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Original article

The sphenofrontal suture: Age, gender characteristics, and correlation with craniometric parameters

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Abstract

The purpose of the study *was to study the length of the sphenofrontal suture in age and gender aspects, as well as its correlation with craniometric parameters.*

Methods. *The research material consisted of 200 skulls. There were 20 skulls of adolescence age, I adulthood age 68, II adulthood age 72, and elderly age 40. In total, there were 86 male skulls and 114 female skulls. The statistical significance of the difference between the groups' indicators was assessed by the Student-Bonferroni t-test, F-Fisher tests, nonparametric Mann-Whitney U-test, and nonparametric Kruskal-Wallis H-test. A non-parametric ρ-Spearman's rank correlation was used in the study.*

Results. *Analysis of male skulls by age did not reveal a statistically significant difference for the length of the left sphenofrontal suture (PF = 0.177; PH = 0.142). Also, on male skulls, the length of the right sphenofrontal suture values did not have a statistically significant difference (PF = 0.916; PH = 0.936). On female skulls, the value of the studied parameter also did not differ statistically across age periods: for the left sphenofrontal suture (PF = 0.643; PH = 0.688) and for the right sphenofrontal suture (PF = 0.956; PH = 0.880). The left sphenofrontal suture's length differed statistically significantly between male and female skulls only in adulthood age II (PF < 0.001; PU < 0.001). The length of the left sphenofrontal suture had a statistically significant direct correlation with a large number of craniometric parameters (maximum cranial length, nasio-occipital length, maximum cranial breadth, basion-bregma height, cranial base length, maxilla-alveolar breadth, minimum frontal breadth, upper facial breadth, nasal height, nasal breadth, left orbital height, right orbital height, parietal chord, mastoid height and biasterionic breadth). The length of the right sphenofrontal suture was statistically significantly directly correlated with cranial base length, left orbital height, right orbital height, parietal chord, and biasterionic breadth.*

Conclusion. *Considering that isolated premature synostosis of the sphenofrontal suture has been increasingly identified in clinical practice in recent years, study is of not only theoretical but also practical interest.*

Key words: *sphenofrontal suture, a non-parametric ρ-Spearman's rank correlation, male skulls, female skulls, craniometric parameters.*

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Introduction

Close attention to the study of the sphenofrontal (frontosphenoidal) suture is primarily associated with the involvement of this suture in the process of premature synostosis and a number of external and functional defects resulting from this pathology [1–5]. According to Sperber GH. et al. [6], the growth of the anterior cranial fossa in the anteroposterior direction depends on the growth of the sphenofrontal, frontoethmoidal, and sphenoethmoidal sutures. Sutures are sites of cell proliferation and fiber formation where appositional osteogenesis promotes growth of adjacent bones. Experimental evidence shows that sutural bone growth compensates for separating forces, which are the main determinants of cranial growth. The separation of bones is not a purely translatory movement, but rather an alternating oscillatory movement. It responds to functional matrices that act through pressure or tension on the bones resulting from organ growth or muscle pull. Calandrelli R. et al. [7] indicated that the continuation of each coronal suture to the base of the skull is divided into anterior and posterior branches. The anterior branch consists of the fronto-sphenoidal suture (minor) and ethmoidosphenoidal synchondrosis, and the posterior branch consists of the spheno-squamous and sphenoidparietal sutures (minor) and spheno-petrosal synchondrosis. The shortened length of the middle cranial fossa is associated with the extension of the synostotic process towards the minor sutures of the anterior branch of the coronary ring. In particular, welding of fronto-sphenoidal sutures plays a key role in reducing the growth of the middle cranial fossa. The presence of major sutures in the coronal ring (coronal sutures) and minor sutures in the posterior branch of the coronal ring does not lead to a decrease in the length of the middle cranial fossa. According to Runyan CM. et al. [8], the pattern of increasing involvement and severity of suture fusion was observed for both major and minor sutures within the different arches and intraoccipital synchondroses. In general, minor suture fusion presented together with, or before, fusion of the major suture within the same arch.

Transorbital neuroendoscopic approaches (TONES) promise to open up new possibilities in skull base surgery, offering alternative routes to reach the anterior and middle cranial fossa (ACF and MCF, respectively). The plane of attachment of the lateral canthal tendon and sphenofrontal suture (SFS) have been identified as key anatomical landmarks for TONES approaches [9].

A small number of studies have been devoted to the prenatal morphogenesis of the sphenofrontal suture [10, 11]. According to Captier G. et al. [10], the sphenofrontal suture was first identified in the fetus at 2.7 months of age as two distinct regions. The first was located medially between the orbital part of the frontal bone and the lesser wing of the sphenoid bone. It was located almost in a horizontal plane and formed the roof of the orbit. The second was located laterally between the frontal bone and the greater wing of the sphenoid bone and formed the lateral wall of the orbit. The medial part was the junction of the membranous ossification of the frontal bone and the endochondral ossification of the ala orbitalis. The lateral sphenofrontal suture develops, like other sutures, between two membranous bones: the orbital part of the frontal bone and the greater wing of the sphenoid bone. This is an end-to-end suture, the growth axis of which is vertical relative to the lateral wall of the orbit. Mathijssen IM. et al. [11] in their study found that in the youngest specimen (15 weeks of gestation), ossification of the cartilages of the lesser and greater wings of the sphenoid bone continued, while a significant part of the roof of the orbit, formed by the frontal bone, had already formed. A fairly wide membranous interface was observed between the sphenoid and frontal bones. This distance between the free edges of the frontal bone inside the orbit and the sphenoid bone gradually decreased over the following weeks. At week 19, the greater wing of the sphenoid bone and the frontal bone are at their closest approach in the upper lateral corner of the orbit. The first origin of the frontosphenoidal suture was seen at this site, extending just beyond the orbit in the temporal region in a 21-week fetus. Over time, suture formation spreads from this point intraorbitally in the mediocaudal direction and temporally in the occipito-cranial direction. Skull at approximately 34 weeks' gestation with completed frontosphenoidal suture, both intraorbital and temporal. In the temporal region, the frontosphenoidal suture lies in front of the sphenoid fonticulus, which closes during the first year of life.

The importance of growth in the sphenofrontal suture for intracranial enlargement and formation of the upper part of the face is indicated [12–14]. According to Enlow DH. and Hans MG. [12], there is resorption from the anterior wall of the middle cranial fossa, deposition on the orbital surface of the sphenoid bone and in the sphenofrontal suture, as well as displacement of the anterior cranial fossa forward as the frontal lobes shift anteriorly. Jhamb T. et al. [13] have suggested that the growth of the sphenoethmoidal and sphenofrontal sutures in the anterior cranial base ceases at about 7 years of age; therefore, the anterior cranial base is used as a reference structure for superimposing radiographs in 2-dimensional (2D) and 3-dimensional (3D). These data are consistent with the study by Sakurai A. et al. [14], which indicates that premature closure of the coronal suture, which also includes a similar process in the sphenofrontal suture, retards forward growth of the frontal bone.

The main features of the spheno-frontal suture craniosynostosis, which distinguish it from other plagiocephaly types, are the following: the supraorbital margin on the affected side is displaced downward; the deviation of the nose is insignificant and always manifests itself in the form of a displacement of the tip of the nose towards the affected side and the root of the nose towards the healthy side. Its synostosis limits the growth of the superolateral edge of the orbit upward, outward, and forward, which causes such main signs of synostosis as drooping of the roof of the orbit, flattening of the supraorbital region, and frontal and temporal regions (which are adjacent to each other in this place) [1].

The literature review, as follows from the above, covers many aspects of theoretical and practical medicine with the study of the sphenofrontal suture. However, unfortunately, it was not possible to find a general work on the morphometry, age, and gender characteristics of this suture. The bulk of research [1–5, 7, 8, 14] concerns premature synostosis of the sphenofrontal suture with the development of plagiocephaly. Craniosynostosis is a process of premature suture closure and occurs as the brain continues to grow, whereas craniostenosis is the result of this process [7].

To thoroughly explain the role of the sphenofrontal suture in the development of plagiocephaly and to clarify the predisposition of this suture to premature synostosis, it is necessary to study age and gender characteristics, as well as its correlation with the main craniometric parameters.

It was not possible to find any work carried out for this purpose.

The purpose of the study was to study the length of the sphenofrontal suture in age and gender aspects, as well as its correlation with craniometric parameters.

Material and methods

The research material was 200 skulls from the craniological collection of the museum of the Department of Human Anatomy and Medical Terminology of the Azerbaijan Medical University. The age periodization scheme adopted in 1965 at the 7th All-Union Conference on Problems of Age-Related Morphology, Physiology, and Biochemistry was used [15]. Thus, there were 20 skulls of adolescence age, I adulthood age 68, II adulthood age 72, and elderly age 40. In total, there were 86 male skulls and 114 female skulls. The length of the sphenofrontal suture was measured between its intersection with the coronal suture and its intersection with the sphenozygomatic suture. All skulls with synostosis of the suture sections involved in the formation of the points between which the length of the sphenofrontal suture was measured were excluded from the study.

The length of the sphenofrontal suture was first measured in two ways: in the first method, the tracing paper was placed on the sutures, and the suture's serrations were carefully outlined with a pencil. Then the tracing paper was transferred to graph paper and the length of the suture was measured. With the second method, the thread was inserted into the suture using a needle completely, along the entire length of the suture; then the thread was pulled out of the suture and its length was measured. The length of the suture was taken as the average of the two indicated values. All cranial measurements were made according to Langley NR. et al. [16]. These sizes were also determined using an electronic digital caliper (resolution: 0.01 mm, accuracy: ±0.02 mm). In the study we calculated the mean (M), median (Me), 25%, and 75% percentiles (Percentile 25, Percentile 75) of the investigated parameters. Statistical analysis was carried out using the program "IBM Statistics SPSS-26". The statistical significance of the difference between the groups' indicators was assessed by the Student-Bonferroni t-test, F-Fisher tests, nonparametric Mann-Whitney U-test, and nonparametric Kruskal-Wallis H-test. A non-parametric ρ-Spearman's rank correlation was used in the study [17]. The limit of statistical significance was taken equal to be 0.050. Correlations of the length of the left and right sphenofrontal sutures with age, gender, maximum cranial length, nasio-occipital length, maximum cranial breadth, bizygomatic breadth, basion-bregma height, cranial base length, basion-prosthion length, maxilla-alveolar breadth, maxilla-alveolar length, biauricular breadth, nasion-prosthion height, minimum frontal breadth, upper facial breadth, nasal height, nasal breadth, left orbital breadth, right orbital breadth, left orbital height, right orbital height, biorbital breadth, interorbital breadth, frontal chord, parietal chord, occipital chord, foramen magnum length, foramen magnum breadth, mastoid height, biasterionic breadth, bimaxillary breadth, and zygoorbitale breadth were studied.

The protocol of this study to investigate the correlation between the length and width of the foramen magnum and craniometric data of the skull was approved by the Bioethics Committee of the Azerbaijan Medical Academy in 2020.

Results

The values of the left and right sphenofrontal sutures length on male skulls of adolescence and I adulthood age are given in Table 1; the same parameters for II adulthood age and elderly age are given in Table 2.

Table 1 - The values of the left and right sphenofrontal sutures length on male skulls in adolescence and I adulthood age (in mm)

Age periods	Adolescence				I adulthood age			
Parameters and their values	M	Me	Percentile 25	Percentile 75	M	Me	Percentile 25	Percentile 75
Left sphenofrontal suture's length	23.9	23.8	21.2	26.4	24.0	23.5	22.0	26.2
Right sphenofrontal suture's length	22.8	22.5	19.5	26.0	23.2	22.1	20.8	25.7

Table 2 - The values of the left and right sphenofrontal sutures length on male skulls of in II adulthood and elderly ages (in mm)

Age periods	II adulthood age				Elderly age			
Parameters and their values	M	Me	Percentile 25	Percentile 75	M	Me	Percentile 25	Percentile 75
Left sphenofrontal suture's length	25.3	25.1	23.4	26.8	23.6	22.8	21.2	25.9
Right sphenofrontal suture's length	23.2	23.8	21.2	25.9	22.6	22.3	21.2	24.6

The values of the left and right sphenofrontal sutures length on female skulls of adolescence and I adulthood age are given in table 3; the same parameters for II adulthood age and elderly age are given in Table 4.

Table 3 - The values of the left and right sphenofrontal sutures length on female skulls in adolescence and I adulthood age (in mm)

Age periods	Adolescence				I adulthood age			
Parameters and their values	M	Me	Percentile 25	Percentile 75	M	Me	Percentile 25	Percentile 75
Left sphenofrontal suture's length	22.5	22.3	21.0	23.8	22.9	22.4	21.2	24.0
Right sphenofrontal suture's length	22.7	22.0	20.7	25.0	22.7	21.6	20.4	25.5

Analysis of male skulls by age did not reveal a statistically significant difference for the length of the left sphenofrontal suture (PF=0.177; PH=0.142). Also, on male skulls, the length of the right sphenofrontal suture values did not have a statistically significant difference (PF=0.916; PH=0.936). On female skulls, the value of the studied parameter also did not differ statistically across age periods: for the left sphenofrontal suture (PF = 0.643; PH = 0.688) and for the right sphenofrontal suture (PF=0.956; PH = 0.880).

Table 4 - The values of the left and right sphenofrontal sutures length on female skulls in II adulthood and elderly ages (in mm)

Age periods	II adulthood age				Elderly age			
Parameters and their values	M	Me	Percentile 25	Percentile 75	M	Me	Percentile 25	Percentile 75
Left sphenofrontal suture's length	22.9	22.3	21.6	23.9	23.6	23.1	21.5	24.4
Right sphenofrontal suture's length	23.0	22.9	20.9	24.0	23.1	22.3	21.2	24.2

The left sphenofrontal suture's length differed statistically significantly between male and female skulls only in adulthood age II (PF < 0.001; PU < 0.001). In other age periods, the length of the left sphenofrontal suture did not have a statistically significant difference between male and female skulls: in adolescence (PF = 0.326; PU = 0.409), in I adulthood (PF = 0.134; PU = 0.080), and in elderly age (PF = 0.978; PU = 0.967). A study of the difference in the length of the right sphenofrontal suture did not reveal a statistically significant difference in all age periods studied: in adolescence (PF = 0.922; PU = 0.934), in I adulthood (PF = 0.529; PU = 0.481), in II adulthood (PF = 0.818; PU = 0.401), and in elderly age (PF = 0.604; PU = 0.892).

The values of the sphenofrontal suture indicators by age periods are given in Table 5.

Table 5 - Values of the length of the sphenofrontal suture by age periods (in mm)

		Age periods			
		Adolescence	I adulthood	II adulthood	Elderly
Left sphenofrontal suture	Mean	22.9	23.4	24.0	23.6
	Median	22.7	22.9	23.6	23.1
	Percentile 25	21.1	21.2	21.9	21.3
	Percentile 75	25.5	25.7	26.1	24.7
Right sphenofrontal suture	Mean	22.7	22.9	23.1	22.8
	Median	22.0	21.7	23.3	22.3
	Percentile 25	20.7	20.5	21.1	21.2
	Percentile 75	25.5	25.5	24.9	24.4

Left sphenofrontal suture: PF = 0.398; PH = 0.296. Right sphenofrontal suture: PF = 0.976; PH = 0.858.

The values of the length of the sphenofrontal suture indicators for males and females are given in Table 6.

Table 6 - Values of the length of the sphenofrontal suture for male and female skulls (in mm)

		Gender			
		Male skulls	Female skulls		
Left sphenofrontal suture	Mean	24.4	23.0	PF = 0.001	PU < 0.001
	Median	24.3	22.5		
	Percentile 25	22.1	21.2		
	Percentile 75	26.5	24.1		
Right sphenofrontal suture	Mean	23.0	22.8	PF = 0.698	PU = 0.433
	Median	22.5	22.2		
	Percentile 25	21.0	20.6		
	Percentile 75	25.7	24.6		

The results of correlations of the sphenofrontal suture obtained are presented in the form of Tables 7 – 11.

Table 7 - Correlation relationships between left and right sphenofrontal sutures's length with age, gender, maximum cranial length, nasio-occipital length, and maximum cranial breadth

Data	SFS (l)	SFS (r)	Age	Gender	MCL	NOL	MCB
SFS (l) ρ p	1.000	0.676** 0.000	0.077 0.282	-0.254** 0.000	0.310** 0.000	0.310** 0.000	0.226** 0.001
SFS (r) ρ p	0.676** 0.000	1.000	0.037 0.604	-0.056 0.434	0.121 0.087	0.080 0.263	0.088 0.216

* - the null hypothesis is rejected.
SFS (l): sphenofrontal suture (left); SFS (r): sphenofrontal suture (right); MCL: maximum cranial length; NOL: nasio-occipital length; MCB: maximum cranial breadth.

Table 8 - Correlation relationships between left and right sphenofrontal sutures's length with bizygomatic breadth, basion-bregma height, cranial base length, basion-prosthion length, maxilla-alveolar breadth, maxilla-alveolar length, and biauricular breadth

Data	BZB	BBH	CBL	BPL	MAB	MAL	BAB
SFS (l) ρ p	0.096 0.177	0.227** 0.001	0.285** 0.000	0.012 0.866	0.172* 0.015	0.044 0.543	0.071 0.319
SFS (r)ρ p	0.006 0.931	0.075 0.292	0.189** 0.007	0.039 0.588	-0.026 0.714	-0.024 0.739	0.028 0.691

* - the null hypothesis is rejected.
BZB: bizygomatic breadth; BBH: basion-bregma height; CBL: cranial base length; BPL: basion-prosthion length; MAB: maxilla-alveolar breadth; MAL: maxilla-alveolar length; BAB: biauricular breadth.

Table 9 - Correlation relationships between left and right sphenofrontal sutures's length with nasion-prosthion height, minimum frontal breadth, upper facial breadth, nasal height, nasal breadth, left orbital breadth, and right orbital breadth

Data	NPH	MFB	UFB	NH	NB	OBL	OBR
SFS (l)ρ p	0.101 0.157	0.224** 0.001	0.159* 0.025	0.211** 0.003	0.147* 0.039	0.087 0.221	0.025 0.723
SFS (r) ρ p	0.005 0.949	0.118 0.096	0.086 0.226	0.109 0.124	0.133 0.061	0.089 0.212	0.067 0.346
* - the null hypothesis is rejected. NPH: nasion-prosthion height; MFB: minimum frontal breadth; UFB: upper facial breadth; NH: nasal height; NB: nasal breadth; OBL: orbital breadth left; OBR: orbital breadth right.							

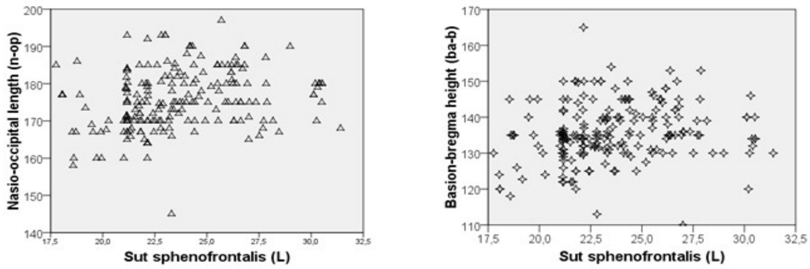
Table 10 - Correlation relationships between left and right sphenofrontal sutures's length with left orbital height, right orbital height, biorbital breadth, interorbital breadth, frontal chord, parietal chord, and occipital chord

Data	OHL	OHR	BOB	IOB	FC	PC	OC
SFS (l) ρ p	0.142* 0.046	0.208** 0.003	0.047 0.506	0.074 0.301	0.128 0.071	0.152* 0.032	-0.041 0.564
SFS (r) ρ p	0.171* 0.015	0.161* 0.022	-0.043 0.544	-0.085 0.229	-0.043 0.544	0.140* 0.047	0.032 0.649
* - the null hypothesis is rejected. OHL: orbital height left; OHR: orbital height right; BOB: biorbital breadth; IOB: interorbital breadth; FC: frontal chord; PC: parietal chord; OC: occipital chord.							

Table 11 - Correlation relationships between left and right sphenofrontal sutures's length with foramen magnum length, foramen magnum breadth, mastoid height, biasterionic breadth, bimaxillary breadth, and zygoorbitale breadth

Data	FML	FMB	MH	BiAB	BMB	ZOB
SFS (l) ρ p	0.053 0.460	-0.029 0.681	0.237** 0.001	0.189** 0.008	0.088 0.220	0.137 0.054
SFS (r) ρ p	0.051 0.474	0.039 0.582	0.100 0.159	0.141* 0.047	0.037 0.605	0.135 0.056
* - the null hypothesis is rejected. FML: foramen magnum length; FMB: foramen magnum breadth; MH: mastoid height; BiAB: biasterionic breadth; BMB; bimaxillary breadth; ZOB: zygoorbitale breadth.						

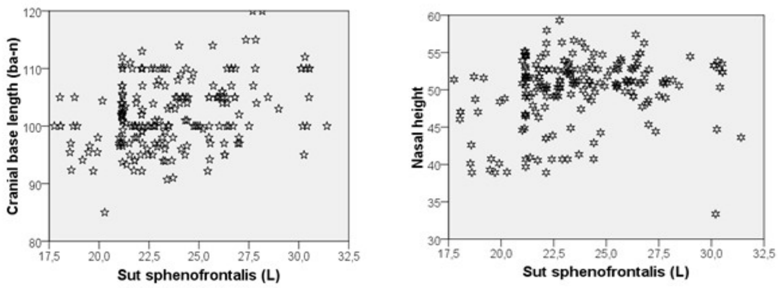
The correlation relationships between SFS (l) and nasio-occipital length (NOL), and between SFS (l) and basion-bregma height (BBH) are presented in the Figure 1.



a *b*

Figure 1 - The correlation relationships between SFS (l) and nasio-occipital length (NOL), and between SFS (l) and basion-bregma height (BBH)

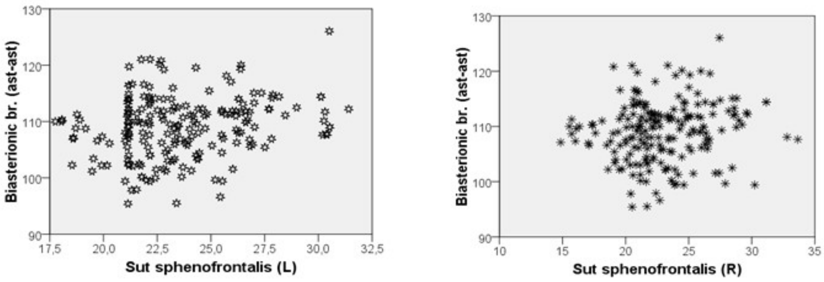
The correlation relationships between SFS (l) and cranial base length (CBL), and between SFS (l) and nasal height (NH) are presented in the Figure 2.



a *b*

Figure 2 - The correlation relationships between SFS (l) and cranial base length (CBL), and between SFS (l) and nasal height (NH)

ρ-Spearman's rank correlation showed that there is correlation between SFS (l) and BiAB (biasterionic breadth) (ρ = 0.189, P = 0.008). Also SFS (r) and BiAB are in correlative relationships (ρ = 0.141, P = 0.047). Results of these correlations are presented in the Figure 3.



a *b*

Figure 3 - The correlation between SFS (l) and BiAB (biasterionic breadth)

ρ-Spearman's rank correlation showed that there is correlation between SFS (r) and CBL (ρ = 0.189, P = 0.007). Result of this correlation is presented in the Figure 4.

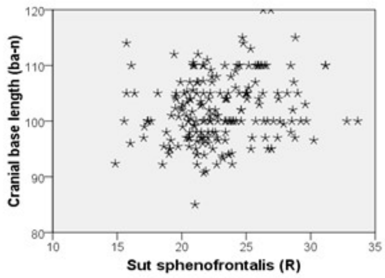


Figure 4 - The correlation between SFS (r) and CBL

Discussion

According to Yasonov SA. et al. [1], sphenofrontal craniosynostosis (SFC) is a new form of premature closure of cranial sutures. Based on cases of craniosynostosis and frontal plagiocephaly observed in the Russian Children's Clinical Hospital since 1999, authors estimated the frequency of isolated SFC to be 1:43 among all cases of synostosis and 1:8 among cases of frontal plagiocephaly.

Plagiocephaly is a complex asymmetrical deformity that affects the skull, facial bones, and mandible [14]. Kreiborg S. et al. [18] also note severe deformation of the base of the skull. According to Opperman L.A. [19], in humans, the end point of cranial vault growth is determined upon fusion of associated bones in the third decade of life. However, in the facial complex, the bones remain separated by a fibrous union until the seventh or eighth decade of life. The sphenofrontal suture, although it refers to the sutures of the cranial vault, in terms of its development in prenatal ontogenesis has connections with the base of the skull, and as follows from the above literary data, with premature synostosis it affects the facial skeleton. The main attention in the literature is paid to such sutures as sagittal, coronal, and lambdoid [20–22]. However, the role of "the minor sutures" in premature synostosis and the resulting reduction in the size of the cranial fossa cannot be underestimated [7, 23]. The temporozygomatic suture on the zygomatic arch grows predominantly in the anteroposterior horizontal direction, largely due to the longitudinal growth of the brain and spheno-occipital synchondrose cartilage. The anteroposterior growth of the nasomaxillary sutures, forming a raised bridge of the nose, is the result of anteroposterior expansion of the nasal septum. The frontomaxillary, frontozygomatic, frontonasal, ethmoidomaxillary, and frontoethmoidal sutures are sites of bone growth primarily in the vertical direction as a result of the expansion of the eyeball and nasal septum [6].

According to our study, the left sphenofrontal suture's length differed statistically significantly between male and female skulls only in adulthood age II (PF < 0.001; PU < 0.001). In other age periods, the study of the difference in the length of the sphenofrontal suture between male and female skulls did not reveal statistical significance.

The correlation of the length of the sphenofrontal suture has not been considered in the literature. According to our data, the length of the left sphenofrontal suture is shorter on female skulls than on male ones. The difference was statistically significant (ρ=-0.254, P<0.001). The right sphenofrontal suture was also longer on male skulls; although this difference was not statistically significant (ρ=-0.056, P=0.434). We found that the length of the left sphenofrontal suture had a statistically significant direct correlation with a large number of craniometric parameters (maximum cranial length, nasio-occipital length, maximum cranial breadth, basion-bregma height, cranial base length, maxilla-alveolar breadth, minimum frontal breadth, upper facial breadth, nasal height, nasal breadth, left orbital height, right orbital height, parietal chord, mastoid height, and biasterionic breadth). The length of the right sphenofrontal suture was statistically significantly directly correlated with cranial base length, left orbital height, right orbital height, parietal chord, and biasterionic breadth. Thus, both sphenofrontal sutures statistically significantly directly correlate with the height of both orbits, cranial base length, parietal chord, and biasterionic breadth. According to Enlow DH. and Hans MG. As the brain expands, the sutures respond by depositing new bone at the contact edges of the frontal, parietal, occipital, and temporal bones. This expands the perimeter of each bone. At the same time, bone is deposited at both the ectocranial and endocranial sites to increase thickness [12]. The main factor, a kind of impulse for the formation of the vault and base of the skull, is the brain. Speransky VS. and Zaichenko A.I. noted that in adult skulls, the anterior quadrants of the skull base were large in total on the left in 20%, on the right in 25%, and were symmetrical in 54.5% of cases [24]. The sphenofrontal sutures have "roots" at the base of the skull and extend to the vault; thus, they are related to the anterior cranial fossa, the cranial vault, and the orbits. This determines, in our opinion, such a number of statistically significant direct correlations with craniometric parameters; their predominance on the left side can be associated with the greater formative activity of the left hemisphere and the contents of the left part of the cranial cavity.

Conclusion

Due to the high relevance of the spread of the plagiocephaly and the involvement of the sphenofrontal suture in this pathology, this suture was studied in age and gender aspects; the correlation of the sphenofrontal suture with craniometric parameters was also studied. Considering that isolated premature synostosis of the sphenofrontal suture has been increasingly identified in clinical practice in recent years, our study is of not only theoretical but also practical interest.

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Speranskij V.S., Zajchenko A.I. Forma t konstrukciya cherepa (The shape and construction of the skull) [in Russian]. - Moskva: Medicina. 1980; 280 p. [Google Scholar]

Сфеноид-маңдай тігісі: Жасы, жыныс ерекшеліктері және краниометриялық параметрлермен корреляциясы

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Түйіндеме

Зерттеудің мақсаты жас және жыныс аспектілері бойынша сфеноид-маңдай тігісінің ұзындығын, сондай-ақ оның краниометриялық параметрлермен корреляциясын зерттеу болды.

Әдістері. Зерттеу материалына 200 бас сүйек (20 кәмелетке толмаған бас сүйек, 68 бірінші, 72 екінші жетілген және 40 қарт бас сүйек) кірді. Барлығы 86 ер адамның бас сүйегі мен 114 әйелдің бас сүйегі зерттелді. Топтар арасындағы айырмашылықтың статистикалық маңыздылығы Студент-Бонферрони t-тесті, Фишердің F-тесті, параметрлік емес Манн-Уитни U-тесті және параметрлік емес Крускал-Уоллис H-тесті арқылы бағаланды. Зерттеуде параметрлік емес ρ-Спирман дәрежелік корреляциясы қолданылды.

Нәтижелері. Жасы бойынша ерлердің бас сүйектерін талдау сол жақ сфеноид-маңдай тігісінің ұзындығы бойынша статистикалық маңызды айырмашылықты анықтаған жоқ (PF = 0,177; PH = 0,142). Сондай-ақ, ерлердің бас сүйектерінде оң жақ сфенофронтальді тігістің ұзындығының мәндерінде статистикалық маңызды айырмашылық байқалмады (PF = 0,916; PH = 0,936). Әйелдердің бас сүйектерінде зерттелетін индикатордың мәні әртүрлі жас кезеңдерінде де статистикалық тұрғыдан ерекшеленбеді: сол жақ сфеноид-маңдай тігісі бойынша (PF = 0,643; PH = 0,688) және оң жақ сфеноид-маңдай тігісі бойынша (PF = 0,956; PH = 0,880). Сол жақ сфенофронтальді жік тігісінің ұзындығы тек II ересек жаста (PF < 0,001; PU < 0,001) ерлер мен әйелдердің бас сүйектері арасында статистикалық тұрғыдан айтарлықтай ерекшеленді. Сол жақ сфеноид-маңдай тігісінің ұзындығы көптеген краниометриялық параметрлермен статистикалық маңызды тікелей корреляцияға ие болды (максималды бассүйек ұзындығы, мұрын-желке ұзындығы, максималды бассүйек ені, базион-брегма биіктігі, бас сүйегінің негізі ұзындығы, жоғарғы жақ-альвеолярлық ені, ең кіші маңдай ені, жоғарғы бет ені, мұрын биіктігі, мұрын ені, сол жақ орбитаның биіктігі, оң жақ орбитаның биіктігі, париетальды хорда, мастоид биіктігі және биастеронды ені). Оң жақ сфенофронтальді жіптің ұзындығы бас сүйегінің негізінің ұзындығымен, сол жақ орбитаның биіктігімен, оң жақ орбитаның биіктігімен, қабырғалық хордамен және биастерондық енімен статистикалық тұрғыдан айтарлықтай тікелей байланысты болды.

Қорытынды. Соңғы жылдары клиникалық тәжірибеде сфеноид-фронтальды тігістің оқшауланған мерзімінен бұрын синостозы жиі анықталып жатқанын ескере отырып, зерттеу тек теориялық емес, сонымен қатар практикалық қызығушылық тудырады.

Түйін сөздер: сфенофронтальді тігіс, параметрлік емес ρ-Спирмен дәрежелі корреляция, ерлердің бас сүйектері, әйел бас сүйектері, краниометриялық параметрлер.

Клиновидно-лобный шов: Возрастные, половые особенности и корреляция с краниометрическими параметрами

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Резюме

Целью исследования явилось изучение длину клиновидно-лобного шва в возрастном и половом аспектах, а также ее корреляцию с краниометрическими показателями.

Методы. Материалом исследования послужили 200 черепов (20 черепов юношеского возраста, 68 первого, 72 второго зрелого возрастов и 40 черепов пожилого возраста). Всего было исследовано 86 мужских черепов и 114 женских черепов. Статистическую значимость разницы между показателями групп оценивали с помощью t-критерия Стьюдента-Бонферрони, F-критерия Фишера, непараметрического U-критерия Манна-Уитни и непараметрического H-критерия Краскела-Уоллиса. В исследовании использовалась непараметрическая ранговая корреляция ρ-Спирмена.

Результаты. Анализ мужских черепов по возрасту не выявил статистически значимой разницы по длине левого клиновидно-лобного шва (PF = 0,177; PH = 0,142). Также на мужских черепах значения длины правого клиновидно-лобного шва не имели статистически значимой разницы (PF = 0,916; PH = 0,936). На женских черепах значение изучаемого показателя также статистически не различалось в разные возрастные периоды: для левого клиновидно-лобного шва (PF = 0,643; PH = 0,688) и для правого клиновидно-лобного шва (PF = 0,956; PH = 0,880). Длина левого клиновидно-лобного шва статистически значимо различалась между мужскими и женскими черепами только во II зрелом возрасте (PF < 0,001; PU < 0,001). Длина левого клиновидно-лобного шва имела статистически значимую прямую корреляцию с большим количеством краниометрических показателей (максимальная черепная длина, назион-затылочная длина, максимальная черепная ширина, высота базион-брегма, длина основания черепа, максилло-альвеолярная ширина, наименьшая ширина лба, верхняя лицевая ширина, высота носа, ширина носа, высота левой орбиты, высота правой орбиты, теменная хорда, высота сосцевидного отростка и биастерионическая ширина). Длина правого клиновидно-лобного шва статистически значимо напрямую коррелировала с длиной основания черепа, высотой левой орбиты, высотой правой орбиты, теменной хордой и биастерионическая шириной.

Выводы. Учитывая, что в последние годы в клинической практике все чаще выявляют изолированные преждевременные синостозы клиновидно-лобного шва, исследование представляет не только теоретический, но и практический интерес.

Ключевые слова: клиновидно-лобный шов, непараметрическая ранговая корреляция ρ-Спирмена, мужские черепа, женские черепа, краниометрические параметры.