Original Article

Indian Journal of Anatomy
Volume 7 Number 5, September - October 2018
DOI: http://dx.doi.org/10.21088/ija.2320.0022.7518.2

Study of Supraorbital Foramen and Notch in the Skulls of the Eastern Indian Population

Sudeepa Das[1], Bikash Chandra Satapathy[2], Minati Patra[3]

Abstract

Introduction: The supraorbital notch/foramen (SON/F) is present in the frontal bone through which the supraorbital nerve passes. The knowledge regarding the different positions of the SON/F becomes essential while performing surgeries around the orbit and in the face. This study aims to provide a baseline metrical data regarding the supraorbital foramen (SOF) in eastern Indian population. *Material and Methods:* In this study 52 dry human skulls (36 male, 16 female) were taken and a detailed viewing of all 104 sides was done for its form, position and occurrence along with measuring the dimensions of SON/F and its distance from different bony landmarks. *Result:* Our study shows the supraorbital notch was present more commonly as in 76.92%cases than supraorbital foramen which was found only in 23.08% cases. The mean distances of SON/F from the mid facial line is 19.9±3.8 mm on left and 20.9±3.4 mm on right, from the frontozygomatic suture it is 28.1±2.5 mm in left and 27.7±1.9 mm in right. And from the temporal crest is found to be 25.5±2.5 mm in left and 25.4±2.3 mm in right. *Conclusion:* Accuracy in knowing the position of SON/F will aid preventing iatrogenic damage to the supraorbital nerve in various surgeries.

Keyword: Supraorbital Foramen; Supraorbital Notch; Accessory Foramina; Mid Facial Line; Frontal Bone; Frontozygomatic Suture.

Introduction

The supraorbital notch/foramen(SON/F) lies at the superomedial margin of the orbit in frontal bone through which the supraorbital nerve and vessels emerges to supply the skin of scalp, upper eyelid, forehead and nose [1,2]. Supraorbital nerve is the sole sensory supply in this region, making it a nerve of choice for rendering optimum regional block required for the biopsies and surgeries done for cosmetic purposes by the surgeons and anesthetists. Knowledge of the location of different facial foramina with accuracy is needed for various invasive approach into the maxillofacial areas [3–5] and the reconstructive surgeries involving flaps. There may be bleeding, paraesthesia or hypoesthesia or even anaesthesia, neuralgia and entrapment neuropathies as the supraorbital neurovascular bundle lies in close proximity while passing through SON/F [4,6]. Various literature suggests the existence of the variability in the position and occurrence of SON/F. There are evidences which clearly shows that the exit of the supraorbital neurovascular bundle varies in different population [7–10]. Thus anatomical knowledge of this foramen is of great use. As per the data there is very less known facts about the morphology of SON/F in the eastern population hence this study is an attempt to establish some of the parameters important for the localization of SON/F using its morphology and distances from certain bony landmarks.

Author's Affiliation: [1]Assistant Professor [3]Professor, Department of Anatomy, Kalinga Institute of Medical Sciences KIIT Deemed to be University, Bhubaneswar, Odisha 751024, India. [2]Assistant Professor, Department of Anatomy, All India Institute of Medical Sciences, Mangalagiri, Vijayawada, Andhra Pradesh 520008, India.

Corresponding Author: Dr. Bikash Chandra Satapathy, Department of Anatomy, All India Institute of Medical Sciences, Mangalagiri, Temporary Campus, Siddhartha Medical College, Vijayawada, Andhra Pradesh 520008, India.
E-mail: bikash.satapathy@gmail.com,

Received | 13.08.2018, **Accepted** | 17.09.2018

Material and Methods

Fifty two skulls of known gender were collected from the osteology unit of the department of anatomy of KIMS; Bhubaneswar. 104 sides of these 52 skulls were inspected for any damage in the orbit and frontal

bone region. The intact skulls only were considered for this study while the damaged ones were rejected. The supraorbital foramen was studied in relation to different bony anatomical landmarks. The morphometric measurements of the supraorbital foramen and its distances from the various anatomical bony landmarks were measured with the aid of digital caliper which is calibrated with accuracy nearest to 0.1mm. All measurements were taken twice by the authors from which average value was calculated. The following parameters were studied.

- Transverse diameter of SOF
- Vertical diameter of SOF
- The distance of the medial margin of SON/F from the mid facial line (FM).
- Distance between SON/F from the temporal crest of the frontal bone.
- Distance between SON/F from the frontozygomatic suture.
- Distance between the superior orbital margin from the inferior margin of SOF.
- Position of SON/F with respect to infraorbital foramen.

The data collected were compiled and statistically analyzed in Quickcalcs online calculator by www.Graphpad.com.

Result

Supraorbital nerve comes out of the cranium either through the corresponding notch or foramen. Our study shows that the supraorbital notches are more frequently seen as in 76.92% cases as compared to supraorbital foramen which is found only in 23.08%cases. Out of the 52 skulls, bilateral supraorbital notches seen in 55.8% cases while bilateral supraorbital foramina seen in 9.6%cases as shown in table1. In one of the skull double accessory foramina was found to be present unilaterally. One of the female skull showed presence double accessory foramina on one side. Presence of bilateral accessory foramina observed only in 8 skulls (Table 1).

Discussion

There are noted variations in position and occurrence of SON/F as per various studies done in different populations [7–12]. Supraorbital notches are more common than supraorbital foramen which is similar with the findings of other researches. The supraorbital neurovascular bundle if passes through the foramen then its position is fixed and its clinical implication will be more as there will be chance of stretching of the nerves and vessels during retraction procedure of the cranium [11]. In the population where the incidence of SOF is higher, the superior border of the orbital rim needs careful handling by the operating surgeons. Not all the nerve fibers pass through the corresponding foramen but few exits by different routes where the role of accessory foramen comes into play. There is documented evidences suggestive of presence of more than one supraorbital nerve [9,10,13]. The prevalence of accessory foramen in the present study is 38.5% while in other studies the incidence seen is less but Ashwini et al in 2012 reported the presence of accessory foramen in their study to be 66.25% which is very high. In 64.5% cases these accessory foramina lies lateral to SON/F [9]. This finding is at par with the studies done earlier by Gupta [13] and Ashwini et al. [9]. In this study we found 63.33% of the accessory foramina lying laterally and 36.67% lying medially to SON/F which coincides with the study done by Ashwini et al. [9]. Due to these accessory exits there may be incomplete anaesthesia during the regional Supraorbital Nerve block. The incidence of bilateral presence of supraorbital notches is much higher than the presence of bilateral foramina [4,9,10]. Our study concludes that in 55.8% cases (56.3%females, 55.6%males) there is supraorbital notches present bilaterally whereas only in 9.6%cases (6.3%females, 11.1%males) the supraorbital foramina are present bilaterally and in 25% cases there is unilateral notch or a foramen. There are various other studies done by different authors in different races suggesting the

Table 1: Position of SON/F in relation to IOF

	Male (36)	Female (16)	Total (52)
Bilateral supraorbital notches	20(55.6)	9(56.3)	29(55.8)
Bilateral supraorbital foramina	4(11.1)	1(6.3)	5(9.6)
Unilateral notch and foramen	9(25)	5(31.3)	13(25)
Bilateral accessory foramina	5(13.9)	3(18.8)	8(15.4)
Unilateral Accessory foramina	10(27.8)	2(12.5)	12(23.1)

Table 2: Comparison of parameters between male and females

Distance	Male		Female		p value
	Number	Mean ± SD in mm	Number	Mean ± SD in mm	
SOF-TD	18	2.8±0.8	6	2.3±0.7	0.156
SOF-VD	18	1.4±0.3	6	1.3±0.2	0.59
SOF-SOM	18	1.7±0.9	6	1.4±1.4	0.53
SON/F-FM	72	20.5±3.2	32	20.2±4.5	0.766
SON/F-TCFB	72	25.6±1.8	32	25.1±3.4	0.294
SON/F-FZS	72	28.1±1.8	32	27.4±2.9	0.127

wide range of discrepancy regarding the SON/F (table 2).

The mid facial line is very often considered as an important landmark for the localization of SON/F [3,6,9–11,14]. In the Chinese population Cheng et al. [11] found that the distance between the facial midline and the supraorbital notch/foramen was 24.56 mm. Their study also revealed that 80% of the exits of supraorbital nerve were lying at a distance 20.77 mm and 30.52 mm from the facial midline. In our study apart from the mid facial line, the distances of the frontozygomatic Suture and the temporal crest of the frontal bone were used for the localization the SON/F. Gender predisposition is quite evident in our studies as per the linear measurements of SON/F from FZS and TCFB is considered. Side related disparity have been reported in earlier studies for the SON/F position with relation to TCFB, FZS and FM [11,15]. No significant differences was observed between the right and left side measurements in our study (Table 3). Cheng et al. [11] reported asymmetry in right side location of SON/F in relation to the superior border of the orbital rim. Chrcanovic et al. [15] in their study showed differences in distance of SON/F from FZS and TCFB in both sides which was significant statistically. However there are many studies including in Indian population not showing any side related disparity [9,10,14,16]. Table 5 shows the average distances of SON/F from the mid facial line, TCFB and FZS with its statistical values. As stated by Cutright et al. [7] the localization of mid facial line could be difficult intra operatively, so the temporal crest which can be palpated easily by getting the temporalis muscle can be considered as more reliable bony landmark to locate the supraorbital neurovascular bundle while performing surgeries.

Standard textbooks in anatomy writes that both infraorbital and supraorbital foramina lie in the same sagittal plane [1]. As per the findings of this study(as shown in table) in 57.7% cases SON/F lies medial to infraorbital foramen and only in 1.9% SON/F is present lateral to infraorbital foramen while in rest in 40.4% cases it lies in the same sagittal plane. But many other studies have shown different location of SON/F with regard to infraorbital foramen [3,7,10]. These differences may be due to racial and ethnic factors.

Table 3: Parameters of left and right sides of crania

Distance	Left		Right		p value
	Number	Mean ± SD in mm	Number	Mean ± SD in mm	
SOF-TD	10	2.5±0.53	14	2.8±0.9	0.441
SOF-VD	10	1.5±0.28	14	1.3±0.3	0.325
SOF-SOM	10	1.1±0.47	14	2.1±1.2	0.0258
SON/F-FM	52	19.9±3.84	52	20.9±3.4	0.185
SON/F-TCFB	52	25.5±2.47	52	25.4±2.3	0.783
SON/F-FZS	52	28.01±2.51	52	27.8±1.9	0.542

Table 4: Position of SON/F in relation to IOF

Position	No	%
Medial to IOF	60	57.7
Lateral to IOF	2	1.9
In the same vertical plane as IOF	42	40.4

Table 5: Comparison of different parameters with other authors

Study	SON/F-FM (mm)	SON/F-FZS (mm)	SON/F-TCFB (mm)
Gupta [13] (Indian)	23.9	-	29.9
Cheng et al. [11] (Chinese)	24.6	-	-
Apinhasmit et al. [10] (Thai)	25.14	-	26.57
Agthong et al. [14] (Thai)	24.4 (right side) 25.1 (left side)	-	-
Chrcanovic et al. [15] (Brazilian)	26.98	-	23.57
Chung et al. [3] (Korean)	22.7	-	-
Barker et al. [6] (Caucasian)	23.97±4.07	-	-
Ashwini et al. [9] (Indian)	22.2 (right side) 22.2 (left side)	29.3 (right side) 28.7 (left side)	-
Nanayakkara et al [2] (Sri Lankan)	23.6 (male) 22.7 (female)	27.9 (male) 26.3 (female)	28.7 (male) 27.3 (female)
Present Study (Indian)	20.45±3.24 male 20.22±4.45 female	28.10±1.83 male 27.38±2.91 female	25.60±1.8 male 25.06±3.35 female

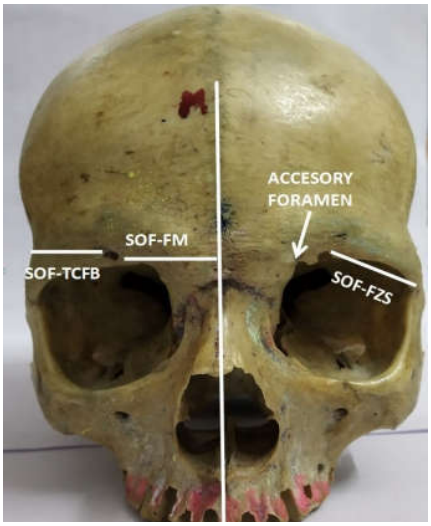

Fig. 1:

Conclusion

The supraorbital nerve exits either through a foramen or a notch. This nerve is important for the anaesthesiologist giving nerve block for treating chronic paroxysmal hemicrania and migraine [17]. These metrical linear data are of practical use clinically that will aid the surgeons for locating SON/F with more accuracy thereby reducing the risk of damage to the adjacent neurovascular bundle.

References

1. Black S. External skull. In: Standring S, editor. Gray's anatomy: the anatomical basis of clinical practice. 41st ed. London: Churchill Livingstone Elsevier; 2016.p. 416–28.
2. Nanayakkara D, Manawaratne R, Sampath H, Vadysinghe A, Peiris R. Supraorbital nerve exits: positional variations and localization relative to surgical landmarks. Anat Cell Biol [Internet]. 2018 Mar;51(1):19. Available from: https://synapse. koreamed.org/DOIx.php?id=10.5115/acb.2018.51. 1.19.
3. Chung MS, Kim HJ, Kang HS, Chung IH. Locational relationship of the supraorbital notch or foramen and infraorbital and mental foramina in Koreans. Acta Anat (Basel) [Internet]. 1995;154(2):162–6. Available from: http://www.ncbi.nlm.nih.gov/pubmed/8722516.
4. Malet T, Braun M, Fyad JP, George JL. Anatomic study of the distal supraorbital nerve. Surg Radiol Anat [Internet]. 1997;19(6):377–84. Available from: http://www.ncbi.nlm.nih.gov/pubmed/9479712.
5. Singh R. Morphometric analysis of infraorbital foramen in Indian dry skulls. Anat Cell Biol [Internet]. 2011 Mar;44(1):79–83. Available from: http://www.ncbi. nlm.nih.gov/pubmed/21519552.
6. Barker L, Naveed H, Adds PJ, Uddin JM. Supraorbital notch and foramen: positional variation and relevance to direct brow lift. Ophthal Plast Reconstr Surg [Internet]. 2013;29(1):67–70. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23299811.
7. Cutright B, Quillopa N, Schubert W. An anthropometric analysis of the key foramina for maxillofacial surgery. J Oral Maxillofac Surg [Internet]. 2003 Mar [cited 2018 Aug 18];61(3):354–7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/12618976.
8. Ongeti K, Hassanali J, Ogeng'o J, Saidi H. Biometric features of facial foramina in adult Kenyan skulls. Eur J Anat. 2008;12(2):89–95.
9. Ashwini LS A, Mohandas Rao KG MR, Saran S, Somayaji SN S. Morphological and morphometric

analysis of supraorbital foramen and supraorbital notch: a study on dry human skulls. Oman Med J [Internet]. 2012 Mar;27(2):129–33. Available from: http://www.ncbi.nlm.nih.gov/pubmed/22496938.

10. Apinhasmit W, Chompoopong S, Methathrathip D, Sansuk R, Phetphunphiphat W. Supraorbital Notch/Foramen, Infraorbital Foramen and Mental Foramen in Thais: anthropometric measurements and surgical relevance. J Med Assoc Thai [Internet]. 2006 May;89(5):675–82. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16756055.
11. Cheng ACO, Yuen HKL, Lucas PW, Lam DSC, So KF. Characterization and Localization of the Supraorbital and Frontal Exits of the Supraorbital Nerve in Chinese: An Anatomic Study. Ophthalmic Plast Reconstr Surg [Internet]. 2006 May;22(3):209–13. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16714932.
12. Saylam C, Ozer MA, Ozek C, Gurler T. Anatomical variations of the frontal and supraorbital transcranial passages. J Craniofac Surg [Internet]. 2003 Jan;14(1):10–2. Available from: http://www.ncbi.nlm.nih.gov/pubmed/12544215.
13. Gupta T. Localization of important facial foramina encountered in maxillo-facial surgery. Clin Anat [Internet]. 2008 Oct;21(7):633–40. Available from: http://www.ncbi.nlm.nih.gov/pubmed/18773483.
14. Agthong S, Huanmanop T, Chentanez V. Anatomical variations of the supraorbital, infraorbital, and mental foramina related to gender and side. J Oral Maxillofac Surg [Internet]. 2005 Jun [cited 2018 Aug 18];63(6):800–4. Available from: http://linkinghub.elsevier.com/retrieve/pii/S0278239105002119.
15. Chrcanovic BR, Abreu MHNG, Custódio ALN. A morphometric analysis of supraorbital and infraorbital foramina relative to surgical landmarks. Surg Radiol Anat [Internet]. 2011 May;33(4):329–35. Available from: http://www.ncbi.nlm.nih.gov/pubmed/20625730.
16. Singh, Nishtha; Singh Alok K; Gupta Rakesh; Zaidi SHHCNS. A study of the supraorbital notch and foramen in North Indian human crania. Eur J Anat [Internet]. 2014;18(1):21–5. Available from: http://eurjanat.com/web/paper.php?id=130108ns.
17. Antonaci F, Pareja JA, Caminero AB, Sjaastad O. Chronic paroxysmal hemicrania and hemicrania continua: anaesthetic blockades of pericranial nerves. Funct Neurol [Internet]. [cited 2018 Aug 18];12(1):11–5. Available from: http://www.ncbi.nlm.nih.gov/pubmed/9127119.