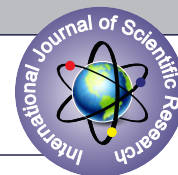


STUDY OF MANDIBULAR FORAMEN IN RELATION TO VARIOUS LANDMARKS ON RAMUS OF MANDIBLE ALONG WITH ITS CLINICAL SIGNIFICANCE IN TELANGANA REGION.



Anatomy

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ABSTRACT

INTRODUCTION: The mandibular foramen is a landmark for procedures like inferior alveolar nerve block, mandibular implant treatment, and mandibular osteotomies. Nerve block is very commonly given in various dental procedures like removal of third molar tooth, periapical abscess, dental pain, painful procedures on mandible or lower lip or chin. There are chances of failure of Inferior Alveolar Nerve block due to variations in position of mandibular foramen. So, it is very essential to know the anatomy of mandible particularly mandibular foramen which is situated just above the centre of medial surface of the ramus of mandible as it gives passage to Inferior Alveolar Nerve and Vessels, supplying teeth of lower jaw. **AIM AND OBJECTIVES:** The present study was conducted to identify the precise location of the mandibular foramen in human dry adult mandibles along with its clinical significance in Telangana. **MATERIALS AND METHODS:** The study was conducted on 50 dry human adult mandibles in the Department of Anatomy, Osmania Medical College, Koti, Hyderabad. Various parameters like Distance of mandibular foramen from Anterior Border and Posterior Border of Ramus, Mandibular Notch and Base of Mandible of both Right and Left sides were calculated by using Vernier Calipers and were evaluated statistically. **RESULTS:** The study shows mean distance of mandibular foramen to anterior border of ramus was 15.41 ± 1.8 mm on right side and 15.32 ± 1.5 mm on left side, to posterior border of ramus was 10.38 ± 1.6 mm on right side and 10.06 ± 1.8 mm on left side, to mandibular notch was 17.51 ± 2.1 mm on right side and 17.64 ± 2.3 mm on left side, base of mandible was 27.9 ± 1.9 mm on right side and 27.96 ± 2.1 mm on left side, breadth of the ramus from anterior to posterior border was 25.83 ± 2.7 mm on right side and 25.45 ± 2.6 mm on left side. **CONCLUSION:** The Anatomical knowledge of mandibular foramen is clinically important for useful to the maxillofacial surgeons, oncologists and radiologists in providing information for successful Inferior Alveolar Nerve block during various dental procedures and surgeries.

KEYWORDS

Mandible, Mandibular Foramen, Mandibular Notch, Inferior Alveolar Nerve Block

INTRODUCTION

The mandibular foramen is an irregular foramen located a little above the centre of the medial surface of the mandibular ramus. The mandibular canal runs obliquely downwards in the body of mandible and opens at the mental foramen. The anterior margin of mandibular foramen is marked by a tongue-shaped projection known as Lingula.

The inferior alveolar nerve is the terminal branch of posterior division of mandibular nerve. It along with inferior alveolar vessels pass through the mandibular foramen and traverse the mandibular canal and divides into mental and incisive branches to supply the mandibular teeth and participates in the formation of the anterior loop.

Inferior alveolar nerve block is a common local anaesthetic technique used in anaesthesia, dentoalveolar surgery planning, and endodontic treatments. But the failure rate of this technique is reported to be as high as 20%–25%. The commonest cause for inferior alveolar nerve block failure is inaccurate localization of mandibular foramen. The main complications during this technique are haemorrhage, injury to the neurovascular bundle, fractures, and necrosis of mandibular ramus. Hence, thorough knowledge of the mandibular foramen is very essential.

MATERIAL AND METHODS

The present study was conducted on 50 dry human adult mandibles in the Department of Anatomy, Osmania Medical College, Koti, Hyderabad. This study included fully ossified, dried, cleaned mandibles only. Broken and deformed mandibles were excluded from the study.

To precisely locate the mandibular foramen, the following parameters were measured on both sides of the mandible:

- (1) AB-MF: distance from the midpoint of anterior margin of Mandibular foramen to the nearest point on the anterior border of the ramus of mandible.
- (2) PB-MF: distance from the midpoint of posterior margin of mandibular foramen to the nearest point on the posterior border of the ramus of mandible.
- (3) MF-MN: distance from the lowest point of mandibular notch to the inferior limit of mandibular foramen.
- (4) MF-MB: distance from inferior limit of Mandibular foramen to the base of the mandible.
- (5) AB-PB: breadth of the ramus from anterior to posterior border.

The quadrant where mandibular foramen was located horizontally, was obtained by identifying the distance between the anterior border of the mandibular ramus and the midpoint of the mandibular foramen opening hole, calculated by subtracting, from AB-PB, the sum of the distances AB-MF and PB-MF. The result yields the width of mandibular foramen. This distance was divided into halves to determine the midpoint of the mandibular foramen opening hole, and added to distance AB-MF. It was then calculated, in percentage, how much the distance between anterior border of the ramus and the midpoint of mandibular foramen represented in relation to the total width of the ramus (AB-PB). This value indicated in which quadrant mandibular foramen was in an anteroposterior location.

In the vertical direction, the quadrant on which Mandibular foramen was located was identified by calculating how much MF-MN represented, in percentage of the addition of MF-MN and MF-MB distance.

All dimensions were measured with the help of Vernier Calipers in an accuracy of 0.01mm. All measurements were repeated twice to eliminate observer bias. The data was compiled and analysed statistically using Microsoft Excel Software.

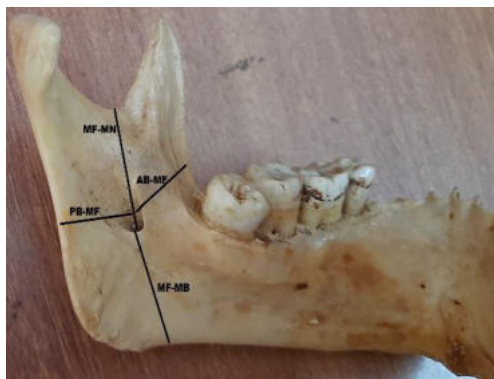


Fig: Medial surface of mandibular ramus showing measurements taken from various landmarks to determine the position of the mandibular foramen.



Fig: Measurement of parameters with Vernier Calipers

RESULTS

A total of 50 adult human mandibles were studied for the position of mandibular foramen. The minimum, maximum, average, and standard deviation values of the various parameters which were studied on either side of the mandible are shown in Table 1. There was no statistically significant difference between the values obtained on the right and left sides ($P>0.05$).

Table 1. Distance of mandibular foramen (MF) from various mandibular landmarks on the right and left sides

Measurement	Right side (mm)	Left side (mm)
AB-MF	15.41±1.8	15.32±1.5
PB-MF	10.38±1.6	10.06±1.8
MF-MN	17.51±2.1	17.64±2.3
MF-MB	27.9±1.9	27.96±2.1
AB-PB	25.83±2.7	25.45±2.6

Values are presented as mean±SD.

AB-MF, distance from midpoint of anterior margin of mandibular foramen to the nearest point on anterior border of ramus; PB-MF, distance from midpoint of posterior margin of mandibular foramen to the nearest point on posterior border of ramus; MF-MN, distance from mandibular notch to inferior limit of mandibular foramen; MF-MB, distance from Mandibular Base to inferior limit of mandibular foramen; AB-PB, distance from anterior to posterior border of ramus.

Localization of mandibular foramen in anteroposterior and superoinferior axis of the ramus of mandible:

The percentile of the distance from anterior border of ramus to midpoint of mandibular foramen in relation to the distance from anterior to posterior border of ramus on the right side was 56.69±3.34% and on the left side it was 63.1±2.45%. The percentile of distance MF-MN in relation to MF-MN+ MF-MB was 48.87±3.73% on the right side and 44.51±4.9% on the left side (Table 2). There was no statistically significant difference in the location of mandibular foramen on the right and left sides ($P>0.05$) in both the anteroposterior

axis and superoinferior axis.

Table 2. Percentile of the distance from anterior border of ramus to midpoint of mandibular foramen in relation to the AB-PB, percentile of distance MF-MN in relation to MF-MN+MF-MB and quadrant of mandibular foramen localization on anteroposterior and superoinferior axis of mandibular ramus on both sides

Side	Anteroposterior localization (%)	Superoinferior localization (%)
Right side	56.69±3.34%	48.87±3.73%
Left side	63.1±2.45%	44.51±4.9%

Values are presented as mean±SD. AB-PB, distance from anterior to posterior border of ramus; MF-MN, distance from mandibular notch to inferior limit of mandibular foramen; MF-MB, distance from mandibular base to inferior limit of mandibular foramen.

DISCUSSION

The location of the mandibular foramen is essential for mandibular surgeries like vertical ramus osteotomy, inverted L osteotomy and also aesthetic surgeries for dentofacial deformities. The inferior alveolar nerve is at a greater risk during these surgical procedures. There are variations in the values obtained in each of the studies and the values are compared with the results of the present study in Table 3.

Table 3. Comparison of results of different studies on localization of mandibular foramen on right and left sides

Author	Population	Right side AB-MF (mm)	Left side AB-MF (mm)	Right side PB-MF (mm)	Left side PB-MF (mm)	Right side MF-MN (mm)	Left side MF-MN (mm)
Oguz and Bozkir	Turkey	16.9	16.78	14.09	14.37	22.37	22.17
Ennes and Medeiros	Brazil	9.4±2.03	6.9±2.06	8.6±1.2	8.4±1.77	18.3±3.25	17.5±3.37
Prado et al.	Brazil	19.2±3.6	18.8±3.8	14.2±2.4	13.9±2.6	23.6±3.1	23.1±3.0
Samanta and Kharb	India	15.7±2.9	16.2±2.8	13.2±1.7	12.7±2.0	22.7±3.0	22.2±2.9
Raghavendra and Benjamin	India	16.2±2.1	16.6±2.3	11.±2.3	11.1±2.3	21.3±3.9	20.9±3.3
Present study	Telangana	15.4±1.8	15.3±1.5	10.3±1.6	10.1±1.8	17.5±2.1	17.6±2.3

CONCLUSION

The precise localization of mandibular foramen is very important to achieve a successful inferior alveolar nerve block, prior to dental surgeries in the lower jaw like osteotomy, orthognathic reconstruction surgeries of the mandible and dental implant procedures, and also to avoid injury to the neurovascular contents passing through it.

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