Int. J. Morphol.,
42(4):1144-1149, 2024.

Morphometric Analysis of Stylomastoid Foramen and its Clinical Significance

Análisis Morfométrico del Foramen Estilomastoideo y su Importancia Clínica

Marko Devic[1,2]; Nikolina Pupovac[3]; Tamara Zelenovic[1,2]; Milica Pisaric[1,2]; Dusan Zbucnovic[1]; Dusan Tucakovic[2,4] & Ivan Sivcev[1,2]

DEVIC, M.; PUPOVAC, N.; ZELENOVIC, T.; PISARIC, M.; ZBUCNOVIC, D.; TUCAKOVIC, D. & SIVCEV, I. Morphometric analysis of stylomastoid foramen and its clinical significance. *Int. J. Morphol., 42(4)*:1144-1149, 2024.

SUMMARY: The stylomastoid foramen is located on the inferior surface of the petrous part of the temporal bone between the base of the styloid process and mastoid processes. Through the stylomastoid foramen the facial nerve completes its intracranial part. The aim of this study was to analyze the morphometric parameters, shape and position of the stylomastoid foramen on the skulls in Serbian population, and to correlate it with gender and body side. The study included 44 dry adult skulls (88 stylomastoid foramen). After we determined the gender, the skulls were photographed, and then distances of the stylomastoid foramen from various important landmarks of the skull base were measured in programme ImageJ. The shape and position of the stylomastoid foramen were also noted. The statistical significance was found in male skulls between right and left side in relation to parameter (P2) the shortest distance from the upper end of the anterior margin of the mastoid process (MP) to the center of stylomastoid foramen (CSMF), and on the left side for parameter (P6) the shortest distance between CSMF and the line passing through the tip of the MP in relation to gender. The most common shape of the stylomastoid foramen was round in 46 (52.27 %) cases, and most common position was on the line passing through the upper end of the anterior margin of both MP in 36 (40.91 %) and medially to the line connecting the tips of the MP and styloid process in 88 (100 %) cases. The results of this study will be useful for neurosurgeons during surgeries on the facial nerve trunk or anesthetics to give facial nerve block near the foramen and prevent its complications.

KEY WORDS: Stylomastoid foramen; Facial nerve; Morphometry; Skull base.

INTRODUCCIÓN

The stylomastoid foramen (SMF) is a curved aperture located on the inferior surface of the petrous part of the temporal bone, midway between the styloid process (SP) and the mastoid process (MP) (Babacan *et al*., 2022). The SMF is the end of facial nerve canal and the facial nerve, which is the seventh cranial nerve (CN VII), leaves the skull and the stylomastoid artery, that is a branch of the posterior auricular artery, enters the skull through it (Pupovac *et al*., 2020; Knezi *et al*., 2020; Ottaiano *et al*., 2023).

Bell's palsy (BP), represents the most common diagnosis associated with paralysis or weakness of the facial nerve. In most cases, BP leads to a partial or complete inability to spontaneously move the facial muscles on the affected side. (Kochhar *et al*., 2016). The etiology of BP is idiopathic and the diagnosis is based on careful clinical examination and systematic exclusion of possible causes of nerve paralysis or weakness (Zhang *et al*., 2020). The prevailing hypothesis is that BP occurs as a result of swelling and inflammation of the ipsilateral nerve on the side of weakness of the mimic musculature. It is assumed that nerve inflammation is actually a response to infection, most commonly herpes simplex virus type 1 (HSV-1), leading to its swelling. Compression of the inflamed facial nerve was previously attributed to a size discrepancy between the lumen of the facial canal and its new width (Celik *et al*., 2017). Recently, studies have been published on variations in SMF size and shape that may also have clinical implications in unexplained cases of facial nerve palsy (Shin *et al*., 2014; Ghosh & Narayan, 2021).

[1] Clinic for Otorhinolaryngology and Head and Neck Surgery, University Clinical center of Vojvodina, Hajduk Veljkova 1-9, 21000 Novi Sad, Serbia.
[2] Faculty of Medicine, University of Novi Sad, Hajduk Veljkova 3, 21000 Novi Sad, Serbia.
[3] Department of Anatomy, Faculty of Medicine, University of Novi Sad, Hajduk Veljkova 3, 21000 Novi Sad, Serbia.
[4] Clinic for Eye Diseases, University Clinical center of Vojvodina, Hajduk Veljkova 1-9, 21000 Novi Sad, Serbia.

Received: 2024-04-16 Accepted: 2024-05-08

However, sometimes facial nerve paralysis is necessary for the safe performance of surgical interventions. Effective anesthesia is crucial for the safe conduct of intraocular surgeries (Chatellier *et al*., 2013). There are four different approaches to cause a facial nerve block: Atkinson block, van Lint's block, O'Brien block and Nadbath block. The Nadbath block, also known as the modified O'Brien block, is considered to be better than the Atkinson and van Lint blocks in reducing eyelid movements and closure force (Sharma & Varshney, 2015). To perform the Nadbath block, access to the facial nerve is obtained at the level of the stylomastoid foramen, which carries the risk of injuring other nerves (vagus nerve, accessory nerve, glossopharyngeal nerve) and causing serious neurological complications (Kutoglu *et al*., 2021).

The aim of this study was to determine the morphometric parameters, shape and position of the SMF in Serbian population and to correlate it with sex and body side.

MATERIAL AND METHOD

The study included 44 dry adult human skulls (88 SMF) which belong to the osteological collection of the Department of Anatomy, Faculty of Medicine, University of Novi Sad. Only those skulls with preserved bony structures and openings at their inferior surface were considered. The sample consisted of 26 male skulls and 18 female skulls. The sex of the skull was determined based on the assessment of the next four morphological structures: External occipital protuberance, mastoid process, supraorbital margin, and glabella (Stevenson *et al*., 2009). The skulls were placed in a horizontal position with the base facing up and that surface was photographed with a digital camera Olympus SP-560UZ with 18x optical zoom.

Three imaginary lines were drawn (Fig. 1):

1. XY – transverse line passing through the upper end of the anterior margin of both MP
2. AB – line passing through the tip of the MP which is perpendicular to the XY line
3. CD – line connecting the tip of the MP and the tip of the SP

Following parameters were measured on both sides of the skull (Figs. 2 and 3):

P1 – the shortest distance between the tip of the MP to center of stylomastoid foramen (CSMF)
P2 – the shortest distance from the upper end of the anterior margin of the MP to CSMF
P3 – angle (a) between AB and the shortest distance between the tip of the MP to CSMF
P4 – the shortest distance from the CSMF to the center of jugular fossa
P5 – the shortest distance between the CSMF and the root of the SP
P6 – the distance from the CSMF to the AB is determined by drawing a line from the CSMF that is perpendicular to the AB
P7 – the distance from the CSMF to the CD

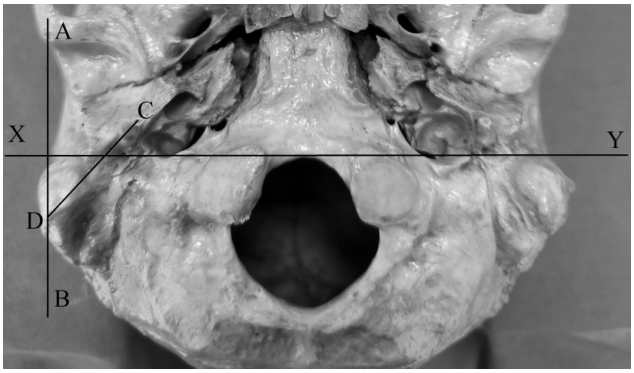

Fig. 1. Imaginary lines: XY - passing through the upper end of the anterior margin of mastoid processes (MP); AB - passing through the tip of MP; CD - connecting the tip of MP and the tip od styloid process (SP).

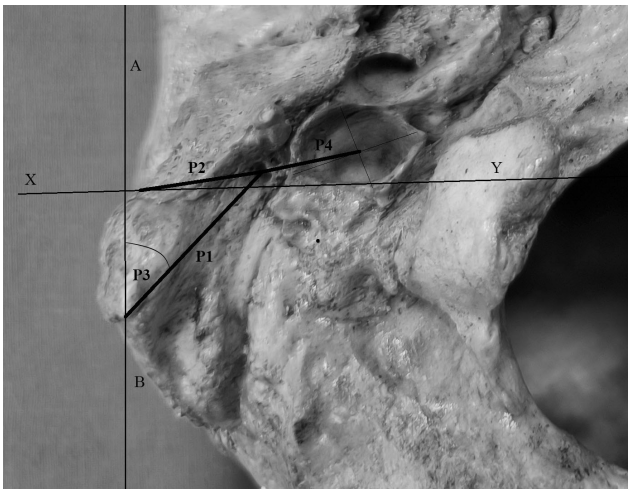

Fig. 2. Measurements done on stylomastoid foramen: P1 - the shortest distance between the tip of the MP to the center of stylomastoid foramen (CSMF); P2 - the shortest distance from the upper end of the anterior margin of the MP to CSMF; P3 - angle (a) between AB and the shortest distance between the tip of the MP to CSMF; P4 - the shortest distance from the CSMF to the center of jugular fossa.

On the two female skulls we were not able to measure parameter P4 the shortest distance from the CSMF to the center of jugular fossa (on one on the right side and on the other on the both sides) because of bone damage in this area.

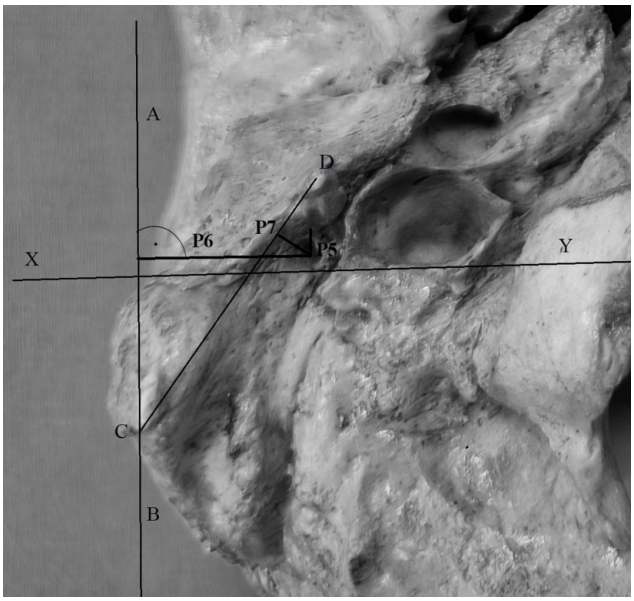

Fig. 3. Measurements done on stylomastoid foramen: P5 - the shortest distance between the CSMF and the root of the SP; P6 - the distance from the CSMF to the AB is determined by drawing a line from the CSMF that is perpendicular to the AB; P7 - the distance from the CSMF to the CD.

The shape and position of the SMF in relation to XY and CD were also noted. All images were transferred to the computer and we measured following parameters using a computer program Image J 1.48 v. All of the measurements were taken three times by the same person, and the mean value, expressed in millimeters (for the angle in degrees), was taken as the reference.

Statistical Analysis. From all the measurements, mean and standard deviation ($\bar{x}\pm SD$) were calculated. Data analysis was done by using the Statistical Package for Social Sciences (SPSS) 19 version, and $p<0.05$ was considered to be statistically significant.

Ethic approval. The authors hereby declare that the study was conducted only after approval (No. 01-39/129/1 from 29.12.2023.) had been obtained from the Ethics Committee for Research of the Faculty of Medicine, University of Novi Sad, whose guidelines are in accordance with the Declaration of Helsinki (1964) and all subsequent revisions.

RESULTS

After dividing the examined skull specimens by the sex, a statistically significant difference was found only in parameter P2 between the right and left sides in the group of male skulls (p=0.01). In the group of female skulls, no statistically significant difference was found between the right and left sides in any of the measured parameters on the skull base **(Table I).**

By comparing the average values of the mentioned parameters on the right and left sides of the skull between male and female, a statistically significant difference was found only in parameter P6 on the left side (p=0.03). The male skulls had higher values **(Table II)**.

Table I. Differences between right and left sides of skull bases in relation to the sex.

	Male				Female			
	Right side x±SD	**Left side x±SD**	***t***	***p***	**Right side x±SD**	**Left side x±SD**	***t***	***p***
P1	18.56±2.41	18.13±2.38	0.64	0.53	17.40±2.84	16.87±2.68	0.57	0.57
P2	11.53±1.55	10.32±1.66	2.69	**0.01**	10.94±2.07	10.76±2.19	0.26	0.79
P3	48.83±7.22	51.13±8.35	1.06	0.29	48.72±7.73	48.37±7.31	0.14	0.89
P4	11.47±2.10	11.41±1.77	0.11	0.91	9.58±3.97	10.27±3.25	0.57	0.57
P5	2.05±1.01	1.75±0.83	1.14	0.26	1.76±0.81	1.75±0.71	0.02	0.98
P6	13.72±1.82	13.97±2.16	0.44	0.66	12.88±2.09	12.52±2.16	0.51	0.61
P7	2.30±1.30	2.62±1.28	0.90	0.37	2.49±0.83	2.20±0.71	1.09	0.28

Table II. Differences between male and female skulls in relation to the side of the skull base.

	Right side				Left side			
	Male x±SD	**Female x±SD**	***t***	***p***	**Male x±SD**	**Female x±SD**	***t***	***p***
P1	18.56±2.41	17.40±2.84	1.46	0.15	18.13±2.38	16.87±2.68	1.64	0.11
P2	11.53±1.55	10.94±2.07	1.06	0.29	10.32±1.66	10.76±2.19	-0.74	0.46
P3	48.83±7.22	48.72±7.73	0.04	0.96	51.13±8.35	48.37±7.31	1.13	0.26
P4	11.47±2.10	9.58±3.97	2.05	0.47	11.41±1.77	10.27±3.25	1.50	0.14
P5	2.05±1.01	1.76±0.81	1.01	0.32	1.75±0.83	1.75±0.71	0.12	0.99
P6	13.72±1.82	12.88±2.09	1.41	0.16	13.97±2.16	12.52±2.16	2.17	**0.03**
P7	2.30±1.30	2.49±0.83	-0.53	0.60	2.62±1.28	2.20±0.71	1.27	0.21

The most common shape of the SMF was round in 46 (52.27 %), irregular in 21 (23.86 %), and oval in 18 (20.45 %) cases. The triangular and square shapes were the rarest in both sexes. The various shapes of the SMF are shown in Table III and Figure 4.

The position of the SMF in relation to (XY) transverse line passing through the upper end of the anterior margin of both MP was along in 36 (40.91 %), anterior in 29 (32.95 %) and posterior in 23 (26.14 %) cases. In relation to (CD) line connecting the tip of the MP and the tip of the SP the SMF was positioned medially in all 88 (100 %) cases. These results are shown in Table IV.

Table III. Various shapes of the SMF.

Shape	**Male**		**Female**		**Total (n=88)**
	Right (n=26)	**Left (n=26)**	**Right (n=18)**	**Left (n=18)**	
Round	14 (53.84 %)	15 (57.69 %)	8 (44.44 %)	9 (50.00 %)	46 (52.27 %)
Oval	5 (19.23 %)	6 (23.07 %)	2 (11.11 %)	5 (27.78 %)	18 (20.45 %)
Square	1 (3.84 %)	0 (0 %)	0 (0 %)	0 (0 %)	1 (1.13 %)
Triangular	1 (3.84 %)	0 (0 %)	1 (5.56 %)	0 (0 %)	2 (2.27 %)
Irregular	5 (19.23 %)	5 (19.23 %)	7 (38.89 %)	4 (22.22 %)	21 (23.86 %)

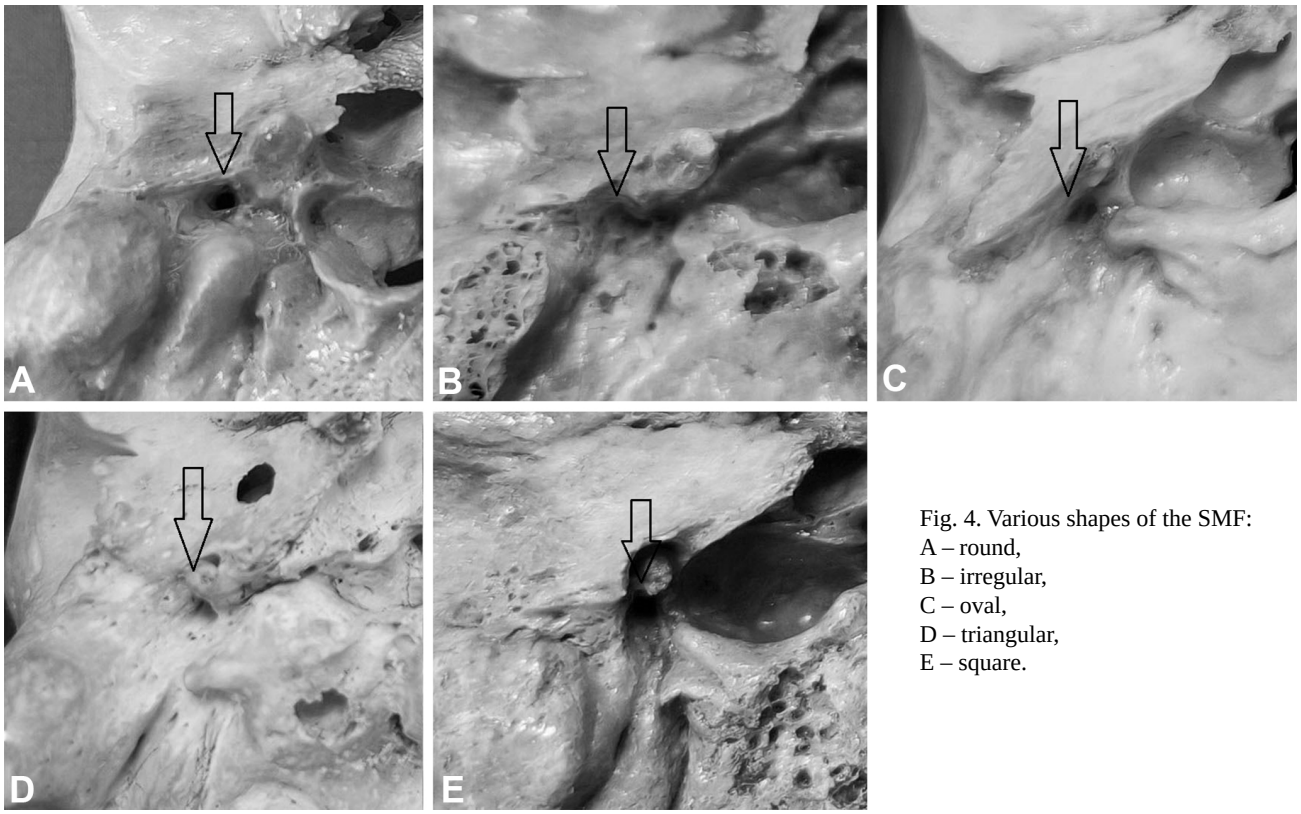

Fig. 4. Various shapes of the SMF:
A – round,
B – irregular,
C – oval,
D – triangular,
E – square.

Table IV. Position of the SMF in relation to XY and CD.

Line	**Position of the SMF**	**Male**		**Female**		**Total (n=88)**
		Right (n=26)	**Left (n=26)**	**Right (n=18)**	**Left (n=18)**	
XY	Posterior	7 (26.92 %)	8 (30.77 %)	4 (22.22 %)	4 (22.22 %)	23 (26.14 %)
	Along	12 (46.15 %)	10 (38.46 %)	6 (33.33 %)	8 (44.44 %)	36 (40.91 %)
	Anterior	7 (26.92 %)	8 (30.77 %)	8 (44.44 %)	6 (33.33 %)	29 (32.95 %)
CD	Medial	26 (100 %)	26 (100 %)	18 (100 %)	18 (100 %)	88 (100 %)
	Along	0 (0 %)	0 (0 %)	0 (0 %)	0 (0 %)	0 (0 %)
	Lateral	0 (0 %)	0 (0 %)	0 (0 %)	0 (0 %)	0 (0 %)

DISCUSSION

Variations in the size and shape of the SMF could potentially play a role in the onset of BP cases with unclear etiology. Additionally, targeted blockade of the facial nerve in the region of the SMF for safer implementation of intraocular surgical interventions is a preferred method (Kutoglu *et al*., 2021).

In this study, the average value of the shortest distance between the tip of the MP to CSMF (parameter P1) in male skulls was 18.56 ± 2.41 mm on the right side and 18.13 ± 2.38 mm on the left side. In female skulls, the average value on the right side was 17.40 ± 2.84 mm, while on the left side was 16.87 ± 2.68 mm. There were no statistically significant differences between sexes and sides. In the study conducted by Babacan *et al*. (2022), on skulls of the Turkish population, the average value of this parameter was 13.77 ± 2.68 mm, without separate determination for each side. Tewari *et al*. (2020), obtained an average value for the right side of 16.00 ± 2.4 mm and for the left side of 15.70 ± 2.6 mm in 58 skulls of the Indian population. All measurements mentioned so far were conducted on dry skulls, while Greyling *et al*. (2007), performed measurements during cadaver dissection and obtained average values of this parameter as 9.3 ± 1.6 mm on the right side and 9.1 ± 2.0 mm on the left side.

The shortest distance from the upper end of the anterior margin of the MP to CSMF (parameter P2) showed statistically significant differences only concerning the side in male skulls (average values were 11.53 ± 1.55 mm on the right side and 10.32 ± 1.66 mm on the left side, respectively). In the study by Sharma & Varshney (2015), the difference between the left (10.38 ± 1.50 mm) and right (10.22 ± 2.10 mm) sides was not statistically significant, and the most frequently obtained repeated values of this parameter were 10.40 mm on the left side and 10.25 mm on the right side.

They also measured the angle between AB and the shortest distance between the tip of the MP to CSMF (parameter P3), with average values of 66.57 ± 2.6 degrees on the right side and 65.96 ± 1.8 degrees on the left side (Sharma & Varshney, 2015). The average angle value in male skulls in this study was 48.83 ± 7.22 degrees on the right side and 51.13 ± 8.35 degrees on the left side. In female skulls, the average value on the right side was 48.72 ± 7.33 degrees, while on the left side, it was 48.37 ± 7.31 degrees. Tewari *et al*. (2020), also measured the same angle, and in their study, the average value on the right side was 51.6 ± 10.6 degrees, while on the left side was 53.5 ± 9.8 degrees, which is quite similar to the results in this study. Both Tewari *et al*. (2020), as well as Sharma & Varshney (2015), conducted measurements on skulls from the Indian population. The population of India, as a country with a large population and diverse genetic backgrounds, may exhibit variations in anatomical characteristics that can influence the outcomes of such studies. This angle could serve as a useful landmark for determining the direction of the needle when performing a facial block (Kutoglu *et al*., 2021).

In this study, the average value of the shortest distance from the CSMF to the center of jugular fossa (parameter 4) in male skulls was 11.47 ± 2.10 mm on the right side and 11.41 ± 1.77 mm on the left side, while in female skulls, on the right side was 9.58 ± 3.97 mm and on the left side was 10.27 ± 3.25 mm. There were no statistically significant differences between sexes and sides.

In the study by Babacan *et al*. (2022), the average distance between the CSMF and the root of the SP (parameter P5) was 4.73±1.28 mm. However, in the skulls of our population, these two anatomical structures were closer to each other, with values around 2 mm.

Comparing the average values of the distance from the CSMF to the AB (parameter P6) on the right and left sides of the skull between males and females, a statistically significant difference was found on the left side. Male skulls had higher values of this parameter (13.97 ± 2.16 mm) compared to female skulls (12.52 ± 2.16 mm). The reason for this may be that we had a higher number of male (26) compared to female skulls (18) in our study. The distance from the CSMF to the CD (parameter P7) was not statistically significant.

In this study, we found five different types of shapes of the SMF: round, oval, square, triangular, and irregular. Round, irregular and oval shapes were the most common, constituting over 90 % of skulls (52.27 % round, 23.86 % irregular and 20.45 % oval, respectively), with approximately similar prevalence on both sides. Singh (2023), published nearly identical results, the most common shape of SMF was round (54.25 %), then oval (29.85 %). The rarest shapes was square and triangular, which in Ghosh & Narayan (2021) study, as well in this study, were predominantly unilateral. Given that BP is significantly more common unilaterally, these rarer variants of the SMF could potentially play a role in the onset of BP.

In this study, the most common position of SMF in relation XY line was along in 40.91 % and the least common position was posterior in 26.14 % cases. Researchers from India (Sharma & Varshney, 2015; Tewari *et al*., 2020) and Turkey (Kuto?lu *et al*., 2021) reported that in their studies, the most common position was anterior to the XY line. In relation to CD line the SMF was positioned medially in all 88 (100 %) cases.

All the mentioned studies in this paper have focused on the differences in the SMF and its relations with surrounding structures in relation to the side of the body, but not in relation to sex as we did. Considering that there is significant anatomical variations between sexes, future research should incorporate this division when analyzing their data (Milella *et al*., 2021). Our study included 44 skulls from a single center, but the results would have been more reliable if a larger sample size had been available, as well as samples from other centers in our region.

As a conclusion, this study provides important information about precise location and shape of the stylomastoid foramen, using various anatomical parameters on the basis of the skulls of our adult population. These results may be of great benefit to neurosurgeons during surgeries on the facial nerve trunk or anesthetics to give facial nerve block near the foramen and prevent its complications.

DEVIC, M.; PUPOVAC, N.; ZELENOVIC, T.; PISARIC, M.; ZBUCNOVIC, D.; TUCAKOVIC, D. & SIVCEV, I. Análisis morfométrico del foramen estilomastoideo y su importancia clínica. *Int. J. Morphol., 42(4)*:1144-1149, 2024.

RESUMEN: El foramen estilomastoideo se encuentra en la superficie inferior de la parte petrosa del hueso temporal entre la base del proceso estiloides y el proceso mastoides. A través del foramen estilomastoideo el nervio facial completa su parte intracraneal. El objetivo de este estudio fue analizar los parámetros morfométricos, la forma y la posición del foramen estilomastoideo en cráneos de población serbia y correlacionarlos con el sexo y el lado del cuerpo. El estudio incluyó 44 cráneos adultos secos (88 forámenes estilomastoideos). Después de determinar el sexo, se fotografiaron los cráneos y luego se midieron en el programa ImageJ las distancias del foramen estilomastoideo desde varios puntos importantes de la base del cráneo. También se observó la forma y posición del foramen estilomastoideo. La significación estadística se encontró en cráneos de hombres entre el lado derecho e izquierdo en relación al parámetro (P2) la distancia más corta desde el extremo superior del margen anterior del proceso mastoides (PM) hasta el centro del foramen estilomastoideo (CFM), y en el lado izquierdo para el parámetro (P6) la distancia más corta entre CFM y la línea que pasa por la punta del PM en relación al sexo. La forma más común del foramen estilomastoideo era redonda en 46 (52,27 %) casos, y la posición más común estaba en la línea que pasa por el extremo superior del margen anterior de ambos PM en 36 (40,91 %) y medialmente a la línea que conecta las puntas del PM y el proceso estiloides en 88 (100 %) casos. Los resultados de este estudio serán útiles para los neurocirujanos durante las cirugías en el tronco del nervio facial o los anestésicos para bloquear el nervio facial cerca del foramen y prevenir sus complicaciones.

PALABRAS CLAVE: Foramen estilomastoideo; Nervio facial; Morfometría; Base del cráneo.

REFERENCES

Babacan, S.; B?yat, R.; Büyükfirat, E. & Deniz, M. The precise location of the stylomastoid foramen and clinical implication for facial nerve block. *Med. Rec., 4(3)*:355-60, 2022.

Celik, O.; Eskiizmir, G.; Pabuscu, Y.; Ulkumen, B. & Toker, G. T. The role of facial canal diameter in the pathogenesis and grade of Bell's palsy: a study by high resolution computed tomography. *Braz. J. Otorhinolaryngol., 83(3)*:261-8, 2017.

Chatellier, A.; Labbé, D.; Salamé, E. & Bénateau, H. Skin reference point for the zygomatic branch of the facial nerve innervating the orbicularis oculi muscle (anatomical study). *Surg. Radiol. Anat., 35(3)*:259-62, 2013.

Ghosh, S. K. & Narayan, R. K. Variations in the morphology of stylomastoid foramen: a possible solution to the conundrum of unexplained cases of Bell's palsy. *Folia. Morphol. (Warsz.), 80(1)*:97-105, 2021.

Greyling, L. M.; Glanvill, R.; Boon, J. M.; Schabort, D.; Meiring, J. H.; Pretorius, J. P. & van Schoor, A. Bony landmarks as an aid for intraoperative facial nerve identification. *Clin. Anat., 20(7)*:739-44, 2007.

Knezi, N.; Stojsic, D. L.; Adjic, I.; Maric, D. & Pupovac, N. Morphology of the pterion in Serbian population. *Int. J. Morphol., 38(4)*:820-4, 2020.

Kochhar, A.; Larian, B. & Azizzadeh, B. Facial nerve and parotid gland anatomy. *Otolaryngol. Clin. North Am., 49(2)*:273-84, 2016.

Kutoglu, T.; Çetkin, M.; Turan, Ö.; Bayko, S. & Yarkan, I. S. Morphometric and topographic features of stylomastoid foramen and its clinical significance in facial nerve block. *J. Neurol. Surg. B Skull Base, 82(Suppl. 3)*:e271-7, 2021.

Milella, M.; Franklin, D.; Belcastro, M. G. & Cardini, A. Sexual differences in human cranial morphology: Is one sex more variable or one region more dimorphic? *Anat. Rec. (Hoboken), 304(12)*:2789-810, 2021.

Ottaiano, A. C.; Gomez, G. D. & Freddi, T. A. L. The facial nerve: anatomy and pathology. *Semin. Ultrasound CT MR, 44(2)*:71-80, 2023.

Pupovac, N.; Eric, M.; Sekulic, S.; Knezi, N.; Vlaski, A.; Hajder, D. & Petkovic, B. Morphological and morphometric analysis of the external aperture of the carotid canal in Serbian population. *Int. J. Morphol., 38(4)*:1026-31, 2020.

Shin, K. J.; Gil, Y. C.; Lee, J. Y.; Kim, J. N.; Song, W. C. & Koh, K. S. Three-dimensional study of the facial canal using microcomputed tomography for improved anatomical comprehension. *Anat. Rec. (Hoboken), 297(10)*:1808-16, 2014.

Singh, R. Morphological study of stylomastoid foramen at the base of skull and its role in facial nerve palsy. *J. Craniofac. Surg., 34(5)*:1584-6, 2023.

Stevenson, J. C; Mahoney, E. R.; Walker, P. L. & Everson, P. M. Technical note: prediction of sex based on five skull traits using decision analysis (CHAID). *Am. J. Phys. Anthropol., 139(3)*:434-41, 2009.

Tewari, S.; Gupta, C. & Palimar, V. A morphometric study of stylomastoid foramen with its clinical applications. *J. Neurol. Surg. B Skull Base, 83(1)*:33-6, 2020.

Zhang, W.; Xu, L.; Luo, T.; Wu, F.; Zhao, B. & Li, X. The etiology of Bell's palsy: a review. *J. Neurol., 267(7)*:1896-905, 2020.

Corresponding author:
Marko Devic, MD, PhD student
Clinic for Otorhinolaryngology
Head and Neck Surgery
University Clinical center of Vojvodina
Hajduk Veljkova 1-9
21000 Novi Sad - SERBIA

E-mail: marko.devic@mf.uns.ac.rs

ORCID ID: 0009-0007-8565-0254