterion is an important boane marker due to its frequent proximity to Broca's Area and the anterior branch of the middle meningeal artery.
Aim & Objectives: The aim of the study was to examine the different types of pterions and gauge the distance between bony landmarks on the skull and the midpoint of the pterion.
Materials and Methods: The study used 30 adult dried human skulls of undetermined age and sex. Bilateral observation of pterion types and locations was made. The fronto-zygomatic suture, the center of the zygomatic arch, the tip of the mastoid process, the glabella, the anterosuperior edge of the external auditory meatus, and the asterion were all measured using a digital Vernier caliper.
Results: A total of five varieties of pterions were observed; Spheno-parietal, frontotemporal, stellate, epipteric, and atypical pterion. Bilaterally Sphenoparietal was the most prevalent form of skull among those examined. The mean distances from the midpoint of the pterion to the fronto-zygomatic suture were 30.99±5.48 mm and 30.21±5.72 mm, respectively. The average distances to the middle of the zygomatic arch were 37.77± 3.61 mm and 37.94±3.89 mm, respectively. The average distances to the asterion were 82.54±7.18 mm and 84.43±6.78 mm. The mean distances to the external acoustic meatus were 50.70±3.18 mm and 51.35±3.37 mm; to the glabella, it was 78.01±6.15 mm and 75.66±6.73mm; to the tip of the mastoid process, it was 80.27±6.20 mm on the right side and 78.98±5.45 mm on the left side.
Conclusion: The pterion is the most popular surface landmark. Neurosurgeons, radiologists, anthropologists, and forensic pathologists will benefit from the study's findings about the classification of pterion.

1. Introduction

The floor of the temporal fossa's front portion is made up of four bones, including the frontal, parietal, greater wing of the sphenoid, and squamous temporal bone. These four bones are interconnected and create a sutural junction that resembles the shape of an "H," which is known as the pterion. [1–4] The Pterion is an important anatomical landmark located at the center of a roughly H-shaped junction formed by the frontal, parietal, greater wing of sphenoid, and squamous temporal bones. Clinically, it is significant as it lies over the anterior branch of the middle meningeal artery, middle meningeal vein, and the stem of the lateral sulcus of the cerebral hemisphere (known as the sylvian point). [1–6] Other structures related to the Pterion include Broca's area 44, 45, the anterior pole of the insula, and the middle cerebral artery. [7] It is located within a circle of approximately 1 cm in diameter, centered 2.6 cm posterior and 1.3 cm superior to the posterolateral margin of the Frontozygomatic suture. [1,6] The distance from the center of the Pterion to the Frontozygomatic suture varies between 2.5 cm to 3.5 cm, as reported by different authors. [3,4]

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The pterion is situated about 4 cm above the midpoint of the zygomatic arch and is the weakest area of the skull due to its thin bones.[1,4,8] Traumatic impact on this area can result in the rupture of the middle meningeal vessels and the formation of an extradural hematoma, which may put pressure on the motor area of the cerebral cortex. To stop the bleeding, the damaged artery or vein must be tied or blocked, and a burr hole in the skull wall should be placed approximately 1 to 1.5 inches (2.5 to 4 cm) above the midpoint of the zygomatic arch. Several sources report the pterion's location and its vulnerability to trauma.[1,5]

Murphy has classified pterions into four types based on the bones that are in contact with each other. The first type is the sphenoparietal type, where the sphenoid and parietal bones are directly in contact. The second type is the fronto-temporal type, where the frontal and squamous temporal bones are directly in contact. The third type is the stellate type, where all four bones articulate with each other at one point. The fourth and final type is the epipteric type, which is characterized by the presence of small sutural bones between the four bones.[9]

Several studies have investigated the pterion topography in different populations using various methods, such as direct measurements, radiographic imaging, and digital models. However, there is limited data on the pterion topography in the Northern Indian population, particularly in the Kashmir Valley region, which is known for its unique genetic and cultural diversity.

To address these gaps in knowledge, we conducted a comprehensive institutional analysis of pterion topography in dry human skulls from the Kashmir Valley region. Our study aimed to determine the location, shape, size, and variability of the pterion, as well as its relationships with other cranial landmarks. We used direct measurements to obtain accurate and reliable data. The results of our study can provide valuable information for neurosurgeons, anatomists, anthropologists, and other professionals who deal with the craniofacial region.

2. Materials and Methods

2.1. Study design

Cross sectional study.

2.2. Sample collection

Thirty adult dried human skulls of unknown age and sex were obtained from the Department of Anatomy, Government Medical College Srinagar, and were used for the study.

Bilateral observation: The skulls were examined bilaterally for the types and locations of the pterion. The pterion types were classified based on their locations as sphenoparietal, frontotemporal, or stellate.

Identification of landmarks: The following anatomical landmarks were identified on each skull and used for measurements: the fronto-zygomatic suture, the center of the zygomatic arch, the tip of the mastoid process, the glabella, the anterosuperior edge of the external auditory meatus, and the asterion. These landmarks were identified using a combination of visual inspection and palpation.

2.3. Measurement

Measurements were taken using a digital Vernier caliper (resolution 0.01 mm) to the nearest 0.1 mm. The distance between the fronto-zygomatic suture and the center of the zygomatic arch, the distance between the center of the zygomatic arch and the tip of the mastoid process, the distance between the glabella and the anterosuperior edge of the external auditory meatus, and the distance between the asterion and the midpoint of the lambdoid suture were measured.

2.4. Data recording

Data were collected and recorded in Microsoft Excel spreadsheets.

2.5. Data analysis

Descriptive statistics, including mean, standard deviation, and frequency distribution, were used to analyze the data.

Ethical considerations: The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and was approved by the institutional ethical committee.

3. Results

Table 1: Prevalence of pterion types among examined skulls

Pterion Type	Frequency	Percentage
Spheno-parietal	25	83.33%
Frontotemporal	2	6.67%
Stellate	1	3.33%
Epipteric	1	3.33%
Atypical	1	3.33%
Total	30	100%

Table 1 displays the prevalence of pterion types among the 30 examined skulls. Five varieties of pterions were observed in the study, with the most prevalent form being the spheno-parietal pterion, accounting for 83.33% of the examined skulls. The frontotemporal and stellate pterion types were relatively rare, accounting for only 6.67% and 3.33%, respectively. The epipteric and atypical pterions were also observed but were also rare, each accounting for 3.33% of the examined skulls. Overall, the results indicate that the spheno-parietal pterion is the most common type in

Table 2: Mean distances from midpoint of pterion to landmarks (in mm)

Landmark	Right Side	Left Side
Fronto-zygomatic suture	30.99±5.48	30.21±5.72
Center of zygomatic arch	37.77±3.61	37.94±3.89
Asterion	82.54±7.18	84.43±6.78
External acoustic meatus	50.70±3.18	51.35±3.37
Glabella	78.01±6.15	75.66±6.73
Tip of mastoid process	80.27±6.20	78.98±5.45

the population studied.

Table 2 presents the mean distances from the midpoint of the pterion to various landmarks on both the right and left sides. The measurements were taken using a digital Vernier caliper. The table shows that the mean distances to thefronto-zygomatic suture were similar on both sides, with a range of 30.21-30.99mm. The mean distances to the center of the zygomatic arch were also similar on both sides, ranging from 37.77-37.94mm. The mean distances to the asterion were slightly different on the right and left sides, with ranges of 82.54-84.43mm. The mean distances to the external acoustic meatus were also slightly different on the right and left sides, with ranges of 50.70-51.35mm. The mean distances to the glabella were higher on the right side (78.01mm) compared to the left side (75.66mm). Finally, the mean distances to the tip of the mastoid process were slightly different on the right and left sides, with ranges of 80.27-78.98mm. These results provide detailed information on the topography of the pterion and its relationship to various anatomical landmarks in the population studied.

4. Discussion

The pterion is a crucial landmark for neurosurgeons, anthropologists, and radiologists because of its association with the middle meningeal artery and its proximity to the temporal lobe. In this study, we investigated the topography of pterion in dry human skulls from the Northern Indian population, particularly in the Kashmir Valley region. We observed five types of pterion, including spheno-parietal, frontotemporal, stellate, epipteric, and atypical pterion. The spheno-parietal pterion was the most prevalent type, which is consistent with several studies conducted in other populations.[10,11]

Our study found that the mean distance from the midpoint of the pterion to the fronto-zygomatic suture was 30.99±5.48 mm and 30.21±5.72 mm, respectively. This finding is similar to previous studies conducted in the Indian population.[12,13] However, it is lower than the distance observed in a study conducted in the other population.[14] This discrepancy might be due to differences in skull morphology and population genetics.

The average distances from the pterion to the middle of the zygomatic arch were 37.77±3.61 mm and 37.94±3.89 mm, respectively. This finding is consistent with previous studies conducted in the Indian population.[12,13] However, it is slightly lower than the distance observed in studies conducted in other populations.[15,16] This difference might be due to variations in skull morphology and population genetics.

The mean distances to the asterion were 82.54±7.18 mm and 84.43±6.78 mm. This finding is consistent with previous studies conducted in the Indian population.[12,13] This difference might be due to variations in skull morphology and population genetics.

The mean distances to the external acoustic meatus were 50.70±3.18 mm and 51.35±3.37 mm, respectively. This finding is consistent with previous studies conducted in the Indian population.[12,13] However, it is lower than the distance observed in a study conducted in the other population.[17] This difference might be due to variations in skull morphology and population genetics.

The mean distance to the glabella was 78.01±6.15 mm and 75.66±6.73mm, respectively. This finding is similar to previous studies conducted in the Indian population.[12,13] However, it is higher than the distance observed in a study conducted in the other population.[18] This difference might be due to variations in skull morphology and population genetics.

The mean distances to the tip of the mastoid process were 80.27±6.20 mm on the right side and 78.98±5.45 mm on the left side. This finding is consistent with previous studies conducted in the Indian population.[12,13] However, it is higher than the distance observed in a study conducted in other population.[14] This difference might be due to variations in skull morphology and population genetics.

5. Conclusion

This study investigated the topography of pterion in dry human skulls from the Northern Indian population, particularly in the Kashmir Valley region. The study observed five types of pterion, and the spheno-parietal pterion was found to be the most prevalent type. The study also provided valuable information on the distances from the pterion to various landmarks on the skull. The findings of this study can be useful for neurosurgeons, anthropologists, and radiologists who deal with cranial surgeries and forensic cases. Additionally, this study contributes to the global understanding of the variations in pterion topography among different populations.

6. Source of Funding

None.

7. Conflict of Interest

None.

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