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MORPHOMETRIC ANALYSIS ON SUPRAORBITAL NOTCHES AND FORAMINA IN SOUTH INDIAN SKULL

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ABSTRACT

Objectives: A clear knowledge regarding the supraorbital notches and foramina is essential for clinicians to avoid the injury of neurovascular bundle passing through the same. In the present study, a detailed morphometric analysis of supraorbital notches and foramina were carried out and compared with the available literatures.

Methods: The various types, position and dimension of supra orbital notches and foramina in different races and regions were studied in one hundred twenty human skull. The parameters for the present study used were the various types of combination of supra orbital notches and foramina, and their absence in some skulls, their distance from nasal midline, vertical and transverse diameter of supra orbital foramen and transverse diameter of supra orbital notch, any accessory supra orbital foramina .

Results: In present study, total thirteen types of combination were found. Out of hundred twenty skulls, 33.33% had bilateral notch, 19.75% had bilateral foramen, 20.83% had notch on one side and foramen on other side. The mean (± SD) distance of supra orbital foramen/ notch from the nasal midline was 21.94 ± 4.32 mm on right side and 20.18 ± 4.17mm on left side. The mean (± SD) transverse diameter of supraorbital foramen and notch was 4.62 ± .83mm on right side, 4.16 ± 1.12 mm on left side and 6.93 ± 1.19mm on right side and 6.73 ± 1.14mm on left side respectively . While the mean (± SD) vertical diameter of foramen was 2.29 ± .75mm on right side and 1.93 ± .83mm on left side. The accessory supraorbital foramina were observed in 12% of cases.

Conclusion: The present study revealed that supraorbital notches and foramina frequently vary in positions and dimensions in various races and region. Therefore anatomical knowledge of combinations of supra orbital notches and foramina are essential for clinicians while performing craniofacial surgeries like forehead and brow lift surgeries to avoid injuries of neurovascular bundle passing through these notches and foramina. Hence this study has been reported.

Keywords: Skulls, Supraorbital notch, Supraorbital foramen, Variation, Absence of supraorbital notches and foramina

INTRODUCTION

Supraorbital margin is interrupted by supraorbital notch at its junction of sharp lateral two third and rounded medial third. Sometimes (25% cases) the notch is converted into foramen by ossification of periosteal ligament bridging it. Duke Elder (1961) has named it as supraorbital ligament[1]. Partial ossification of this ligament results in incomplete foramen[2].Supra orbital notch or foramen transmits supraorbital nerve and vessels which supply skin of forehead, scalp, upper eyelid and nose [3]. The position of supra orbital notches / foramina is not constant. In some skull incomplete foramina, double foramina,

double notch or absence of all of them has also been reported[4].

Anatomical knowledge of supra orbital notches and foramina is essential for many occulo plastic surgery like forehead, coronal and brow lifting procedures for deep division of supra orbital nerve [5]. It is also a important landmark for probing procedure of nasolacrimal canal[6] and for supra orbital nerve block in treatment of migraine and chronic paroxysmal hemicranias[7]. Thus in maxillofacial surgery, the knowledge of variations in the position and dimension of supra orbital notches and foramina provides accurate approach and facilitates the surgeon's approach. This helps in decreasing morbidity and provides satisfactory results. Hence the morphometric study of supra orbital notches and foramina has been done to ascertain the normal localization and dimension. This can facilitates surgical, diagnostic, therapeutic, local anesthetic and other invasive procedures, without causing any injury to neurovascular bundle passing through it and the surrounding vital structures.

MATERIALS AND METHODS

This study was carried out on hundred twenty dry human skull of anatomy department of Velammal Medical College Hospital and Research Institute, Madurai, Tamil Nadu and Rajarajeswari Medical College, Mysore Road, Bangalore. The parameters taken for this study were different types and combination of supraorbital notches and foramina, their distance from nasal midline, dimension of supraorbital notch(transverse diameter) and foramen(vertical and transverse diameter). Nasal midline was taken from vertex of the skull through the nasion to the anterior nasal spine and intermaxillary suture line. The measurements were done with the help of dividers and meter ruler. Observations thus made were tabulated and statistical data were calculated.

RESULTS

Total thirteen types of combination of supraorbital notches, foramina, incomplete foramina along with partial or complete absence of all the features at supraorbital margin were observed [table 1]. The mean (±SD) distance of supra orbital foramen/ notch from the nasal midline was 21.94 ± 4.32 mm on right side and 20.18 ± 4.17mm on left side [table 2]. Various dimensions of supraorbital notches and foramina were shown in table 3.

DISCUSSION

The various studies showed that the position of supraorbital foramina/ notches are not constant. A detailed morphometric analysis can ascertain the site and dimensions of foramina/notches as an important landmark for both diagnostic and surgical procedures. This can prevent the complications due to injury of neurovascular bundle i.e, anasthesia or hypoesthesia of the forehead, hematoma formation in subgaleal plane, ischemia or necrosis in portions of the forehead flap[8] .

The present study showed the supraorbital notches of varied shape like broad flat designs to narrow key holes or bilobed form. The foramina were ovoid in shape with longer axis lying in horizontal plane. Incidence of bilateral notches in skull was highest (33.33%) like study of Rao et al (38.5%)[4] and D.J.Trivedi et al.[8](35.62%). Combination of bilateral supraorbital foramina is higher(17.5) next to bilateral notches but it was highest (21.45%) in Bilodi et al studies[9]. In present study incidence of unilateral notch or incomplete foramina and absence of all these features on contralateral side was lowest(.83% each) which is similar to Rao et al studies. D.J.Trivedi[8], Bilodi et al[9] and Rao et al[4] had reported the absence of both notch and foramen in .42%, .33% and 1.5% skull respectively. 1.67% of skull had no notch and foramen over supraorbital margin in our study. Complete absence of notch or foramen may deprive the

supraorbital nerves and vessels the protection given by these and make them more vulnerable to injuries at sharp supraorbital margins[10]. Some of the combinations were present in our study but absent in Rao et al[4] and Bilodi et al[9] studies[table 2]. The above variation in incidence of different types of combinations may be due to population or material difference.

Emeka Anthony Osunwoke et al[10] (2012) found supraorbital notches (male- 50%, female-58.33%) were more frequent than supraorbital foramina (male- 30.56%, female-33.33%) in South Nigerian skull. Chung M.S. found incidence of supraorbital notches (69.9%) were higher than supraorbital foramina (28.9%) in Korean skull[11].

. Bilateral supraorbital notch in 50% skull, bilateral supraorbital foramen in 17% skull and one side notch, other side foramen in 33% skull in Thai population were reported by Apinhasmit W et al[12](2006). Similarly in present study out of hudred twenty skulls, bilateral supraorbital notches in 33.33% of skulls, bilateral supraorbital foramina in 17.5% of skulls and a notch on one side and foramen in contralateral side in 20.83% of skulls were seen. .Trivedi et al (2010)[8] has reported the incidence of supraorbital notch was 62.66% on right side and 65.66% on left side and foramen was 36.90% on right side and 32.62% on left side in Gujrati skull. In a study of 300 adult human skulls of Nepal, Bilodi et al[9] (2002) observed supraorbital notch and foramen was 47.38%, 39% on right side and 36.60%, 43.30% on left side respectively. However the present study showed the incidence of supraorbital notch as 45.8% on right side and 48.33% on left side , whereas supraorbital foramen was 35.83% on right side and 31.67% on left side.

Saylam et al(2003)[13] observed, accessory supraorbital foramina were in 2% of Turkish skull, Ashwini LS et al (2012)[14] observed in 66.25% of South Indian skull. But in present study accessory supraorbital foramen was found in lesser skull (12%).

The position of supraobital notches and foramina varied in different races and region. Supraorbital notches/foramina was 25.14± 4.29mm lateral to nasal midline in Thai skull[12], 22.7 mm in Korean skull[11] . The mean distance of supraorbital notches/foramina to the nasal midline was 22.24mm on the right side and 22.20 mm on the left side in a study of 83 human adult South Indian skull[12,] 24.30mm on the right side and 23.73mm mm on the left side in a study of 233 Gujrati skull[8]. In present study also, the average distance of notches/foramina to the nasal midline was comparatively more on right side (21.94 ± 4.32 mm) than left side (20.18 ± 4.17mm).

The anthropometric measurements in 106 Thai skull revealed that the mean transverse diameter of the supraorbital notch was 4.31 ± 1.61mm and that of the supraorbital foramen was 2.81 ± 0.62mm in 106 Thai skull[12], mean horizontal width of the supraorbital notch/foramen was 4.7mm in skull of Korea[11]..Trivedi et al[8] reported the mean transverse diameter of supraorbital foramen was 3.67 mm on right side, 3.54 mm on left side and that of notch was 4.59mm on right side and 4.67mm on left side in Gujrati skull. The mean transverse diameter of supraorbital notch was 5.17 mm on the right side and 5.58 mm on the left side in 83 south Indian skull[14]. These observations were not in accordance with the present study since the values were higher (table 3).

CONCLUSION

Our study revealed that position of supraorbital notch/foramen always varied in different races and region, accordingly the exit point of supraorbital nerves and vessels also varies. The present study can serve as a guide for anesthetic, therapeutic, diagnostic or invasive surgical purpose. It can also helpful for anthropologists and forensic scientists in the localization and characterization of these foramina and notches.

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Table 1- Incidences of various types of combinations of supraorbital notches/foramina

S.No.	Types of combinations in same skull		Skull numbers	Percentage (%)
	Right	Left		
1	N	N	40	33.33
2	F	F	21	17.5
3	F	N	14	11.66
4	N	F	11	9.17
5	IF	IF	09	7.50
6	F	IF	08	6.67
7	IF	F	06	5
8	IF	N	O3	2.5
9	N	IF	O3	2.5
10	A	A	02	1.67
11	A	N	01	.83
12	N	A	01	.83
13	IF	A	01	.83
14	A	IF	0	0
15	F	A	0	0
16	A	F	0	0

Table 2- Comparison of types of combination between present study and other studies.

S.No.	Types of combination		Present study (%)	D.J.Trivedi et al (%) 2010	Bilodi et al (%) 2002	Rao et al (%) 1997
	Right	Left				
1	N	N	32.33	35.62	4.6	38.5
2	F	F	17.5	21.45	16	6.5
3	F	N	11.66	9.01	3.6	3
4	N	F	9.17	7.72	1.5	3.63
5	IF	IF	7.50	6.43	12.5	4.6
6	F	IF	6.67	5.15	0	3.5
7	IF	F	5	3.43	4	3.5
8	IF	N	2.5	5.15	0	0
9	N	IF	2.5	3.43	5	2.5
10	A	A	1.67	.42	.33	1.5
11	IF	A	.83	0	0	0.5
12	A	IF	0	0	0	0
13	N	A	.83	.85	0.66	1.0
14	A	N	.83	0	0	0
15	F	A	0	.85	0	0
16	A	F	0	.42	0	0

Table 3 – Dimensions and distance of supraorbital notches/foramina from nasal midline

	Foramen dimension				Notch dimension		Distance of foramen or notch from midline	
	Vertical diameter		Transverse diameter		Transverse diameter		Right	Left
	Right	Left	Right	Left	Right	Left	Right	Left
Mean ± SD (mm)	2.29 ±.75	1.93 ± .83	4.62 ± .83	4.16 ± 1.12	6.93 ± 1.19	6.73 ± 1.14	21.94 ± 4.32	20.18 ± 4.17
Range (mm)	1 - 4	1 - 4	3- 7	2 - 7	3 - 9	4 - 9	15 - 31	10 - 29

Table 4- Incidences of suprorbital notches/foramina in both sides

Types	Right side		Left side	
	No. of skulls	Percentage	No. of skull	Percentage
Supraorbital notch	55	45.8	58	48.33
Supraorbital foramina	43	35.83	38	31.67
Supraorbital incomplete foramina	19	15.83	20	16.67

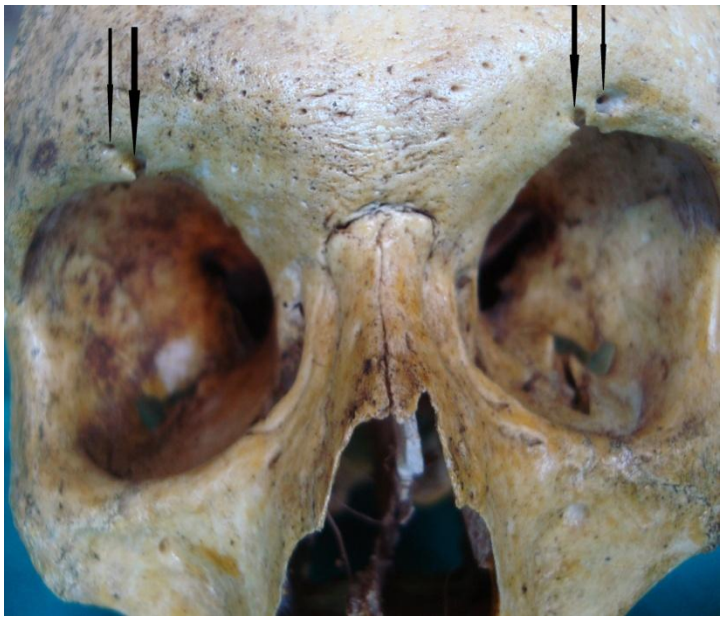


Fig.1- Bilateral supraorbital notch with accessory foramina

Fig.2- Bilateral supraorbital foramina

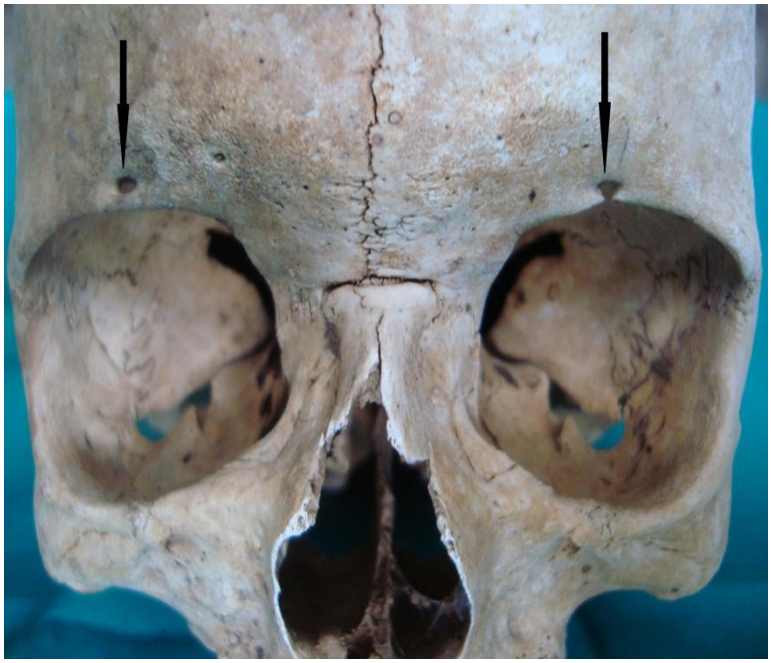
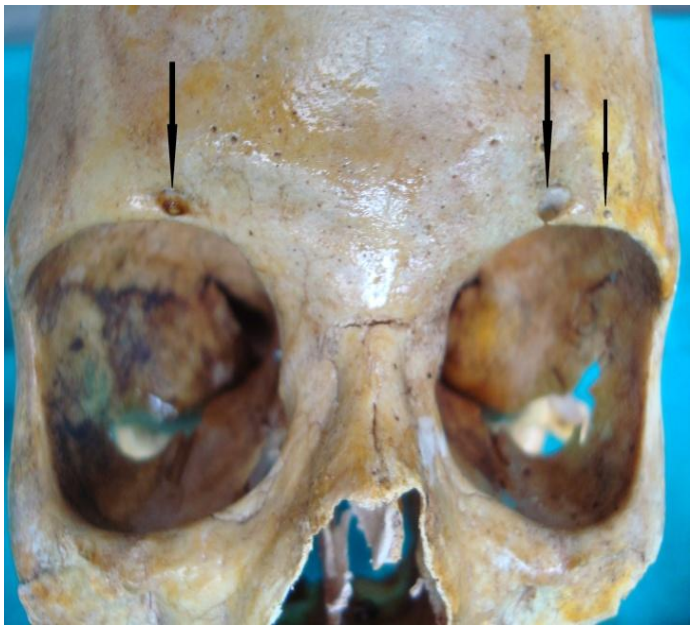


Fig.3- Supraorbital foramen on right side and notch on left side

Fig.4- Incomplete supraorbital foramen on right side and complete foramen on left side

Fig.5- Absent foramen / notch on either side

Fig.6- Supraorbital notch on right side and absent foramen/notch on left side



Fif.7- Supraorbital foramen on right side and incomplete foramen with accessory foramen on left side

Fig.8- Bilobed supraorbital notch on right side and notch on left side with accessory foramen