

Morphometrical Study of Supraorbital Foramen and Supraorbital Notch in Eastern U.P. Region

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ABSTRACT

The supraorbital foramen is a bony elongated path located above the orbit (eye socket) and under the forehead. Supraorbital foramen is considered as an important landmark for various surgical and anesthetic procedures. Exact positioning of the foramen with respect to adjacent anatomical landmarks avoids damage to the neurovascular structures passing through them.

A morphometric study of the supraorbital foramen/notch was carried out on 75 dry human skulls in the Departments of Anatomy Hind Institute of Medical Sciences, Mau, Ataria, UP, INDIA. Out of 75 skulls, 40% had bilateral supraorbital foramen, 21.45% had bilateral supraorbital notch, 26.7% had a notch on one side and a foramen on other side, 4% had only notch and both foramen and notch were absent in 1.3% skulls. Total 9 types of combinations were found in this study. Shapes of most of the foramen on right and left sides were oval (38.75% on right and 45% on left). The average distance from the nasal midline (NM) to the supraorbital foramen/ notch (SOF/N) was 22.17 ± 5.39 mm on right side and 23.42 ± 3.49 mm on left side while the average distance from the temporal crest to SOF/N was 24.46 ± 6 mm and 26.25 ± 3.19 mm on right and left sides respectively. The mean length and width of SOF on right side were 2.13 ± 0.7 mm and 3.96 ± 1.55 mm whereas they were 1.95 ± 0.39 mm and 3.8 ± 1.17 mm respectively on left side. Likewise, the mean length of SON were 3.1 ± 1.06 mm and 2.54 ± 0.86 mm on right and left sides whereas mean width were 5.19 ± 1.93 mm and 5.01 ± 1.4 mm respectively.

There is a difference in the position and dimensions of SOF /SON between different races and people of different regions. Anatomical knowledge of SON /SOF is important in facilitating local anesthetic, forehead lifting, blepharoplasty and other craniofacial surgical procedures.

KEYWORDS: Nasal midline, Orbit, Supraorbital foramen, Supra orbital notch, Temporal crest.

INTRODUCTION

A foramen is simply a passage. The supraorbital foramen is a bony elongated path located above the orbit (eye socket) and under the forehead. It lies directly under the eyebrow. When the opening is completely surrounded by bony cartilage, it is known as the supraorbital foramen but if it is partially covered by bone, it is known as the supraorbital notch.¹

The supraorbital foramen/notch transmits the neurovascular structures namely the supraorbital artery, veins and nerve and supplies the area around the eye, skin over the forehead. These neurovascular structures are prone to get injured during various procedures performed at their areas of supply and will lead to Paralysis of the structures being supplied by them.²

The supraorbital nerve is one of the main cutaneous nerves supplying the forehead and scalp region. It exits through its foramen to innervate the skin and may be injured during various surgical and anesthetic procedures.³

Knowledge of exact location of supraorbital notch/foramen is important when supraorbital block is given. This block is carried out in treatment of migraine and chronic paroxysmal hemicranias.⁴ The supraorbital nerve blocks are commonly performed in the region of supraorbital foramen during procedures such as closure of facial wounds, biopsies, and scar revisions, as absolute but temporary treatment for supraorbital neuralgia and other cosmetic cutaneous procedures.⁵

Excessive dissection and retraction close to such neurovascular bundles can cause scarring, which may lead to entrapment neuropathies and painful neuralgias.^{6,7} Clinicians must be aware of the exact position of SOF / SON while diagnosing conditions like supraorbital neuralgia, as it is normally characterized by forehead pain and tenderness over the SON/SOF.⁸

Effective and precise analgesia can be achieved only if one is aware of the most frequent location of exit of the nerve in this region.⁵ A morphometric study of the supraorbital foramen will therefore entail a careful topographical anatomic examination of adult human skulls in order to ascertain the normal localization and dimensions of the foramen and notches for proper analysis.⁹

It has been observed that supraorbital notches are present in 37.25% of cases on the right side and 33.33 % on the left side in adult Nepalese human skulls . Bilateral supraorbital notches have also been found in 44.25% of the 400 north Indian skulls studied while 18.25% demonstrated bilateral supraorbital foramina and 12.55% demonstrated a notch on one side.¹⁰

In this study, we aimed to ascertain the position and dimension of supraorbital foramina and supraorbital

notches with reference to anatomical landmarks in adult human dry skull bones.

MATERIALS AND METHODS

75 skulls of unknown age and sex were collected from the Department of Anatomy, Hind Institute of Medical Sciences, Mau, Ataria, UP. Skulls showing any breakage near supraorbital rim were not included in the study. Following observations were taken:

- Presence/Absences of Supraorbital notch (SON) or foramen (SOF)
- Shape of Supraorbital foramen (SOF)
- Dimensions of the foramen (transverse and vertical)
- Distance from nasal midline (NM) to Supraorbital notch or foramen (SOF)
- Distance from temporal crest (TC) to Supraorbital notch or foramen (SOF)
- Horizontal length of the notch

The midline of the forehead was marked by suspending a thread connecting the vertex of the skull to the anterior nasal spine by passing through the nasion. A digital vernier caliper and measuring tape were used to take observations. Observations thus made were compiled; tabulated and statistical data were calculated



Figure 1. Shows Foramen on one side and Notch on the other side



Figure 2. Shows Notch on the both sides



Figure 3. Shows only Notch on one side

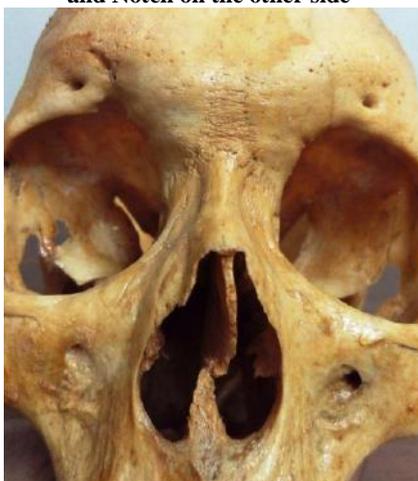


Figure 4. Shows Foramen and Notch on one Side and Foramen on the other side



Figure 5. Shows measurement of horizontal diameter of SOF



Figure 6. Shows measurement of vertical diameter of SOF



Figure 7. Shows measurement of horizontal diameter of SOF



Figure 8. Shows measurement of vertical diameter of SOF



Figure 9. Distance between Nasal midline and SOF

Table 1: Distribution of notches and foramen

SN	Presence of SOF/N	Number	Percentage
1	Bilateral foramen	30	40%
2	Bilateral notch	21	28%
3	Notch or foramen on one side	20	26.7%
4	Only foramen	0	0
5	Only notch	3	4%
6	Absent	1	1.3%

Table 2: Pattern of distribution of foramen and notch on right and left side of skull

SN	SOF and Notch combination in skull		Number	Percentage (%)
	Right side	Left side		
1	Notch	Notch	21	28
2	Notch	Foramen	7	9.3
3	Notch	Incomplete foramen	5	6.7
4	Notch	Absent	3	4
5	Foramen	Foramen	17	22.7
6	Foramen	Notch	8	10.7
7	Foramen	Incomplete foramen	6	8
8	Incomplete foramen	Incomplete foramen	7	9.3
9	Absent	Absent	1	1.3

Table 3: Shape of supraorbital foramen (Total: 80)

Shape	Right	Left
Round	2 (2.5%)	11 (13.75%)
Oval	31 (38.75%)	36 (45%)

Table 4: Distance of SOF/N from Nasal Midline (NM) and Temporal Crest (TC)

Distance	Right	Left
SOF/N- NM	22.17±5.39	23.42±3.49
SOF/N-TC	24.46±6	26.25±3.19

Table 5: Length and width of SOF and Notch

Side	Supraorbital foramen		Supraorbital notch	
	Length	Width	Length	Width
Right (mean±sd)	2.13±0.7	3.96±1.55	3.1±1.06	5.19±1.93
Left (mean±sd)	1.95±0.39	3.8±1.17	2.54±0.86	5.01±1.4

RESULTS & DISCUSSION

A morphometric study on the supraorbital foramen/notch entails a careful topographical anatomic examination of the adult human skulls in order to ascertain the localization and 3 dimensions of the foramen/notch. The determination of the specific dimensions and location of the supraorbital foramina and notches are important landmarks frequently encountered in surgical operations.¹¹

Among the risks of forehead surgeries, are injuries to the supraorbital and supratrochlear neurovascular bundles. Problems resulting from such injuries include:-

1. Haematoma formation in subgaleal plane.
2. Anaesthesia or hypoaesthesia of the forehead.
3. Ischemia or necrosis in portions of the forehead flap.
4. Hair loss.¹²

In our study 40% skulls showed bilateral foramen, 21% showed bilateral notch whereas 26.7% had foramen on one side and notch on the other side. In 4% of skulls only notch was present while both foramen and notch were absent on 1.3% of skulls studied. Chung M.S. found supraorbital notches (69.9%) were more frequent than supraorbital foramina (28.9%).¹⁰

Trivedi et al conducted study of 233 skulls and showed bilateral notches in 35.62% of skulls and bilateral foramina in 21.45 % of skulls and 16.73 % of skulls demonstrated a notch on one side and a contralateral foramen.¹² Apinhasmit et al. observed 50% of the study samples had bilateral SON, 17% had bilateral SOF and 33% had a notch on one side and a foramen on the other side, multiple supraorbital foramen was found in 8% of 65 dry skulls.¹³ Dr. S Swaminathan had observed 74 sides (52.3%) had notch, 41 sides (31.2%) had foramen, 8 sides had both notch and foramen, 6 sides found to have double foramen.¹⁴

Priya Roy et al, observed accessory SOF in 9 sides. In their study, 142 sides (59.16 %) had notch, 73 sides (30.41 %) had foramen, 7 sides had both notch and foramen, one side found to have double foramen are found in 120 skull (240 sides).¹⁵ Mexicans and Chinese showed a higher frequency of SOF than other populations.¹⁶ Prevalence of the supraorbital notch was very high in studies of North Indian skull by (80.99 %) Nishtha et. al. 80.99%.¹⁵

Study of Anthony et al, showed presence of bilateral foramen in 30.56% of the male skulls and 33.33% in the female skulls. 50% of the male skulls had bilateral notch while 58.33% of female skulls had bilateral notch. Multiple foramina have also been revealed to occur in 7.84% of skulls on the right side and 17.64% of skulls on the left side in Nepal.¹¹

In our study we found the predominance of oval shaped SOF on both right (38.75%) and left (45%) sides of the skull. Study of Roy P et al showed the presence of oval shaped SOF on 22.6% of male skulls in right side and 20% of male skulls in left side. In case of females, 35.55

% of skulls had oval shaped foramen on right side and 44.44% on left side.¹⁵

When distance of SOF or SON was calculate from the nasal midline (NM), we found that, the mean distance between SOF/N and NM was 22.17 ± 5.39 mm on right side and 23.42 ± 3.49 mm on left side which was similar to the findings of S Illankathir et al, who showed mean distance from NM-SOF/N to be 22.96 ± 2.17 mm on the right side and 22.41 ± 1.98 mm over the left side.¹⁷ Chung M.S. observed average distance from nasion to the centre of supraorbital notch/foramen was 22.7 mm.¹⁰ In the study of OMJ et al, the SOF/SON measuring approximately 22 mm was observed from the midline.¹⁸ It is interesting to note that in one of the studies conducted on North Indian skulls; the average distance between the SOF/ SON and the midline was 24 mm, which is slightly higher than the current observation. However, a much longer (29 mm) distance between the SOF and midline was observed in a study conducted on a Korean population.¹⁹ Our results were also comparatively lower than that obtained by Gertude M. Beer who observed average distance of supraorbital notch/foramen to nasion as 31 mm.²⁰ Trivedi et al showed average distance from nasion to supraorbital notch/foramen was 23.73 mm on the left side and 24.30 mm on the right side.¹² Bruno et al demonstrated distance between SOF-NSM is 28.06 ± 5.24 in male and 26 ± 3.66 in female.¹⁵

We also observed the mean distance from SOF/N to temporal crest to be 24.46 ± 6 mm on the right side and 26.25 ± 3.19 on the left side. According to Bruno et al the mean distance between SOF-TCFB was 23.73 ± 4.40 (male) and 23.49 ± 3.66 (female).¹⁵

The mean length of SOF was 2.13 ± 0.7 on the right and 1.95 ± 0.39 on the left side. Our findings were slightly higher than the values obtained by S Ilankathir et al who observed mean length of SOF to be 2.08 ± 0.49 mm on right and 1.82 ± 0.41 mm on left sides.¹⁷ Trivedi et al found mean length of SOF to be 2.49mm on right and 2.45 mm on the left side.¹² According to Sharma N et al. mean height of SOF was 2.75 ± 0.55 mm on the right side and 2.35 ± 0.23 mm over the left side.²¹ Our results were comparatively lower than the results of these authors.

Mean width of SOF was 3.96 ± 1.55 on right and 3.8 ± 1.17 on left sides which was slightly higher than that obtained by Trivedi et al (3.67 mm on the right side and 3.54 mm over the left side).¹² Where as our results were comparatively lower when compared with the studies of Ashwini et al (mean diameter was 5.17 ± 0.35 on right) and 5.58 ± 0.45 on left)¹⁸ and Sharma N et al (4.62 ± 0.83 mm on the right side and 4.31 ± 0.51 mm on left).²¹

The mean vertical heights of SON obtained in our study were 3.1 ± 1.06 mm on right and 2.54 ± 0.86 mm while mean horizontal diameter were 5.19 ± 1.93 mm and 5.01 ± 1.4 mm on right and left sides respectively. It was

reported that the mean width of the supraorbital notch/foramen was 4.7mm in a research conducted in Korea.¹⁰ These results were not in line with what was obtained in the study conducted by Anthony et al since the values were higher. (5.21±1.65mm for right and 5.40±1.89mm for left mean width in males and in females 4.97±0.18mm for right and 5.00±0.20mm for left).¹¹

CONCLUSION

The position of the SOF/SON is not constant and it varies between different races and people of different regions. Damage of supraorbital neurovascular bundle is an important complication reported with varying frequency during anterior orbital approach, fronto-glabella reconstruction flap, blepharospasm, and Graves' disease surgery, and in supraorbital nerve block for procedures like closure of facial wounds, treatment of migraine and chronic paroxysmal hemicranias. The results of the present study will serve as a guide to surgeons carrying out craniofacial surgery to avoid injury to the neurovascular bundles of the face and also assist anthropologists and forensic scientists in the localization and characterization of these foramina and notches.

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