

TOPOGRAPHIC STUDY OF SUPRAORBITAL MARGINS, AND NOTCHES IN NORTH INDIAN HUMAN DRY SKULLS AND ITS CLINICAL APPLICATIONS

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ABSTRACT

Introduction: The supraorbital notch (SON) is present at the junction of sharp lateral two-thirds and rounded medial third of supraorbital margin. The neurovascular bundle exit via this notch/foramen. The morphometric variations of the supraorbital ridge, notch, or foramen are not uncommon. The knowledge of these parameters is important to preserve the neurovascular bundle during surgery in this area.

Materials and Methods: This study included seventy skulls obtained from department of Anatomy, Doon government medical college Dehradun and Sri Guru Ram Rai Institute of medical and health sciences Dehradun following standard guidelines. All the parameters were observed and measured with the help of vernier caliper and reported in the tabulated form.

Results: Out of seventy skulls, bilateral supraorbital notch and supraorbital foramen were found in 37.14% and 14.28% respectively. Unilateral notch and contralateral foramen was found in eight skulls i.e. 11.42%. notch or foramen was absent in 5.71% skulls. The distance from SON/F to the midline (nasion) and frontozygomatic suture were 25.86 ± 3.11 and 29.89 ± 2.19 mm. respectively. The mean distance between supraorbital notch or foramen to infraorbital foramen was 42.33 ± 3.11 mm.

Conclusion: Topographical anatomy of supraorbital ridge, notch and foramen and its variation is important to prevent the complications after surgical procedure in this area.

KEY WORDS: Supraorbital Ridge, Supraorbital Foramen, Nasion, Frontozygomatic Suture.

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INTRODUCTION

The upper part of the face is occupied by the orbits and the bridge of the nose. The supraorbital margin is formed entirely by the frontal bone and the infraorbital margin is formed by the zygomatic bone laterally and maxilla medially. The supraorbital notch (SON) is present

at the junction of sharp lateral two-thirds and rounded medial third of supraorbital margin [1]. It was hypothesized that the distribution of the occurrence and location of these openings depends on climatic conditions in which the population lived [2]. Occasionally the ligament that bridges across the notch become ossified

converting the supraorbital notch into supraorbital foramen (SOF) [3] which transmit the supraorbital nerve, which is a larger terminal branch of frontal nerve [4,5] supraorbital vessels.

The nerve ascends on the forehead and divided into two branches, medial and lateral deep to the frontal belly of occipitofrontalis muscle, which supplies the skin of the scalp, forehead, upper eyelid and nose [6,1].

The medial branch perforates the muscle to reach the skin, while the lateral branch pierces the epicranial aponeurosis. The knowledge of SOF and notch is important for diagnostic and clinical procedure like various maxillofacial and cosmetic surgical procedures⁷. An injury to these vessels and nerve will cause paralysis to the structures being supplied by them. A morphometric study of the SOF, notch and other accessory foramen will be helpful for topographical anatomic examination of adult human skulls in order to ascertain the normal position and dimensions of the foramen and notches for proper analysis. The exact and detailed knowledge of morphology and positional variations of supraorbital nerve exits is important when given the regional anesthesia and supraorbital block. This block is carried out in treatment of migraine and chronic paroxysmal hemicranias [8].

The exact knowledge of these structures is also important to avoiding the injury of neurovascular bundle exit through foramen during surgery of this region.

In the present study the position and incidence of the SON, Foramen and other accessory foramen in relation to median line and frontozygomatic suture was recorded. It was also revealed that these structures are lying in the same vertical plane as the IOF or lying lateral or medial to this plane.

MATERIALS AND METHODS

In the present the seventy dry adult human skulls were collected from the Department of Anatomy, Doon Medical College and SGRRIM & HS Dehradun. The age and sex of the skulls were unknown and not taken into consideration. Particular attention was focused on the morphology of the supraorbital rim, specifically,

the presence of a supraorbital notch or supraorbital foramen. The frontal bone and supraorbital margins of both side of skull were carefully observed for the supraorbital notch (SON), supraorbital foramen (SOF), incomplete foramen, double foramen, and other accessory foramina of each skull and their unilateral or bilateral prevalence were observed and recorded in tabulated form. The position of SON/foramen in relation to the position of IOF was also observed. The comparison was made between both sides of the skull. All the measurements were taken with the help of vernier calipers and documented in tabulated form. For the analysis of collected data statistics was used. Frequency (N), Mean, median, standard deviation (SD), maximum length and minimum length were assessed. The following parameters were taken into consideration and recorded. Perpendicular distance between the supraorbital notches, supraorbital foramen to the nasal midline (nasion). Distance between the SON/SOF to the frontozygomatic (FZ) suture. Distance between the SON/SOF to the infraorbital foramen (IOF) / notch.

RESULTS

In present study a total of seventy human skulls were observed. The incidence of bilateral supraorbital notch and supraorbital foramen were found in 37.14% and 14.28% respectively. (Tab 1, Fig. 1 & Fig. 2). Unilateral notch and contralateral foramen was found in eight skulls i.e. 11.42% (Tab 1, Fig 3). Out of seventy in twenty skulls (28.57%), the U/L foramen & notch and & contralateral foramen was observed. (Tab 1, Fig 4). In 5.71% skulls the supraorbital margins were smooth and not show any type of notch or foramen on either side (Tab 1, Fig 5). The different measurements were taken with the help of vernier caliper in total of 70 skulls as shown in Fig. 6-8 & Table 1. The distance between SON/F to the midline (nasion) ranged between 23.23 mm – 28.14, mean value is 25.86 ± 3.11 . (Tab 2, Fig. 6). The mean value of SON/F to FZS was found 29.89 ± 2.19 mm. (Tab 2, Fig 7). It was measured that the distance between supraorbital notch or foramen to infraorbital foramen ranged between 39.49 mm -45.11 mm, with a mean of 42.33 ± 3.11 mm. (Tab 2, Fig 8).

Fig. 1: Bilateral supraorbital notch



Fig. 2: Bilateral supraorbital foramen.

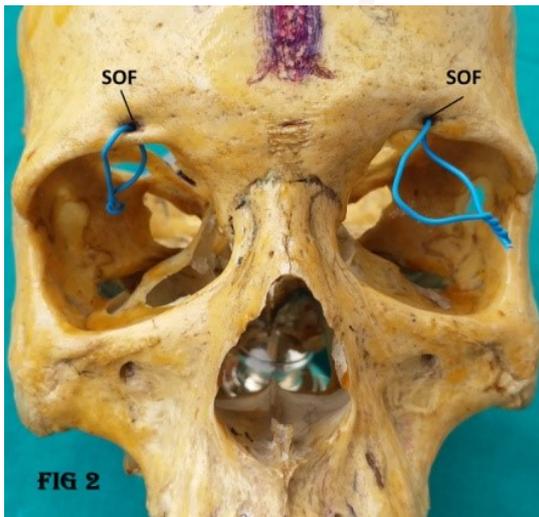


Fig. 3: Unilateral notch, C/L foramen.

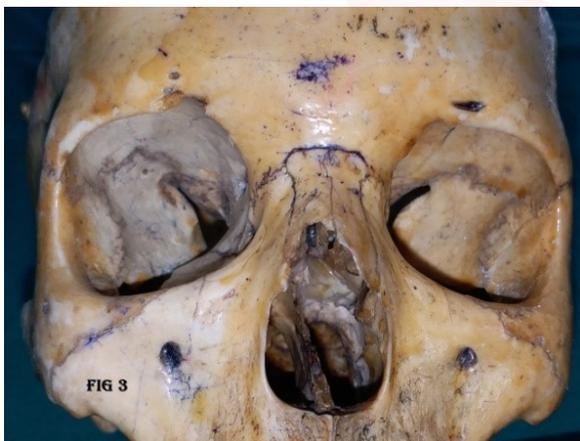


Fig. 4: Unilateral foramen and notch and C/L foramen

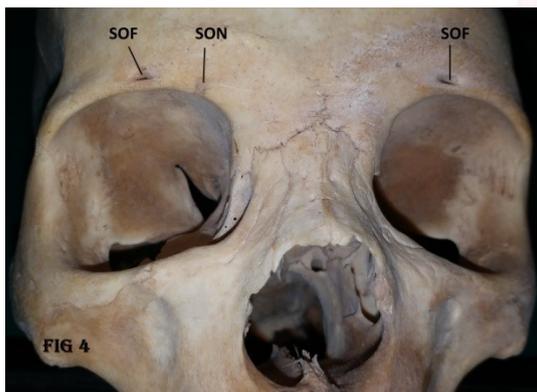


Fig. 5: Bilateral absent notch or foramen



Fig. 6: distance between SOF to nasion



Fig. 7: distance between SOF to FZS



Fig. 8: Distance between SOF to IOF



Table 1: Incidence of morphological parameters (notch/foramen) of supraorbital ridge.

Parameters	No. of skull	Percentage (%)
B/L supraorbital notch	26	37.14
B/L supraorbital foramen	10	14.28
U/L notch & contralateral foramen	8	11.42
U/L notch and foramen & contralateral notch	20	28.57
B/L absent notch/foramen	4	5.71

Table 2: Measurements of distance from the reference point (SON/F).

Distance	Min.(mm)	Max.(mm)	Mean (mm)	S.D.
SON/F to nasion	23.23	28.14	25.86	3.11
SON/F to FZS	26.13	31.39	29.89	2.19
SON/F to IOF	39.49	45.11	42.33	3.11

Table 3: Comparison of incidence of various distance of present study with others as reported in the literature.

Author's	Metric observations in mm		
	SON/F – nasion	SON/F – FZS	SON/F – IOF
Ebraheim NA et al [12]	39 ± 4	-	-
Apinhasmit et al [12]	25.14 ± 4.29	-	-
Turhans et al [13]	24.9 ± 4.5	-	-
Webster et al [14]	32.02	-	-
Bjelakovic et al [15]	21.9	27.5	-
Present study	25.86 ± 3.11	29.89 ± 2.19	42.33 ± 3.11

Table 4: Comparison of morphological parameters from various authors in percentage (%).

Parameters	Mallet et al. [16]	Webster et al [14]	Apinhasmit et al [12]	Agnieszka et al [2]	Cheng et al [18]	Present study
B/L supraorbital notch	65	49.07	50	33.3	40.2	37.14
B/L supraorbital foramen	20	25.93	17	13.2	24.8	14.28
U/L notch & contralateral foramen	10	25	33	16.8	24.8	11.42
U/L notch and foramen & contralateral notch	-	-	-	-	-	28.57
B/L absent notch/foramen	-	-	-	8.2	-	5.71

DISCUSSION

In the current study, the various dimensions and incidence of various morphological parameters like supraorbital notch, foramen etc. of the superior-orbital margin have been observed and measured. The supraorbital margin is formed entirely by the squamous part of the frontal bone, In 25% individuals, the notch is converted into foramen by ossification of the periosteal ligament crossing it (Hollenshed, 1966) [9], and has been referred as supra orbital ligament in literature (Duke, 1961) [10]. The supraorbital foramen provides the passage for supraorbital nerve (SON) and supraorbital vessels (SOV). During the surgical procedure of forehead, to preserve the SON and SOV surgeons need to know how frequently foramina occur. Improper knowledge of supraorbital notches may lead to injuries of supraorbital neurovascular bundle during surgery of forehead area. After taking the measurements of different parameters and morphological variations as described in

material and methods, the results of the present study were compared with the results of the other authors [11-18]. (Table No. 3 &4).

The mean distance of the SON/F to nasion varies from 21.09 mm to 39 ± 4 (Tab 3). In the present study the it was measured as 25.86±3.11 mm (Tab.3, Fig. 6). Webster et al [14], Ebraheim et al [11] and Bjelakovic et al [15] reported it to be 32.02 mm, 39 ± 4 mm and 21.9 mm respectively (tab 3). All these values are higher than what was recorded in our study except Bjelakovic et al [15]. The mean diameter of SON/F to FZS measured by Bjelakovic et al [15] was 27.5 mm, which is lower as compared to our reading (29.89±2.19) (Tab. 3, Fig 7). The mean distance between SON/F to ION was recorded as 42.33±3.11 in present study, which was rarely recorded by the previous authors (Fig 8). As the sex of skulls was not known to us, we could not measure male and female skulls separately. The knowledge of various distance from the supraorbital notch or foramen have a great importance

in identifying existing neurovascular structures during dissection and also during surgical procedures in this area (Kleier et al 1983) [19].

We also noted the various morphological parameters as mentioned in materials and methods and recorded their percentage of incidence depending upon the presence or absence of a supraorbital notch and foramen. In the present study the B/L supraorbital notch was noted in 37.1% skulls (Tab 1, Fig 1). It was recorded by previous authors ranging from 65 to 33.3%. (Tab. 4). 5.71% skulls were recognizable without any notch or foramen (fig 5), which was recorded as 8.2% by Agnieszka et al [17] was higher than our study. The occurrence of B/L supraorbital foramen (Fig. 2) were observed by the previous researchers varies from 17% - 25.93%. (Tab.4). In our study it was 14.28%, which is very close to the study of Agnieszka et al [17] (13.2%).

Present study of seventy skulls, 11.42% showed notch on one side and a contralateral foramen (Fig 3). It was also observed by Mallet et al (10%), Agnieszka et al [17] (16.8%), Webster et al [15] (25%) and Apinhasmit et al [12] in 33% (Tab.4). The finding of Mallet et al is quite close to what was recorded in current study. It was also found the U/L notch and foramen & contralateral notch in 28.57% skulls in our study (tab. 4, fig. 4). It was not recorded by the previous authors. The difference seen between the values of present study and that of other workers could be explained on the basis of ethnic and racial variations and also due to smaller number of bones. So it is worthwhile to perform similar study on more number of bones for its theoretical and practical importance in the future.

CONCLUSION

On the basis of present study and other authors it is concluded that the passage of neurovascular bundle are not constant. It may be notch or foramen. Sometimes there may be the combination of both. This knowledge is very vulnerable for surgeons during the surgery in the area of supraorbital margins or forehead. Our study also confirms that the incidence of supraorbital notch is more common than supraorbital foramen.

ABBREVIATIONS

SON - Supraorbital notch

SOF - Supraorbital foramen

FZS - Frontozygomatic suture

IOF - Infraorbital foramen, S.D. - standard deviation, mm- millimeter

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Conflicts of Interests: None

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