

MORPHOMETRIC STUDY OF PTERION

Alper Sindel ¹, Eren Ögüt ², Günes Aytaç ³, Nurettin Oguz ⁴, Muzaffer Sindel ^{*5}.

¹ Dt. PhD., Assistant Professor, Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Akdeniz University, Turkey.

² PhD. Student, Department of Anatomy, Akdeniz University Faculty of Medicine, Turkey.

³ MD., PhD. Student, Department of Anatomy, Faculty of Medicine, Akdeniz University, Turkey.

⁴ Professor, Akdeniz University Faculty of Medicine, Department of Anatomy, Turkey.

^{*5} Professor, Department of Anatomy, Akdeniz University Faculty of Medicine, Turkey.

ABSTRACT

Objective: The aim of this study is to analyze dried skulls morphometrically to determine the prevalence of the pterion types and discuss their clinical significance. There are four types of sutural pattern: sphenoparietal, the sphenoid and parietal bones are indirect contact; frontotemporal, the frontal and temporal bones are indirect contact; stellate, all the four bones meet at a point; and epiptereric, when there is a small sutural bone uniting all the bones.

Material and Methods: A total number 150 adult dried skulls of unknown age and sex studied for the pterion types. For this study calvaria's intact human skulls collected from the Akdeniz University Medical Faculty Department of Anatomy. We separated the pterions into 4 groups as sphenoparietal, frontotemporal, stellate and epiptereric. We measured distances between the center of the pterion and some important points. Morphometrical measurements are taken with digital caliper.

Results: In the present study all types of pterion are observed. Sphenoparietal type of pterion was 63%, frontotemporal type of pterion was 2%, stellate type was 19% and epiptereric type of pterion was 16% in our study. According to measurements pterion was lying approximately 3.98 cm above the arcus zygomaticus and 3.4 cm behind the frontozygomatic suture.

Conclusion: The pterion has close relation with the branches of middle meningeal artery and Broca's motor speech area on the left side. Therefore knowledge and understanding of the type and location of the pterion and its relation to surrounding bony landmarks is important, especially for neurologists, neurosurgeons, radiologists and anthropologists.

KEY WORDS: Antero-Lateral Fontanelle, Stellate, Epiptereric Bones.

Address for Correspondence: Dr. Muzaffer Sindel, Professor, Department of Anatomy, Akdeniz University Faculty of Medicine, Turkey. Tel:00905325620900 **E-Mail:** sindelm@akdeniz.edu.tr

Access this Article online

Quick Response code



DOI: 10.16965/ijar.2016.119

Web site: International Journal of Anatomy and Research
ISSN 2321-4287
www.ijmhr.org/ijar.htm

Received: 26 Jan 2016

Accepted: 12 Feb 2016

Peer Review: 27 Jan 2016

Published (O): 29 Feb 2016

Revised: None

Published (P): 29 Feb 2016

INTRODUCTION

The pterion is a point where the frontal, parietal, temporal, and sphenoid bones join together. It is an important anatomic landmark, as it overlies the anterior branch of the middle

meningeal artery and the lateral fissure of the cerebral hemisphere. The pterion corresponds to the site of the antero-lateral fontanelle of the neonatal skull, which closes in the third month after birth [1]. One or more sutural bones could

appear between the sphenoidal angle of the parietal and the greater wing of the sphenoid, known as pterion ossicles or epipterical bones [1]. This point is an important clinical landmark because the calvaria's wall is thin in this region. Therefore pterion is a fragile point that could be fractured easily.

The anterior branch of the middle meningeal artery runs beneath the pterion. It is vulnerable to damage at this point and rupture of the artery may give rise to an extradural hematoma. The Sylvian point, where the stem of lateral sulcus of cerebral hemisphere divides into its three limbs, anterior, ascending and posterior, right beneath the pterion [2, 3]. Middle meningeal artery has some vascular markings on the inner surface of the skull. The osseous groove for the middle meningeal artery begins at the foramen spinosum and divides into frontal (anterior) and parietal (posterior) branches 15 to 30 mm anterolateral to the foramen spinosum. The groove for the frontal branch also divides behind the lateral part of the greater wing into a lateral branch, which passes laterally and posteriorly across the pterion, and a medial branch, which courses medially along the lower surface of the sphenoid ridge.

Therefore this point is an important landmark for anterior branch of middle meningeal artery, Broca's motor speech area in the left, insula, the lateral cerebral fissure, for the pathologies of optic nerve, orbit, sphenoidal ridge [4-7] and for the anterior circulation aneurysms and tumours [6]. The pterion was first classified into three types (sphenoparietal, frontotemporal and stellate) by Broca in 1875. Subsequently, four types (sphenoparietal, frontotemporal, stellate, and epipterical) were defined by Murphy (1956). Murphy's classification of pterion includes 4 types of pterion namely, Spheno-parietal type, Greater wing of sphenoid articulates with the parietal bone to form the letter 'H'; frontotemporal type, squamous part of the temporal bone articulates with the frontal bone; stellate type, here all bones articulate at a point in the form of letter 'K'; epipterical type, a sutural bone is lodged between the 4 bones forming the pterion [7-9]. The objectives of the present study is include determining the position of the pterion to two bony landmarks (the frontozygomatic

suture and the midpoint of zygomatic arch) and classifying the types of pterion based on Murphy's classification and comparing the right and left sides.

MATERIALS AND METHODS

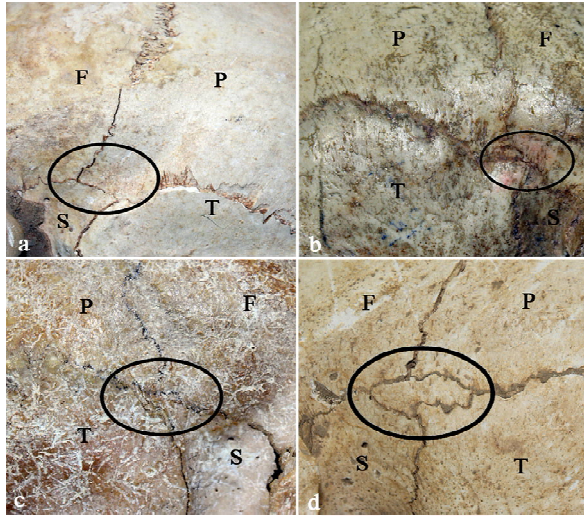
A total number 150 adult dried skulls of unknown age and sex studied for the pterion types. For this study calvaria's intact human skulls collected from the Akdeniz University Medical Faculty Department of Anatomy. We separated the pterions into 4 groups as sphenoparietal, frontotemporal, stellate and epipterical. Damaged skulls, newborn, infants and children skulls and very old skulls with obliterated sutures are excluded from the study. Morphometrical measurements are taken with 0-150 mm digital electronic caliper. We measured the vertical distance from the center of the pterion to the zygomatic arch (P-ZA), the distance from the center of the pterion to the posterolateral aspect of the frontozygomatic fissure (P-FZ), the horizontal distance from the internal aspect of the center of the pterion to the lateral margin of the optic canal (P-OC), the horizontal distance from the internal aspect of the center of the pterion to the outer end of the sphenoid ridge on the lesser wing of the sphenoid (P-LWS).

RESULTS

In the present study all types of pterion are observed. Sphenoparietal type of pterion was 63%, frontotemporal type of pterion was 2%, stellate type was 19% and epipterical type of pterion was 16% in our study (Figure 1). Measurements are taken from both sides of each skull. Mean values of vertical distance from the center of the pterion to the zygomatic arch (P-ZA), the distance from the center of the pterion to the posterolateral aspect of the frontozygomatic fissure (P-FZ), the horizontal distance from the internal aspect of the center of the pterion to the lateral margin of the optic canal (P-OC), the horizontal distance from the internal aspect of the center of the pterion to the outer end of the sphenoid ridge on the lesser wing of the sphenoid (P-LWS) are measured (Table 1). According to measurements pterion was lying approximately 3.98 cm above the arcus zygomaticus and 3.4 cm behind the

frontozygomatic suture. Occurrence of sphenoparietal type pterion was notably higher than the others.

Fig. 1: Types of the pterion.



a. Sphenoparietal type; b. Frontotemporal type; c. Stellate type; d. Epiptereric type. S: sphenoid bone T: temporal bone F: frontal bone P: parietal bone

Table 1. Mean values of distances from zygomatic arch (ZA), frontozygomatic fissure (FZ), lateral margin of the optic canal (OC) and lesser wing of the sphenoid (LWS) to the center of the pterion (P).

	Sphenoparietal type		Stellate type		Epiptereric type		Frontotemporal type	
	Right side	Left side	Right side	Left side	Right side	Left side	Right side	Left side
P-ZA	4.16	4.09	3.96	3.84	3.60	3.46	4.10	3.70
P-FZ	3.05	3.10	2.88	3.00	2.60	2.75	2.90	2.80
P-OC	5.21	5.26	5.01	5.43	5.30	4.90		
P-LWS	1.88	1.75	1.60	1.60	1.80	1.50		

DISCUSSION

The anatomic location of the pterion therefore is important in surgical interventions like extradural haemorrhages as well as tumors involving inferior aspects of the frontal lobe, such as olfactory meningiomas [10]. The middle meningeal artery may be torn in temporal fractures or trauma, resulting in separation of the dura mater from the bone leading to extradural hemorrhage [11].

The pterion is used as a surface landmark for the anterior branch of the middle meningeal artery and for the Sylvian [1, 2]. The 'pterional approach' could be used during the operations of the Broca's motor speech area [12] and during repairing aneurysms of the middle cerebral artery [13]. A similar approach is also could be used, to treat aneurysms of the middle

cerebral artery or upper basilar complex, and in operations involving petroclival tumors [13-16]. Moreover this approach has several advantages over traditional craniotomy that including minor tissue damage, less brain retraction, a superior cosmetic result and shorter duration of surgery [17].

In the dominant hemisphere Broca's motor speech area is stated to lie one fingerbreadth above the pterion [6]. The pterion junction has been used as a common extra-cranial landmark for surgeons in microsurgical and surgical approaches towards important pathologies of this region [4, 6, 9, 18]. Additionally, the pterion is a primary region during surgical interventions of the sphenoid ridge and optic canal [5, 6]. In skulls with an epiptereric bone variation, the landmark pterion can mistakenly be assessed to be at the most anterior junction of bones where placement of a burr hole may cause inadvertent penetration into the orbit.

Saxena et al observed predominance of sphenoparietal type of pterion in Indian population (95.30%) [7]. Oguz et al. observed predominance of sphenoparietal type of pterion in Turkish population (88.46%) [6]. Fishpool et al. studied in 76 adult Indian skulls, reported the most common type of pterion was the sphenoparietal type [19]. We also found that the most common bony configuration was the H-type sphenoparietal arrangement (63%).

The pterion has been reported to lie 4 cm above the arcus zygomaticus and 3.5 cm behind the frontozygomatic suture [3]. According to our measurements pterion was lying approximately 3.98 cm above the arcus zygomaticus and 3.4 cm behind the frontozygomatic suture. Results of our study are consistent with the general findings reported in other studies that the pterion is 3-4 cm above the upper border of the zygomatic arch and 3- 3.5 cm behind the frontozygomatic suture [6]. Zalawadia et al. found the distance between the the pterion and the lesser wing of the sphenoid bone 1.40 ± 0.33 cm and 1.48 ± 0.32 cm on the right and left sides respectively (Zalawadia et al., 2010). In our study we measured the distances 1.6 ± 0.1 cm in the left, 1.73 ± 0.13 cm in the right. In the same study they found distance between the internal aspect of the pterion and the medial margin of

the optic canal is 4.39 ± 0.40 cm and 4.36 ± 0.40 cm on the right and left sides respectively. We found the same distance 5.16 ± 0.27 in the left and 5.15 ± 0.15 in the right. They claimed that the distances between the pterion and the lesser wing of the sphenoid bone and optic canal are have practical importance during the surgical approaches to these regions via the pterion[20]. Moreover this approach has several advantages over traditional craniotomy that including minor tissue damage, less brain retraction, a superior cosmetic result and shorter duration of surgery [17].

CONCLUSION

In conclusion, despite its clinical importance, there are a few published article about surface anatomical landmarks of the pterion especially about the distances between the pterion and the lesser wing of the sphenoid bone and optic canal. The different types and locational differences of the pterion and its relationship with the surrounding bony landmarks have been defined in different articles, and this knowledge is important for surgical interventions.

Conflicts of Interests: None

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How to cite this article:

Alper Sindel, Eren Ögüt, Günes Aytac, Nurettin Oguz, Muzaffer Sindel. MORPHOMETRIC STUDY OF PTERION. *Int J Anat Res* 2016;4(1):1954-1957. DOI: 10.16965/ijar.2016.119