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Original Research Article

# A STUDY OF THE ANATOMY OF SUPRAORBITAL NOTCH AND FORAMEN AND ITS CLINICAL CO-RELATES

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## ABSTRACT

**Objectives:** A detailed knowledge of the position of supraorbital notch/ foramen is essential for performing invasive surgical procedures involving anesthetic and therapeutic procedures. It is also helpful for anthropologists and forensic scientists.

**Materials and Methods:** Supraorbital notch and or foramen were analyzed in 100 human dry skulls bilaterally using digital vernier Calipers. The parameters that were taken up in the study were number of the notches/ foramen, shape of the foramen and distance of the supraorbital notch/foramen from the nasion and from the frontozygomatic suture.

**Results:** Supraorbital notches were found to be more in number 43.8% as compared to foramens which were about 17.7%. Numbers of oval shaped foramina were more than round shaped foramina. The mean distance of Supra orbital Foramen (SOF)/ Supra orbital Notch SON from the nasion was about 21.66mm on right and 21.51mm on left side. Distance of SOF/ SON from the frontozygomatic suture on the right side was about 29.29mm while on the left side it was about 28.98mm.

**Conclusion:** Shape and position of the supraorbital notch/foramen was quite variable as was found in the present study. Hence detailed morphological analysis of supraorbital notch/foramen is essential for various therapeutic and anesthetic procedures.

**KEY WORDS:** Supraorbital notch, Supraorbital foramen, Supraorbital nerves and vessels.

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## INTRODUCTION

The supraorbital nerve emerges from a foramen and supplies the skin of the forehead region, where there are chances of nerve injury during various surgical and anaesthetic procedures [1]. The supraorbital foramen region is used for supraorbital nerve blocks for carrying out procedures such as closure of wounds, biopsies and other facial cosmetic procedures hence a thorough knowledge of this region is necessary for the clinicians to effectively anaesthetize the supraorbital nerve [1-3]. A knowledge of the exact location of the supraorbital notch and foramen is essential for prevention of supraorbital neuralgia, and entrapment neuropathies which can result from injury due to excessive dissection or scarring, close to the neurovascular bundle [4-6]. This study was done

on dry human skulls to assess the presence of a notch or foramen or a combination of both along with its location, the data thus obtained was compared with other studies.

## MATERIALS AND METHODS

One hundred dry human skulls of unknown age and gender were selected from the Departments Of Anatomy at Integral Institute of Medical Sciences, Era's Lucknow Medical College and King George Medical University. The skulls selected for study were without any apparent abnormalities/ fracture. (Out of 100 skulls, four skulls were fractured and hence were excluded from the study).

Both sides of the skulls were assessed using direct inspection to establish the shape, orientation and location of supraorbital notch or foramen. Midline of the forehead was established using a silk thread by dropping it from the vertex of the skull through nasion to the anterior nasal spine and intermaxillary suture line (fig 1).

Parameters studied were:

· Distance between the supraorbital foramen/ notch and the frontozygomatic suture (fig 2)

· Distance between the nasion and the supraorbital notch and or foramen.(fig 3)

**Fig. 1:** Midline of the forehead established by dropping a thread from Vertex of the skull, through Nasion, to the intermaxillary suture line.

**Fig. 2:** Distance of supraorbital notch/foramen from the frontozygomatic suture.

**Fig. 3:** Distance between the Nasion and the supraorbital notch and or foramen.

All measurements were done using a digital vernier calliper, accurate to 0.02mm for linear measurements on both sides; observations thus made were compiled and tabulated. All the measurements were expressed in mean SD (standard deviation) in millimetres. Care was exercised to differentiate the supraorbital foramen from the frontal foramen which is present medial to the foramen/ notch (Berry and Berry 1967; Standering et al 2005).

## RESULTS

A total of 100 skulls were analysed bilaterally during the study and observations made are as shown in Table 1.

**Table 1:** Distribution according to frequency of occurrence of depression, notch and foramen.

| Supraorbital notch/foramen/depression | Frequency | Percentage (%) |
|---|---|---|
| Depression | 13 | 13.5 |
| Depression and foramen | 1 | 1 |
| Foramen | 17 | 17.7 |
| Foramen and Notch | 21 | 21.9 |
| Notch | 42 | 43.8 |
| Notch and Depression | 2 | 2.1 |

Notches were found to be higher in number (43.8%), followed by foramen (17.7%), depressions were found to be (13.5%). Certain combinations were found out of which the combination of foramen and notch was the highest (21.9%), notch and depression was (2.1%) while presence of a depression and foramen was (1%) (As shown in Table2)

**Table 2:** Shape of the foramen.

| Shape of foramen | Frequency | Percentage% |
|---|---|---|
| Oval | 5 | 29.41 |
| Round | 3 | 17.65 |
| Indeterminate | 9 | 52.94 |

Oval shaped foramina were more in number (29.41%) than round foramen (17.65%)

**Table 3:** Frequency of occurrence of notch, depression or foramen unilaterally (U/L), bilaterally (B/L) on the right (R) or left side(L).

| B/L, U/L,Depression,Notch,Foramen on the Right and Left side | Frequency | Percentage % |
|---|---|---|
| B/L Notch | 65 | 67.7 |
| B/L Foramen | 1 | 1 |
| B/L foramen and notch | 2 | 2.1 |
| B/L depression | 1 | 1 |
| Depression/L/Notch/L | 2 | 2.1 |
| Depression/R/Foramen/L | 1 | 1 |
| Foramen/L/Notch/R | 5 | 5.2 |
| Foramen/R/Notch/L | 15 | 15.6 |
| Notch/R/Depression/L | 2 | 2.1 |
| U/L Depression on L | 1 | 1 |
| U/L Depression on R | 1 | 1 |
| Total | 96 | 100 |

The presence of a bilateral notch was the most common occurrence (67.7%). The presence of a foramen on the right side and notch on the left side (15.6%) was the next common occurrence. (Table 3)

**Table 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) is as follows.

| Distance of supraorbital notch/ foramen from nasion | Number | Minimum distance in milimeters | Maximum distance in milimeters | Mean | Standard deviation |
|---|---|---|---|---|---|
| D/Nas/R | 94 | 16 | 29 | 21.66 | 2.997 |
| D/Nas/L | 95 | 14 | 36 | 21.51 | 3.583 |

**Table 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 foramen notch depression from the frontozygomatic suture | Number | Minimum distance in milimeters | Maximum distance in milimeters | Mean | Standard deviation |
|---|---|---|---|---|---|
| D/FZS/R | 93 | 21 | 36 | 29.29 | 2.913 |
| D/FZS/L | 94 | 21 | 38 | 28.98 | 3.002 |

The values of distance of notch, foramen, depression from the nasion were found to be lower than values of the distance of the distance from the notch/ foramen/depression to the frontozygomatic suture (Tables 4 and 5).

On comparing values for the distance between supraorbital notch/ foramen/depression from the nasion and from the frontozygomatic suture on the right and left side, we found that the correlation is significant at 0.01 level (two tailed test).

A mild correlation between D/Nas/R and D/Nas/L was observed (r=0.405) which was also significant statistically (p<0.001). A moderate correlation (r=0.642) was observed between D/FZS/R and D/FZS/L which was also significant statistically (p<0.001). None of the other correlations were significant statistically.

## DISCUSSION

The supraorbital foramen is situated along the supraorbital margin, which is entirely formed by the frontal bone. Just superior to the rim of each orbit are raised superciliary arches. These are more pronounced in men than in women [7].

Knowledge of the distance from the supraorbital rim may be useful in identifying critical structures during dissection as well as during other surgical procedures (Kleier et al., 1983).

Cosmetic and endoscopic surgery is always a challenge in the area of supraorbital notch and foramen as the supraorbital nerve may be damaged causing loss of sensation (Rosenberg GJ 1998). In our study the supraorbital notch /foramen measured 21.6mm from the midline similar to other studies. A study conducted on the North Indian skulls found the average distance between supraorbital notch and foramen to be 23.9 mm. A study conducted by Jeong et al in 2010, found the distance to be 29mm from the nasal midline which is much higher than the present study.

**Table 6:** DISTANCE OF SOF/SON FROM THE MIDLINE.

| INVESTIGATORS | DISTANCE IN mm |
|---|---|
| Jeong et al 2010 [6] (Korean population) | 29mm |
| Gupta et al 2008 [1] (Indian population) | 23.9mm |
| Cheng et al 2006 [7] (Chinese population) | 24.6mm |
| Apinhasmit et al 2006 [8] (Thai population) | 25.14mm |
| Agthong et al 2005 [9] | 24.75mm |
| Cutright et al 2003 [3] | 25mm |
| Chung et al 2003 [10] (Korean population) | 22.7mm |
| Webstser et al 1986 [11] | 32.02mm |

**Table 7:** Distance Of Sof/Son From The Frontozygomatic Suture.

| INVESTIGATORS | DISTANCE OF SON/SOF FROM THE FRONTOZYGOMATIC SUTURE |
|---|---|
| Smith et al 2010 [12] | 26.2mm |
| Liu et al 2011 [13] | 20.55mm |

In our study the mean distance of supraorbital notch /foramen from the frontozygomatic suture was29.29mm.

Few reports are available on the distance between SOF/SON from the frontozygomatic suture where the reported measurement is much less than our study ( Table 7).

There are many workers who have reported the frequency of notches to be higher than foramina.

An Indian study (Gupta et al 2008) found that the frequency of notches was 64.6%. Apinhasmit et al in 2006 found the frequency to be 66.5% which was much similar to our frequency of 67.79%.

The accurate anatomical location of supraorbital notch/foramen is essential for diagnostic and surgical procedures in this region. The injury of supraorbital vessels and nerves may lead to complications such as haematoma formation in the subgaleal plane, anaesthesia and hair loss [11]. When injecting Botulinum toxoid to treat hyperactive musculature around the nose, care should be taken to avoid infiltration or deposition in the vicinity of supraorbital nerves (Rainer Laskawy 2008). Irritation, entrapment and compression of the supraorbital nerve have been considered as frontal triggers of migraine headaches [14,15].

In cases of Le Forte II and III and nasoethmoidal complex fractures, while making an incision in the glabellar or nasal bridge region for exposure of nasal, lacrimal bone, care should be taken to avoid injury to the supraorbital and supratrochlear nerves.( Sargent et al 2007) In cases of panfacial trauma, when a bicoronal incision is done for the treatment of fracture of frontal bone, nasoethmoidal complex, zygomatic complex, zygomatic arch the nerves should be carefully freed from the notch/foramen to avoid injury (Larry AMD 2007).

In cases of Central Nervous System stimulation through a painful stimulus, readily accessible supraorbital or supratrochlear nerves are used. (Michele Brignole 2007).

## CONCLUSION

The knowledge of the distances from surgically encountered anatomical landmarks in the present study may assist surgeons to localize these important maxillofacial openings and avoid injuring the neurovascular bundles and facilitate surgical, local anesthetic, and other invasive procedures. The results from the present study are of practical clinical value and thus should encourage further studies.

## ABBREVIATIONS

SOF- Supraorbital foramen

SON- Supraorbital notch

U/L- Unilateral

B/L- Bilateral

L- Left

R-Right

(D/Nas/R)- Distance of Nasion on the right side

(D/Nas/L)- Distance of Nasion on the left side

D/FZS/R- Distance of frontozygomatic suture on the right side

D/FZS/L- Distance of frontozygomatic suture on the left side

**Conflicts of Interests: None**

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