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Original Research Article

STUDY OF MORPHOLOGY OF PTERION AND ITS CLINICAL IMPLICATIONS

Vasudha T.K [1], Divya Shanthi D'Sa *[2], Sadashivana Gowd [3].

[1] Associate Professor, Department of Anatomy, Subbaiah Institute of Medical Sciences, Shimoga, Karnataka, India.

*[2] Assistant Professor, Department of Anatomy, Subbaiah Institute of Medical Sciences, Shimoga, Karnataka, India.

[3] Professor, Department of Anatomy, Subbaiah Institute of Medical Sciences, Shimoga, Karnataka, India.

ABSTRACT

Background: Pterion is an anthropometrical landmark situated in the floor of the temporal fossa. The pterion corresponds to the site of the anterolateral fontanelle of the neonatal skull which closes at third month after birth. Pterion has been described as H shaped sutural confluence seen in the norma lateralis of the skull formed by the frontal and parietal bones superiorly and the greater wing of sphenoid and squamous temporal inferiorly. It's location is approximately 4 cm above zygomatic arch and 3.5 cm behind the frontozygomatoc suture. Four different types of pterion i.e. sphenoparietal, frontotemporal, stellate and epipteric have been described in various population groups.

Methods and Results: The present study was undertaken in 150 adult skulls of unknown sexes available in department of Anatomy, Subbaiah Institute of Medical Sciences, Shimoga, to determine the location of pterion and define its type. In the present study, the sutural pattern of pterion was based on Murphy's classification. Sphenoparietal was the commonest type (69.33%) of pterion. The second commonest type of pattern of pterion was epipteric pattern (14%) followed by stellate (11%) and frontotemporal (5.67%) types.

Conclusion: These findings will be of importance to anthropologists, anatomists, forensic pathologists and neurosurgeons.

KEY WORDS: Epipteric bones, Pterion, Pterion types.

Address for Correspondence: Dr. Divya Shanthi D'Sa, Assistant Professor, Department of Anatomy, Subbaiah Institute of Medical Sciences, Shimoga -577201, Karnataka, India. Mobile no: 9448579590
E-Mail: drdivyadsa17@gmail.com

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INTRODUCTION

Pterion is an anthropometrical landmark situated in the floor of the temporal fossa and corresponds to the site of the anterolateral fontanelle of the neonatal skull which closes at third month after birth [1]. It has been described as H shaped sutural confluence seen in the norma lateralis of the skull formed by the frontal and parietal bones superiorly and the greater wing of sphenoid and squamous temporal inferiorly. Its location is approximately 4 cm above zygomatic arch and 3.5 cm behind the frontozygomatic suture [1].

It is a commonly used neurosurgical landmark.

The anatomic location of the pterion is important in surgical approach to the anterior and middle cranial fossae, in surgical interventions following extradural hemorrhage, in repair of aneurysms of the middle cerebral artery and of the upper basilar complex as well as for tumors involving inferior aspects of the frontal lobe, such as olfactory meningioma. Pterional access is of importance in operations on the Broca's motor speech area, sphenoid ridge and optic canal [2]. Initially pterion was classified into three types by Broca [2]. They were sphenoparital, frontotemporal and stellate.

Pterion has also generated a lot of interest in anthropologists & forensic pathologists since different types of pterion have been described. They help in assessing the location of the pterion in incomplete archeological remains or forensic materials.

The present study has been undertaken to describe the different types of pterion based on the sutural pattern that may be of importance to anthropologists, anatomists, forensic pathologists and neurosurgeons. Different authors have classified Pterion according to the sutural pattern. Murphy in 1956, classified pterion into four types (sphenoparietal, frontotemporal, stellate, and epipteric) [3].

Wang et al. in 2006 further elaborated and gave the six types (sphenoparietal, frontotemporal, stellate, epipteric, zygomatico-parietal and zygomatico-temporal) [4].

He gave additional zygomatico-parital type, a variation of the sphenoparietal type in which zygomatic bone articulates with the parietal bone separating the frontal bone from the temporal or sphenoid bone and zygomatico temporal type in which the zygomatic bone articulates with the temporal bone separating the sphenoid from frontal and parietal bones. It is considered as the subtype of frontotemporal type.

In relation to the development of sutural bones, there is still no unanimity regarding their occurrence. They are considered to be just a simple anatomical variation for which the mechanism of development is not fully understood [5].

These wormian bones are also called ossa wormiana, intersutural bones or Inca bones. When present in the region of the pterion, they are called epipteric ossicles, epipteric bones or even flower bones [6]. One or more epipteric bones may appear between the sphenoid angle, parietal bone and greater wing of the sphenoid bone [7].

Studies reveal that the wormian bones are markers for various diseases and are important in the primary diagnosis of brittle bone disease (osteogenesis imperfecta) and neurocranial variables which can be misleading in the diagnosis of fractures [8,9]. The presence of sutural bones is usually associated with cranial and central nervous system anomalies [10,11].

The present study was conducted to determine the various types of pterion utilizing Murphy's classification as well as presence of sutural bones at pterion in 150 human dry skulls from Indian population.

MATERIALS AND METHODS

This study was conducted in the department of Anatomy, Subbaiah Institute of Medical Sciences, Shimoga. A total of 150 dry human adult aged skull of unknown sex without any gross pathology or abnormality were studied.

On the either side of each skull, the sutural pattern of the pterion was 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. Spheno-parietal 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)

Fig. 1: Spheno-parietal type.

Fig. 2: Spheno-parietal type.

Fig. 3: Stellate type.

Fig. 4: Epipteric type.

OBSERVATION AND RESULTS

Table 1: Frequency of different types of Pterion on left and right side of skull.

Types of Pterion	Right n=150		Left n= 150		Total n= 300 sides	
	No	%	No	%	No	%
Sphenoparietal	108	72	100	66.67	208	69.33
Frontoparietal	8	5.3	9	6	17	5.67
Stellate	15	10	18	12	33	11
Epipteric	19	12.6	23	15.3	42	14

On observing the sutural pattern and the bones articulating to form the pterion we found that Sphenoparietal type of pattern was most common on both right & left sides. The second most common type observed in our study was epipteric type. The findings are tabulated in table 1.

DISCUSSION

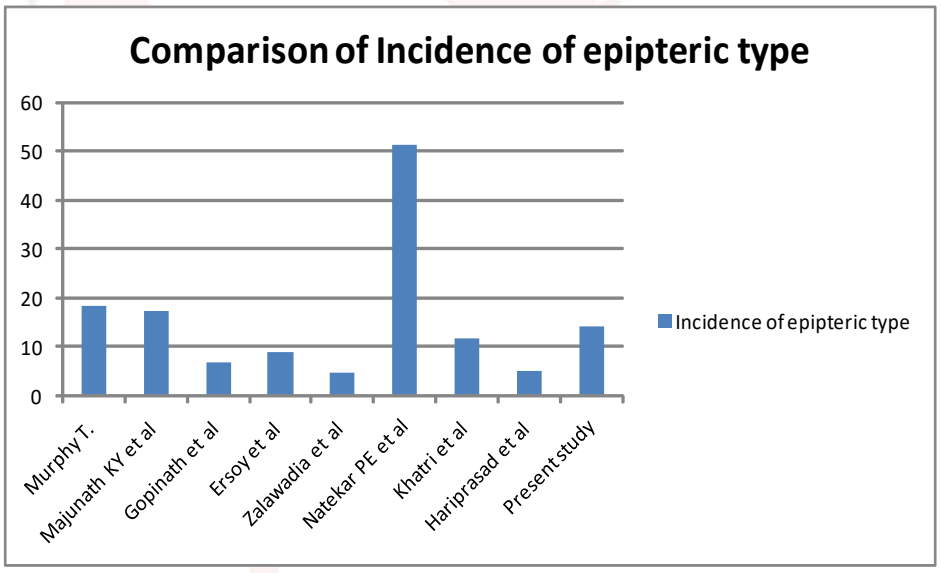
The morphological configuration of the sutural junctions of the bones associated with the pterion varies significantly in humans. Population-based differences suggest that various genetic variations in humans underlie the different sutural patterns of the pterion [2]. According to previous studies, the sphenoparietal type of pterion is the dominant form in humans whereas the frontotemporal type is dominant in nonhuman primates [12,13].

In the present study, sphenoparietal was the commonest type (69.33%) of pterion similar to previous studies. The second commonest type of pattern of pterion mentioned in most of the studies is frontotemporal type. But in the present study we found that epipteric pattern (14%) was more common than frontotemporal (5.67%) type. The data was compared with different studies in different population groups. A comparison of distribution of types of pterion in different population groups in 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. One or more pterion ossicles or epipteric bones may appear between the sphenoidal angle, parietal and the greater wing of the sphenoid. They vary greatly in size, but are more or less symmetrical. Sutural bones appear in great numbers in hydrocephalic skulls and they have been linked with rapid cranial expansion. The wormian bones can cause weakness of the cranium and help in extension of the fractures according to their location. Hence, presence of these bones provides false impressions of fractures or the fractures may be interpreted for wormian bones either radiologically or clinically which may lead to complications during burr hole surgeries. Although their occurrence is less frequent, their presence may serve as a marker for the identification of various anomalies of the central nervous system, dysmorphic features and syndromes.

Table 2: Percentage of distribution of types of the pterion in different populations.

Study	Population	Total (n)	Type of the pterion			
			Sphenoparietal (%)	Frontotemporal (%)	Stellate (%)	Epipteric (%)
Murphy T. 1956. [3]	Australian aborigines	388	73	7.5	1	18.5
Saxena et al., 1988 [13]	Nigerian	40	84.79	10.11	5.06	-
Saxena et al., 1988 [13]	Indian	72	95.3	3.46	1.38	-
Matsumura G et al 1991 [14]	Japanese	614	79.1	2.6	17.7	0.6
Manjunath et.al., 1993 [15]	South Indian	170	93.55	3.52	2.93	17.3
Saxena et al. 2003 [16]	Indians	203	84.72	10.01	5.17	-
Ersoy et al. 2003 [17]	Turks	300	87.35	3.47	8.98	0.2
Oguz O et al. 2004 [18]	Turkish male skulls	26	88	10	2	-
Mwachaka PM 2009 [19]	Kenyans	79	66	15	12	7
Zalawadia et al 2010 [20]	Western Indian	42	91.7	2.4	1.2	4.8
Apinhasmit et al. 2011 [21]	Thai	268	81.2	-	-	17.4
Hussain Saheb S et al 2011 [22]	Indian	125	69.25	17.35	9.7	3.7
Suchit 2011 [23]	North Indian	40	86.25	11.25	2.5	-
Natekar PE et al. 2011 [7]	Indian	150	85.33	8	10.6	51.4
Seema D et al. 2013 [24]	Indian	50	94	1	3	2
Sunday A et al. 2013 [25]	Nigerian	37	86.1	8.3	5.6	-
Nair 2014 [26]	Indian16	500	89.9	2.3	1.9	5.9
Hariprasad et al 2014 [27]	North Indian	60	89.2	3.3	5	2.5
Pavan P et al. 2015 [28]	South Indian	250	72.8	16.4	8.8	2
Present study	Indian	150	69.33	5.67	11	14



Graph 1: Comparison of incidence of epipteric type with other studies.

In the present study, we found that the second most common type was epipteric, where sutural (wormian) bones are lodged between the bones forming the pterion. This was compared with other studies which are depicted in the graph 1.

CONCLUSION

Pterional access has been the time tested approach in the management of a wide variety of neurosurgical disorders in the anterior, middle and upper part of posterior cranial fossa. The present study will also contribute additional information of skull bone fractures in infancy and early childhood, which may be associated with large intersutural bones giving false appearance of fracture radiologically and also during surgical interventions involving burr hole surgeries, as their extensions may lead to continuation of fracture lines.

Conflicts of Interests: **None**

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