

Research Article

Study of variations of bony pattern and presence of wormian bone at pterion in dry human skulls

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Abstract

Pterion is an important bony landmark of skull present on norma lateralis. Variations of bony pattern at pterion are common and are of clinical importance. Present study was carried out in Department of Anatomy IIMS & R to find out variations at pterion in dry human skull of north Indian origin. We utilized 60 dry human skulls for the study. The pattern of pterion and presence of sutural was observed. Sphenoparietal was the commonest type of pterion in both left (86.7%) and right (91.7%) side of skull, stellate type was found in (5%) of skulls and frontotemporal was found in 3.3% of left and right each. Sutural bone was present in 5% skulls on the left side. Variation in pattern of pterion and presence of sutural bones are important from surgical and radiological point of view.

Keywords: pterion, sphenoparietal, frontotemporal, sutural bone

1. Introduction

Pterion is defined as an H-shaped sutural junction formed by the meeting of four bones: frontal, parietal, temporal and sphenoid on norma lateralis of the skull¹. Pterion is the weakest part of the skull and the most interesting bone meeting points in craniofacial osteology.

Pterion has a significant importance as it is a craniometric point that is related to various structures in the cranial cavity like, anterior branch of the middle meningeal artery, Broca's area, the insula, and the stem of the lateral sulcus. Pterional fractures may therefore tear the frontal branch of middle meningeal artery leading to extra dural haematoma². It is also a primary site during surgery to gain access to the sphenoid ridge and optic canal³.

According to the bony pattern of pterion it was classified by different authors e.g. classified into four types (sphenoparietal, frontotemporal, stellate, and epipteric) by Murphy in 1956, six types by Wang *et al.* 2006 (sphenoparietal, frontotemporal, stellate, epipteric zygomatico-parietal and zygomatico-temporal)^{4,5}.

In present study we tried to find out incidence of various types of pterion utilizing Murphy's classification as well as presence of sutural bones at pterion in human dry skulls from Indian population.

2. Materials and Methods

A total of 60 dry human adult aged skull of unknown sex without any gross pathology or abnormality were collected from the Department of Anatomy, Integral Institute of Medical Sciences & Research, Lucknow and King George's Medical University, Lucknow for the study.

On the either side of each skull, the sutural pattern of the pterion is determined based on Murphy's classification.

- 1) Spheno-parietal type: Greater wing of sphenoid articulates with the parietal bone to form the letter 'H'. (figure 1)
- 2) Frontotemporal type: Squamous part of the temporal bone articulates with the frontal bone. (figure 2)
- 3) Stellate type: Here all bones articulate at a point in the form of letter 'K'. (figure 3)
- 4) Epipteric type: A sutural bone is lodged between the 4 bones forming the pterion. (figure 4)

Figure 1: Sphenoparietal type



Figure 2: Frontotemporal type



Figure 3: Stellate type



Figure 4: epipteric type showing presence of wormian bone



3. Observation and Results

On observing the sutural pattern and the bones articulating to form the pterion we found that Sphenoparietal type of pattern was most common both the sides. On the left side out of sixty, fifty two (86.7%) skulls were having this pattern and on the right side fifty five(91.7%) out of sixty were having this pattern.

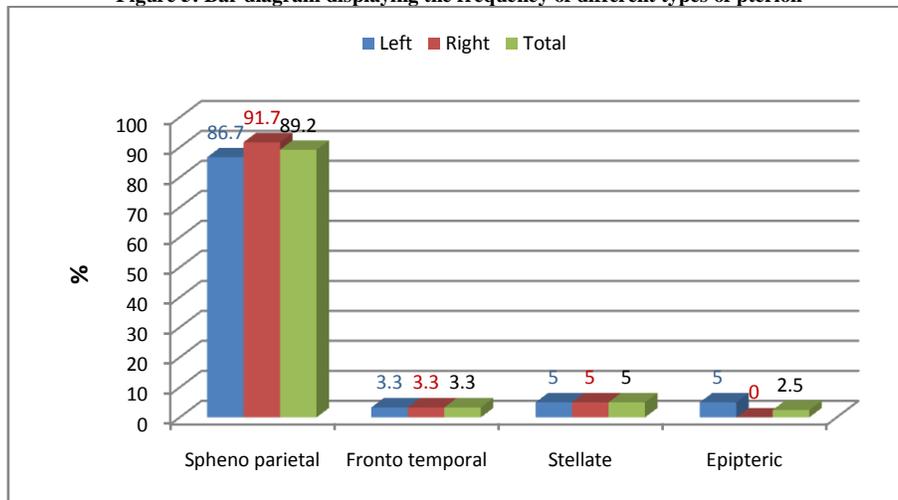
Second commonest was the stellate pattern which was present in three (5.0%) skulls on left side as well as right side. It was followed by Frontotemporal pattern present in two (3.3%) skulls on left side and in two skulls on right side.

Sutural (wormian) bone was found in three (5%) skulls on the left side but none of it was found on the right side. This type of pterion where the sutural bone was present, classified as epipteric type. The findings were tabulated in table 1 and displayed in figure 5.

Table-1: Frequency of different types of pterion on left and right side of skull

Type of pterion	Left (n=60)		Right (n=60)		Total (n=60)	
	No.	%	No.	%	No.	%
Sphenoparietal	52	86.7	55	91.7	107	89.2
Frontotemporal	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

Figure 5: Bar diagram displaying the frequency of different types of pterion



4. Discussion

It is well known that the morphological configuration of the sutural junctions of the bones associated with the pterion varies significantly in humans. Population-based differences suggest that various genetic variations in humans underlie the different sutural patterns of the pterion⁵.

According to previous studies, the sphenoparietal type of pterion is the dominant form in humans whereas the frontotemporal type is dominant in nonhuman primates^{6,7}. In the present study, sphenoparietal was the commonest type (89.2%) of pterion similar to previous studies. The second commonest type of pattern of pterion mentioned in most of the studies is frontotemporal type. It was different in present study where we found that stellate pattern (5.0%) was more common than frontotemporal (3.3%) type. A comparison of incidences of various studies is displayed in table 2.

Epipteric (wormian) bones are small, irregular ossicles formed due to additional ossification centers in or near the lambdoid suture, pterion and asterion. Studies reveal that the wormian bones are markers for various diseases and are important in the primary diagnosis of brittle bone disease (osteogenesis imperfecta). The presence of sutural bones is usually associated with cranial and central nervous system anomalies^{8,9}.

One or more pterion ossicles or epipteric bones may appear between the sphenoidal angle, parietal and the greater wing of the sphenoid. They can cause weakness of the cranium and help in extension of the fractures according to their location. Hence, presence of these bones provide false impressions of fractures or the fractures may be interpreted for wormian bones, especially in the region of pterion either radiologically or clinically¹⁰. The presence of epipteric bones may lead to complications in making burr holes at the pterion¹¹. It is therefore, relevant to surgeons and radiologists to have this essential information before and during surgical intervention.

An epipteric type pterion was observed in a small number of skulls (5.0%) in the present study, being significantly less than that reported in previous studies but similar to that reported by Zalawadia 2010 as 4.8%¹². A comparison of incidences of epipteric bones in different studies is displayed in table 3

Table-2: Comparison of types of the pterion in different studies to present study

Study/Population	Type of the pterion			
	Sphenoparietal	Frontotemporal	Stellate	Epipteric
Saxena <i>et al.</i> , 1988, Nigerian ⁷	84.79%	10.11%	5.06%	-
Saxena <i>et al.</i> , 1988, Indian ⁷	95.3%	3.46%	1.38%	-
Manjunath <i>et al.</i> , 1993, South Indian ¹³	93.55%	3.52%	2.93%	17.3%
Zalawadia <i>et al</i> 2010 Western Indian ¹²	91.7%	2.4%	1.2%	4.8%
Apinhasmit <i>et al.</i> , 2011 Thai ¹⁴	81.2%	-	-	17.4%
Suchit 2011 North Indian ¹⁵	86.25%	11.25%	2.5%	-
Nair 2014 Indian ¹⁶	89.9%	2.3%	1.9%	5.9%
Present study	89.2%	3.3%	5.0%	2.5%

Table: 3 Comparison of incidences of wormian bones at pterion reported in different studies.

Type of studies	Incidence of sutural bone at pterion
Majunath KY <i>et al</i> 1993 ¹³	17.30%
Gopinath <i>et al</i> 1998 ¹⁷	6.74%
Ersoy <i>et al</i> 2003 ¹¹	9.0%
Zalawadia <i>et al</i> 2010 ¹²	4.8%
Khatri <i>et al</i> 2012 ¹⁸	11.73%
Present study 2014	5.0%

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