Accessory Infraorbital Foramen And Morphometric Localization Of Infraorbital Foramen In North Indian Region

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Abstract: Background**:** Aim of present study was to note the frequency of accessory infraorbital foramen in north Indian population and to determine the distance of infraorbital foramen from various anatomical landmarks in adult dry human crania. Methodology**:** 64 adult north Indian dry human crania of unknown age and gender were analysedfor the presence ofaccessoryinfraorbital foramen and their unilateral or bilateral prevalence was calculated.Shortest distance between the infraorbital foramen from midline, pyriform margin, nasion, infraorbital margin, anterior nasal spine and frontozygomatic suture was measuredon both sides in each craniawith Vernier caliper accurate to 0.1 mm for linear measurement.Observations thus made were compiled and tabulated followed by comparison using appropriate statistical tests. Results: Prevalence of accessory infraorbital foramen is 7.81%, while bilateral prevalence of accessory infraorbital foramen is only 1.56 %, however unilaterally accessory infraorbital foramen is present in 6.25% (2.34 % on right side and 3.9 % on left side). Mean shortest distance of infraorbital foramen from midline was 34.78 ± 3.19mm, while mean shortest distance between the infraorbital foramen to the pyriform margin was 21.26 ± 2.78 mm.Mean shortest distance of infraorbital foramen to the nasion andinfraorbital marginwas 44.95 ± 4.62mm. and 6.58 ± 1.59 mm respectively.Mean shortest distance of infraorbital foramen to the anterior nasal spine and frontozygomatic suture was 36.63 ± 3.16mm.and 35.62 ± 1.98 mm respectively. Conclusion**:** The knowledge of the distances from surgically encountered anatomic landmarks may be of assistance in locating these important maxillofacial neurologic structures during many procedures. Understanding the location of these foramina will also assist the clinician in performing local anesthetic blocks. [Singh A NJIRM 2015; 6(5):28-33]

Key Words: infraorbital foramen, accessory infraorbital foramen, morphometry

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Introduction: Infra orbital foramen, which transmits theinfra orbital vessels and nerve lie about 1 cm. below the infraorbital margin [1]. Itis presenton anterior surface of maxillary bone of the skull. The precise location of infra orbital foramen is essential in various clinical and surgical proceduressuch as maxillofacial surgeries, infra orbital nerve block etc. Infra orbital nerve block is used to anesthetize the lower eyelid, upper lip, lateral nose, upper teeth and related gingivae. The presence of accessory infraorbital foramen may cause difficulties during anesthetization of the region innervated by infraorbital nerve.Knowledgeofexactlocationofinfraorbitalforamenaidsinsurgicalmaneuveringinthemaxillofacialregionandimplementingtheregionalblockanesthesia[2]. Thepresent study was conducted on dry human adult crania to determine the prevalence of accessory infra orbital foramen in north Indian population and to do morphometric localization of infraorbital foramen with reference to surrounding important anatomical surface landmarks in north Indian population.

Material and Methods: 64dry adult north Indian human crania of unknown age and gender were analysed in the Department of Anatomy of Government Medical College, Orai(Jalaun), India; Rohilkhand Medical College & Hospital, Bareilly, IndiaandMotiLal Nehru Medical College, Allahabad, India. Crania showing any lytic lesion or exostosis were excluded from the study. Care was exercised to exclude the brittle crania from this study.

Accessory infraorbital foramina lie immediately adjacent to the infraorbital foramen and they are comparatively smaller than infraorbital foramen. Anterior surface of maxilla below infraorbital margin of each skull was carefully observed for the presence of accessory infraorbital foramen and their unilateral or bilateral prevalence was calculated. **(Fig.1)**

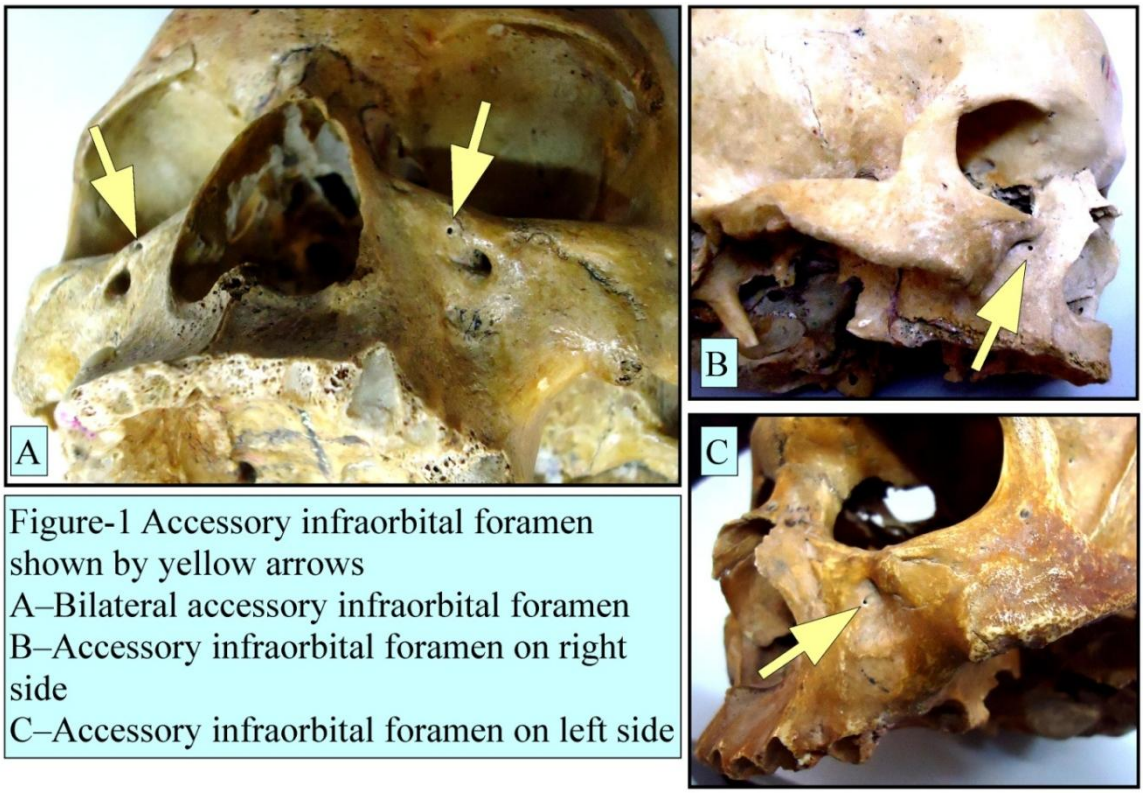


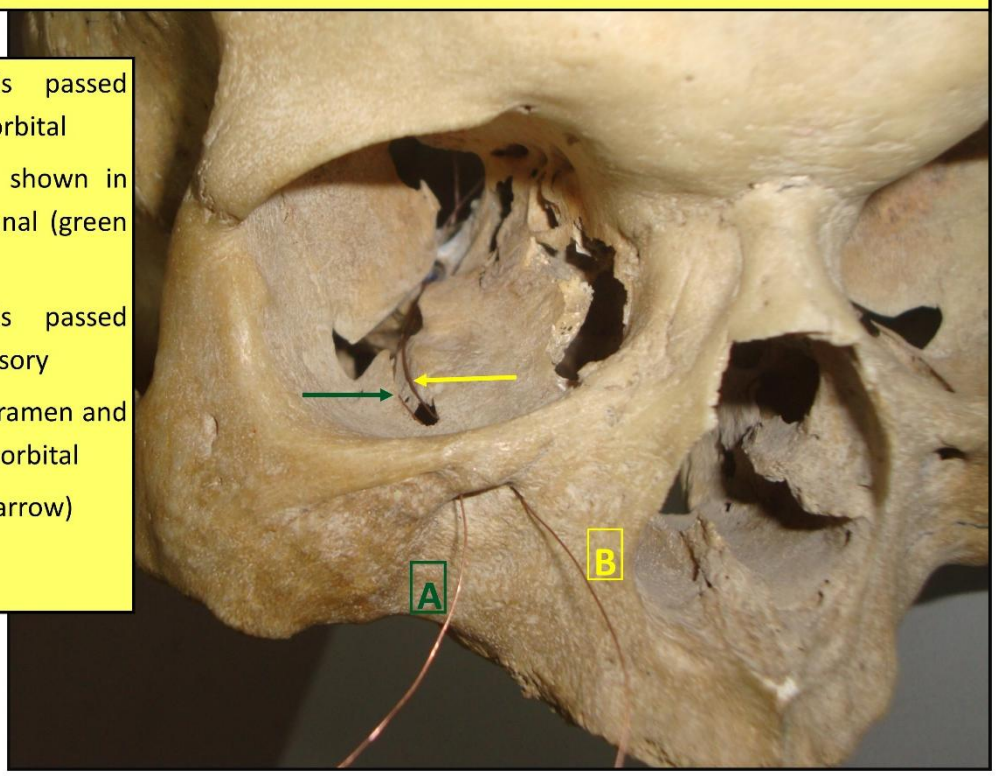
Figure-1 Accessory infraorbital foramen shown by yellow arrows
A–Bilateral accessory infraorbital foramen
B–Accessory infraorbital foramen on right side
C–Accessory infraorbital foramen on left side

Thin gauge wire was introduced through accessory infraorbital foramen to observe communication with infraorbital canal. **(Fig.2)**

Figure-2 Infraorbital foramen and accessory infraorbital foramen communicating in infraorbital canal

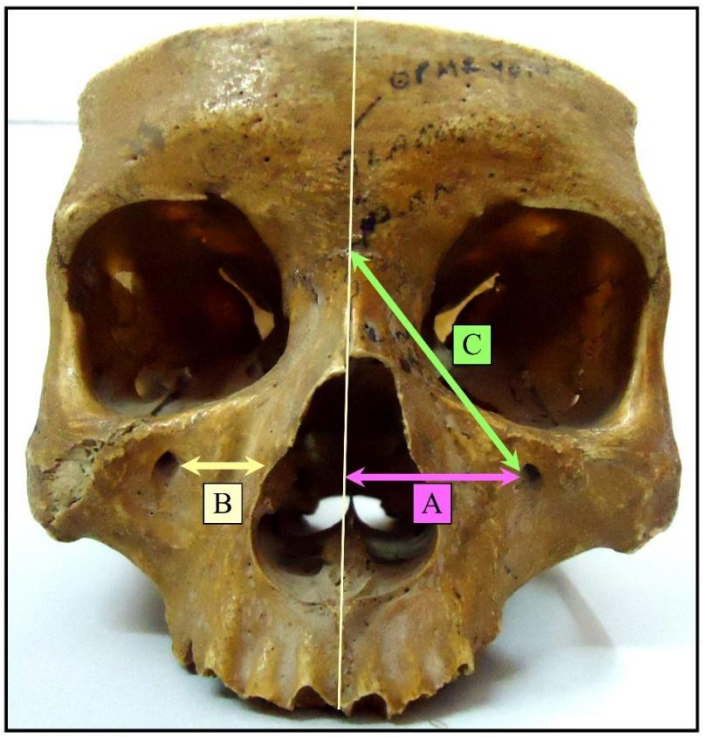
Wire "A" is passed through infraorbital foramen and shown in infraorbital canal (green arrow)

Wire "B" is passed through accessory infraorbital foramen and shown in infraorbital canal (yellow arrow)



Following parameters for infraorbital foramen were also studied:

- Shortest distance between the infraorbital foramen from midline**(Fig. 3)**
- Shortest distance between the infraorbital foramen to the pyriform margin.**(Fig. 3)**
- Shortest distance between the infraorbital foramen to the nasion.**(Fig. 3)**
- Shortest distance between the infraorbital foramen to the infraorbital margin.**(Fig. 4)**
- Shortest distance between the infraorbital foramen to the anterior nasal spine.**(Fig. 4)**
- Shortest distance between the infraorbital foramen to the frontozygomatic suture.**(Fig. 4)**



Figure– 3
A-Shortest distance between the infraorbital foramen from midline (Pink arrow)
B-Shortest distance between the infraorbital foramen to the pyriform margin.(Yellow arrow)
C-Shortest distance between the infraorbital foramen to the nasion. (Green arrow)

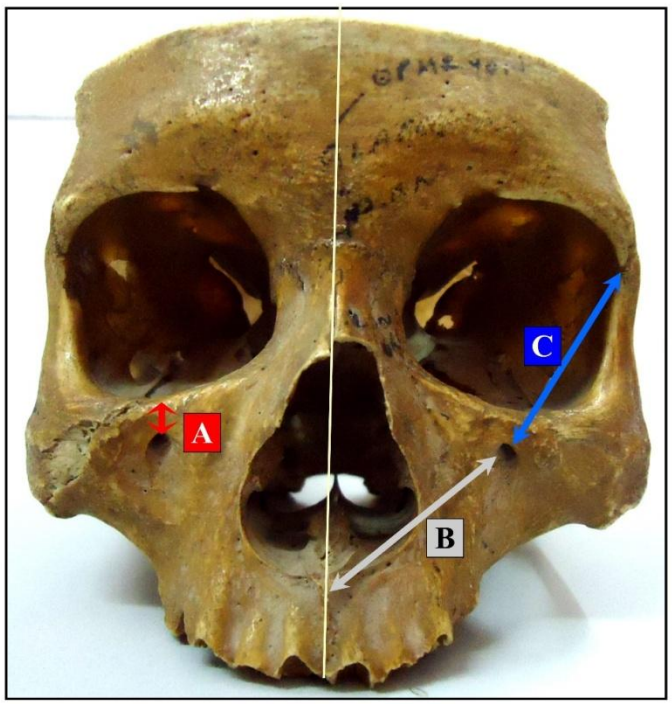


Figure-4
A-Shortest distance between the infraorbital foramen to the infraorbital margin. (Red arrow)
B-Shortest distance between the infraorbital foramen to the anterior nasal spine. (Grey arrow)
C-Shortest distance between the infraorbital foramen to the frontozygomatic suture (Blue arrow)

The midline of the forehead was established by dropping a suture from the vertex of the skull through the nasion to the anterior nasal spine and inter-maxillary suture line. The measurements were taken on both sides with Vernier calipers accurate to 0.1 mm for linear measurement.Observations thus made were compiled and tabulated. All the measurements were expressed in Mean ± SD in mm. and were compared between two side using Paired 't' test. (SD=standard deviation) Unpaired 't' test was performed to check out the significance of difference with other population data.

Results:

Table 1: Frequency of accessory infraorbital foramen in 64 crania

Parameter			Number of crania
Accessory infraorbital foramen	Bilateral		1
	Unilateral	Right sided	3
		Left sided	5

Discussion - Out of 64 human crania (128sides), accessory infraorbital foramen was present only in 10 sides (1 bilateral, 5 on left side and 3 on right side). Thus over all prevalence of accessory infraorbital foramen is 7.81%, while bilateral prevalence of accessory infraorbital foramen is only 1.56 %, however unilaterally accessory infraorbital foramen is present in 6.25% (2.34 % on right side and 3.9 % on left side) **(Table 1)**

Berry et al[3] reported the frequency of accessory infraorbital foramen as 4.7% in Egyptians, 6.4% in Nigerian, 6.4% in Modern Palestinian, 6.7% in Indians (Punjabi), 6% in North Americans and7.5% in Burmese. Prevalence noted in present study is higher than the prevalence noted in populations in the study of Berryetal[3] except in South American population with a higher prevalence of13.2%.

The frequency of accessory infraorbital foramen was reported as 10% by Kadanoff et al [4], 12.78% by Saylam et al [5], 15% by Aziz et al [6], 5.7% by Kazkayasi et al [7] and 7.25% by Tezer et al [8].

Apinhasmit et al [9] observed frequency of accessory infraorbital foramen 3.6% in Thai adult population while Bresnan et al. [10]observed frequency of accessory infraorbital foramen 4.7% in Italian adult population. Hindy et al[11]reported frequency of accessory infraorbital foramen 10% in adult Egyptians while Elias et al[12] reported frequency of accessory infraorbital foramen 14% in adult Brazilian population, which is higher than the prevalence in present study. In the study by Berryetal[3] and Gauretal[16], multiple foramina wereal soreported.

In the present study multiple accessory infraorbital foramina were not found in any crania. This may be important for surgeons because injury to any branch can result in sensory deficit and partial nerve blockade.

Mean shortest distance of infraorbital foramen from midline was 35.19 ± 2.99 mm. on right side ranging from 26.4 mm. to 41.8 mm and 34.37 ±3.33 mm. on left side ranging from 26.5 mm. to 39.6 mm, which showed a significant difference between two sides **(Table 2).** On comparison with data from other studies, we found that distance of infraorbital foramen from midline in this study showed significant difference from the study of Apinhasmit[9] in Thai population. ($p<0.001$)

Mean shortest distance between the infraorbital foramen to the pyriform margin was 21.22 ± 2.87 mm. on right side ranging from 15.4 mm. to 28.4 mm and 21.29 ± 2.7 mm. on left side ranging from 14 mm. to 25.5 mm showing no significant difference between two sides **(Table 2)**.Distance of infraorbital foramen to the pyriform margin in present study showed significant difference from the study of Macedo et al [13] on Brazilian skulls ($p<0.001$) and with the study of Kazkayasi et al [7].($p<0.001$)

Mean shortest distance of infraorbital foramen to the nasion was 45.23 ± 4.68 mm. on right side ranging from 25.8 mm. to 51.8 mm and 44.68 ±4.59 mm. on left side ranging from 28.2 mm. to 51.8 mm showing no significant difference between right and left side **(Table 2)**. On comparison with data from study of Przygocka A et al [14], we found that distance of

infraorbital foramen to the nasion showed no significant difference with our study on either side.(p>0.05).

Table 2: Distance of infraorbital foramen from various anatomical landmarks

Parameter	Mean distance (right + left side)	Right side	Left side	Paired *t* test between two sides
	(Mean ±SD in mm.)			
Shortestdistance between the infraorbital foramen from midline	34.78 ±3.19	35.19 ± 2.99	34.37 ±3.33	*t=2.6* $p<0.001^{S}$
Shortest distance between the infraorbital foramen to the pyriform margin	21.26 ±2.78	21.22 ±2.87	21.29 ±2.7	*t*=0.36 $p>0.05^{NS}$
Shortest distance between the infraorbital foramen to the nasion	44.95 ± 4.62	45.23 ±4.68	44.68 ±4.59	*t*=1.58 $p>0.05^{NS}$
Shortest distance between the infraorbital foramen to the infraorbital margin	6.58 ±1.59	6.61 ±1.71	6.55 ±1.47	*t*=0.32 $p>0.05^{NS}$
Shortest distance between the infraorbital foramen to the anterior nasal spine	36.63 ±3.16	36.73 ±3.11	36.51 ±3.23	*t*=1.01 $p>0.05^{NS}$
Shortest distance between the infraorbital foramen to the frontozygomatic suture	35.62 ±1.98	35.53 ±2.63	35.72 ±2.16	*t*=0.95 $p>0.05^{NS}$

Mean shortest distance of infraorbital foramen to the infraorbital margin was 6.61 ± 1.71 mm. on right side ranging from 3.5 mm. to 10.4 mm and 6.55 ± 1.47 mm. on left side ranging from 3.7 mm. to 10.3 mm showing no significant difference between right and left side **(Table 2)**.

On comparison with data from other studies, we found that distance of infraorbital foramen to the infraorbital margin showed significant difference from the study ofAgthong[15] in Asian population (p<0.001), Apinhasmit[9]in Thai population (p<0.001), Aziz et al [6] (p<0.001), Kazkayasi et al [7](p<0.01). On comparison with data from study of Gauretal[16], we found that distance of infraorbital foramen to the infraorbital margin was significantly higher in our findings (p<0.001). It can be helpful to determine the location of infraorbital foramen in relation to in fraorbital margin more precisely since that this distance has are relevant importance during clinical procedures that use the IOF as ananatomic al repair point.[13]

Mean shortest distance of infraorbital foramen to the anterior nasal spine was 36.73 ± 3.11mm. on right side ranging from 30.3 mm. to 47.8 mm and 36.51 ±3.23 mm. on left side ranging from 26.4 mm. to 47.3 mm showing no significant difference between right and left side **(Table 2)**.We found that distance of infraorbital foramen to the anterior nasal spine showed significant difference from the study of Agthong[15] in Asian population (p<0.001), though on comparison with the study of Lopes et al [16] on Brazilian population, no significant difference was found on any side.(p>0.05)

Mean shortest distance of infraorbital foramen from frontozygomatic suture was 35.53 ± 1.8 mm. on right side ranging from 32.5 mm. to 40.5 mm and 35.72 ± 2.16 mm. on left side ranging from 32.1 mm. to 40.3 mm showing no significant difference between right and left side**(Table 2)**.

Conclusion: This study gives an account of frequency of accessory infraorbital foramen as well as it helps to determine the precise location of infraorbital foramen in relation to various anatomical landmarks, which can assist surgeons to localize the foramen avoiding injury

to neurovascular bundle and facilitate surgical, local anesthetic and other invasive procedures.

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