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Anatomical Variations of the Supraorbital and Supratrochlear Nerves: Their Intraorbital Course and Relation to the Supraorbital Margin

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

ABCDEF 1 Robert Haładaj
CDEF 2 Michał Polguj
ACDEF 1 Mirosław Topol

1 Department of Normal and Clinical Anatomy, Interfaculty Chair of Anatomy and Histology, Medical University of Łódź, Łódź, Poland
2 Department of Angiology, Interfaculty Chair of Anatomy and Histology, Medical University of Łódź, Łódź, Poland

Corresponding Author: Robert Haładaj, e-mail: robert.haladaj@umed.lodz.pl
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Background: This study aimed to describe the topographical anatomy of the supraorbital and supratrochlear nerves. Anatomical variations of both the intraorbital course of the 2 nerves and their relation to the supraorbital margin were analyzed.

Material/Methods: The research material involved 50 isolated adult cadaveric hemi-heads and 25 macerated adult skulls. All studied specimens were of Caucasian origin.

Results: Taking into account the location of the frontal nerve division, 2 main variants of the intraorbital course of the supraorbital and supratrochlear nerves were distinguished. The first variant (variant I, 42%) involved cases in which the supraorbital and supratrochlear nerves branched off from the frontal nerve in the distal half of the length of the orbit. In the second variant (variant II, 58%), the frontal nerve branched into the supraorbital and supratrochlear nerves in the proximal half of the orbit. Variant II was characterized by the presence of a thick supraorbital nerve and a long, tiny supratrochlear nerve. For variant I, 27.8% of the supraorbital nerves were divided into the medial and lateral branch within the orbit, whereas, for variant II, 75% of nerves were divided into the medial and lateral branch within the orbit (before crossing the supraorbital margin). Single passage was observed on the supraorbital margin in 80% of wet specimens and in 78% of orbits examined on the macerated skulls.

Conclusions: Both the intraorbital and extraorbital course of the branches of the supraorbital and supratrochlear nerves were highly diverse. These variations should be taken into account during medical procedures performed within the orbital and frontal regions.

MeSH Keywords: Anatomic Variation • Anatomy • Nerve Block • Neuralgia • Orbit

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Background

The supraorbital and supratrochlear nerves are the terminal branches of the frontal nerve, which is the largest branch of the ophthalmic division of the trigeminal nerve [1]. However, taking into account its sensory characteristics, the frontal nerve is considered to be formed by the union of these 2 nerves [2]. According to the classic description, the supraorbital nerve divides into 2 branches: a lateral branch which typically passes through the supraorbital notch (or foramen) and provides the sensory innervation to the skin of the forehead (reaching as far as the temporal and parietal areas), and a thinner medial branch which passes through the frontal notch (or, very rarely, foramen) to innervate the bridge of the nose, medial part of the upper eyelid, and medial forehead [1–5]. However, there are numerous significant deviations from this typical arrangement [6–9]. Just after exiting the orbit, the supraorbital nerve divides into superficial branches (that pass over the frontalis muscle and provide sensory supply to the forehead skin) and a deep branch which remains deep to the corrugator supercilii and frontalis muscles [3,5,10]. The deep branch runs across the lateral forehead between the galea aponeurotica and the pericranium as the sensory nerve to the frontoparietal scalp [5]. Additionally, the supraorbital nerve probably provides the postganglionic sympathetic fibers which innervate the sweet glands of the supraorbital area [1].

Knowledge of the anatomy of the supraorbital and supratrochlear nerves has become more important in connection with the development of modern diagnostic and therapeutic methods and surgical techniques. This applies to procedures such as the anterior orbital approach, corneal neurotization, fronto-glabellar reconstruction flap, supraorbital injection, surgical treatment of migraine headaches, upper eyelid surgeries (e.g., blepharospasm surgery or direct browplasty) and any procedure requiring scalp or forehead incisions such as a forehead lift or endoscopic facial techniques [3–13]. Anatomic characteristics of supraorbital and supratrochlear nerves may also be relevant due to their use in eyeblink conditioning [14] or neurostimulation for preventing and treatment of migraine and cluster headaches [15–17].

Knowledge of the distribution and anatomic variations of supraorbital and supratrochlear nerves is of great clinical significance. However, there are still some gaps in the description of anatomical variations of the supraorbital nerve (e.g., different types of passage of its superficial and deep sub-branches through the exit points on the supraorbital rim) and supratrochlear nerve (e.g., its passage within or beyond the frontal notch). Knize [5] emphasized in a study report that anatomical illustrations of the supraorbital nerve beyond the superior orbital rim frequently misrepresent its course. Thus, our study aimed to describe the topographical anatomy of the supraorbital and supratrochlear nerves and their branches. Special emphasis has been placed on detailed presentation of anatomical variations of the intraorbital course of both these nerves and their arrangement within the openings located on the supraorbital margin. The study was supplemented by morphometric measurements and carefully selected graphic material.

Material and Methods

Study specimens included 50 isolated adult cadaveric hemiheads (29 right and 21 left hemi heads, fixed in 10% formalin and preserved in 70% ethanol) and 25 macerated human adult skulls. All studied specimens (both macerated skulls and wet specimens of the head) were of Caucasian origin. The study was approved by the local Bioethics Committee.

The dissecting procedure was designed and performed according to previously described protocols [6,18–20]. The orbit was carefully opened through removal of its entire superior wall (the orbital roof) using bone chisel and Luer bone rongeur. The superior orbital fissure was also opened. At this stage of the dissection, the frontal, supraorbital, and supratrochlear nerves were traced through the periosteum of the superior wall of the orbit. Next, the orbital periosteum was removed using scissors and the nerves were exposed in their entirety. The branching patterns of both the frontal nerve (into the supraorbital and supratrochlear nerves) and the supraorbital nerve (into the medial and lateral branches) were assessed at this stage in relation to the length of the orbit. The points of branching of the frontal and supraorbital nerves were measured in relation to the supraorbital margin (Figure 1). The measurements were made in situ with a Digimatic Digital Caliper (Mitutoyo Company, Kawasaki-shi, Kanagawa, Japan).

At further steps in the dissection, the supratrochlear and supraorbital nerves were traced to the level of the supraorbital margin. During this step of the procedure, careful blunt dissection was performed on both sides (external and internal) of the supraorbital margin. The skin covering the supraorbital region was detached *en bloc* with the underlying tissues (muscles and the periosteum) and reflected inferiorly to expose both the supraorbital and frontal notches (or foramina) located in the frontal bone, at the edge of the superior orbital margin. The entrances of both the supraorbital and supratrochlear nerves into the brow region were identified and their morphology was assessed, based on classification provided by Beer et al [6] and Wu et al. [21]. To avoid misunderstandings, the supraorbital notch (or foramen) was defined as located between the middle and medial thirds of the supraorbital margin. The frontal notch (or foramen) was defined as located on the junction between the supraorbital and the medial orbital margins. When well-developed, it contained the medial branch of the supraorbital nerve (or its subbranches) and, occasionally, the supratrochlear nerve. The variations in the course of the lateral and

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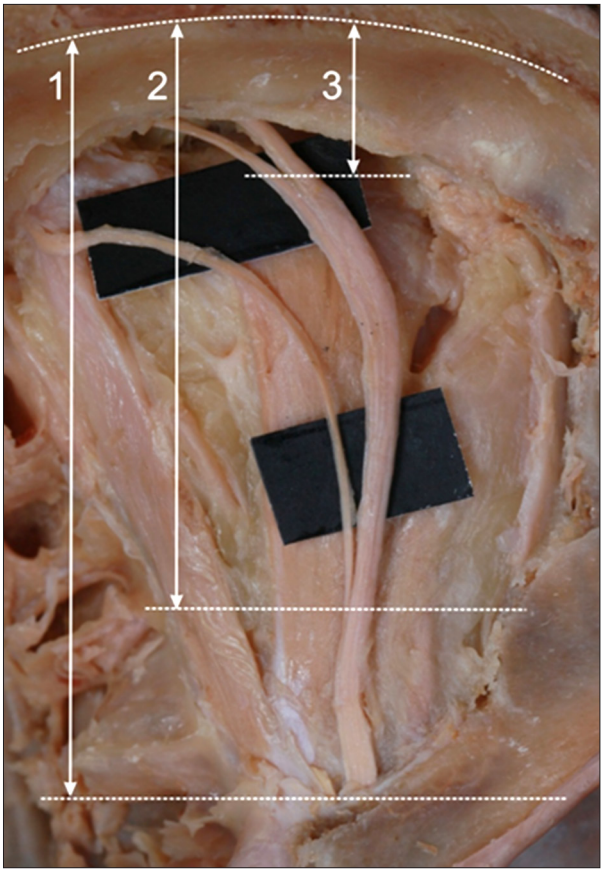

Figure 1. Measurements of the points of branching of the frontal and supratrochlear nerves performed in relation to the supraorbital margin: 1) length of the orbit, 2) distance to the division of the frontal nerve into supraorbital and supratrochlear nerves, 3) distance to the division of the frontal nerve into medial and lateral branch.

medial branches of the supraorbital nerve (including their subbranches) were recorded. Further stratigraphic dissection of previously reflected soft tissues allowed us to trace the origin of both the superficial branches and the deep branch of the supraorbital nerve. The distances from the midline to the supraorbital and frontal notch (foramen) were measured at the level of the orbital rim. The widths of the supraorbital and frontal notch (foramen) were also recorded. The same measurements were performed on the macerated skulls. Each measurement was taken twice; the average of both measurements was accepted as the result. Basic descriptive statistics were applied to structure the raw data. The chi-square test was used to test relationships between selected variables, ie, the occurrence of different types of passages on the supraorbital margin with regard to the location of the point of the frontal nerve division into the supraorbital and supratrochlear nerves. The significance level adopted in the analysis was P=0.05. The calculations were made with STATISTICA software, version 10.0 PL.

Results

Anatomical variations of intraorbital course of the supraorbital and supratrochlear nerves

Taking into account the location of the point of the frontal nerve division, 2 main variants of the intraorbital course of the

Table 1. The intraorbital location of the origins of the supraorbital and supratrochlear nerves, and the diameters of both nerves.

	Measured parameter	Min [mm]	Max [mm]	Mean [mm]	Median [mm]	SD [mm]
Variant I (origin in the distal part of the orbit)	Diameter of the supraorbital nerve*	1.23	1.87	1.58	1.63	0.24
	Diameter of the supratrochlear nerve*	0.68	1.51	1.09	1.04	0.25
	Distance to point of branching of the frontal nerve**	8.41	26.9	18.2	18.1	5.6
Variant II (origin in the proximal part of the orbit)	Diameter of the supraorbital nerve*	1.19	2.41	1.54	1.43	0.38
	Diameter of the supratrochlear nerve*	0.55	1.04	0.79	0.76	0.18
	Distance to point of branching of the frontal nerve**	27.8	38.9	32.0	32.1	3.6
Total	Diameter of the supraorbital nerve*	1.19	2.41	1.56	1.48	0.3
	Diameter of the supratrochlear nerve*	0.55	1.51	0.95	0.96	0.26
	Distance to point of branching of the frontal nerve**	8.41	38.9	25.1	27.4	8.5

* The diameters of the nerves were measured at the levels of their origin. ** The distances to the specific points of branching were measured from the supraorbital margin. SD – standard deviation.

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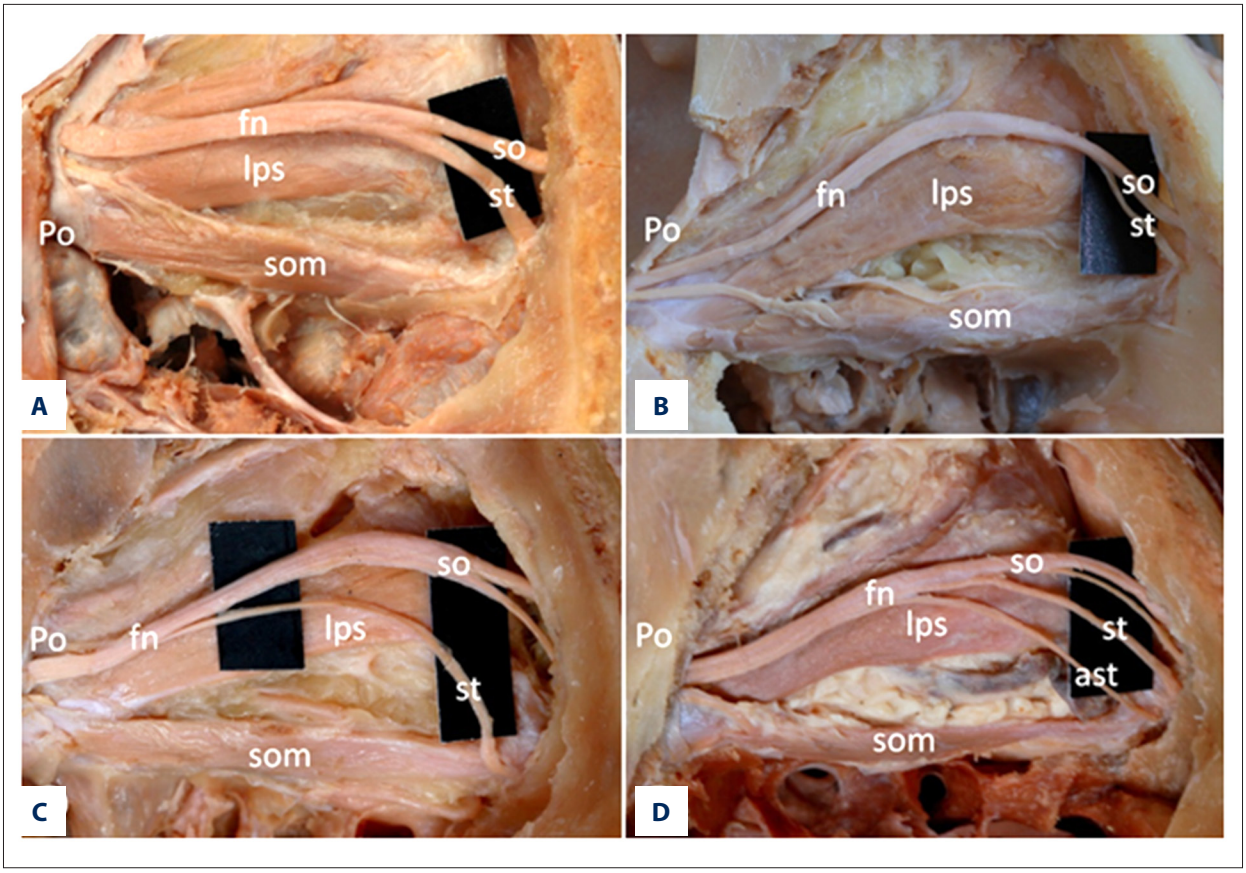

Figure 2. Anatomical variations of intraorbital parts of the supraorbital and supratrochlear nerves. Superior views to the left orbit. (**A**) The supratrochlear and supraorbital nerves branch in the distal half of the orbit. Both nerves have similar diameter. (**B**) The supratrochlear and supraorbital nerves branch in the distal half of the orbit. The supratrochlear nerve is thin. (**C**) The frontal nerve divides into supraorbital and supratrochlear nerves in the proximal half of the orbit. (**D**) The presence of the accessory supratrochlear nerve (ast). Both supratrochlear nerves have similar diameter. fn – frontal nerve; lps – levator palpebrae superioris muscle; so – supraorbital nerve; som – superior oblique muscle; st – supratrochlear nerve; Po – posterior side.

supraorbital and supratrochlear nerves were distinguished. The measurements regarding the location of the branching point of the supraorbital and supratrochlear nerves, as well as diameters of both nerves, are presented in Table 1. The first variant (variant I) involved 18 out of all 50 cases (36% of cases) in which the supraorbital and supratrochlear nerves branched off from the frontal nerve in the distal half of the length of the orbit, ie, half of the distance from the medial orbital rim to apex of the orbit (Figure 2A, 2B). In variant I, the distance between the supraorbital margin and the point of branching of the frontal nerve included on average 36.7% of the orbital length (min=15.8%, max=47.9%, standard deviation = 9.1%). Among those cases, both nerves had comparable diameter in 3 specimens (6% of all examined specimens, 1 right and 2 left orbits; Figure 2A), whereas the supratrochlear nerve was significantly thinner in 15 out of 18 of specimens representing variant I (30% of examined specimens, 5 left and 10 right orbits; Figure 2B).

In the second variant (variant II), which was found in 32 out of all 50 cases (64%, 14 left and 18 right orbits), the frontal nerve was divided into supraorbital and supratrochlear nerves in the proximal half of the orbit, in close proximity to the superior orbital fissure. In variant II, the distance between the supraorbital margin and the point of branching of the frontal nerve included on average 71.2% of the orbital length (min=54.8%, max=88.4%, standard deviation=10.1%). Variant II was characterized by the presence of a thick supraorbital nerve and a long, tiny supratrochlear nerve (Figure 2C). The presence of the accessory supratrochlear nerve was noticed in 2 cases (2 out of 50 orbits, 4%; Figure 2D).

Among 18 supraorbital nerves classified as variant I, only 5 (27.8%) were divided into the medial and lateral branch within the orbit. In turn, 24 out of 32 supraorbital nerves representing variant II (75% of nerves representing variant II) were clearly divided into the medial and lateral branch (or even further sub-branches) within the orbit.

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Table 2. Frequency of each type of passage within the supraorbital margin based on morphology (notch/foramen), number, and configuration of those exit point(s).

	Types of passages on the supraorbital margin	Wet specimens			Macerated skulls			Total (n=100)
		Right (n=29)	Left (n=21)	Total (n=50)	Right (n=25)	Left (n=25)	Total (n=50orbits)	
Single opening	Single well-developed supraorbital notch	16 (55.2%)	11 (52.4%)	27 (54%)	10 (40%)	12 (48%)	22 (44%)	49 (49%)
	Single supraorbital foramen	4 (13.8%)	2 (9.5%)	6 (12%)	4 (16%)	5 (20%)	9 (18%)	15 (15%)
	Single broad and flat frontal notch located medially	3 (10.3%)	4 (19%)	7 (14%)	5 (20%)	3 (12%)	8 (16%)	15 (15%)
Double opening	Cooccurrence of foramen and notch	6 (20.7%)	3 (14.3%)	9 (18%)	5 (20%)	4 (16%)	9 (18%)	18 (18%)
	Double foramen	0	1 (4.8%)	1 (2%)	1 (4%)	1 (4%)	2 (4%)	3 (3%)

Table 3. Distances to midline measured for each type of passage on the supraorbital margin.

	Types of passages on the supraorbital margin		Distance to the midline (both wet specimens and macerated skulls)				
			Min [mm]	Max [mm]	Mean [mm]	Median [mm]	SD [mm]
Single opening	Single well-developed supraorbital notch		18.3	2.9	22,7	21,2	3.5
	Single supraorbital foramen		19.4	34.9	26.2	24.7	4.7
	Single broad and flat frontal notch located medially		12.9	16.7	15.3	15.5	1.4
Double opening	Cooccurrence of foramen and notch	Notch	16.3	23.8	20.9	21.6	2.8
		Foramen	19.5	34.4	29.1	29.2	4.7
	Double foramen	Foramen	20.6	29.2	23.7	21.3	4.8
		Accessory foramen	16.6	27.1	22.4	23.4	5.3

SD – standard deviation.

Table 4. Measurements of widths or diameters performed for each type of passage located on the supraorbital margin.

	Types of passages on the supraorbital margin		Width (for notch) or diameter (for foramen) (wet specimens and macerated skulls)				
			Min [mm]	Max [mm]	Mean [mm]	Median [mm]	SD [mm]
Single opening	Single well-developed supraorbital notch		3.15	6.76	5.16	5.14	1.23
	Single supraorbital foramen		1.93	4.46	2.56	2.45	2.72
	Single broad and flat frontal notch located medially		7.61	10.36	8.3	7.91	0.96
Double opening	Cooccurrence of foramen and notch	Notch	3.85	7.31	5.37	5.16	1.11
		Foramen	1.18	3.23	2.19	2.34	0.78
	Double foramen	Foramen	2.79	3.33	3.03	2.97	0.27
		Accessory foramen	1.33	2.63	1.92	1.81	0.66

SD – standard deviation.

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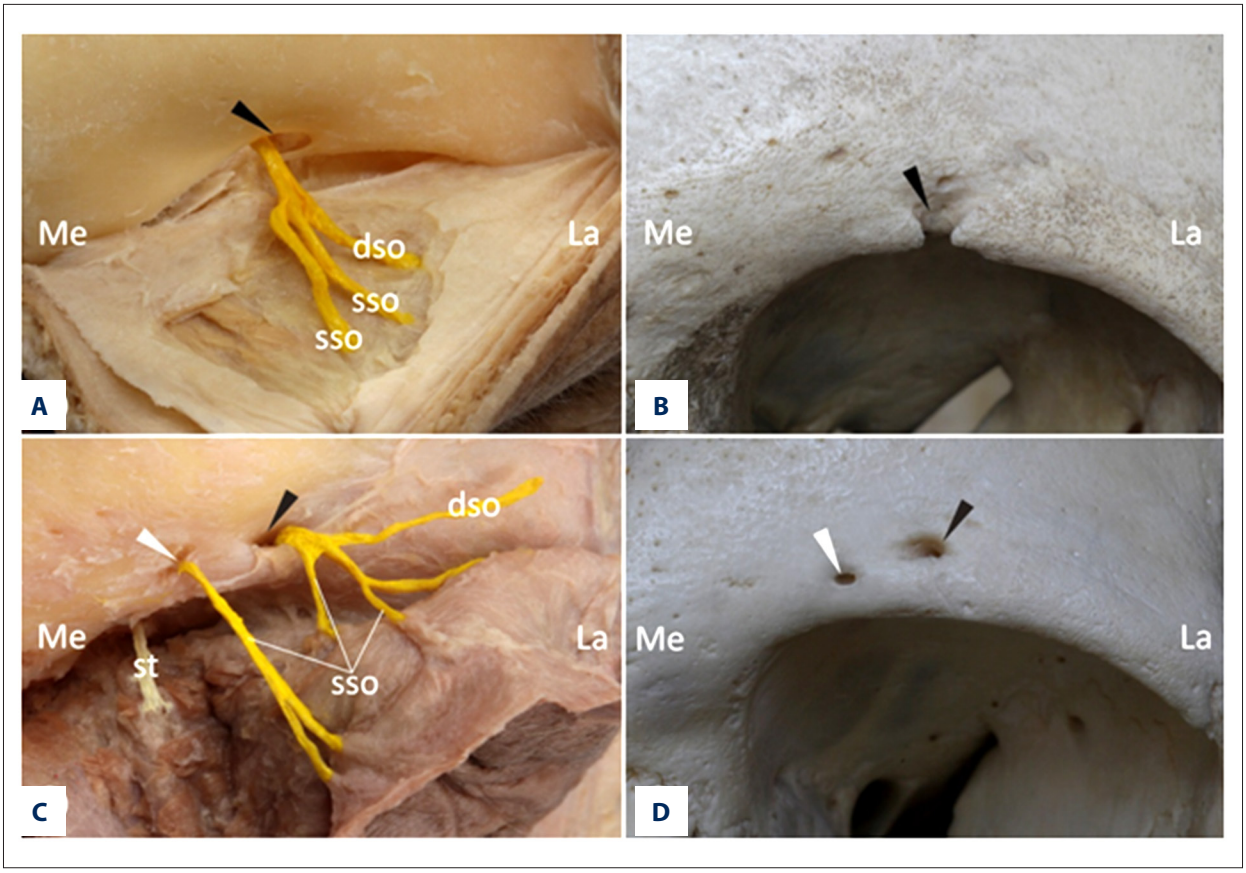

Figure 3. Anatomical variations of notches and foramina on the supraorbital margin shown on wet specimens and macerated skulls. Selected anatomical variations of arrangement the supraorbital and supratrochlear nerves (colored by acrylic paint) have also been presented. (**A**) A single well-developed supraorbital notch (marked by black arrowhead) located between middle and medial thirds of the supraorbital margin. An undivided trunk of the supraorbital nerve passing through the notch has been exposed. The supraorbital nerve is divided directly at its emerging point into superficial branches (sso) and deep branch (dso). (**B**) Another specimen of macerated skull showing single well-developed supraorbital notch (marked by black arrowhead). (**C**) Presence of 2 foramina on the supraorbital margin. The main foramen (marked by black arrowhead) is the place where the lateral branch of the supraorbital nerve emerges. The second, accessory, foramen (marked by white arrowhead) is emerging point for thinner medial branch of the supraorbital nerve. The deep branch (dso) originates from the lateral branch of the supraorbital nerve, while the superficial branches (sso) are derived from both lateral and medial branches of the nerve. The supratrochlear nerve (st) runs beyond both foramina, under the medial part of supraorbital margin. (**D**) Presence of 2 foramina: the main (marked by black arrowhead) and accessory (marked by white arrowhead) on the supraorbital margin of macerated skull. La – lateral side; Me – medial side.

Variability in the shape and number of openings on the supraorbital margin

Several anatomical variations related to number and morphology of transcranial passages located within the supraorbital margin were observed in the examined material. The detailed data on frequency of each type of passage within the supraorbital margin, observed in this study, are presented in Table 2. The measurements performed for each type of passage on the supraorbital margin (widths or diameters and distances to the midline) are presented in Tables 3 and 4.

Single aperture was observed in 40 out of 50 wet specimens (80%) and in 39 out of 50 orbits (78%) examined on the macerated skulls (Table 2). These cases involved: 1) the presence of single well-developed supraorbital notch (this group was most frequent and also included cases with bony prominences on edges of the notch that resembled incomplete foramen; see Figure 3A, 3B), 2) the presence of single well-developed supraorbital foramen, or 3) the presence of single broad and flat frontal notch (Figure 4A, 4B). In our study, we did not find a complete lack of any opening on supraorbital margin, however, for the sake of clarity, it should be noted that huge differences were observed in the size and location of the notches. Due to the relatively common (14% of wet specimens and 16% of

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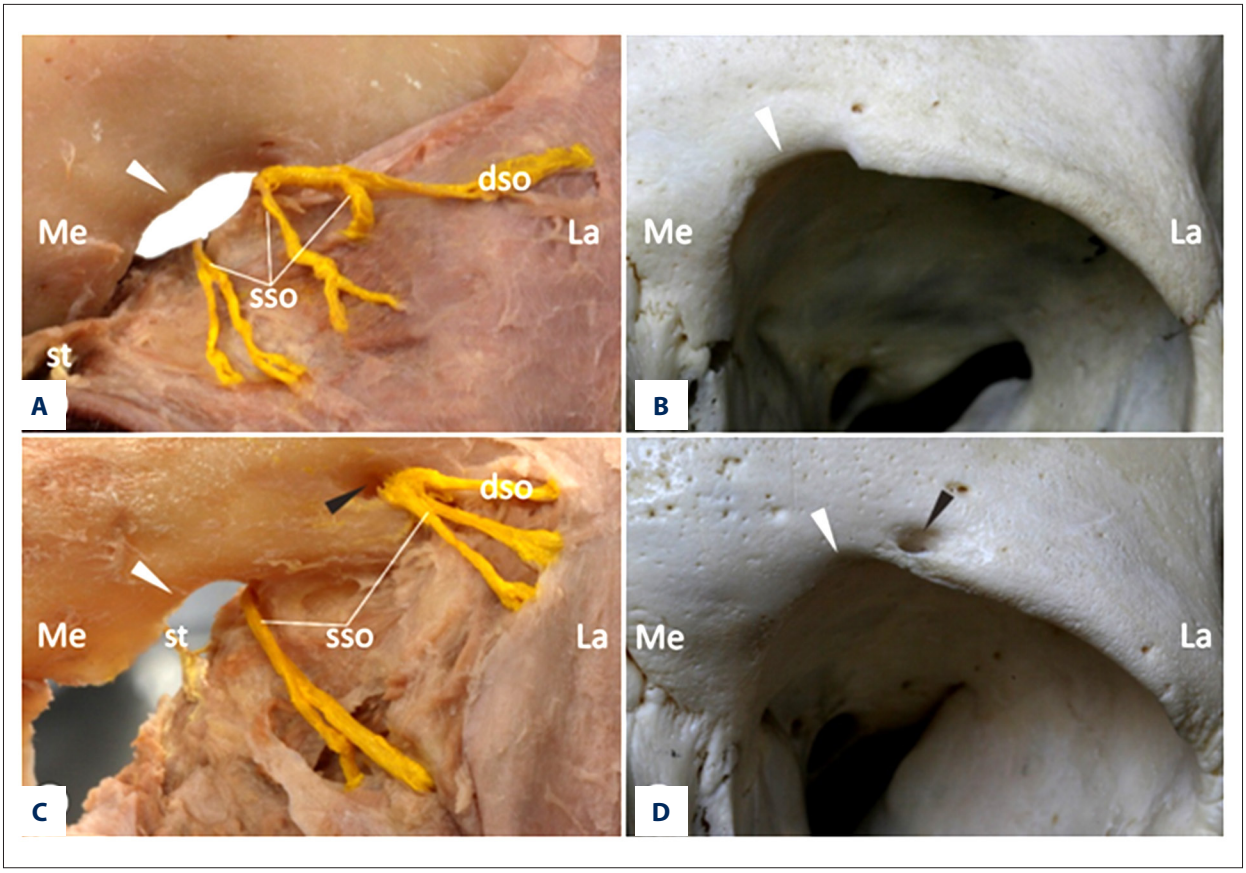

Figure 4. Anatomical variations of notches and foramina on the supraorbital margin shown on wet specimens and macerated skulls. Selected anatomical variations of arrangement the supraorbital and supratrochlear nerves (colored by acrylic paint) have also been presented. (**A**) A single broad and flat notch (marked by white arrowhead) located medially on the supraorbital margin. The lateral and medial branches of the supraorbital nerve passing through the notch has been exposed. (**B**) Another specimen of macerated skull showing single broad and flat notch (marked by white arrowhead). (**C**) Cooccurrence of notch and foramen on the supraorbital margin. The supraorbital foramen (marked by black arrowhead) is the place where the lateral branch of the supraorbital nerve emerges. The notch (marked by white arrowhead) is emerging point for medial branch of the supraorbital nerve. The deep branch (dso) originates from the lateral branch of the supraorbital nerve, while the superficial branches (sso) are derived from both lateral and medial branches of the nerve. The supratrochlear nerve (st) runs within the frontal notch. (**D**) Cooccurrence of notch (marked by white arrowhead) and foramen (marked by black arrowhead) on the supraorbital margin of macerated skull. La – lateral side; Me – medial side.

orbits examined on macerated skulls) presence of broad and shallow notches directly on the medial edge of the supraorbital rim, we decided to distinguish another variant of aperture: the presence of well-developed frontal notch (Figure 4A, 4B).

Double aperture on the supraorbital margin was noticed in 10 out of 50 wet specimens (20%) and in 11 out of 50 orbits (22%) examined on the macerated skulls (Table 1). These cases involved: 1) co-occurrence of foramen (located laterally in all cases) and notch (which in all cases occupied more medial position on the supraorbital margin; see Figure 3C, 3D), as well as 2) the presence of double foramen on the supraorbital rim (Figure 4C, 4D).

No statistically significant relationships were found between the occurrence of different types of passages on the supraorbital margin and the location of the point of the frontal nerve division into the supraorbital and supratrochlear nerves.

Anatomical variations of the supratrochlear and supraorbital nerves within the exit points on the supraorbital rim

The arrangement of the supraorbital nerve (or its branches) within the exit points on the supraorbital rim was highly variable. However, in all the cases with double exit points on the supraorbital rim, the arrangement of the lateral and medial branch of the supraorbital nerve was constant. In all those cases (20% of all examined wet specimens), the more lateral

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aperture contained lateral branch of the supraorbital nerve. The more medial exit point (notch in 18% and foramen in 2% of those cases, respectively) served for the passage of the medial branch (or its sub-branches) of the nerve.

We also observed huge diversity regarding the course of the superficial and deep branches. However, in all examined material, the lateral branch of the supraorbital nerve gave both the deep branch and some of the superficial branches, while the medial branch was the source of only superficial branches (Figures 2C, 3A, 3C). Unlike the superficial branches, the course of the deep branch in all specimens was consistent. The deep branch occupied the most lateral position regardless of type of exit points on the supraorbital rim (Figures 2A, 2C, 3A, 3C).

For most wet specimens (45 out of 50 specimens, 90%), the supratrochlear passed under the exit points located on the supraorbital margin (Figure 3C). However, in 4 out of 7 cases with broad frontal notch and in 1 out of 9 cases of co-occurrence of notch and foramen on the supraorbital margin, the supratrochlear nerve passed through the notch (Figure 4C).

Discussion

Arrangement of the apertures on the supraorbital margin

The supraorbital margin forms the upper boundary of the anterior open end (base) of the orbit and separates the frontal squama from the orbital portion of the frontal bone. In the published literature, there have been numerous classifications of foramina or notches located on the supraorbital margin. In the scientific literature, there have been numerous classifications of foramina or notches located on the supraorbital margin, so the data on the occurrence of variations of these exits varies among different authors. The study by Beer et al [6] focused on anatomical variations of the frontal and supraorbital transcranial passages. They emphasized that both the location and arrangement of the exit point of the supraorbital nerve were not constant. They focused on the morphology (notch/foramen), number, and configuration of exit point(s) on the supraorbital rim. Out of 200 skulls, 106 specimens had a frontal foramen (or notch), and all the samples had a supraorbital foramen (or notch). Regarding the supraorbital passage, it was found as a foramen in 133 of specimens and as a notch in 358 of specimens [6]. In 9 of the specimens, there were double notches or foramina. In a study in a Korean population, the frequency of the supraorbital notch was found to be 69.9% and was higher than the frequency of the foramen, which occurred in 28.9% of cases [21]. According to Nanayakkara et al. [22], a majority of supraorbital nerve exits existed as notches (73.8%) and the rest as foramina (26.2%); and accessory passages were observed in 18.9% skulls [22].

In our study, we distinguished another type of single exit on the supraorbital margin; The wide and shallow depression on the medial, rounded part of the supraorbital margin was defined as a frontal notch. In a study by Saylam et al. [8], 500 frontal and supraorbital transcranial passages were studied in 50 cadavers and 200 crania: 106 specimens had a frontal foramen (notch) and all samples had a supraorbital foramen (notch). The frontal passage was a foramen in 7 samples and a notch in 99 samples [8]. As for the supraorbital passage, it was found as a foramen in 133 of specimens and as a notch in 358 of specimens; in 9 of the specimens, there were double notches or foramina [8].

Tsutsumi et al. [23] examined the supraorbital notch/foramen involving the segment of the supraorbital nerve and the supraorbital artery that has infrequently been explored with magnetic resonance imaging (MRI). They concluded that segments of the supraorbital nerve passing through the supraorbital exit could be reliably located using contrast MRI and the supraorbital rim might function as the intracranial to extracranial anastomotic channel. According to Beer et al. [6], if division of the supraorbital nerve occurs extraorbitally, the 2 branches (lateral and medial) leave the orbit together by a single exit point. In our study, among supraorbital nerves classified as variant I (branching off from the frontal nerve within distal half of the orbit), only 27.8% were divided into medial and lateral branches within the orbit. In turn, 75% of supraorbital nerves representing variant II (branching off from the frontal nerve within proximal half of the orbit) were clearly divided into medial and lateral branches (or even further sub-branches) within the orbit. Regarding the supratrochlear nerve, in most cases it seems not to pass through the frontal notch (or frontal foramen) but under this notch.

Our study presented the variations and characteristics of the supraorbital foramen or notch with regards to the content of branches of the supraorbital nerve. Previous detailed studies on supraorbital nerve branching patterns relative to the corrugator supercilii and frontalis muscles fibers have been described by Janis et al. [4] and Gil et al. [3]. The supraorbital nerve was also studied by Knize [5] in 12 fresh cadaver specimens (anatomical dissection), and in 30 living individuals (using selective nerve blocks). According to those previous studies, the supraorbital nerve has 2 consistent divisions beyond the orbital rim: a superficial (medial) division that passes over the frontalis muscle, providing sensory supply to the forehead skin; and a deep (lateral) division that runs across the lateral forehead. Our study supplements these earlier findings. We observed huge diversity regarding the course of the medial and lateral branches of the supraorbital nerve and the pattern of their division into superficial and deep sub-branches within the passages on the supraorbital margin. However, in all examined study material, the lateral branch gave both the

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deep branch and some of the superficial sub-branches, while the medial branch gave off a variable number of superficial branches. The deep branch occupied the most lateral position regardless of the type of exit points on the supraorbital rim.

Thorough knowledge of the positional variations of passages on the supraorbital margin is important to ensure safe and successful medical procedures, such as regional anesthesia, and to avoid iatrogenic nerve injuries during surgery in this region [22]. In a study by Nanayakkara et al [22], the supraorbital nerve exit was located on average 23.64 mm (±3.49 mm) laterally from the facial midline in male patients, and in female patients on average 22.69 (±3.28 mm) laterally from the facial midline. In a study by Tsutsumi et al [23], the median distance from the midline to the midpoint of the supraorbital notch/foramen explored with MRI was 22.6 mm (±3.08 mm) on the right side and 22.8 mm (±3.07 mm) on the left. Malet et al. [24] studied Caucasian specimens. Their measurements were made to nasion points and were reported to be much lower than in other studies (18.32 mm). Chung et al. [25], in studies from photographs of Korean skulls, found that the average distance from the median plane to the center of the supraorbital notch or foramen was 22.7 mm. However, huge diversity (from 22 mm to 49 mm) in the distance to the midline was observed by Beer et al. [6]. In our study, the distance to the midline ranged from 12.9 mm to 34.9 mm for all types of passages located on the supraorbital margin (Table 3). According to Tomaszewska et al. [26], extra care should be taken during surgical procedures in the supraorbital region because population variations regarding passages on supraorbital notch have been described.

Limitation of the study

Anatomical variations of the territory of innervation of superficial and deep branches of the supraorbital nerve, as well as territory of the supratrochlear nerve were not examined. However, a detailed study on supraorbital nerve branching patterns relative to the corrugator supercilii and frontalis muscles fibers has been described by Janis et al. [6] and Gil et al. [3].

Conclusions

Both the intraorbital and extraorbital course of branches of the supraorbital and supratrochlear nerves are highly diverse. These variations should be taken into account during medical procedures performed within the orbital and frontal regions.

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Conflict of interest

None.

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