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MORPHOMETRIC ANALYSIS OF PTERION: A CLINIC-ANATOMICAL STUDY IN NORTH INDIAN DRY SKULLS

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ABSTRACT

Pterional approach is the most versetile approach in neuro-surgery. It is used for the access to the structures of anterior and middle cranial fossa, so the morphometry of pterion is clinically important. The study was conducted in the department of Anatomy, IIMS & R, Lucknow; on 60 dry human skulls of north Indian origin. The most common type of sutural pattern found was sphenoparietal type (89.2%) followed by stellate type (5%). The average distance of center of pterion from superior edge of midpoint of zygomatic arch was 3.68±0.35 cm on left and 3.71±0.39 cm on the right side and from posterolateral aspect of frontozygomatic suture was 3.11±0.40 cm on the left side and 3.20±0.39 cm on the right side. Average distance measured between the center of pterion and anterosuperior margin of auditory meatus was 5.12±0.32 cm and 5.19±0.59 and to the inferior margin of mastoid process was 8.13±1.45cm and 8.02±0.58 on the left side and right side respectively. These findings can be helpful to locate pterion.

INTRODUCTION

Pterion is defined as an H-shaped small circular area formed by the junction of four bones: frontal, parietal, temporal and sphenoid on norma lateralis of the skull, being approximately 4.0 cm above the zygomatic arch and 3.5 cm behind frontozygomatic arch (Moore et al. 1999, Ersoy et al. 2003, Saxena et al. 2003).

It is a craniometric point that is related to structures in the cranial cavity. It is an important landmark for the anterior branch of the middle meningeal artery, Broca's area, the insula, and the stem of the lateral sulcus. It marks the anterior middle meningeal arterial ramus, pterional fractures may therefore tear the frontal branch of middle meningeal artery leading to extra dural haematoma (Lama et al. 2000). It is also a primary site during surgery to gain access to the sphenoid ridge and optic canal (Saxena et al. 2003).

According to sutural pattern the pterion was classified in different types by different authors; three types by broca, four types by Murphy and six types by Wang (Wang 2006). Murphy in 1956 classified the pterion as four types, sphenoparietal, frontotemporal, stellate and epipteric, which we utilized in present study.

As the pterion is covered by the scalp its loction cannot be determined without use of palpable landmarks. The present study was designed to find out the percentage of different pterional types in human skulls and to measure the distance of various identifiable bony landmarks from the center of pterion.

MATERIAL AND METHODS

A total of 60 dry human adult aged skull of unknown sex without any gross pathology or abnormality is studied. The skulls were collected from the Department of Anatomy, Integral Institute of Medical Sciences & Research, Lucknow and King George's Medical University, Lucknow. Other material utilized were green cotton sheet, thread, scale, venire calipers, compasses and color pencil.

On both the left and right sides of each skull, the sutural pattern of the pterion is determined (based on Murphy's classification) and noted. (figure 1A, B, C, D)

For measurement of distance of pterion from different bony landmarks the center of pterion was first established, with the help of compass utilizing perpendicular bisectors theorem. The suture between the bones coming in direct contact at pterion (sphenoid and parietal in case of sphenoparietal type and frontal and temporal in case of frontotemporal type) was utilized. Firstly one end of the suture was taken as a centre and arcs having more than of the half of the length of suture were drawn above and below. Then other end of suture was taken as centre and arcs were drawn above and below (figure 2A). The points where both arcs were intersected were joined by a scale. Thus obtained line was halved using perpendicular bisector

and the mid-point was taken as the centre of pterion. (figure 2 B,C,D). Same procedure was repeated to establish centre of frontotemporal type (figure 3 A, B).

In case of stellate type the meeting point of all four bones was taken as centre. All the epiteric type of pterion found were associated with sphenoparietal type, so the center of it was taken using two points where the wormian bone met the fronto-sphenoidal suture and pareito-temporal suture.

Measurement of distance of center of pterion from important bony landmarks: The distance of center of pterion was measured from different bony landmarks in all skulls on both right and left side. Measurements were done with the help of both manual and digital calipers (figure 4).

PFZ: distance from the centre of the pterion to the posterolateral aspect of the frontozygomatic suture.

PZA: the distance from the centre of the pterion to the superior edge of mid-point of zygomatic arch

PPM: distance from the centre of the pterion to the most inferior aspect of the mastoid process.

PSS: Distance from the centre of pterion to the anterosuperior margin of external auditory meatus.

Statistical analysis

The results are presented in mean±SD and percentages. The Unpaired t-test is used to compare the distances between left and right side of skull. The p-value<0 .05 is considered significant. The analysis is carried out by using Statistical Program for Social Sciences (SPSS) ver. 16.0 (Chicago, Inc., USA).

Observations and results

Type of pterion

In present study we found that sphenoparietal was the commonest type of pterion in both left (86.7%) and right (91.7%) side of skull. Second most common type of pterion found was stellate type (5%) in both right and left side. The findings were tabulated in table 1.

Distance of center of pterion from various bony landmarks. The average of measured distance of center of pterion from various bony landmarks were noted and tabulated in table 2.

It was found that most of the distances were higher on the right side than on the left side. However the differences were not statistically significant.

Discussion

In neurosurgery, it is important to have the most suitable bony aperture in order to be minimally invasive (Ersoys et al. 2003). Pterional access has either alone or in combination with other approaches has paved the way for the management of wide variety of neurosurgical disorders with minimal tissue injury. So knowledge of its peculiar morphology is mandatory for the pterional approach used in microsurgery and surgery (Uruzi et al. 2003).

Most common type of pterion reported in different studies is sphenoparietal type ranging from 81% to 95% (Saxena et al. 1988, Manjunath et al. 1993, Apinhasmit et al. 2011). The second most common variety reported is either frontotemporal (Saxena et al. 1988, Suchit et al. 2011) or epipteric type (zalawadia et al. 2010, Nair et al. 2014). In present study the most common type of pterion was sphenoparietal type (89.2%) followed by stellate type (5.0%).

The average distance of pterion from mid-point of zygomatic arch found in present study was less than mentioned by the Ukoha et al. 2013 and Eboh et al. 2014 in Nigerian skull but similar to that reported by Kumar et al. 2013 in north Indian skull. The pterion in present study was found to be located more posteriorly than mentioned by the Ukoha et al. 2013 in Nigerian skulls and Apinhasmit et al. 2011 in thai skulls but the distance is almost similar that mentioned by the Kumar et al. 2013 in north Indian skulls.

The distance of pterion from the anterosuperior margin of external auditory meatus and from inferior margin of mastoid process, we measured in present study can be more useful as the two are very clearly palpable and point landmark rather than linear.

CONCLUSION We concluded that the pterion was predominantly sphenoparietal type and is typically located 37 mm superior to the zygomatic arch, 32 mm posterior to the frontozygomatic suture. The average distance between anterosuperior margin of external acoustic meatus was 5cm and to that of inferior margin of mastoid process was 8 cm. Anatomical variations of the pterion, which are of interest to anthropologists, forensic pathologists and surgeons, deserve further investigation in other populations from different geographical areas.

Figure 1: type of pterion A) sphenoparietal type B) frontotemporal type C) stellate type D) epipteric type

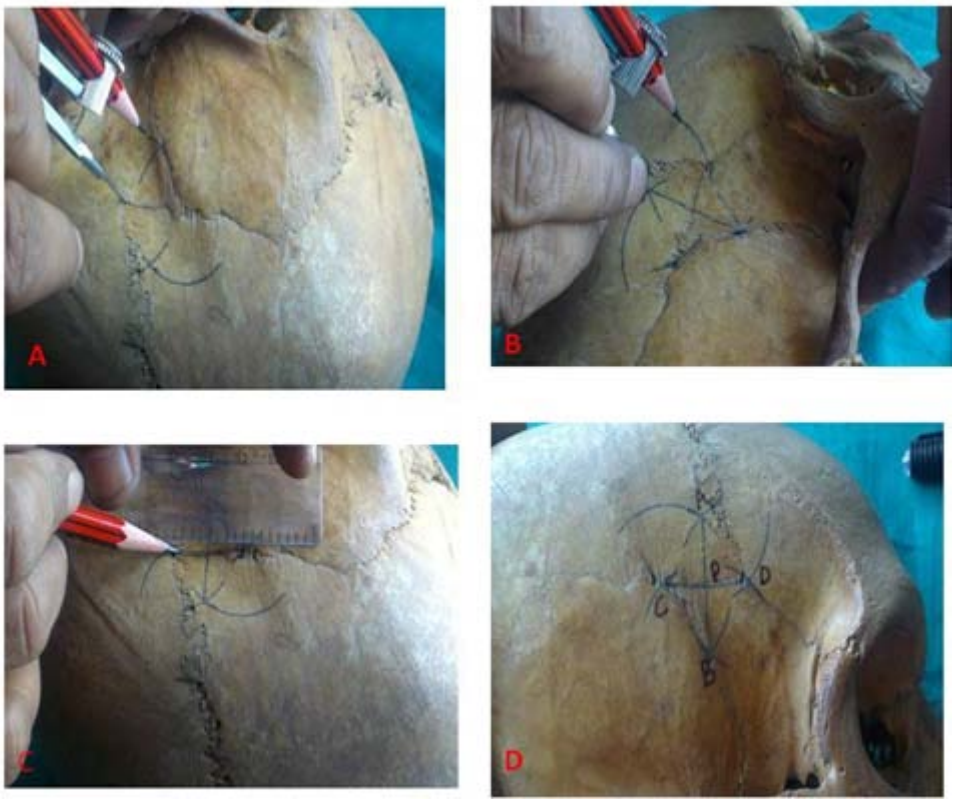

Figure 2: Steps to find the centre of pterion for sphenoparietal type of pterion

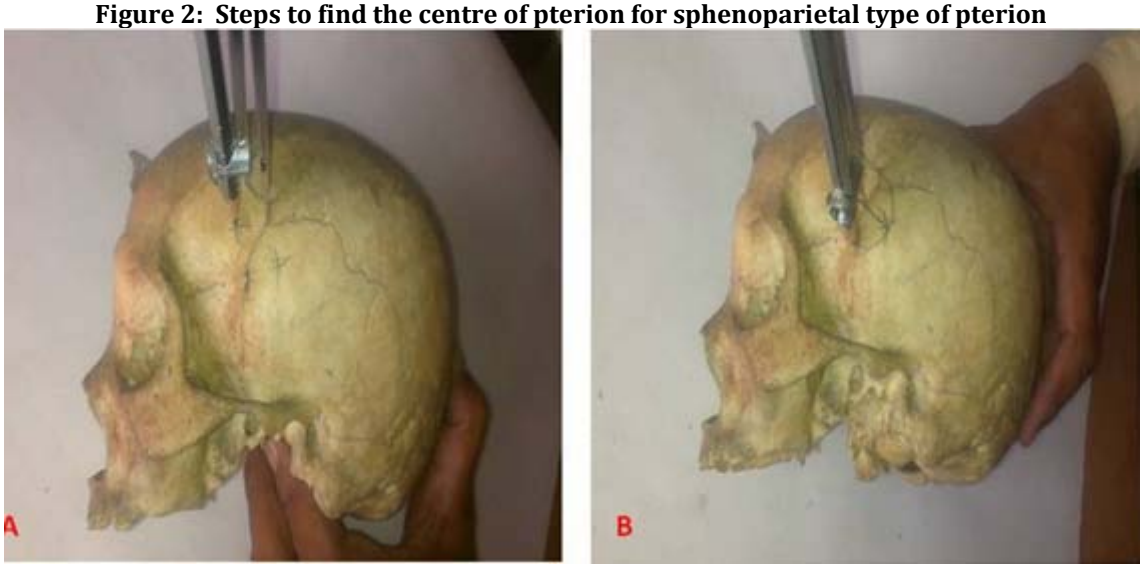

figure 3: steps to find out center of frontotemporal type of pterion

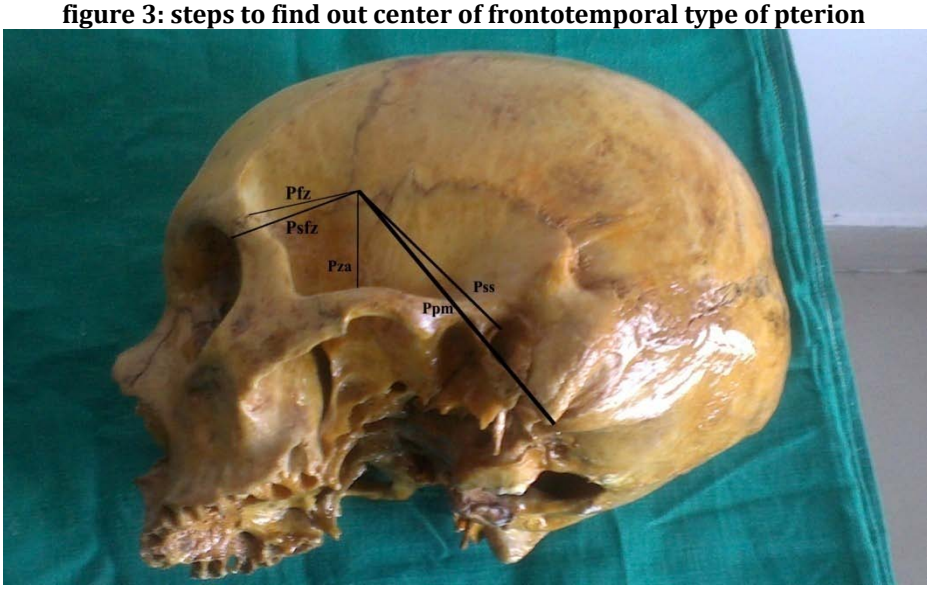

figure 4: Distances from the centre of pterion of different bony landmarks.

Table-1: Type of pterion in left and right side of skull

Type of pterion	Left (n=60)		Right (n=60)		Total (n=60)	
	No.	%	No.	%	No.	%
Spheno parietal	52	86.7	55	91.7	107	89.2
Fronto temporal	2	3.3	2	3.3	4	3.3
Stellate	3	5.0	3	5.0	6	5.0
Epipteric	3	5.0	0	0.0	3	2.5

Table 2: Distance of center of pterion from various bony landmarks

parameter	Left (mean±SD) in cm	right(mean±SD) in cm
Distance between center of pterion and superior edge of midpoint of zygomatic arch (PZA)	3.68±0.35	3.71±0.39
Distance between center of pterion and posterolateral aspect of frontozygomatic suture (PFZ)	3.11±0.40	3.20±0.39
Distance between center of pterion and anterosuperior margin of auditory meatus (PSS)	5.12±0.32	5.19±0.59
Distance between center of pterion and inferior margin of mastoid process (PPM)	8.13±1.45	8.02±0.58

Table-3 compares type of the pterion of the present study with other studies

studies	Comparison of distances of center of pterion from different bony landmarks			
	Distance from mid-point of zygomatic arch (in cm)		Distance from frontozygomatic suture (in cm)	
	Right side	Left side	Right side	Left side
Mwachaka et al (2008) 90 skulls Kenyan	3.035±.34	3.034±.43	3.888±.35	3.824±.35
Apinhasmit et al (2011) 268 skull thai.	3.848± .43	3.848±.44	3.112±.49	3.112±.49
Ukoha et al (2013). 56 Nigerian skulls	4.02 ± 0.05	4.01 ± 0.03	2.74 ± 0.07 cm	2.74 ± 0.06
Suchit et al (2013) 40 north Indian skulls	3.76 ±.66	3.76 ±.66	3.25 ±.11	3.25 ±.11
Eboh and Obaroefe (2014) 50 skulls Nigerians	4.022±.29	3.952±.33	3.206±.26	3.108±.22
Present study 50 north Indian skulls	3.71±0.39	3.68±0.35	3.20±0.39	3.11±0.40

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