
ORIGINAL ARTICLE**Morphometric analysis of supraorbital foramen in South Indian dry skulls with its clinical implications in craniofacial surgeries***Vikram Palimar^{1*}, Chandni Gupta²**¹Department of Forensic Medicine, ²Department of Anatomy, Kasturba Medical College, Manipal, Manipal Academy of Higher Education, Manipal-576104 (Karnataka) India*

Abstract

Background: Knowing the location of supraorbital foramen and notch is very important as it transmit supraorbital vessels and nerve and they can get damage while doing several surgeries like eyebrow lift surgery and treating facial wounds. *Aim and Objectives:* To find out the occurrence of supraorbital notches and foramina in adult skull, dimensions of foramen and to locate its distance from the nasion. *Material and Methods:* The study was carried out on 50 dry skulls. Measurements of supraorbital foramen were taken from the nasion on both sides of the skull. Presence or absence of notch and foramen was also noted. Dimensions of foramen were also noted. Data analysis was done by using the Statistical Package for Social Sciences (SPSS) 19 version. *Results:* The mean distance of the supraorbital foramen to the nasion was 2.39, 2.29 cm on the right and left side respectively. The mean width of the foramen was 6.36, 5.36 mm on the right and left side respectively. The mean height of the foramen was 2.7, 3.10 mm on the right and left side respectively. Bilateral notch was present in 38% of skulls, bilateral foramen was seen in 22% of skulls, one side notch and one side foramen was seen in 34% of skulls and both side supraorbital notch was absent in 6% of skulls. On right and left side notch, foramen was present in 54% and 56%, 40% and 38% of skulls. *Conclusion:* Knowing the location of supraorbital foramen and notch is very important as it transmits the supraorbital vessels and nerve and they can get damaged while doing several surgeries like eyebrow lift surgery and treating facial wounds.

Keywords: Supraorbital Foramen, Eyebrow Lifting, Surgery, Supraorbital Nerve

Introduction

Supraorbital notch or foramen is located at the junction of lateral 2/3rd and medial 1/3rd on the supraorbital margin of the orbit. Supraorbital nerve and vessels exits through this foramen. Supraorbital nerve is the terminal branch of the frontal nerve. After exiting it supplies upper eyelid, conjunctiva, frontal sinus and the skin from the forehead. Supraorbital artery is a branch of ophthalmic artery [1].

The ligament that bridges the notch sometimes gets ossified and covert the notch into foramen [2]. Supraorbital notch/foramen is generally used

as a landmark for localizing the nasolacrimal canal while doing surgeries for nasolacrimal stenosis or atresia [3].

Localization of supraorbital foramen is also needed in cases of supraorbital nerve block which is given in the management of supraorbital neuralgias and suturing facial wounds. Its location is also needed in cosmetic surgeries like face-lift, forehead lift, Botox injections etc. While doing surgical procedure close to the foramen can lead to scarring, this can cause nerve entrapment and can cause painful neuralgias [4-5]. Sometime if the

nerve gets damage while doing surgeries it can lead to its loss of sensation of the skin of forehead [2]. Its location is also important while doing other surgeries like orbital decompression and draining frontal sinusitis [6].

Sometimes the neurovascular bundle can get damaged when the surgeon wants to approach the orbit from anterior side or in cases of fronto-glabella reconstruction flap and in blocking the supraorbital nerve for treating migraine and chronic paroxysmal hemicranias [7].

So, in all these cases the surgeons should know the precise location of supraorbital foramen or notch and its dimensions. Therefore, the objectives of this study were to:

1. Find out the occurrence of supraorbital notches and foramina in adult skull.
2. Measure various morphometric parameters of the foramen.
3. Locate its distance from the nasion.

The main aim of the study was to understand the existence of supraorbital notch and foramen and to measure its various morphometric parameters which will help the surgeons to locate it carefully while doing surgeries.

Material and Methods

Study setting: Department of Anatomy, KMC, Manipal.

Study period: 2 months (August 2021-October 2021).

Sample size: 50 skulls were used in this study which were available in the department by random sampling method.

Study was exempt from review as study was done on anonymized skulls which are stored in the department of anatomy for academic and research purpose.

Inclusion criteria: All adult skulls were included in the study.

Exclusion criteria: Skulls of children and broken skulls were excluded from the study.

Methodology

Presence or absence, type (foramen or notch), was noted on both sides of the skull.

Following parameters were measured: (Figure 1 and 2)

- 1) The distance between the medial margin of supraorbital foramen or notch and the nasion on both right and left side.
- 2) Maximum transverse diameter of the supraorbital foramen
- 3) Maximum vertical diameter of the supraorbital foramen

The measurements associated with supraorbital foramen were measured using scale and divider and then these measurements were transferred to Vernier calipers (least count 0.01 mm) to measure the distances. Before using the Vernier caliper it was calibrated using the following procedure- Firstly the caliper's jaws were cleaned to make sure they are free of any dirt or grease. Then the gear was moved back and forth to make sure that there was no hindrance in its movement. Next the jaws were brought in contact with each other and the reading on the dial was set at zero. Then a 0.500 inch standard gauge block was inserted between the jaws to measure outer diameters. Both the jaws were in contact with the block but the jaws were not pressed too tightly on the surface. Reading was recorded accurately up to 3 decimal places. Three readings were taken to eliminate any inconsistency while measuring. Later it was repeated with a 1 inch gauge block and afterwards with a 4 inch block.



Figure 1: Showing distance measured from nasion to supraorbital notch



Figure 2A: Measuring maximum transverse diameter of supraorbital foramen

Figure 2B: Measuring maximum vertical diameter of supraorbital foramen

Statistical Analysis: From all the measurements, mean and standard deviation (mean ± SD) were calculated. Data analysis was done by using the Statistical Package for Social Sciences (SPSS) 19 version. Independent T- test was done to compare right and left side parameters and P < 0.05 was considered to be statistically significant.

Results

The mean distances of the supraorbital foramen from nasion on both right and left sides, its mean transverse and vertical diameter on both sides are tabulated in Table 1.

There was no significant differences in distances of the supraorbital foramen from nasion on both right and left sides as the P value was >0.05. There was no significant differences in transverse diameter of the supraorbital foramen on both right and left sides as the P value was >0.05. But there was significant differences in vertical diameter of the supraorbital foramen on both right and left sides as the P value was <0.05. The values are shown in Table 1. Bilateral notch was present in 19 skulls (38%). Bilateral foramen was seen in 11 skulls (22%). And one side notch and one side foramen is seen in 17 skulls (34%).

Table 1: Measurements on supraorbital notch and foramen

| Parameters | Mean ± SD | | Range | p |
|------------------------------------------------|-----------|-------------|---------|-------|
| | Right | Left | | |
| Distance of notch and foramen from nasion (cm) | Right | 2.39 ± 0.53 | 1.5-3.9 | 0.127 |
| | Left | 2.29 ± 0.35 | 1.6-3.1 | |
| Width of the foramen (mm) | Right | 6.36 ± 3.25 | 3-17 | 0.040 |
| | Left | 5.36 ± 1.68 | 2-9 | |
| Height of the foramen (mm) | Right | 2.7 ± 0.73 | 2-4 | 0.247 |
| | Left | 3.10 ± 0.53 | 1-5 | |

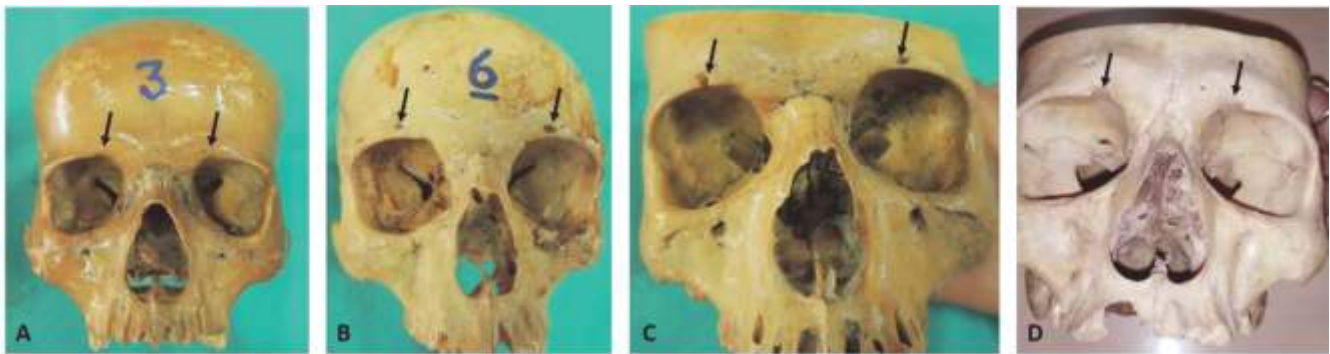


Figure 3A: Bilateral absence of supraorbital notch or foramen

Figure 3B: Bilateral presence of supraorbital foramen

Figure 3C: Presence of one side supraorbital notch and other side foramen

Figure 3D: Bilateral presence of supraorbital notch

In 3 skulls (6%) both side's supraorbital notch and foramen were absent. (Figure 3) On right side notch and foramen was present in 54% and 40% of skulls. In 6% of skulls both notch and foramen were absent. On left side notch and foramen was present in 56% and 38% of skulls. In 6% of skulls both notch and foramen were absent.

Discussion

Now a days to defeat aging many people are going for forehead and eyebrow lifting procedures. And due to this these procedures have got a lot of importance in the recent years. For this anatomy of forehead has to be clearly understood. And in the forehead region the knowledge of supraorbital notch and foramen should be well understood [8]. Wazir conducted a study on 37 skulls. They found that supraorbital notch was present more on right side in 56.8% of skulls than on left side in 35.1% of skulls [9]. Chavan and Shende have conducted a study on 96 skulls. In 52% male and 30.8% female skulls supraorbital notches were present on both side [8]. Nallathamby and Soman have done a study on 106 skulls. They found bilateral notches in 41.51% of skulls. The mean width of

the notch was 3.76 mm on right and 3.66 mm on left side [6]. Trivedi *et al.* have did a study on 249 skulls. They found bilateral notches was seen in 35.62% of skulls [10]. Nanayakkara *et al.* have conducted a study on 58 skulls and found supraorbital notch in 73.8% of skulls. Bilateral notches were seen in 55.1% of skulls [11]. Sheikh *et al.* have conducted a study on 59 skulls. They found that bilateral supraorbital notches were seen in 30.51% of skulls [12]. Ilayperuma *et al.* have conducted a study on 108 skulls. They found supraorbital notch was more common in 64.81% of skulls. 55.56% skulls had bilateral supraorbital notches [13]. Singh *et al.* have conducted a study on 71 skulls and found supraorbital notches in 80.99% of skulls while bilateral notches in 73.24% of skulls [7]. But in our study we found bilateral notch in 38% of skulls. This differences in the results are might be because of geographical differences as our study is done in south Indians and theirs is done in north Indians people.

Varsha and Thenmozhi have conducted the study on 50 skulls and found bilateral supraorbital notch in 50% of skulls [14]. Webster *et al.* have

conducted a study on 108 skulls. They found bilateral supraorbital notches in 49.07% of skulls. [2] Sonia *et al.* have conducted a study on 100 skulls and found in 43.8% of cases has supraorbital notches [15].

Chavan and Shende have found that in 10.05% male and 30.8% female skulls supraorbital foramina was present on both sides. In 36.9% male skulls and 38.5% female skulls notch was present on one side and foramina on other side [8]. Trivedi *et al.* have found notch on one side and foramen on other in 16.73% of skulls [10].

Nanayakkara *et al.* have found supraorbital foramina in 26.2% of skulls, one side notch and

one side foramen in 36.3% of skulls. [11] Sheikh *et al.* have found notch on one side and foramen on the other side in 11.86 % of cases [12].

Ilayperuma *et al.* have found supraorbital foramen in 35.19% of skulls. 24.07% of skulls had a notch on one side and a foramen on the contralateral side [13]. But in our study we found bilateral foramen in 22% of skulls and one side notch and one side foramen was seen in 34% of skulls. This differences in the results are might be because of racial differences as our study is done in Indians and theirs is done in Srilankan and Egyptian people.

Table 2: Comparison of morphometric parameters of supraorbital foramen of present study with other authors

| Authors | Presence of supraorbital foramen (%) | | | Width of foramen | | Height of foramen | | Distance from nasion (cm) | |
|--------------------------------|--------------------------------------|------|-----------|------------------|------|-------------------|------|---------------------------|------|
| | Right | Left | Bilateral | Right | Left | Right | Left | Right | Left |
| Wazir [9] | 40.5 | 62.2 | - | - | - | - | - | 2.61 | 2.52 |
| Nallathamby and Soman [6] | - | - | - | 2.96 | 3.27 | 1.55 | 1.61 | 2.36 | 2.41 |
| Trivedi <i>et al.</i> [10] | - | - | 21.45 | - | - | - | - | 2.43 | 2.37 |
| Singh <i>et al.</i> [7] | - | - | 11.27 | - | - | - | - | 2.46 | 2.48 |
| Thenmozhi <i>et al.</i> [14] | 14 | 16 | 20 | - | - | - | - | - | - |
| Sonia <i>et al.</i> [15] | - | - | 17.7 | - | - | - | - | 2.16 | 2.15 |
| Ashwini <i>et al.</i> [16] | - | - | - | 5.17 | 5.58 | 3.5 | 3.04 | 2.22 | 2.22 |
| Nanayakkara <i>et al.</i> [11] | - | - | 8.6 | - | - | - | - | - | - |
| Sheikh <i>et al.</i> [12] | - | - | 18.64 | - | - | - | - | - | - |
| Ilayperuma <i>et al.</i> [13] | - | - | 20.37 | - | - | - | - | - | - |
| Present study | 40 | 38 | 22 | 6.36 | 5.36 | 2.7 | 3.10 | 2.39 | 2.29 |

Singh *et al.* have found supraorbital foramen in 19.01% of skulls. 7.75% of skulls had notch on one side and foramen on the other side [7]. Webster *et al.* have found notch on one side and a foramen on the other side in 25% of skulls [2]. Sonia *et al.* have found supraorbital foramens in only 17.7% of skulls [15]. But in our study we found bilateral foramen in 22% of skulls. This differences in the results are might be because of geographical differences as our study is done in south Indians and their study is done in the north Indians people.

Comparison of morphometric parameters of supraorbital foramen of present study with other authors is shown in Table 2.

The knowledge of exact location of supraorbital vessels and nerve is needed while doing surgeries on forehead as if they get damaged it can lead to complications like development of hematoma, sensory disturbances of the skin of forehead, flap necrosis etc. [2]. Its location is also significant while doing surgeries which involve the superior orbital wall such as orbital decompression, frontal sinus obliteration and fractures explorations and orbital exenteration [6]. If the anesthetist knows the exact and the more common site of the exit of the nerves they can give effective and accurate anesthesia for various surgeries in the craniofacial

region [17]. The information about the exact position of this nerve is also crucial while doing different types of endoscopic procedures, which are now a days commonly used for cosmetic facial operations like eyebrow lifting, face lift etc. [18]. These data will aid the anesthetics while giving nerve blocks and surgeons while doing various surgeries on the forehead.

Conclusion

The present study was carried out on 50 dry skulls. The mean distance of the supraorbital foramen to the nasion was 2.39 cm and 2.29 cm on the right and left side respectively. The mean width of the foramen was 6.36 mm and 5.36 mm on the right and left side respectively. The mean height of the foramen was 2.7 mm and 3.10 mm on the right and left side respectively. Bilateral notch was present in 38% of skulls, bilateral foramen was seen in 22% of skulls, one side notch and one side foramen was seen in 34% of skulls and both side supraorbital notch was absent in 6% of the skulls. Knowing the location of supraorbital foramen and notch is very important as it transmit supraorbital vessels and nerve and they can get damage while doing several surgeries like eyebrow lift surgery and treating facial wounds.

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