Original Article

Indian Journal of Anatomy
Volume 9 Number 2, April – June 2020
DOI: http://dx.doi.org/10.21088/ija.2320.0022.9220.12

Morphometric Analysis of Supraorbital Notch and Foramen with it's Clinical Relevance

Vaishali Sitaram Kirwale[1], Shivaji B Sukre[2]

How to cite this article:
Vaishali Sitaram Kirwale, Shivaji B Sukre. Morphometric Analysis of Supraorbital Notch and Foramen with it's Clinical Relevance. Indian J Anat. 2020;9(2):157–161.

Author's Affiliation: [1]Assistant Professor, [2]Professor & Head, Department of Anatomy, Government Medical College Aurangabad, Maharashtra 431004, India.
Corresponding Author: Shivaji B Sukre, Professor & Head, Department of Anatomy, Government Medical College Aurangabad, Maharashtra 431004, India.
E-mail: drsukresb@yahoo.co.in
Received 04.03.2020 | **Accepted** 20.05.2020

Abstract

Introduction: The supraorbital margin is interrupted at it's lateral two third and medical third by the supraorbital notch/foramen. The supraorbital notch/ foramen transmits the supraorbital artery, vein and nerve. The surgeon should have knowledge of precise location and difference in prevalance of SON/SOF in order to reduce the risks while performing clinical procedures.

Materials and Methods: In the present study 112 skulls were studied. Each skull was examined at it's supraorbital margin on both sides for presence of SON/SOF. The prevalance of bilateral, unilateral SON/SOF was calculated, presence of accessory SOF and shape of SOF were also noted. The distance of SON/SOF from nasal midline, Frontozygomatic suture, Infraorbital foramen was calculated by using digital vernier calliper in millimeters.

Results: The present study concluded that the frequency of occurrence of SON (66.07%) was more than that of SOF (33.92%). Bilateral SON we're found in 51.78% and bilateral SOF were found in 17.85% of skulls. Unilateral presence of SON/SOF were noted in 34 skulls. 14.28% of cases showed presence of accessory SOF. The average distance between nasal midline, FZS, IOF and SON/SOF was 22.39–22.40 mm, 30.89–30.53 mm, 39.27-39.45 mm respectively on right and left side.

Conclusion: The present study provides detail information regarding prevalance of SON/SOF and it's exact position by calculating theaverage distance between SON/SOF from nasal midline, frontozygomatic suture, infraorbital foramen. This data is very essential during various diagnostic, therapeutic, anaesthetic and surgical procedures.

Keywords: Supraorbital nerve; Supraorbital notch; Supraorbital foramen; Skulls.

Introduction

The orbital opening is approximately quadrangular in shape. Upper, supraorbital margin of each orbit is entirely formed by the frontal bone, interrupted at the junction of its sharp lateral two-thirds and rounded medial third by the supraorbital notch or foramen.[1] The supraorbital nerve is the larger terminal branch of frontal nerve. This branch continues in the line of the parent stem. The nerve passes through the supraorbital notch or foramen and turns upwards into the forehead. Normally It divides into two in the scalp, but if this occurs in the orbit, the larger lateral part occupies the supraorbital notch.[2]

The supraorbital nerve supplies the mucous membrane lining the frontal sinus, skin and conjunctiva covering the upper eyelid and skin over the forehead and scalp. The supraorbital nerve ascends on the forehead with the supraorbital artery and divides into medial and lateral branches which supplies skin of scalp as far as lambdoid suture. These branches runs deep to frontal belly of occipitofrontalis. The medial branch perforates the muscle to reach the skin, while the lateral

Pierce's the epicranial aponeurosis.[1] In 25% of cases the supraorbital notch is cross by periosteal ligament which become ossified converting the supraorbital notch into Foramen.[3] The periosteal ligament crossing supraorbital notch is referred as supraorbital ligament by the Duke et al.[4]

The supraorbital nerve block is given in the region of SON/SOF during different procedures like, cosmetic facial corrections, supraorbital neuralgia, forehead and brow lift surgeries. For precise and effective supraorbital nerve block exact location of supraorbital nerve is mandatory.[5]

Materials and Methods

The present study was carried out by using 112 adult dry human skulls of unknown age and gender. The samples were collected from the department of Anatomy, government medical college Aurangabad during the year 2019. The skulls with gross abnormalities were excluded from the study to avoid any kind of bias in the study. Each skull was examined carefully at it's supraorbital margins on both sides for the presence of supraorbital notch or foramen. The presence of unilateral or bilateral supraorbital notch/foramen was carefully observed and noted down for further calculations. The distance between nasal midline and supraorbital notch/foramen was measured. The distance between frontozygomatic suture and supraorbital notch/foramen, also the distance from infraorbital foramen and supraorbital notch/foramen were measured using digital verniercalliper. The obtained data was properly recorded, analysed and tabulated.

Results

In the present study 112 adult dry human skull of unknown gender were analysed bilaterally at both the orbits from government medical college Aurangabad. The findings of present study were summarized and tabulated in (Table 1 and Table 2). The frequency of occurrence of supraorbital notch (66.07%) was much more than that of supraorbital foramen (33.92%). Out of 112 skulls studied 20 skulls (17.85%) shows presence of bilateral supraorbital foramen (Fig. 2) whereas 58 skulls (51.78%) shows presence of bilateral supraorbital notches (Fig. 2). The unilateral presence of supraorbital foramen (i.e. supraorbital notch on other side) was noted in 34 skulls (Fig. 3). The supraorbital foramen present on right side only was found in 14 skulls (12.5%). The supraorbital foramen on left side only was found in 20 skulls (17.85%) out of total 112 skulls studied. The accessory supraorbital foramen was found in 16 skull (14.28%). The oval shaped supraorbital foramen were noted in 19.64% and rounded shape in 13.39% of cases.

The mean distance between nasal midline and SON/SOF was 22.39 ± 2.58 mm on right side and 22.40 ± 2.40mm on left side (Fig. 4). The mean distance between frontozygomatic (FZS) suture and SON/SOF was 30.89 ± 5.78 mm on right side and 30.53 ± 5.89 mm on left side (Fig. 5). The average distance from SON/SOF to infraorbital foramen was 39.27 ± 2.47 mm and 39.45 ± 2.31 mm on right and left side respectively (Fig. 6). These morphometric measurements and statistical analysis of mean distance of SON/SOF from nasal midline, Frontozygomatic Suture and Infraorbital foramen were tabulated in Table 2. The statistical analysis was done, the difference between right and left sides was analyzed by application of paired *t*-test. The results shows that comparison between two sides was not significant statistically in all parameters.

Table 1: Findings of present study showing prevalance of SOF/SON.

Sr. No.	Prevalance of SOF/SON in present study	Number of skulls	Percentage
1	Total prevalance of Supraorbital notch	148 (orbits)	66.07
2	Total prevalance of Supraorbital foramen	76 (orbits)	33.92
3	Bilateral supraorbital foramen	20	17.85
4	Bilateral Supraorbital notch	58	51.78
5	Supraorbital foramen on Right side	14	12.5
6	Supraorbital foramen on Left side	20	17.85
7	No. of accessory foramina's	16	14.28

Table 2: Morphometric measurements and statistical analysis of SON/SOF

Sr. No.	Parameters	Mean distance (*R* + *L*) Mean + SD *N* = 224	Right side Mean ± SD (*N* = 112)	Left side Mean ± SD (*N* = 112)	Paired *t*-test	*p*-value
1	Distance between nasal midline and SON/SOF	22.39 ± 2.58	22.39 ± 2.74	22.40 ± 2.40	$t = 0.055$	$p > 0.05^{NS}$
2	Distance between SON/SOF and FZS	30.71 ± 5.84	30.89 ± 5.78	30.53 ± 5.89	$t = 0.247$	$p > 0.05^{NS}$
3	Distance between Infraorbital foramen and SON/SOF	39.36 ± 2.39	39.27 ± 2.47	39.45 ± 2.31	$t = 0.269$	$p > 0.05^{NS}$

Fig. 1: Bilateral Supraorbital notch.

Fig. 2: Bilateral Supraorbital Foramen.

Fig. 3: Unilateral Supraorbital Foramen on right side.

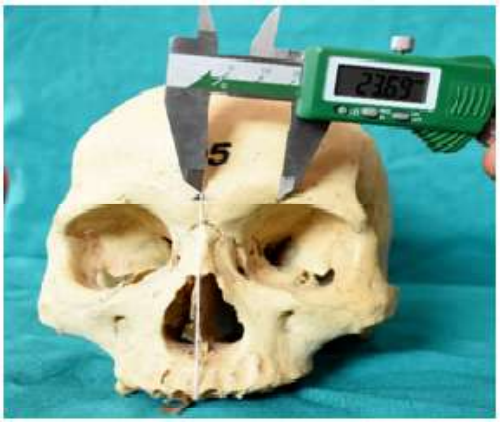

Fig. 4: Measurement of distance between nasal midline and SON/SOF.

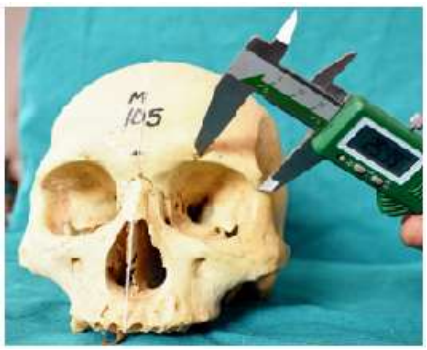

Fig. 5: Measurements of distance between FZS and SON/SOF.

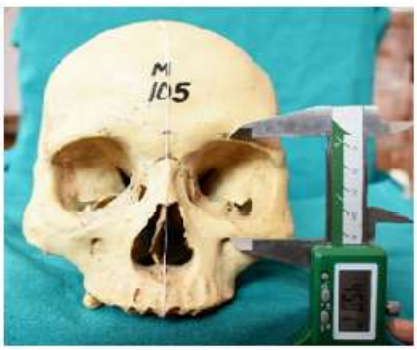

Fig. 6: Measurement of distance between IOF & SOF/SON.

Discussion

In the present study out of 112 skulls studied 66.07% of orbits shows presence of supraorbital notch (SON) which exceeds than the total prevalence of supraorbital foramen (SOF) which was 33.92%, these findings of present study were found to be consistent with the Apinhasmit et al.[6] which shows prevalence of SON and SOF of about 66.5% and 33.5% respectively. Chung MS[7] reportedthat the frequency of SON (69.9%) was more than that of SOF (28.9%) in Korean population, which shows lower prevalance of SOF than present study.

The findings of Dodo[8] showing prevalence of SOF was 39.4%, 44.6%, 46.8% in north, west and east india respectively which were much more than present study. The prevalance of SON/SOF shows variations in different populations. Webster et al.[9] concluded that frequency of prevalence of SON (61.57%) was higher than SOF (38.43%). The frequency of bilateral SON was 49.07% and bilateral SOF was 25.93%, whereas unilateral SOF was present in 12.5% of cases. These findings of Webster et al. didn't match with findings of present study.

Apinhasmit et al.[6] reported the prevalance of bilateral SON (50%) and bilateral SOF (17%) with unilateral SON/SOF in about 16.5% of cases. These findings of Apinhasmit et al. were consistent with the findings of present study. The present study shows presence of bilateral SON in 51.78%, bilateral SOF in 17.85% and unilateral SON/SOF in 14.28% of cases. Cheng et al.[10] given the total prevalence of SOF of about 45.9% and SON about 54.1%, which shows wide variation with the present study.

The presence of accessory supraorbital foramen is a common finding. A minor twig of supraorbital nerve traverse through it, which results in incomplete analgesia and anaesthesia following injection in nerve at SON/SOF. The prevalence of accessory SOF in present study was 14.28%. The frequency of accessory SOF reported by Berry[11] was 50% and by Saylam[12] was 21.2%. In the present study out of total SOF studied 19.64% were oval in shape and 13.39% were rounded in shape.

The present study reported the mean distance between the nasal midline and SON/SOF was 22.39 ± 2.74mm on right side and 22.40 ± 2.40 mm on left side. The average distance from nasal midline ad SON/SOF reported by Cheng et al., Apinhasmit, Webster et al. were 24.56 mm, 25.14 mm, 32.02 mm respectively, these findings were higher than the present study. The mean distance between FZS and SON/SOF was 30.89 ± 5.78 mm on right side and 30.53 ± 5.89 mm on left side in the present study. Smith et al.[13] Liu et al.[14] studied the distance between FZS and SON/SOF which was 26.2 mm & 20.55 mm respectively and found to be much less than present study.

The distance between SON/SOF and infraorbital foramen also shows wide racial variations. Thai population studied by Apinhasmit showed that the average distance of IOF from SON/SOF was 44.95 ± 2.96 mm on right side and 42.52 ± 3.89 mm on left side. Korean population studied by Chung et al.[7] reported that the average distance between IOF and SON/SOF was 45.6 mm, these findings of Thai & Korean population are quite higher than present study which shows average distance between IOF and SON/SOF was about 39.27 ± 2.47 mm on right side and 39.45 ± 2.31 mm on left side respectively.

Conclusion

Wide variations of SON/SOF were present in different populations. The prevalence of SON exceeds than that of SOF, other variations like unilateral SOF, accessory SOF were also common. The precise and exact location of SON/SOF is very essential for different therapeutic, diagnostic, anaesthetic and surgical procedures in order to reduce the relative risk during these clinical procedures.

Abbrevations

SON – Supraorbital Notch

SOF – Supraorbital Foramen

FZS – FrontozygomaticSuture

IOF – Infraorbital Foramen

References

1. Standering S, Ellis H, Healy JC, et al. Ed's. Gray's Anatomy: The Anatomical basis of clinical practice. 39th Edition, Elsevier, Churchill Livingstone, London 2005.pp.511–13.
2. Romanes GJ. Cunningham's Textbook of Anatomy, Head, Neck and Face, 15th ed. London, Oxford University Press 1972.p.106.
3. Hollenshed W.H. Anatomy for surgeons. Vol I. Hoeber Harper, New York & London 1966.
4. Duke Elder SS. System of ophthalmology. Volume II. Henry Kimpton, London 1961.
5. Evan RW, Pareja JA. Supraorbital neuralgia. Headache. J Head Face Pain 2009;492:278–81.

6. Apinhasmit W, Chompoopong S, Methathrathip D, et al. Supraorbital Notch/Foramen, Infraorbital foramen and mental Foramen in Thais: anthropometric measurements and surgical relevance. J Med Assoc Thais 2006 May;89(5):675–82.
7. Chung MS. Locational relationship of the supraorbital notch/Foramen and infraorbital and mental foramina in Koreans. Actaanatomica 1995;154(2):162–66.
8. Dodo Y. Supraorbital Foramen and hypoglossal canal bridging the two most suggestive nonmetric cranial traits in discriminating major racial grouping of man. J Anthropology Soc Nippon 1987;95:19–35.
9. Webster RC, Gaunt JM, Hamdan, et al. Supraorbital and supratrochlear notches and foramina: Anatomical variations and surgical relevance. Laryngoscope 1986;96(3):311–5.
10. Cheng AC, Yuen HK, Lucas PW, et al. Characterization and localization of the supraorbital and frontal exits of the supraorbital nerve in Chinese: An anatomic study. Ophthalmology plastic Reconstruction surgery 2006 May- June;22(3):208–13.
11. Berry AC. Factors affecting the incidence of non-material skeletal variants. J Anat 1975 Dec; 120(pt 3):519–35.
12. Saylam C, Over MA, Ozck C et al. Anatomical variations of the frontal and supraorbital transcranial passages. J Craniofacial. Surg 2003;14(1):10–2.
13. Smith JD, Surek CC, Cortex EA, Withdrawn. Localization of the supraorbital, infraorbital and mental foramina using palpable bony landmarks. Clin Anat 2010 may;23(4):495.
14. Liu DN, GueJL, Luo Q, et al. Location of supraorbital foramen/notch and infraorbital foramen with reference to soft and hard tissue landmarks. J Craniofac Surg 2011 Jan;22(1): 293–96.