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ORIGINAL RESEARCH

Clinically Correlated morphometric study of supra orbital foramen

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ABSTRACT

Introduction: The aim of this study was to analyze the anatomical variations of depression, supraorbital notches and supraorbital foramina. When performing supraorbital endoscopic surgeries and regional nerve blocks, it is important to understand the exact location of the supraorbital fossa.

Aim Migraine treatment, supraorbital endoscopic surgery, regional nerve blocks, and nerve compression all require an understanding of the location of the supraorbital nerve. This work discusses the emergent pathways of the supraorbital nerve and provides a comprehensive review of the literature of previous anatomical studies. Surgeons worldwide will benefit from this comparative analysis.

Materials and Methods : The supraorbital notch and/or opening were bilaterally analyzed in 50 human dry skulls using a digital verniercaliper. The parameters taken in the study were the number of notches/openings and the distance of the supraorbital notch/opening from the nasion and the fronto-zygomatic suture.

Results: The supraorbital notch is more common on the right side, occurring in 66% of cases compared to 50% on the left side. In contrast, the supraorbital foramen is slightly more common on the left side, with a prevalence of 46% compared to 30% on the right side.

Correlation for nasion to right and left supraorbital feature distances is weak and not statistically significant.The Pearson correlation coefficient (r) is 0.245 and the significance value (p) is 0.086, which does not exceed the threshold of statistical significance ($p < 0.05$), that distances from the frontozygomatic suture to supraorbital features moderately predict distances on the other side.

Conclusion: The superior orbital region is used in supraorbital nerve blocks for several procedures such as wound closure, biopsy, scar examination and other facial cosmetic procedures, so a thorough knowledge of this region is critical for physicians to effectively anesthetize the supraorbital nerve.

KEY WORDS: Supraorbital foramen, Fronto-zygomatic suture, Nasion, Supraorbital vessels

INTRODUCTION

At the intersection of the orbit's lateral two thirds and medial one third, the supraorbital notch is located on the supraorbital margin. One can feel the supraorbital notch on the superior rim of the orbit where its medial third and lateral two thirds meet. The easily palpable supraorbital notch can occasionally become less palpable supraorbital foramina due to the ossification of the ligament bridging the notch [1]. Duke Elder referred to this ligament as the supraorbital ligament [2]. Schaffer said that the notch frequently converted into a foramen [3].

Blood vessels and supraorbital nerves are transmitted through the supraorbital notch/foramen. The frontal nerve (a branch of the ophthalmic nerve) gives rise to the supraorbital nerve. In maxillofacial surgery, there has been much emphasis placed on the significance of the anatomical characteristics and location of the supraorbital foramen/notch [4, 5].

The supraorbital nerve is a good candidate for a regional nerve block because of its superficial path, which allows for the application of regional anaesthetic across a broad area. For numerous surgical operations, including the treatment of facial trauma and wounds as well as aesthetic procedures like blepharoplasty, supraorbital nerve block is used. Surgeons can safely achieve effective analgesia if they are aware of the most common location and path of the supraorbital nerve [6].

Supraorbital nerve blocks are used to treat migraines in patients who do not respond well to medication, so this is commonly utilized technique for nerve blocks in clinical settings [7]. Since nerve injury can happen even during a supraorbital nerve block, the anatomical

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characteristics and location of the supraorbital foramen/notch are significant. Additionally, it has been demonstrated to be useful in treating supraorbital nerve discomfort [8].

The aim of this study was to compare the effect of different supraorbital opening variations on the effectiveness of radiofrequency treatment in patients with primary V1 trigeminal neuralgia.

MATERIALS AND METHODS

Study Type- Museum based cross-sectional observational study.

Study Location - Department of Anatomy, SMS Medical College, Jaipur.

Duration of the study- November 2022.

Study specimens-Fifty dry adult human skulls of unknown age and sex.

Inclusion criteria-Dry human skulls complete in all aspects.

Research technique- Single observer method.

Methodology- Measurements were made after obtaining permission from the authorities.

The parameters studied were [Table/Figure1]

1. Distance between supraorbital foramen/notch and frontozygomatic suture
2. Distance between nasion and supraorbital notch and/foramen.

Statistical analysis - All measurements were made with a digital vernier caliper, accurate to 0.02 mm for linear measurements on both sides; the observations thus made were collected and tabulated. All measurements were expressed in millimeters SD (standard deviation) from the mean. The chi-square test was used to assess the relationship between the supraorbital notches/foramen, and nasion and frontozygomatic suture the right and left sides of the skull. Unpaired t-test Used to compare mean distances of supraorbital features from specific anatomical landmarks between the right and left sides of the skull. Correlation analysis (Pearson correlation) was used to examine the distances of supraorbital features from different landmarks on the right and left sides of the skull. These statistical methods allowed a comprehensive analysis of the anatomical variations and associations observed in the study population.

RESULTS

The distribution of supraorbital notches, foramina, and depressions varies between the right and left sides of the skull. The supraorbital notch is more prevalent on the right side, occurring in 66% of cases, compared to 50% on the left side. Conversely, the supraorbital foramen is slightly more common on the left side, with a prevalence of 46%, compared to 30% on the right side. Depressions are equally rare on both sides, appearing in just 4% of cases. Overall Chi-square value of 2.78 with a p-value of 0.248 suggests that there is no statistically significant difference in the distribution of supraorbital notches, foramina, and depressions between the right and left sides. This indicates that these anatomical features are relatively evenly distributed across both sides of the skull in the studied population [Table/Figure 2].

The occurrence of supraorbital features can be bilateral or unilateral, with specific tendencies for each type. Bilateral supraorbital notches are the most common, found in 40% of cases, while bilateral supraorbital foramina occur in 20% of cases. When considering unilateral occurrences, a supraorbital notch is more frequently found on the right side (26%) compared to the left side (10%). Foramina, however, show a reverse trend, being more frequent on the left side (26%) compared to the right side (10%). Unilateral depressions are equally uncommon on both sides, each presenting in 4% of cases [Table/Figure 3].

The measurements of the distance from the nasion to the supraorbital notch, foramen, or depression reveal slight differences between the right and left sides. On the right side, the mean distance is 24.39 mm, with a standard deviation of 3.90 mm. On the left side, the mean distance is slightly greater at 24.81 mm, with a standard deviation of 4.00 mm. These findings suggest a generally consistent distance on both sides, with minor variations [Table/Figure 4].

The unpaired t test result, which compares the mean distances between the right and left sides, has a t value of -0.532 and a p-value of 0.596. This p-value is greater than the standard threshold of 0.05, indicating that there is no statistically significant difference between the mean distances from the nasion to the supraorbital notch, foramen, or depression on the right and left sides of the skull. Therefore, we can conclude that the distances are relatively consistent across both sides in the studied population [Table/Figure 4].

The t-test result, which compares the mean distances between the right and left sides, has a t value of 1.757 and a p-value of 0.082. This p-value is greater than the standard threshold of 0.05, indicating that there is no statistically significant difference between the mean distances from the frontozygomatic suture to the supraorbital notch, foramen, or depression on the right and left sides of the skull. Therefore, we can conclude that the distances are relatively similar across both sides in the studied population, despite the slight difference in the mean values [Table/Figure 5].

The correlation between the distances from the nasion to the supraorbital features on the right and left sides is weak and not statistically significant. The Pearson correlation coefficient (r) is 0.245, with a significance value (p) of 0.086, which does not meet the threshold for statistical significance ($p < 0.05$). This suggests that there is no strong or reliable relationship between

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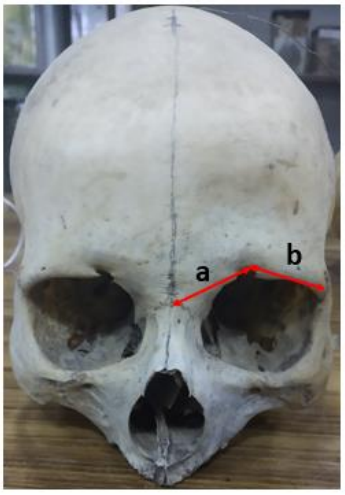
these distances on the right and left sides [Table/Figure – 6 a, 6b].

In contrast, the correlation between the distances from the frontozygomatic suture to the supraorbital features on the right and left sides is moderate and statistically significant. The Pearson correlation coefficient is 0.423, with a significance value of 0.002, indicating a significant positive relationship ($p < 0.01$). This shows that the distances from the frontozygomatic suture to the supraorbital features on one side are moderately predictive of the distances on the other side [Table/Figure 7 a, 7b].

[Table/Figure -1] Measurement of the distance of the supraorbital foramen / notch from the nasion (a) and frontozygomaticfissure(b).



[**Table/Figure -2] Distribution according to frequency of occurrence of depression, notch and foramen**

Supraorbital notch/foramen/depression	Right (Percentage %)	Left (Percentage %)	Total	Chi square test (p value)
Supraorbital notch	33 (66%)	25 (50%)	58	($\chi 2 = 2.78$) ($p = 0.248$)
Supraorbital foramen	15 (30%)	23 (46%)	38	
Depression	2 (4%)	2 (4%)	4	
Total	50	50	100	

[Table/Figure – 3] Frequency of occurrence of notch, depression or foramen unilaterally (U/L), bilaterally (B/L) on the right (R) or left side(L)

Supra orbital notch/foramen/depression	Frequency	Percentage %
Bilateral supraorbital notches	20	40%
Bilateral supraorbital foramina	10	20%
Unilateral notch right	13	26%
Unilateral notch left	5	10%
Unilateral foramina right	5	10%
Unilateral foramina left	13	26%
Unilateral Depression right	2	4%
Unilateral Depression right	2	4%

[Table/Figure- 4] Distance of supraorbital notch/foramen/ depression from the nasion on the right side (D/Nas/R) and on the left side (D/Nas/L)

Distance of supra orbital notch or foramen from nasion	Number	Minimum distance in mm	Maximum distance in mm	Mean	Standard deviation	t test (p value)
D/Nas/R	50	18.53	31.81	24.39	3.90	($t = -0.532$) ($p = 0.596$)
D/Nas/L	50	18.78	35.01	24.81	4.00	

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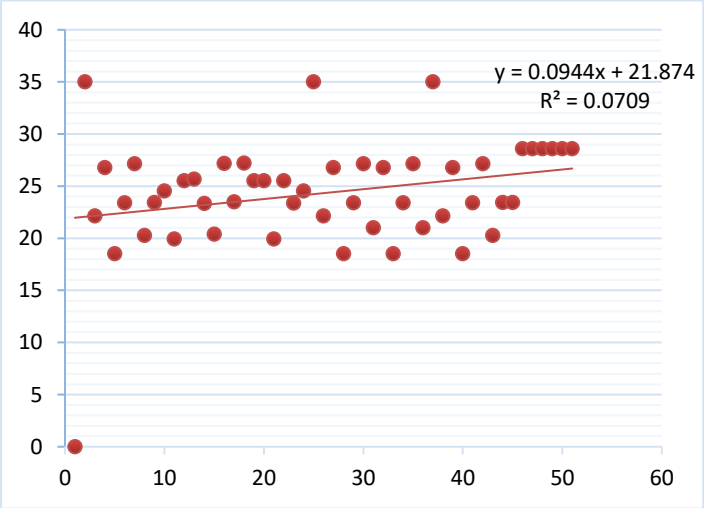
[Table/Figure – 5] Distance of the supraorbital notch/foramen/depression on the right side (D/FZS/R), and on the left side (D/FZS/L)

Distance of supra orbital notch or foramen from frontozygomatic suture	Number	Minimum distance in mm	Maximum distance in mm	Mean	Standard deviation	t test (p value)
D/FZS/R	50	20.44	36.72	32.52	4.062	(t = 1.757)
D/FZS/L	50	21.56	37.98	31.14	3.808	(p = 0.082)

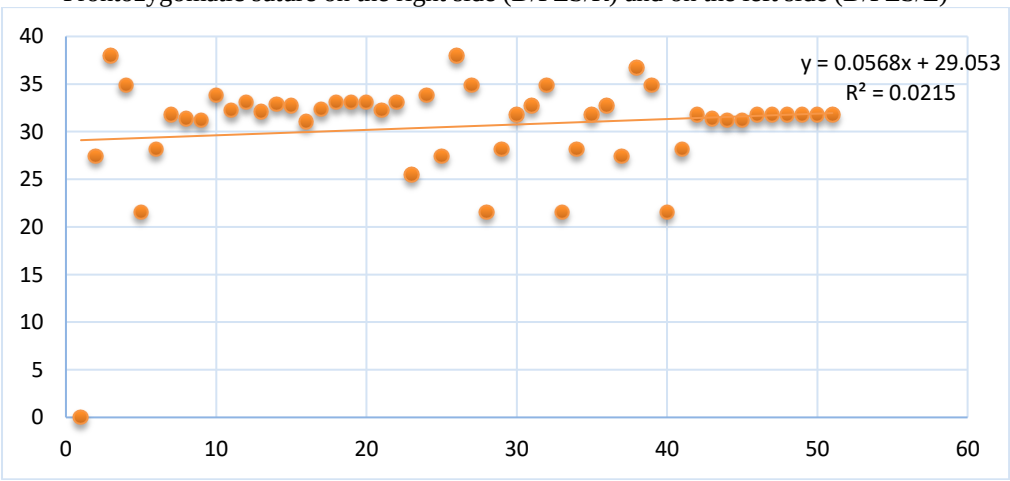
[Table/Figure – 6 a] CORRELATION of distance of supraorbital notch/foramen/ depression from the nasion on the right side (D/Nas/R) and on the left side (D/Nas/L)



[Table/Figure – 6 b]CORRELATION of distance of supraorbital notch/foramen/ depression from the nasion on the right side (D/Nas/R) and on the left side (D/Nas/L)

Correlations			
		D/NAS/R	D/NAS/L
D/NAS/R	Pearson Correlation	1	.245
	Sig. (2-tailed)		.086
	N	50	50
D/NAS/L	Pearson Correlation	.245	1
	Sig. (2-tailed)	.086	
	N	50	50

[Table/Figure -7a] CORRELATION of distance of supraorbital notch/foramen/ depression from the Frontozygomatic suture on the right side (D/FZS/R) and on the left side (D/FZS/L)



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[**Table/Figure 7b]CORRELATION of distance of supraorbital notch/foramen/ depression from the Frontozygomatic suture on the right side (D/FZS/R) and on the left side (D/FZS/L)**

		(D/FZS/R)	(D/FZS/L)
(D/FZS/R)	Pearson Correlation	1	.423**
	Sig. (2-tailed)		.002
	N	50	50
(D/FZS/L)	Pearson Correlation	.423**	1
	Sig. (2-tailed)	.002	
	N	50	50
**. Correlation is significant at the 0.01 level (2-tailed).			

DISCUSSION

Variations of the supraorbital notch and foramen have been cited by several workers, but the available literature is limited. Knowledge of the anatomy of the forehead is not properly understood for surgical procedures in this area. Forehead & Brow lift procedures have become important in the management of the aging phase in recent years. The supraorbital nerve, which pierces the septum of the eye to provide sensation to the medical aspect of the upper eyelid, forehead skin, frontal scalp. The supraorbital artery, which supplies arterial blood from the forehead, is a branch of the ophthalmic artery. To preserve the neurovascular bundle of the supraorbital foramina, it is necessary to know how often the foramina occur. Improper recognition of the supraorbital notches can result in injury to the supraorbital neurovascular bundle during subglial dissection of the supraorbital rim. The present study showed that the supraorbital notch was more on the right side (66%), while the supraorbital foramen was more on the left (46%). The incidence of depression was equal on both sides (2%) [Table/Figure 2]. In the study of Gumusburun et al there were 54.7% skulls having notches on either side, 8.9% had one foramen on one side & notch on other side., 5.3% had one foramina on either side & 24.4% had other combination [9]. Arunkumar S. Bilodi, San ikop MB had shown incidence of supraorbital foramina of 39% on right side and 43.3% on left side [10]. A similar pattern regarding presence of supraorbital foramen and notch was noted in a study conducted by Trivedi D. G. et al, suggesting that the 35.62% skulls had bilateral supraorbital notches, 21.45% had bilateral supraorbital foramina [11]. The incidence of supra orbital foramina as reported by Duke Elder and HollinshedW.Henry was 25% of total adult skulls [2,12]. Berry had found equal incidences of supra orbital notches and foramina in Mexican crania [13]. This difference of incidence of notches and foramia by different authors may be due to study of skulls from different region. In India, an application of technology in medical education particularly in Anatomy is on the way to rise [14]. The changing ways of teaching – learning like Evidence Based Medicine also has impact on understanding the basic anatomy [15]. It is essential that knowledge of Anatomy of Forehead include study of supraorbital notch & structures coming out through it.

CONCLUSION

Knowledge of the anatomy of the forehead and eyelids is necessary during various surgical procedures in this area. Knowledge of the supraorbital notches helps prevent damage to the supraorbital neurovascular bundle as mentioned in several anatomy textbooks. The results of this study have practical clinical value, so they should encourage further research.

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