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Investigation of Foramen Rotundum and Foramen Ovale Morphometric in Trigeminal Neuralgia Patients

Trigeminal Nevralji Hastalarında Foramen Rotundum ve Foramen Ovale'nin Morfometrik Olarak İncelenmesi

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ÖZ

Amaç: Bu çalışmanın amacı, herhangi bir vasküler bası olmaksızın trigeminal nevralji (TN) tanısı alan bireylerin Bilgisayarlı Tomografi (BT) görüntüleri aracılığıyla foramen ovale (FO) ve foramen rotundum'un (FR) morfometrik yapısını araştırmaktır.
Araçlar ve Yöntem: Çalışma, Tokat Gaziosmanpaşa Üniversitesi Klinik Araştırmalar Etik Kurulu, 02.03.2023 tarihinde 83116987-143 sayılı kararla onaylandı. Tokat Gaziosmanpaşa Üniversitesi Tıp Fakültesi Nöroloji Kliniğinde TN tanısı almış 34 hasta (16 erkek, 18 kadın) ile kontrol grubu (KG) olarak belirlenen 34 olgu (15 erkek, 19 kadın) retrospektif olarak incelendi. Tüm bireylerin BT görüntüleri Horos programı kullanılarak koronal, sagittal ve transvers düzlemlerde elde edildi. Elde edilen görüntüler üzerinde düzlem düzeltmeleri yapıldı ve bunlar modifiye düzlemler olarak adlandırıldı. Morfometrik ölçümler modifiye edilmiş düzlemler üzerinde gerçekleştirildi.
Bulgular: TN'li bireyler ile sinir tutulumu olan taraftaki KG arasında FO'nun ortalama uzunluk ve genişlik ölçümlerinde anlamlı bir fark yoktu ($p>0.05$). Trigeminal nevralji grubunda (TNG) etkilenen taraftaki FR'nin ortalama uzunluk ve genişlik ölçümleri KG'ye kıyasla anlamlı olarak daha küçüktü ($p<0.001$). Artan yaşın sağ taraftaki sinir tutulumunu anlamlı olarak etkilediği bulundu ($p=0.005$).
Sonuç: FO ve FR morfolojisinin bilinmesinin TN'nin tanısal ve girişimsel tedavi yaklaşımlarında klinisyenlere katkı sağlayacağına inanıyoruz.

Anahtar kelimeler: bilgisayarlı tomografi; kafa tabanı; sinir tutulumu; yüz ağrısı

ABSTRACT

Purpose: This study aimed to investigate the morphometric structure of the foramen ovale (FO) and foramen rotundum (FR) through Computerized Tomography (CT) images of individuals diagnosed with trigeminal neuralgia (TN) without any vascular compression.
Materials and Methods: The study was approved by the Tokat Gaziosmanpaşa University Clinical Research Ethics Committee on March 2, 2023, with approval number 83116987-143. Thirty-four patients (16 males, 18 females) diagnosed with Trigeminal Neuralgia (TN) at the Clinic of Neurology, Tokat Gaziosmanpaşa University Faculty of Medicine, and 34 individuals (15 males, 19 females) selected as the control group (CG) were retrospectively analyzed. CT images of all participants were obtained in the coronal, sagittal, and transverse planes using the Horos software. Plane adjustments were applied to these images, referred to as modified planes, for morphometric measurements.
Results: There was no significant difference in the mean length and width measurements of the FO between individuals with TN and the CG on the side with nerve involvement ($p>0.05$). The mean length and width measurements of the FR on the affected side in the trigeminal neuralgia group (TNG) were significantly smaller when compared to the CG ($p<0.001$). It was found that increasing age significantly affected nerve involvement on the right side ($p=0.005$).
Conclusion: We believe that knowledge of the morphology of FO and FR would contribute to clinicians in the diagnostic and interventional treatment approaches of TN.

Keywords: computed tomography; facial pain; skull base; nerve involvement

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INTRODUCTION

The trigeminal nerve, the largest cranial nerve, contains sensory and somatomotor fibers. It is divided from the anterolateral of the pons into a motor (radix motoria) and a sensory root (radix sensoria). Sensory root form the trigeminal ganglion (Gasser ganglion) located on the petrous part of the temporal bone. Emerging from the Gasser ganglion, the ophthalmic nerve, maxillary nerve, and mandibular nerve pass through the superior orbital fissure, foramen rotundum (FR), and foramen ovale (FO), respectively, leave the cranium.[1,2]

Trigeminal neuralgia (TN) is a functional disorder of the peripheral nervous system that manifests as paroxysmal pain attacks in specific face areas. The pathophysiology of TN remains unclear today. Focal compressions occurring at the root portion of the trigeminal nerve are among the common causes of TN. However, it is known that TN can also occur in the absence of vascular compression. At this point, some anatomical points that may be effective in developing the disease and the severity of symptoms suggest that stenoses in the FO and FR through which the branches of the trigeminal nerve pass may play a role.[3-6]

A narrow FO and FR may increase the risk of impingement during the course of the nerves. This compression can trigger the development of TN.[5,7,8] Many academic studies in the literature have focused on changes in soft tissues as causes of TN, while bone tissues have been ignored.[9-11] The main purpose of this study is to examine the relationship between the morphometric properties of FO, FR, and TN.

MATERIALS and METHODS

Ethics Statement

This study was approved by the Clinical Research Ethics Committee of Tokat Gaziosmanpaşa University Faculty of Medicine Dean's Office (dated 02/03/2023 and numbered 83116987-143).

Study Population

This study includes Computed Tomography (CT) images of 34 patients and 34 healthy individuals who applied to Tokat Gaziosmanpaşa University Faculty of Medicine, Clinic of Neurology between 2016 and 2023, who did not have vascular compression and were diagnosed with TN as a result of various examinations. The genders of the individuals in the trigeminal neuralgia group (TNG) were 16 males and 18 females; in the control group (CG), there were 15 males and 19 females. CT images of 68 individuals aged between 29 and 91 years were retrospectively analyzed.

Image Analysis

Radiological image examinations were conducted using a 64-slice CT scanner (Optima CT660, GE Healthcare, Milwaukee, USA). The imaging parameters were as follows: 120 kV, 150mAs, collimation 64×0.5, slice thickness 1 mm, matrix 512×512 pixels, and a gantry angle of 0°. After the image series in DICOM (Digital Imaging and Communications in Medicine) format was transferred to the Horos workstation, the contrast setting was set to standard bone dose. CT images were opened in the standard sagittal, transverse, and coronal planes. However, it has been found that the foramen we aimed to examine did not fit exactly in these three planes. Therefore, it was predicted that measurements in standard planes would give projection values, not actual measurement values. To avoid this situation, plane corrections were made to obtain real measurement values. These new planes were referred to as modified planes. Two separate points were identified on the anterior and posterior walls of the FO from sagittal images. The vertical axis was tilted backward to pass through the midpoint of the two points determined in the transverse plane. The actual appearance of the FO was determined in the modified transverse plane. The same procedure was repeated for FR (Figure 1).

Measurement and Evaluation

In the modified transverse plane, the length of FO and FR was measured from the anteroposterior distance. Width measurements were taken concerning the midpoint of the anteroposterior distance. In the modified sagittal plane, the anteroposterior distance of the entrance of the FO on the middle cranial fossa side was considered the ceiling, and the anteroposterior distance of the infratemporal fossa entrance was considered the base (Figure 2). In the same plane, the craniocaudal direction from the entrance of FR

into the middle cranial fossa was determined as the ceiling, and the craniocaudal direction from where it opens into the pterygopalatine fossa was considered as the base. The lines connecting the midpoints of the ceiling and floor were recorded as depth measurements (Figure 3).

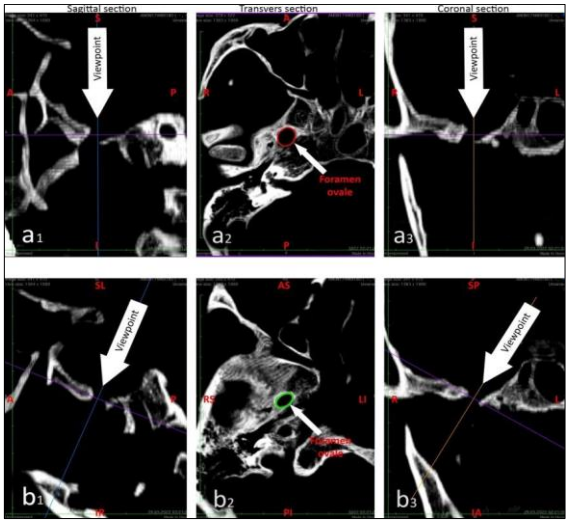

Figure 1. CT Images in the horos software.
a_1. Sagittal a_2. Transverse a_3. Coronal plane before adjusting the viewing angle to the FO,
b_1. Sagittal b_2. Transverse b_3. Coronal plane after adjusting the angle of view to the FO.

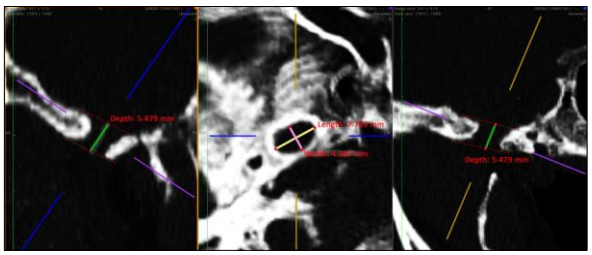

Figure 2. Morphometric measurements of FO in modified planes. The green line represents depth measurement. The yellow line represents the length measurement. The pink line represents the width measurement.

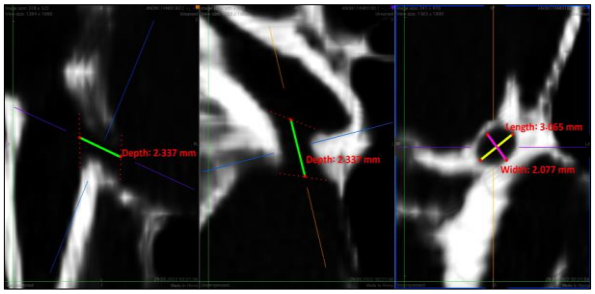

Figure 3. Morphometric measurements of FR in modified planes. The green line represents depth measurement. The yellow line represents the length measurement. The pink line represents the width measurement.

Statistical Analysis

The Shapiro-Wilk test was used for data exhibiting normal distribution, and Yates' correction was employed for gender comparisons between groups. For data with a normal distribution, an independent two-sample t-test was utilized, whereas for data without a normal distribution, the Mann-Whitney U test was employed. Binary logistic regression analysis was used to analyze the effect of independent risk factors on nerve involvement. The significance level was set as $p<0.05$. IBM SPSS V23 was used for data analysis.

RESULTS

Reliability

Intraclass correlation coefficient (ICC) was used to evaluate intra-observer reliability. In our study, the lowest ICC value for intra-observer reliability was 0.98 for all quantitative measures. This ICC value indicates high reproducibility.

The mean age of individuals with TNG was 61.29±14.76 years, while for the CG, it was 52.44±12.02 years ($p<0.05$). The gender distribution of individuals in the TNG was 18 male and 16 female, while in the CG, 19 male and 15 female ($p>0.05$) (Table 1).

Table 1. Demographic and clinical characteristics of individuals.

Variables	TNG (n=34)	CG (n=34)	p
Age (years)	61.29±14.76	52.44±12.02	**0.004***
Gender			1.000**
Female	18 (52.9)	19 (55.9)	
Male	16 (47.1)	15 (44.1)	
Lesion side			
Left	19 (55.8)		
Right	15 (44.2)		
Nerve involved			
V2	15 (44.1)		
V3	10 (29.4)		
V1+V2	2 (5.9)		
V2+V3	7 (20.6)		

Values are given as mean±sd or n (%), TNG: Trigeminal neuralgia group, CG: Control group, *Mann-Whitney U test, **Yates' correction, $p<0.05$

RFOL (right foramen ovale length) and LFOL (left foramen ovale length) were 6.65±1.23 mm and 6.79±1.14 mm in TNG and 7.18±1.26 mm and 7.37±1.51 mm in CG. RFOW (right foramen ovale width) and LFOW (left foramen ovale width) were 3.50±0.99 mm and 3.51±0.97 mm in TNG and 3.25±0.79 mm and 3.49±0.82 mm in CG. RFOD (right foramen ovale depth) and LFOD (left foramen ovale depth) were 4.88±1.16 mm and 5.33±1.31 mm in TNG and 5.76±1.76 mm ve 5.37±1.80 mm in CG. RFOA (right foramen ovale area) and LFOA (left foramen

ovale area) was 18.45±7.04 mm^2 and 18.72±5.73 mm^2 in TNG and 18.66±6.65 mm^2 and 20.78±9.30 mm^2 in CG. RFOV (right foramen ovale volume) and LFOV (left foramen ovale volume) was 87.85±33.00 mm^3 and 99.38±39.54 mm^3 in TNG 104.83±42.27 mm^3 and 112.05±76.17 mm^3 in CG. FO measurements did not show a significant difference between the groups (p>0.05) (Table 2).

Table 2. Comparison of foramen ovale measurements of the groups.

	TNG		CG		
	Mean±SD	**Median(min-max)**	**Mean±SD**	**Median(min-max)**	**p**
RFOL(mm)	6.65±1.23	6.39(4.93-8.45)	7.18±1.26	6.75(5.45-9.88)	0.184**
LFOL(mm)	6.79±1.14	6.65(5.07-9.52)	7.37±1.51	7.01(5.47-13.18)	0.174**
RFOW(mm)	3.50±0.99	3.20(2.03-5.45)	3.25±0.79	3.06(1.68-4.97)	0.346*
LFOW(mm)	3.51±0.97	3.29(1.87-5.43)	3.49±0.82	3.33(2.32-5.84)	0.865**
RFOD(mm)	4.88±1.16	4.66(3.12-7.10)	5.76±1.76	5.59(2.79-9.95)	0.07*
LFOD(mm)	5.33±1.31	5.36(3.43-7.62)	5.37±1.80	4.90(2.25-9.69)	0.935*
RFOA(mm^2)	18.45±7.04	18.23(9.16-36.14)	18.66±6.65	16.30(7.62-34.84)	0.917*
LFOA(mm^2)	18.72±5.73	18.82(10.12-27.66)	20.78±9.30	18.87(10.48-60.46)	0.603**
RFOV(mm^3)	87.85±33.00	74.91(36.57-151.02)	104.83±42.27	100.49(48.81-213.94)	0.154*
LFOV(mm^3)	99.38±39.54	97.15(40.19-195.80)	112.05±76.17	91.04(34.64-477.85)	0.905**

TNG: Trigeminal neuralgia group, CG: Control group, RFOL: Right foramen ovale length, LFOL: Left foramen ovale length, RFOW: Right foramen ovale width, LFOW: Left foramen ovale width, RFOD: Right foramen ovale depth, LFOD: Left foramen ovale depth, RFOA: Right foramen ovale area, LFOA: Left foramen ovale area, RFOV: Right foramen ovale volume, LFOV: Left foramen ovale volume, *Independent two sample t test, **Mann-Whitney U test, $p<0.05$

RFRL (right foramen rotundum length) and LFRL (left foramen rotundum length) were 1.49±0.39 mm and 1.46±0.48 mm in TNG and 2.38±0.55 mm and 2.31±0.51 mm in CG. RFRL and LFRL values were smaller in TNG than in CG (p<0.001). RFRW (right foramen rotundum width) and LFRW (left foramen rotundum width) were 1.11±0.39 mm and 1.14±0.43 mm in TNG and 1.80±0.48 mm and 1.83±0.37 mm in CG. RFRD (right foramen rotundum depth) and LFRD (left foramen rotundum depth) were 4.98±1.55 mm and 4.73±1.28 mm in TNG and 5.09±1.43 mm and 5.45±1.74 mm in CG. Right and left side FR depth measurements did not differ between the groups (p>0.05), whereas width measurements were smaller in TNG (p<0.001). RFRA (right foramen rotundum area) and LFRA (left foramen rotundum area) was 4.98±1.55 mm^2 and 4.73±1.28 mm^2 in TNG and 5.09±1.43 mm^2 and 5.45±1.74 mm^2 in CG. RFRV (right foramen rotundum volume) and LFRV (left foramen rotundum volume) was 7.27±6.71 mm^3 and 6.70±4.63 mm^3 in TNG and 17.96±9.04 mm^3 and 18.04±7.63 mm^3 in CG. Right- and left-sided FR area and volume parameters were larger in CG than in TNG (p<0.001) (Table 3).

Table 3. Comparison of foramen rotundum measurements of the groups.

	TNG		CG		
	Mean±SD	**Median(min-max)**	**Mean±SD**	**Median(min-max)**	**p**
RFRL(mm)	1.49±0.39	1.37 (1.02-2.33)	2.38±0.55	2.28 (1.44-3.92)	**<0.001****
LFRL(mm)	1.46±0.48	1.35 (0.57-2.69)	2.31±0.51	2.24 (1.45-3.41)	**<0.001***
RFRW(mm)	1.11±0.39	1.01 (0.62-2.13)	1.80±0.48	1.85 (0.98-2.97)	**<0.001****
LFRW(mm)	1.14±0.43	1.05 (0.54-2.38)	1.83±0.37	1.77 (1.18-2.98)	**<0.001****
RFRD(mm)	4.98±1.55	4.73 (2.30-8.99)	5.09±1.43	4.95 (2.43-8.53)	0.778*
LFRD(mm)	4.73±1.28	4.95 (2.21-7.32)	5.45±1.74	5.38 (2.18-9.38)	0.091*
RFRA(mm^2)	1.39±0.90	1.09 (0.50-3.88)	3.51±1.61	3.20 (1.22-7.15)	**<0.001****
LFRA(mm^2)	1.45±1.07	1.21 (0.24-4.49)	3.43±1.42	3.02 (1.53-7.97)	**<0.001****
RFRV(mm^3)	7.27±6.71	5.29 (1.64-34.87)	17.96±9.04	15.76 (3.65-37.71)	**<0.001****
LFRV(mm^3)	6.70±4.63	5.87 (0.92-21.89)	18.04±7.63	17.09 (5.38-36.78)	**<0.001****

TNG: Trigeminal neuralgia group, CG: Control group, RFRL: Right foramen rotundum length, LFRL: Left foramen rotundum length, RFRW: Right foramen rotundum width, LFRW: Left foramen rotundum width, RFRD: Right foramen rotundum depth, LFRD: Left foramen rotundum depth, RFRA: Right foramen rotundum area, LFRA: Left foramen rotundum area, RFRV: Right foramen rotundum volume, LFRV: Left foramen rotundum volume, *Independent two sample t test, **Mann-Whitney U test, $p<0.05$

The risk of nerve involvement in FO and FR was analyzed with univariate and multivariate models and it was found that increasing age had a significant effect on right-sided maxillary and mandibular nerve involvement (p=0.005) (Tables 4 and 5). However, no significant effect of age parameter was observed on left-sided nerve involvement (p>0.05) (Tables 6 and 7).

Table 4. Logistic regression analysis of risk factors for right foramen ovale nerve involvement.

	Univariate				Multivariate			
	OR (%95 CI)	**p**	**Cox & Snell R Square**	**Nagelkerke R Square**	**OR (%95 CI)**	**p**	**Cox & Snell R Square**	**Nagelkerke R Square**
Age	1.083 (1.024-1.145)	**0.005**	0.184	0.26	1.098 (1.028-1.172)	**0.005**		
Gender	0.844 (0.246-2.904)	0.788	0.001	0.002	1.697 (0.317-9.087)	0.537		
RFOL	0.537 (0.291-0.993)	**0.047**	0.093	0.132	0.485 (0.238-0.989)	**0.047**	0.279	0.394
RFOW	0.834 (0.38-1.832)	0.651	0.004	0.006	1.695 (0.582-4.932)	0.333		
RFOD	0.879 (0.6-1.289)	0.510	0.009	0.013	0.738 (0.426-1.278)	0.279		
RFOA	0.917 (0.817-1.031)	0.147	0.049	0.069				
RFOV	0.984 (0.965-1.002)	0.086	0.068	0.096				

RFOL: Right foramen ovale length, RFOW: Right foramen ovale width, RFOD: Right foramen ovale depth, RFOA: Right foramen ovale area, RFOV: Right foramen ovale volume, $p<0.05$

Table 5. Logistic regression analysis of risk factors for right foramen rotundum nerve involvement.

	Univariate				Multivariate			
	OR (%95 CI)	**p**	**Cox & Snell R Square**	**Nagelkerke R Square**	**OR (%95 CI)**	**p**	**Cox & Snell R Square**	**Nagelkerke R Square**
Age	1.083 (1.024-1.145)	**0.005**	0.184	0.26	1.111 (1.016-1.215)	**0.021**		
Gender	0.844 (0.246-2.904)	0.788	0.001	0.002	0.263 (0.028-2.427)	0.239		
RFRL	0.031 (0.004-0.228)	**0.001**	0.344	0.486	0.022 (0.001-0.927)	**0.046**	0.471	0.666
RFRW	0.049 (0.007-0.349)	**0.003**	0.254	0.359	0.169 (0.005-6.155)	0.332		
RFRD	1.045 (0.666-1.641)	0.847	0.001	0.001	1.059 (0.494-2.27)	0.884		
RFRA	0.258 (0.11-0.605)	**0.002**	0.312	0.441				
RFRV	0.843 (0.746-0.952)	**0.006**	0.229	0.324				

RFRL: Right foramen rotundum length, RFRW: Right foramen rotundum width, RFRD: Right foramen rotundum depth, RFRA: Right foramen rotundum area, RFRV: Right foramen rotundum volume, $p<0.05$

Table 6. Logistic regression analysis of risk factors for left foramen ovale nerve involvement.

	Univariate				Multivariate			
	OR (%95 CI)	**p**	**Cox & Snell R Square**	**Nagelkerke R Square**	**OR (%95 CI)**	**p**	**Cox & Snell R Square**	**Nagelkerke R Square**
Age	1.034 (0.988-1.081)	0.150	0.04	0.055	1.022 (0.975-1.072)	0.368		
Gender	1.407 (0.456-4.342)	0.552	0.007	0.009	1.817 (0.497-6.64)	0.366		
LFOL	0.744 (0.466-1.188)	0.215	0.032	0.044	0.703 (0.415-1.19)	0.189	0.097	0.133
LFOW	0.917 (0.45-1.868)	0.811	0.001	0.001	1.185 (0.513-2.739)	0.692		
LFOD	1.216 (0.871-1.698)	0.251	0.025	0.034	1.249 (0.87-1.794)	0.228		
LFOA	0.959 (0.879-1.046)	0.341	0.02	0.027				
LFOV	0.999 (0.99-1.008)	0.838	0.001	0.001				

LFOL: Left foramen ovale length, LFOW: Left foramen ovale width, LFOD: Left foramen ovale depth, LFOA: Left foramen ovale area, LFOV: Left foramen ovale volume, $p<0.05$

Table 7. Logistic regression analysis of risk factors for left foramen rotundum nerve involvement.

	Univariate							
	OR (%95 CI)	**p**	**Cox & Snell R Square**	**Nagelkerke R Square**	**OR (%95 CI)**	**p**	**Cox & Snell R Square**	**Nagelkerke R Square**
Age	1.034 (0.988-1.081)	0.150	0.04	0.055	1.112 (1.006-1.228)	**0.037**		
Gender	1.407 (0.456-4.342)	0.552	0.007	0.009	0.388 (0.031-4.92)	0.465		
LFRL	0.041 (0.008-0.226)	**<0.001**	0.389	0.534	0.26 (0.014-5)	0.372	0.56	0.768
LFRW	0.003 (0-0.066)	**<0.001**	0.487	0.668	0.001 (0-0.194)	**0.009**		
LFRD	0.701 (0.479-1.025)	0.067	0.068	0.094	0.461 (0.192-1.107)	0.083		
LFRA	0.161 (0.06-0.434)	**<0.001**	0.435	0.597				
LFRV	0.72 (0.601-0.863)	**<0.001**	0.448	0.615				

LFRL: Left foramen rotundum length, LFRW: Left foramen rotundum width, LFRD: Left foramen rotundum depth, LFRA: Left foramen rotundum area, LFRV: Left foramen rotundum volume, *p<0.05*

DISCUSSION

It has been stated that TN usually arises due to compression of the trigeminal nerve root by a vascular structure.[12,13] However, in the absence of neurovascular compression, some studies hypothesize that a narrow FR and FO are etiologically important.[5,14-16]

The deficiencies in the measurement methods of the radiological studies are notable. When the literature is reviewed, it is observed that foramina are only identified in a single plane, and direct measurements are made on this plane.[6,17] Improvements were made in our study's method to obtain accurate and reliable data. Measurements of the foramina identified in the modified coronal, sagittal, and transverse planes were conducted. Our study brings innovation to the literature with its methodological aspect.

Our study compared right and left side FO measurements between TNG and CG. There was no notable distinction identified among the groups. Patil et al. measured the mean length of the FO was found to be 7.0±2.17 mm on the right side and 6.8±1.40 mm on the left side, and the mean width as 5.0±0.42 mm on the right side and 4.70±0.91 mm on the left side.[18] Akçay et al. measured the mean length of FO as 7.09±1.07 mm on the right side and 7.06±1.01 mm on the left side, and the mean width as 4.16±0.79 mm on the right side and 4.15±0.50 mm on the left side.[19] Somesh et al. calculated the area of FO as 30.808 mm² on the right side and 31.31 mm² on the left side.[20] While our findings regarding the length and width parameters were similar to other studies in both the TN group and control group (CG), the area of the foramen ovale (FO) differed from the study by Somesh et al. The radiological study by Kastamoni et al. also did not observe significant differences in the length, width, and area parameters of the FO between TN patients and asymptomatic individuals, which supports our findings..[21] Liu et al. compared the painful side with the pain-free side in terms of FO, mean length, and width and reported no significant difference between the sides.[14] The study of Liu et al. is similar to the findings of our study.

Hwang et al. reported the mean length of FO as 8.11±0.97 mm on the right side and 8.24±0.64 mm on the left side, and the mean width as 4.12±0.99 mm on the right side and 4.01±0.72 mm on the left side in TN patients.[22] The results of Hwang et al. differed from our findings. The reason for this difference may be the lack of measurements over the modified plane of FO, the genetic characteristics of the study population, and the lack of differentiation of the side of nerve involvement in TN patients.

Studies examining the relationship between the depth and volume parameters of FO and TN are not available in the literature. Our study is original in this regard and has shown no relationship between depth and volume with TN.

Kumar et al. reported FR length of 2.9 mm on the right side, 3.29 mm on the left side, right side area of 8.82 mm², and a left side area of 8.61 mm².[23] The mean length and area values of FR differed from our study. This difference may be attributed to the study being conducted on dry bones and measurements being performed using the ImageJ program, which involved taking photographs of a three-dimensional object, potentially affecting the measurement angles.

Liu et al. stated that there was no difference between the painful and painless sides of TN patients and the mean diameters of the FRs on the right and left sides.[14] Erbagci et al. compared the FR dimensions of TN patients and CG found no significant difference.[6]

However, when the FRs of TNG and CG were compared in our study, a notable distinction was noted in all parameters except for depth. The differences in the results may be due to the lack of measurement technique or the person performing the measurement. Kastamoni et al. reported a significant difference in the length and width parameters of FRs between the painful side of TN patients and asymptomatic individuals.[21] The study of Kastamoni et al. was in parallel with our results.

The literature has reported that gender does not affect nerve involvement.[6,14] However, there are also studies suggesting that the risk of involvement is higher in females and that advancing age increases the possibility of nerve involvement.[24-26] In our study, although no relationship was determined between morphometric measurements of both foramina and gender, it was determined that there was a positive correlation with age.

This study has some limitations. Since the diagnosis of trigeminal neuralgia usually focuses on soft tissues, the small number of patients who underwent brain CT in this study should be noted as a disadvantage. However, our effort to develop a new measurement methodology by adopting a different approach from the measurement methods of existing studies in the literature adds a unique value to our study.

Conclusion

Our study not only offers a new approach in the literature on how FO and FR should be detected in planes, but also reveals a different methodology for obtaining accurate and reliable data. It has shown that all parameters of FR except depth can be related to TN. These results emphasized the necessity of a detailed examination of the morphometric features of the foramen in TN developing without vascular compression. Therefore, morphometric measurements will provide clinicians with a versatile approach to diagnose TN and plan interventional treatment protocols.

Conflict of Interest

The authors declare that there is not any conflict of interest regarding the publication of this manuscript.

Ethics Committee Permission

This study was approved by the Clinical Research Ethics Committee of Tokat Gaziosmanpaşa University Faculty of Medicine Dean's Office (dated 02/03/2023 and numbered 83116987-143).

Authors' Contributions

Concept/Design: SS, MN, OS. Data Collection and/or Processing: OS, SS, MN. Data analysis and interpretation: SS, OS, MN. Literature Search: SS, MN. Drafting manuscript: SS, MN, OS. Critical revision of manuscript: MN, OS. Supervisor: MN, OS.

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