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Original Research

The Morphological and Morphometric Examination of the Asterion in Terms of Surgical Approaches to the Posterior Cranial Fossa

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ABSTRACT

Objective: The asterion is an important cranial anatomical landmark used in surgical approaches to the posterior cranial fossa, which is one of the most complex and surgically challenging regions of human anatomy due to the density of neurovascular structures. This study aims to examine the morphological and morphometric variations of the asterion to determine its preoperative localisation and help neurosurgeons reduce possible complications by providing an understanding of the detailed anatomy of the asterion in surgical approaches applied in posterior cranial fossa pathologies.

Methods: In our study, adult human dry skull specimens (44 intact, 104 hemi skulls) with unknown demographic data were analysed. The asterions were first examined morphologically and categorised into two classifications. These classifications were based on the presence of wormian bone and the distance from the Frankfurt horizontal plane (FHP). Morphometric measurements were based on anatomical landmarks in the human skull. The landmarks used in the measurements were the lambda (L), FHP, the root of the zygomatic arch (RZA), the tip of the mastoid process (TMP), Henle's spine (HS), external occipital protuberance (EOP), basion (B), opisthion (O) and porion (P).

Results: The morphological classification of the asterions was examined. Type 1 and Type 2 were determined as 13.02% and 86.98%, respectively, according to the presence of the wormian bone. In the classification, according to the distance to the FHP, Type 1 was 9.90%, Type 2 was 58.85% and Type 3 was 31.25%. In morphometric measurements, the mean distance of the asterion to L was 85.16 ± 5.64 mm and 84.41 ± 5.43 mm on the right and left sides, respectively. The mean distance of the asterion to the FHP was 13.17 ± 6.81 mm and 14.01 ± 6.96 mm on the right and left sides, respectively. The mean distance of the asterion to the RZA was 56.18 ± 3.58 mm and 56.64 ± 3.69 mm on the right and left sides, respectively. The mean distance of the asterion to the TMP was 49.42 ± 4.16 mm and 48.91 ± 4.03 mm on the right and left sides, respectively. The mean distance of the asterion to HS was 46.15 ± 3.74 mm and 46.69 ± 3.79 mm on the right and left sides, respectively. The mean distance of the asterion to the EOP was 63.19 ± 4.13 mm and 62.71 ± 4.07 mm on the right and left sides, respectively. The mean distance of the asterion to B was 73.50 ± 3.73 mm and 72.96 ± 3.51 mm on the right and left sides, respectively. The mean distance of the asterion to O was 62.46 ± 2.88 mm and 62.23 ± 2.85 mm on the right and left sides, respectively. Finally, the mean distance of the asterion to P was 49.51 ± 3.87 mm and 50.32 ± 3.94 mm on the right and left sides, respectively.

Conclusion: The results obtained in our study suggest that the accurate preoperative positioning of the asterion may contribute to reducing complications that may develop in neurosurgeons' surgical approaches to the posterior cranial fossa.

Keywords: asterion, morphology, morphometry, cranial anatomic landmarks, posterior cranial fossa

INTRODUCTION

The posterolateral fontanelle is located between the parietal, petrous temporal, exoccipital and basioccipital bones; it closes at the end of the first year of life and is called the asterion [1–3]. The asterion is located bilaterally on the posterolateral aspect of the cranium; marks the junction of the occipitomastoid, parietomastoid and occipitoparietal sutures; and also indicates where the transverse sinus turns into the sigmoid sinus and joins the superior petrosal sinus [1,4,5].

The asterion is an important landmark used in posterolateral, posteroinferior and retrosigmoid surgical approaches in lesions found in the posterior cranial fossa, posterolateral cranial base and mastoid triangle [4,6,7]. The posterior cranial fossa is the most complex and surgically challenging region of the human anatomy due to its high density of neurovascular structures, which necessitates the development of a wide variety of surgical approaches. Posterior cranial fossa surgery is a complex area that requires specialisation in this anatomy, as it contains critical structures, such as cranial nerves, arachnoid cisterns and special regions, where even minor surgical errors have the potential to cause significant morbidity [6].

Main Points

- The adult dry human skull specimens (44 intact, 104 hemi skulls) with unknown demographic data were analysed.
- Type 1 and Type 2 of the asterion (two types) were observed in this study.
- The morphometric distance measurements of the asterion to cranial anatomical landmarks (L, the FHP, RZA, TMP, HS, EOP, B, O and P) were performed.

Principally, in order to operate appropriately on lesions in the posterior cranial fossa region, a surgical approach to the lesion must be selected [6,8,9]. Fine micro-neurosurgical techniques require the surgeon to know not only the deep anatomical relationships within the cranium but also the superficial landmarks and to be able to direct the operation accordingly [10]. The asterion can be found by following the lambdoid, parietomastoid and occipitomastoid sutures [1]. Although patient-specific burr hole locations are determined with three-dimensional, computed tomography scanning devices in intracranial, posterolateral and retrosigmoid approaches today, surgeons still use the asterion as a landmark in burr holes opened in the treatment of skull base, brainstem, cerebellar, cerebellopontine angle tumors, microvascular decompression surgery (cranial nerve compression syndromes) and vascular disorders, such as intracranial hemorrhages due to venous sinus injuries [6,8,9,11,12].

Accessory sutural bones (or wormian bones) are islands of bone that may be found within the fontanelles or sutures in the cranium and vary in shape, size and number [1,13]. Although the mechanism of the formation of wormian bones is not clear, genetic factors are thought to be the most important factor in its development [1,13,14]. Wormian bones may develop due to the non-union of ossification centres and are most commonly found in the lambdoid suture [1]. Additionally, wormian bones enable the morphological classification of the asterion into two types [3].

This study aims to determine the preoperative location of the asterion using palpable anatomic landmarks outside the cranium and help neurosurgeons reduce possible complications by providing an understanding of the detailed anatomy of the asterion in surgical approaches applied in posterior cranial fossa pathologies.

MATERIAL AND METHODS

The study was approved by the Istanbul Medical Faculty Clinical Research Ethics Committee (Date: 2021.10.04, Approval Number: 507101). Morphological observations and morphometric measurements were carried out on Turkish adult human dry skull specimens (44 intact, 104 hemi skulls) with unknown demographic data, located in the bone collection of the Anatomy Department Laboratory of Istanbul University Faculty of Medicine.

A total of 192 asterions, which had no pathological deformity, fracture or any other trauma on the asterion and in the measured areas, were evaluated morphologically and morphometrically. The measurements were conducted twice at different times by the same person using an electronic digital caliper (INCA, DCLA-0605, 0.6–150 mm, USA) and tape measure.

In our study, the morphological characteristics of the asterions were defined according to two different classifications.

Classification I: According to the asterion's relationship with the wormian bones:
Type 1: The wormian bone is involved in forming the asterion (Figure 1a).
Type 2: The wormian bone is not involved in forming the asterion (Figure 1b).

The Frankfurt horizontal plane is an imaginary plane that runs between the lowest point of the infraorbital margin and the highest point of the external auditory canal (P) in a lateral view when the human skull is in an anatomical position and is important for anthropometric studies [1,7].

Classification II: According to the asterion's relationship with the FHP:
Type 1: The asterion is situated at the same level as FHP.
Type 2: The asterion is situated at a level above FHP.
Type 3: The asterion is situated at a level below FHP.

The morphometric measurements between the asterion and other cranial anatomical landmarks in our study are described below (Figure 2).
A–L: It is the linear distance measurement between the asterion (A) and the lambda (Figure 2a).
A–FHP: This presents the linear distance measurement between the asterion and the Frankfurt horizontal plane (Figure 2c).
A–RZA: It is the linear distance measurement between the asterion and the root of the zygomatic arch (Figure 2d).
A–TMP: This indicates the linear distance measurement between the asterion and the tip of the mastoid process (Figure 2g).
A–HS: It is the linear distance measurement between the asterion and the suprameatal spine, mostly known as Henle's spine (Figure 2f).

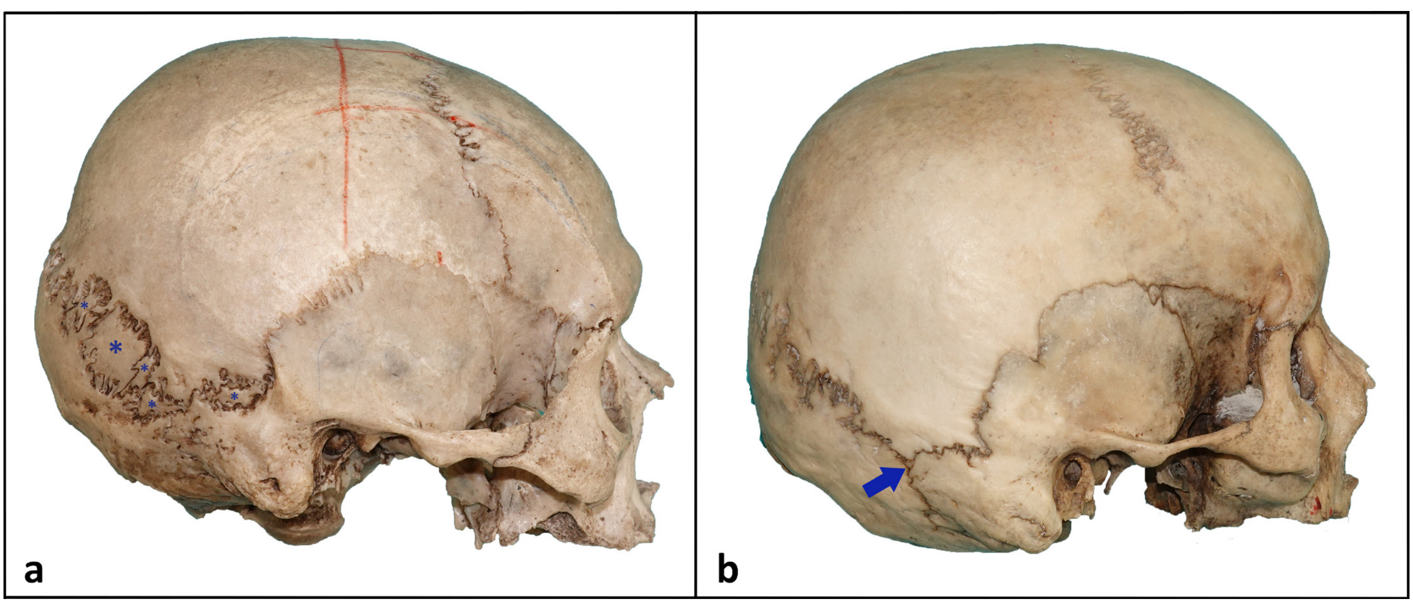

Figure 1. Demonstration of the morphological characteristics of the asterion. **a:** The wormian bones are involved in forming the asterion (type I), blue stars show the wormian bones. **b:** The wormian bone is not involved in forming the asterion (type II), blue arrow shows the asterion.

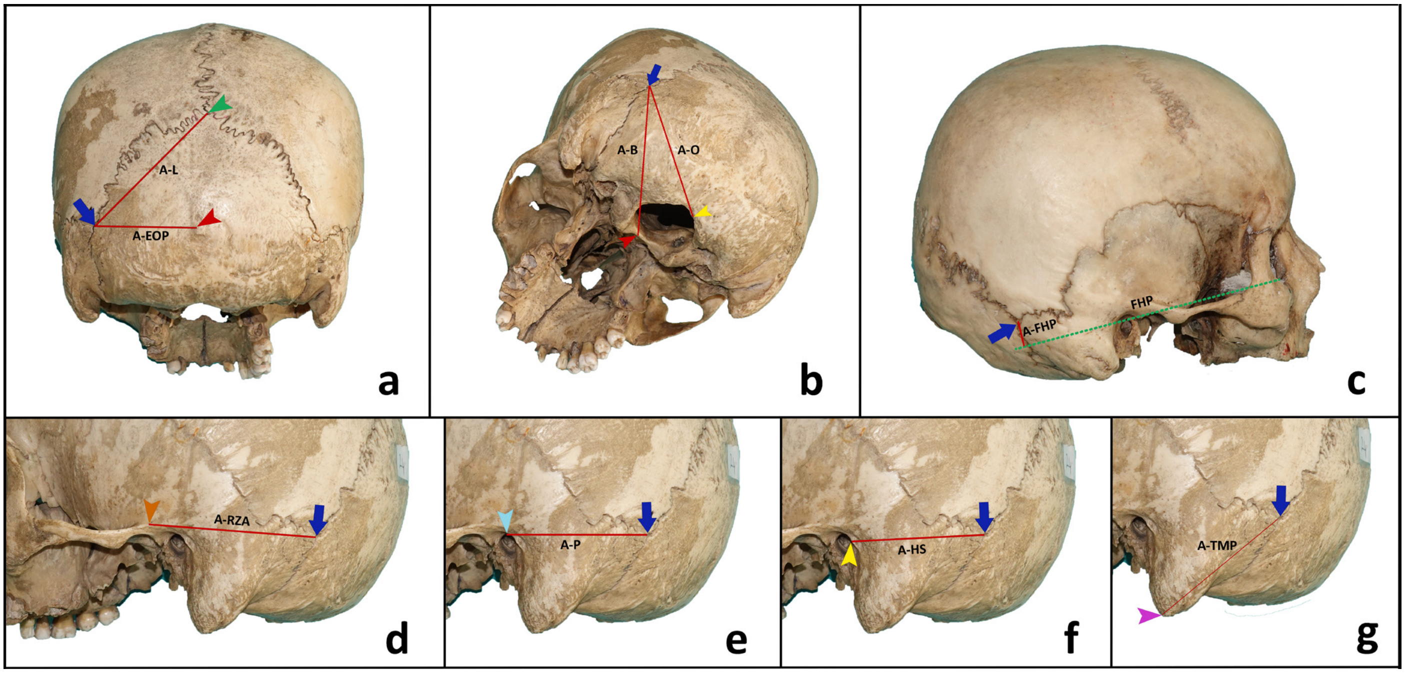

Figure 2. Demonstration of the morphometric measurements regarding the asterion.

a: the linear distance between the asterion and lambda (A-L), the linear distance between the asterion and external occipital protuberance (A-EOP), blue arrow shows the asterion, green arrow shows the lambda, red arrow shows the external occipital protuberance.

b: the linear distance between the asterion and basion (A-B), the linear distance between asterion and opisthion (A-O), blue arrow shows the asterion, red arrow shows the basion, yellow arrow shows the opisthion.

c: the linear distance between the asterion and Frankfurt Horizontal Plane (A-FHP), blue arrow shows the asterion, dashed green line shows the Frankfurt Horizontal Plane.

d: the linear distance between the asterion and root of the zygomatic arch (A-RZA), blue arrow shows the asterion, orange arrow shows the root of the zygomatic arch. **e:** the linear distance between asterion and porion (A-P), blue arrow shows the asterion, turquoise arrow shows the porion.

f: the linear distance between the asterion and the Henle spine (A-HS), blue arrow shows the asterion, yellow arrow shows the Henle spine.

g: the linear distance measurement between the asterion and the tip of the mastoid process (A-TMP), blue arrow shows the asterion, purple arrow shows tip of the mastoid process.

A–EOP: This highlights the linear distance measurement between the asterion and external occipital protuberance (Figure 2a).

A–B: It is the linear distance measurement between the asterion and basion (Figure 2b).

A–O: This denotes the linear distance measurement between the asterion and opisthion (Figure 2b).

A–P: It is the linear distance measurement between the asterion and porion (Figure 2e).

Statistical Analysis

Data were analyzed using SPSS software (v. 21.0, IBM Corp. Armonk, NY, USA). The distribution of the data was evaluated using the Kolmogorov-Smirnov test. Continuous variables were presented as mean ± standard deviation (SD), median, minimum (min), and maximum (max) values. Parameters without normal distribution were compared by using the Mann-Whitney U test. $P < 0.05$ was considered statistically significant.

RESULTS

We evaluated the morphological features of the asterions according to two different classification systems. Classification I was based on the presence of wormian bones. Both Type 1 and Type 2 asterions were observed in the study. Moreover, only 1 of the 44 skulls was bilaterally symmetrical.

Classification II was based on the asterions' relationship to the FHP. All three types of asterion were observed in the 192 specimens in our study.

In this study, the mean distance of the asterion to L was 85.16 ± 5.64 mm and 84.41 ± 5.43 mm on the right and left sides, respectively. The mean distance of the asterion to the FHP was 13.17 ± 6.81 mm and 14.01 ± 6.96 mm on the right and left sides, respectively. The mean distance of the asterion to the RZA was 56.18 ± 3.58 mm and 56.64 ± 3.69 mm on the right and left sides, respectively. The mean distance of the asterion to the TMP was 49.42 ± 4.16 mm and 48.91 ± 4.03 mm on the right and left sides, respectively. The mean distance of the asterion to HS was 46.15 ± 3.74 mm and 46.69 ± 3.79 mm on the right and left sides, respectively. The mean distance of the asterion to the EOP was 63.19 ± 4.13 mm and 62.71 ± 4.07 mm on the right and left sides, respectively. The mean distance of the asterion to B was 73.50 ± 3.73 mm and 72.96 ± 3.51 mm on the right and left sides, respectively. The mean distance of the asterion to O was 62.46 ± 2.88 mm and 62.23 ± 2.85 mm on the right and left sides, respectively. Finally, the mean distance of the asterion to P was 49.51 ± 3.87 mm and 50.32 ± 3.94 mm on the right and left sides, respectively (Table 1). In our study, when the morphometric measurements conducted between asterion and cranial anatomical landmarks were compared between the right and left sides, a statistically significant difference was found only between the right and left A–FHP values. No statistically significant difference was found when the morphometric measurements performed between asterion and other cranial anatomical landmarks were compared between the right and left sides (Table 1).

Table 1. Morphometric measurements of the asterion to anatomical landmarks (mm).

		Right (n=96)					**Left (n=96)**		
Parameters	Mean	SD	Min	Max	Mean	SD	Min	Max	P value
A – L	85.16	5.64	73.39	101.84	84.41	5.43	74.11	97.89	0.212
A – FHP	13.17	6.81	0	30.90	14.01	6.96	0	31.70	0.038
A – RZA	56.18	3.58	45.95	65.07	56.64	3.69	45.11	65.90	0.253
A – TMP	49.42	4.16	39.04	59.75	48.91	4.03	38.73	58.64	0.208
A – HS	46.15	3.74	38.74	56.36	46.69	3.79	38.21	57.19	0.182
A – EOP	63.19	4.13	53.10	77.06	62.71	4.07	53.74	75.92	0.265
A – B	73.50	3.73	67.30	81.51	72.96	3.51	66.82	80.49	0.291
A – O	62.46	2.88	56.45	70.20	62.23	2.85	57.11	69.61	0.556
A – P	49.51	3.87	39.96	58.51	50.32	3.94	40.91	60.13	0.129

A: Asterion; L: Lambda; FHP: Frankfurt Horizontal Plane; RZA: Root of the Zygomatic Arch; TMP: Tip of the Mastoid Process; HS: Henle Spine; EOP: External Occipital Protuberance; B: Basion O: Opisthion P: Porion

DISCUSSION

Nowadays (in modern medicine), treatments are becoming increasingly personalised for patients, and surgical procedures are also following suit. Although surgical procedures are becoming increasingly personalised for patients – due to wars, mass migrations and other reasons (health insurance, etc.) – not everyone has access to modern medical facilities. Therefore, doctors still apply classical methods to treat many patients worldwide. Surgeons still use superficial anatomical landmarks to perform their operations successfully and to reduce complications. In modern neurosurgery, various suboccipital approaches, such as the rectosigmoid approach, are widely employed to treat posterior cranial fossa pathologies. The asterion still serves as an important superficial cranial anatomical landmark for these approaches. We hope that the results obtained in this study will contribute to the types and topography of the asterion.

When analysed morphologically, the first classification of the asterion was made according to the presence of wormian bones: Type I, where the wormian bone involves the form of the asterion; and Type II, where the wormian bone does not include the form of the asterion.

The prevalence of the morphological classification of the asterion in terms of wormian bones in different populations is shown in Table 2. As in other studies, the present study indicates that Type II asterion is more dominant than Type I asterion. In addition, our study coincides with the studies of Caroline Berry and Berry [15] in North America and Egypt, Gümüşburun et al. [14] in Türkiye, Dutt et al. [18] in India, Gharedaghi et al. [21] in Iran and Muche [22] in Ethiopia. The differences between these studies and other studies may be due to genetic variations owing to the ethnic origin in different populations, as well as embryological, environmental and individual factors [16,17,19,20,23–25].

Table 2. Prevalence of classification of Asterion in relationship to the Wormian bones in different populations (in %).

Study	Population	N	Type I(%)	Type II(%)
Caroline Berry and Berry, 1967 [15]	North America	50 skulls	12.00 %	88.00 %
Caroline Berry and Berry, 1967 [15]	South America	53 skulls	7.50 %	92.50 %
Caroline Berry and Berry, 1967 [15]	Egypt	250 skulls	14.40 %	85.60 %
Gümüsburun et al.,1997 [14]	Türkiye	302 skulls	9.92 %	90.08 %
Mwachaka et al., 2009 [16]	Kenya	79 skulls	20.00 %	80.00 %
Galindo-de Leon et al., 2013 [17]	Mexico	88 skulls	25.60 %	74.40 %
Dutt et al., 2017 [18]	India	78 skulls	13.46 %	86.54 %
Havaldar et al., 2015 [19]	India	250 skulls	19.20 %	80.80 %
De Lucena et al., 2019 [20]	Brazil	30 skulls	31.67 %	68.33 %
Gharedaghi et al., 2019 [21]	Iran	210 hemi skulls	14.70 %	85.30 %
Muche, 2021 [22]	Ethiopia	61 skulls	14.80 %	85.20 %
Khan et al., 2023 [23]	South Africa	36 skulls	25.00 %	75.00 %
Bojana et al., 2023 [24]	Serbia	43 skulls	34.88 %	65.12 %
Sarada et al., 2024 [25]	India	96 skulls	39.06 %	60.94 %
Our study, 2025	Türkiye	44 skulls 104 hemi skulls	13.02 %	86.98 %

The second classification of the asterion was based on the relationship with the FHP. Type I is on par with the FHP. Type II is above the FHP. Type III is below the FHP.

Kabakci et al. [7] found 3.2% at the same level as the FHP (Type I), 76.3% above the FHP (Type II) and 20.4% below the FHP (Type III) in their study with 93 human skulls. The present study revealed that 11.46% were on par with the FHP (Type I), 56.25% above the FHP (Type II) and 30.21% below the FHP (Type III). Studies on this classification in different populations are needed. The relationship between the asterion and the cranial landmarks has been investigated by many previous studies, including studies of sex determination by the mastoid triangle and surgical interventions involving pathologies of the posterior cranial fossa. Population and genetic differences and variations in the localisation of the asterion caused by the presence of the wormian bone make it difficult to determine the opening site of the first burr hole, especially for surgical interventions (retrosigmoid approach) [6,8,9].

Yasargil et al. [26] determined three specific points on the skull for the craniotomy process. These points are as follows: (1) an area approximately three fingers wide on the back of the skull, on the side of the external occipital protuberance and just above the superior nuchal line; (2) the point just above the mastoid process; and (3) the point located approximately 3 centimetres inwards from the mastoid process. According to Lang Jr and Samii [10], the FHP is an anatomical reference line on the scalp or bone used to mark the point where the first burr hole will be made in the craniotomy procedure: this first burr hole should be, for males are 50 mm behind the suprameatal spine and 11.5 mm under the FHP and for females are 45-50 mm behind the suprameatal spine and also 11.5 mm under the FHP. Day et al. [27] suggested that the burr hole to be opened in the skull should be located just below the superior nuchal line and at the back of the mastoid bone. Rhoton [28] recommends that the burr hole be opened 2 cm below the asterion, two-thirds behind and one-third in front of the occipitomastoid suture.

Knowing the asterion's distances to the cranial anatomical landmarks encountered superficially and surgically is important for determining safe and accurate burr hole localisation, performing microcraniotomy and reducing complications in surgical interventions [9].

In addition, determining the location of the asterion is also important for plastic reconstructive surgery. In cases of craniosynostosis, especially in patients with posterior plagicephalus, it is known that the asterion is an important factor in developing pathological disorders [29]. In the management of craniosynostosis cases, especially in posterior plagiocephaly, the asterion can serve as a critical anatomical landmark for osteotomy [29,30]. Additionally, the asterion can be used as a cranial anatomical landmark to prevent injury to the mastoid emissary vein in these reconstructive surgical procedures [29,30].

Table 3 summarises the results of measurements between the asterion and cranial anatomical landmarks identified in previous studies in the literature. In the distance measurements between the asterion and L, our study is similar to Khan et al. [23], Akkaşoğlu et al. [3] and Berkban et al. [40] and differs from Muche [22] and Sharma et al [38]. If compare our study with other studies in terms of distance measurement between the asterion and the FHP, it is observed that the obtained results are similar to those of Ucerler and Gövsa [2], but differ from Galindo de Leon et al. [17] and Muche [22]. The RZA and the TMP are two of the most commonly used cranial anatomical landmarks in the literature for the location of the asterion. The A–RZA values obtained in our study are consistent with the studies [2,4,17,23,24,27,32,33,38] in Table 3, except Kabakci et al [7], Muche [22] and Akkasoglu et al. [3]. Regarding the analysed distance measurements of A–TMP, it can be noted that the A–TMP measurements in the studies [2–4,7,17,23,24,27,31–33,35–38] in Table 3 are quite similar and consistent with our study's, except for the female measurements of Saini et al. [34] and Sukre et al. [39], as well as Muche's [22] measurements. In terms of A–HS measurements, it is observed that the longest distance measurement in Table 3 [17,22,24,27,32] belongs to our study, but it can be stated that it is compatible with the measurements of Ucerler and Gövsa [2]. Excluding Muche's [22] study, the A–EOP measurements in Table 3 [3,17,23,24,38] and the results obtained in our study are close. The A–P distance, which is measured as part of sex determination studies based on the mastoid triangle in the literature, was found to be longer in our study than the findings of previous studies (Table 3) [7,31,34–37,39]. There are few studies in the literature on distance measurements of A–B and A–O [32,40]. The fact that these measurements were made in our study makes a valuable contribution to the literature. When Muche's [22] study is excluded from the 20 studies in Table 3 regarding the distance of A–TMP, it is seen that the results are quite close to one another.

Table 3. Comparison of measurements with previous studies (Mean ± SD) (in mm).

	A-L	A-FHP	A-RZA	A-TMP	A-HS	A-EOP	A-B	A-O	A-P
Ucerler & Gövsa [2]		R:14.90±7.90 L:15.20±7.20	R:54.10±5.42 L:55.00±5.40	R:48.70±5.50 L:49.50±5.30	R:45.30±5.80 L:45.70±5.20				
Akkaşoğlu et al. [3]	R:82.00±4.96 L:81.40±7.36		R:43.95±7.02 L:43.97±7.37	R:45.01±6.04 L:43.65±6.75		R:54.75±5.57 L:62.59±8.83			
Fang et al. [4]			R:54.60±5.50 L:54.10±5.42	R:49.10±3.56 L:48.70±2.23					
Kabakçı et al. [7]			R:42.75±4.90 L:44.05±7.15	R:49.58±5.31 L:49.24±5.06					R:42.40±7.21 L:42.80±4.45
Galindo de Leon et al. [17]		5.49±3.20	54.74±4.46	51.53±4.97	44.16±5.81	61.51±7.44			
Muche[22]	R:76.80±5.60 L:74.30±5.50	R:5.60±0.20 L:6.10±0.21	R:63.10±6.10 L:63.90±6.00	R:43.50±5.80 L:43.90±4.60	R:38.30±4.10 L:38.10±3.70	R:48.00±7.40 L:46.60±6.70			
Khan et al. [23]	R:88.40±5.48 L:88.40±4.85		R:55.60±4.15 L:55.60±4.11	R:49.70±5.77 L:49.50±4.92		R:65.60±3.65 L:66.20±3.84			
Bojona et al. [24]			R:54.43±3.85 L:53.41±3.95	R:50.67±5.46 L:49.67±5.54	R:43.01±2.80 L:43.11±3.35	R:64.49±3.99 L:65.45±3.56			
Day et al. [27]			57.00±8.50	49.20±4.40	41.40±4.30				
Galdames et al. [31]				Female R:48.34±3.87 L:50.17±5.18 Male R:50.21±4.96 L:50.22±4.95					Female R:46.74±3.30 L:47.53±3.80 Male R:47.45±3.46 L:47.10±3.46
Çırpan et al. [32]			R:55.11±3.86 L:54.37±4.35	R:48.00±5.04 L:47.63±5.15	R:41.68±3.89 L:41.59±4.03			R:61.79±3.51 L:61.64±3.87	
Wirahiat et al. [33]			R:57.82±6.60 L:58.87±5.66	R:51.24±5.58 L:51.04±5.13					
Saini et al. [34]				Female 43.00±4.32 Male 47.83±4.06					Female 44.69±3.75 Male 47.89±3.17
Madhumathi et al. [35]				R:45.63±5.22 L:44.49±5.18					R: 40.93±5.29 L: 40.45±5.77

Kanchan et al. [36]				Female: 47.16±4.74 Male 48.68±4.66					Female: 42.31±3.74 Male: 43.97±3.24
Jain et al. [37]				R:4.95±0.81 L:4.92±0.81					R: 4.59±0.71 L: 4.60±0.71
Sharma et al. [38]	R:77.71±5.59 L:79.03±3.78		R:55.72±6.11 L:56.90±5.98	R:46.41±5.86 L:45.30±5.99		R:60.01±5.23 L:62.15±5.97			
Sukre et al. [39]				Female 42.59±1.12 Male: 48.33±0.64					Female 40.46±1.03 Male 44.96±0.57
Berkban et al. [40]	R:82.71±6.14 L:81.84±5.44						R:75.92±3.83 L:75.00±3.54		
Our Study	R:85.16±5.64 L:84.41±5.43	R:13.17±6.81 L:14.01±6.96	R:56.18±3.58 L:56.64±3.69	R:49.42±4.16 L:48.91±4.03	R:46.15±3.74 L:46.69±3.79	R:63.19±4.13 L:62.71±4.07	R:73.50±3.73 L.72.96±3.51	R:62.46±2.88 L:62.23±2.85	R:49.51±3.87 L:50.32±3.94

When the differences between women and men in the studies of Saini et al. [34] and Sukre et al. [39] are taken into account, studies in which the distance of A–TMP is measured separately for women and men for each ethnic group may reveal that TMP is more reliable than other cranial anatomical landmarks in determining the location of the asterion.

Morphometric differences between the morphology of the asterion and the distance of the asterion from the cranial anatomical landmarks due to ethnic, genetic and individual characteristics necessitate that burr hole localisation should be considered differently for each patient in modern surgical approaches. Therefore, planning the operation using patient information and imaging methods is probably most appropriate.

Limitations

The study was conducted in a single centre in Türkiye using a small number of dry skulls (hemi skulls). The demographic data of the dry skulls (hemi skulls) could not be obtained. In addition, the measurements of the skulls were made by a single person. It is recommended that more detailed studies on dry skulls be conducted in more than one centre in Türkiye, where demographic data can be obtained, or using 3D imaging methods.

CONCLUSIONS

In this study, the morphological and morphometric features of the asterion in Turkish human skulls were analysed and compared with studies conducted in other populations.

The asterion is used as an important cranial anatomical landmark in the human skull for clinicians. It is frequently used in neurosurgery, especially in surgeries performed in the posterior cranial fossa, where structures such as the cerebellum and brainstem are located. In these surgical approaches, the asterion and other cranial anatomical landmarks are used to determine the location of the burr hole for the correct surgical approach. In this way, the unnecessary removal of a large bone fragment is prevented, the duration of surgery is shortened and the risk of serious complications, such as damage to important vessels (e.g. the sigmoid sinus, transverse sinus or cranial nerves), is reduced.

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