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Original Research Article

Determining the Anatomical Location and Variations of IOF this is Imminent for Successful Regional Anesthesia and Endoscopic Surgeries of the Maxillary Region: Morphometric Analysis

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Conflict of interest: Nil

Abstract

Aim: To assess the anatomical location and variations of IOF this is imminent for successful regional anesthesia and endoscopic surgeries of the maxillary region.

Material & Methods: The study was conducted on 60 Human skull bones of unknown gender from the Department of Anatomy Nalanda Medical College, Patna, Bihar, India. Human adult skull bones without any deformity were included in the study.

Results: 60 skulls (120 sides) – both right and left were studied. Most commonly observed shape of IOF is semilunar 38 % on right side, 42% on left side. Accessory IOF were present in 6.6% of skulls bilaterally. They lie medial to the IOF with mean distance between them as 5 mm on right side & 3 mm on left side.

Conclusion: Our study results will be of immense help to the surgeons and anesthetists, handling this region for operative procedures.

Keywords: Morphometric analysis, infraorbital foramen, dry skull

Introduction

Infra orbital foramen (IOF), which transmits the infra orbital vessels and nerve lies about 1cm below the infra orbital margin [1]. It is present on the anterior surface of the maxilla, its location is essential in various clinical and surgical procedures such as maxillofacial surgeries, infra orbital nerve block etc. Infra orbital nerve block is used to anesthetize the lower eyelid, upper teeth and related gingivae, upper lip and lateral nose. Infra orbital nerve continues inferiorly over the anterior wall of the maxilla and appears on the face through the IOF, where it produces the palpebral, nasal and labial branches to supply the skin of the lower eyelid, conjunctiva, the lateral surface of the external nose and the upper lip, including the skin, mucous membrane and gum [2-4]. Several authors have conducted studies on the morphometric assessment of the IOF [5-13]. In these studies there are wide variation in the prevalence of accessory infra orbital foramens [5,13-15].

The IOF is an important landmark in facilitating aesthetic and surgical interventions of the midface region. The infraorbital nerve block is widely used to accomplish regional anesthesia during surgeries involving the midface region and paranasal sinuses [16-17]. Traumatic or iatrogenic injury to the infraorbital neurovascular bundle may result in

bleeding and hypoesthesia or paraesthesia or anesthesia in the region of its supply [18]. Hence, detailed knowledge of the precise anatomical location and the possible variations of the IOF is fundamental to ensure safe and successful regional anesthesia and to avoid the risk of damaging the neurovascular bundle during surgery in this region.

The surgeries performed around infraorbital foramen that is orbital floor and midface surgeries, involves like orthognathic surgeries for correction of maxillary arch discrepancies and management of Le fort-II fractures and cald well -luc operation done for begin diseases that affects maxillary sinus such as chronic sinusitis, fugal sinusitis, polyposis, biopsy, internal maxillary artery ligation for epistaxis, oroantral fistulas and dental procedures. [19]

Hence, the detailed knowledge of the anatomical location and variations of Infra orbital foramen are necessary for the successful regional anesthesia and for the conventional and endoscopic surgeries of the maxillary region.

Material & Methods:

The study was conducted on 60 Human skull bones of unknown gender from the Department of Anatomy Nalanda Medical College, Patna, Bihar, India. The study was conducted over a period of 6 months.

Human adult skull bones without any deformity were included in the study. The study was approved by institutional ethics committee. Foetal skulls and skulls with facial fractures were excluded from the study.

Both sides of skulls were visually observed for shape, direction of the infraorbital foramen and presence of accessory infraorbital foramina. Sagittal Distance between the infraorbital margins to upper margin of infraorbital foramen were measured.

1. Transverse diameter from lateral margin of pyriform aperture to medial margin of IOF was measured.
2. Oblique distance from anterior nasal spine to inferior margin of IOF, were measured.
3. Vertical and transverse diameter of the IOF was measured.

All the measurements were done on both side of the skull by using sliding vernier caliper {lab world} with the accuracy of 0.1 mm. Software used is SPSS -23

Results:

60 skulls (120 sides) – both right and left were studied. Most commonly observed shape of IOF is semilunar 38 % on right side, 42% on left side, transversely oval 20% on right side, 26% on left side, vertically oval 17% on right side, 10% on left side, and circular 15on right side, 7% on left side, and triangular 9% on right side 13% on left side. (Figure 1) Direction of IOF is 81% medially downwards, 19% downwards. (Figure 2)

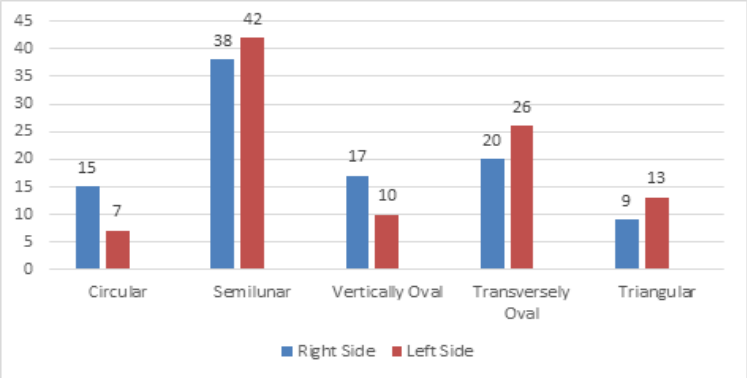

Figure 1: Shape of infraorbital foramen

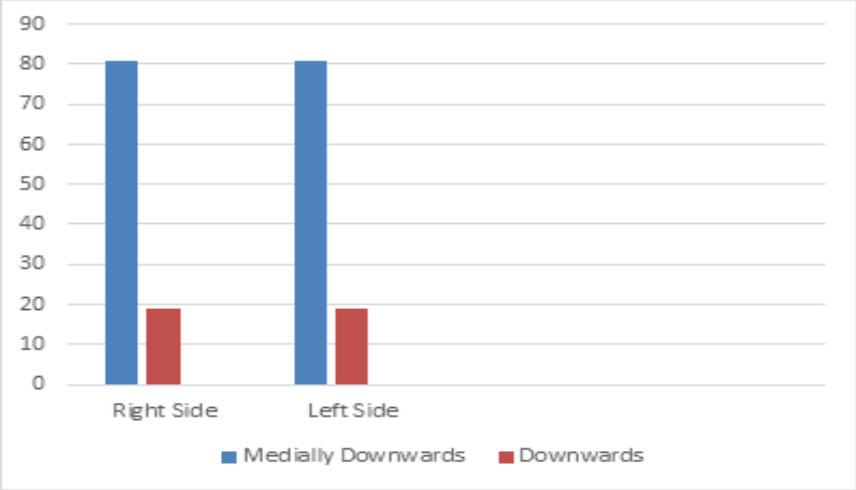

Figure 2: Direction of infraorbital foramen

Accessory IOF were present in 6.6% of skulls bilaterally. They lie medial to the IOF with mean distance between them as 5 mm on right side & 3 mm on left side. (Tables 1 and 2)

Table 1: Number of accessory infraorbital foramen

Types	Right	Left
Single Infraorbital Foramen	60	60
Accessory Infraorbital Foramen	4	4

Table 2: Mean distance between accessory infraorbital foramen and nearby anatomical landmarks

Infra orbital foramen accessory infraorbital Foramen - Mean		Infraorbital margin – Accessory infraorbital foramen Mean		Pyriform aperture – Accessory infraorbital foramen Mean		Anterior nasal spine-Accessory infraorbital foramen Mean	
Right side	Left side	Right side	Left side	Right side	Left side	Right side	Left side
5 mm	3 mm	3 mm	3 mm	8 mm	19 mm	35 mm	34 mm

Discussion:

Infraorbital foramen is located near important anatomical structures like orbit, nose and oral cavity. The location of the infraorbital foramen assumes great importance because an infraorbital nerve block is essential during surgical procedures around the orbit, nose and buccal regions. The most common position of infraorbital foramen is in line of long axis of the second upper premolar. According to Hindy et al [20] 50% of infraorbital foramen was opposite the 2nd maxillary premolar. Varshney et al [21] has reported 64% of infraorbital foramen was opposite the 2nd maxillary premolar. In Tilak Raj et al [22] study, the location of IOF was found in line of second premolar in 81.4% of skulls which was higher than what mentioned by Hindy [20] and Varshney [21].

Regarding the distance between the IOM & IOF mean distance of 6.58 mm on R side, 6.78 mm on left side is similar to Rajeshwari et al [23] and Bahath et al [24] found the lesser dimensions than us. Maoori [25] and Veeramuthu [26] found larger dimensions than us. Nayanakara et al [27] found that IOF is located closer to the IOM on the right compared to the left.

Furthermore, the left side IOF had larger dimensions than the right IOF. This right n left side differences are observed in our study too.

Kadanoff et al. [28] studied 1400 skulls and reported the occurrence of 131 double (9%), 7 triple (0.5%), and 4 greater than three foramina (0.3%) accessory foramina. Berry [29] studied AIOF in skulls from four geographical locations and the incidence of AIOF was reported to be 6.4% and 8.7% in Burmese males and females; 12.5% and 7.9% in North American males and females; 18.2% and 12.5% in Mexican males and females; and 2.2% and 4.8% in English males and females. In the present analysis the incidence of accessory infraorbital foramina was 7.4%. This incidence is comparatively similar to those reported by Tezer et al. [30] and Kazkayasi et al. [31] in Turkish populations. However, higher incidences have been reported in an Indian population (16.25%) by Boopathi et al. [32] and in Mexican males (18.2%) by Berry [29].

Apinhasmit et al [33] observed frequency of accessory infraorbital foramen to be 3.6% in Thai adult population. Alok Kumar Singh et al [34] observed 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). [35]

Conclusion:

Our study results will be of immense help to the surgeons and anesthetists, handling this region for operative procedures. The knowledge of the distances from surgically encountered anatomical landmarks in the present study may assist surgeons to localize the important maxillofacial openings, avoid injury to the neurovascular bundles and facilitate surgical, local and aesthetic and other invasive procedures. The data are of direct relevance to clinical practice and teaching.

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