

Importance of Localization of the Mandibular Foramen for Inferior Alveolar Nerve Block in a Tertiary Care Hospital

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Abstract: ***Background:** The location of mandibular foramen (MF) is a significant anatomical landmark for efficient anaesthesia in many procedures, including dental extraction from the lower jaw and putting mandibular implants. Numerous causes have been examined in this context, and the uncertainty success rate of inferior alveolar nerve block is extremely less due to incorrect localization of the mandibular foramen leading to inappropriate position of the needle. **Objective:** The current study has been conducted on dry mandibles to decide the exact location of mandibular foramen from different landmarks of mandible to provide with the appropriate data to help the surgeons to place the Mandibular foramen with more correctness for doing well Inferior Alveolar Nerve block. **Materials and Methods:** The study was carried out in the department of anatomy, GITAM medical college. A total of 100 dry mandibles were studied on its both sides to locate the mandibular foramen using digital Vernier callipers. **Results:** The Mean and standard deviation values on right and left sides of the mandibles to locate the mandibular foramen from its anterior border are 17.12(±2.69), 18.01(±2.61), posterior border 11.49(±2.01), 11.39(±2.61), Mandibular notch 23.05(±3.60), 24.02(±3.68), angle of Mandible 24.07(±4.82), 24.03(±4.66) and 3M-third molar to mandibular foramen 18.03(±3.68), 16.8(±3.66) respectively. **Conclusion:** The sympathetic of the landmarks for position of mandibular foramen and frequency of variations like incidence of accessory mandibular foramen is of a considerable significance for the surgeons, oncologists and radiologists to carry out successful inferior alveolar nerve anaesthesia, dento alveolar surgeries, endodontic treatments and lesions diagnosis and prevent the injure of neurovascular structures transient through it and thus the complications occurred as an outcome of it.*

Keywords: Anaesthesia, alveolar nerve, Mandibular foramen, Mandible.

1. Introduction

The mandibular foramen (MF) is an aperture on the internal surface of the ramus for divisions of the mandibular vessels and nerve to pass. The mandibular canal starts at the mandibular foramen and descends at an angle forward in the ramus, and afterward in the body of bone containing the inferior alveolar neurovascular bundle.(1) The asymmetrical mandibular foramen is seen slightly above the centre on the medial plane of the ramus of the mandible curving downwards and onward in the body as mandibular canal till it opens as mental foramen.1 The inferior alveolar vessels and nerves passes through the mandibular foramen and canal to supply mandibular teeth and comes out through the mental foramen as mental vessels and nerves.(2) Anaesthesia in the mandible might be associated with diverse complexities. To make inferior nerve block more effective the anaesthetic agent has to be infiltrated closer to the mandibular foramen (3). The success of this procedure depends on the nearness involving the anaesthetic needle and the mandibular foramen,(4) Imperfections in the attainment of the anaesthesia of the lower alveolar nerve must usually due to the lack of observation of the localization of the mandible foramen, noticing them its variations.(5) Numerous articles in the literature describe the anatomic structures relevant to successful mandibular anaesthesia, but failures in this technique still persist.(6) mandibular, mental and lingual foramina in the mandible(5) which indicates the presence of additional branches of inferior alveolar nerves or vessels and possibly is responsible for the failure of IAN block sometimes.(7) Some

authors have predicted the failure rate of inferior alveolar nerve blocks to be about 20–25. Very in short supply literature is available on the exact landmark regarding the position of the mandibular foramen 8-10. For this reason, this study was undertaken to determine the position of the MF from various anatomical landmarks and study the occurrence of accessory MF in dry adult mandibles and provide significant data to the dental students and surgeons dealing with inferior nerve block.

2. Aims and Objectives

The purpose of this study been carried out on dry mandibles to establish the correct location of mandibular foramen from various landmarks; anterior border of ramus, posterior border of ramus, mandibular notch, angle of mandible and from Posterior border of the socket for the third molar tooth to endow with the suitable data to help the dentists and surgeons to locate the Mandibular foramen with more precision for successful Inferior Alveolar Nerve block. In this study we have also experiential for the presence of accessory mandibular foramen on both sides of the mandible.

3. Materials and Methods

This study was carried out in department of anatomy, GITAM institute of Medical sciences and research, Visakhapatnam. A total number of 100 dry mandibles were studied on its both sides for the location of mandibular foramen. Digital Vernier Callipers of 0.001mm accuracy

was used for taking measurements. The measurements were taken by two different people and mean of it was taken to remove observer's bias. Measurements were recorded to the nearest millimetre. Inclusion criteria: mandibles with sockets for 3rd molar tooth was selected. The position of the centre of mandibular foramen was measured and recorded from various landmarks like (fig:1)

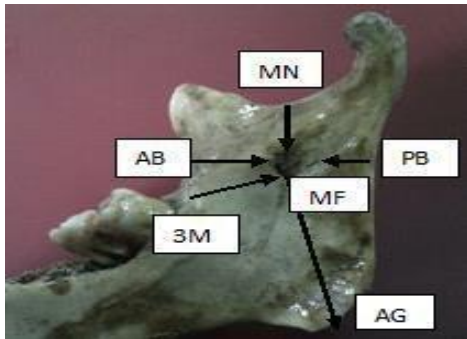


Figure 1: Showing the distance of the mandibular foramen from various landmarks.

AB-MF: Nearest point on the anterior border of the ramus of mandible to the midpoint of the anterior margin of mandibular foramen. PB-MF: Nearest point on the posterior border of the ramus of the mandible to the midpoint of the posterior margin of mandibular foramen. MNMF: Lowest point of the mandibular notch to the midpoint of the upper margin of mandibular foramen. AG-MF: Farthest point on the angle of the mandible to the midpoint of the inferior margin of mandibular foramen. 3M-MF: Posterior border of the socket for the third molar tooth. The mandibles were also observed for the presence of accessory mandibular foramen surrounding the mandibular foramen on the medial side of the ramus and noted by naked eye observation.

4. Observations and Results

The outcomes of the studies are shown in table 1 and table 2. The mean distance of right and left mandibular foramen from anterior border is 17.12 and 18.01 respectively. The mean distance of right and left MF from posterior border is 10.82 each. The mean distance of right and left MF from mandibular notch is 23.05 and 24.02 respectively. The mean distance of right and left MF from angle of the mandible is 24.07 and 24.04 respectively. The mean distance of right and left MF from 3rd molar is 18.03 and 16.8 respectively. These values tell us that mandibular foramen is situated almost at the same distance on both the sides.

Measurement	Side	Min (mm)	Max (mm)	Mean (mm)	SD
AB-MF	Right	8.1	24.2	17.12	2.63
	Left	7.8	25.1	18.01	2.61
PB-MF	Right	7.03	17.9	11.49	2.01
	Left	8.01	20.11	11.39	2.61
MN-MF	Right	12.84	38.02	23.05	3.6
	Left	13.98	33.2	24.02	3.68
AG-MF	Right	12.89	33.9	24.07	4.82
	Left	12.91	36.06	24.03	4.66
3M-MF	Right	10.82	32.2	18.03	3.68
	Left	11.76	32.95	16.8	3.66

Table 2 shows out of 100 mandibles studied, accessory mandibular foramina were found bilaterally in 14%, unilaterally on right side in 23% and left side in 22% of bones.

Table 2: Showing the accessory mandibular foramina observed.

AMF	Number	Percentage
Bilateral	14	14%
Right	23	23%
Left	22	22%

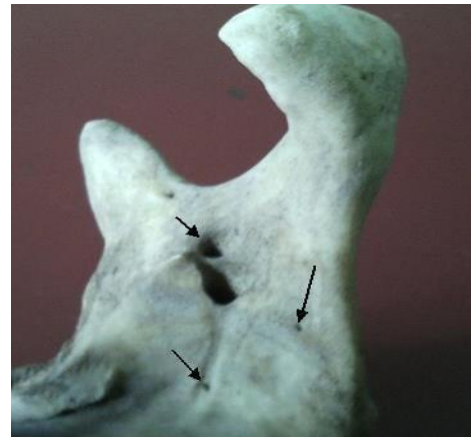


Figure 2: Showing the accessory mandibular foramen

5. Discussion

The comprehension of the MF is of a extensive significance for inferior alveolar nerve anaesthesia, dento alveolar surgeries, endodontic treatments and lesions diagnosis. Its defined position enables a more effective anaesthesia. Inaccurate estimations of its position might be the cause for the ineffective anaesthesia of the inferior alveolar nerve (11,12). One of the most frequent rationale for the not a success in the practice of inferior nerve block is due to the lack of the nearness among anaesthetic needle and mandibular foramen and accordingly the inaccurate localization of the structures of the mandibular foramen (13). Post-operative complications of implant surgery on mandible can damage the inferior alveolar nerve leading to sensory disturbances causing unintentional biting of tongue, lip or cheek: drooling of saliva; pain during mastication and haemorrhage of inferior alveolar artery and its branches (14). There are many anonymous accessory foramina present particularly on the lingual side of the mandible, which vary in their distribution and play a significant role in relation to the effectiveness of local anaesthetic drugs administered for dental procedures (15). The accessory mandibular foramen has gained importance among the radiotherapists while planning radiation therapy as it can give way for the spread of tumour cells following the radiotherapy. Hence the knowledge of the additional foramina is very important (16). Various parameters have been studied by various authors to locate mandibular foramen. Hayward J in 1977 conducted a study on 45 Asian skulls and 62 mixed skulls of Black and white Americans and reported that the mean size of anterior portion is greater than the posterior portion of the ramus, lingula is present on the ant part of the foramen. The mandibular foramen is located in the third quadrant anteroposterior. There was no right- or left-side dominance

in the ramus size and position of the mandibular foramen (17). Nicholson's concluded from his studies on 80 dry bones that the position of the MF was variable which was responsible for the occasional failure in IAN Block (13) The present study shows that the mean and standard deviation values on right and left sides of the mandibles to locate the mandibular foramen from its anterior border are 17.12(\pm 2.69), 18.01(\pm 2.61), posterior border 11.49(\pm 2.01), 11.39(\pm 2.61), Mandibular notch 23.05(\pm 3.60), 24.02(\pm 3.68), angle of Mandible 24.07(\pm 4.82), 24.03(\pm 4.66) and 3M-third molar to mandibular foramen 18.03(\pm 3.68), 16.8(\pm 3.66) respectively. These values tell us that mandibular foramen is situated at bilateral symmetrical distance on both the sides. Similar results have been found with the other authors. The studies conducted on accessory Mandibular foramina are especially a small number of. In 2011 Murlimanju et.al conducted a study on 67 mandibles and concluded the presence of 16.4% of AMF of which 8.9% unilateral and 7.5% bilateral. In 2012 Freire et.al conducted a study on Brazilian population and reported the presence of 27.93% and 43.24% of AMF above and below the mandibular foramen. In 2013 Prajna conducted a study on 60 mandibles and said that 16.66% of the mandibles have AMF.(17-19) In our study we observed 100 mandibles and found accessory mandibular foramen in 47% of the bones out of which 22% on right side, 23% on left side and 14% bilateral. This important occurrence of MF explains the not a success of anaesthesia of inferior alveolar nerve.

6. Conclusion

The sympathetic of the landmarks for position of mandibular foramen and frequency of variations like incidence of accessory mandibular foramen is of a considerable significance for the surgeons, oncologists and radiologists to carry out successful inferior alveolar nerve anaesthesia, dento alveolar surgeries, endodontic treatments and lesions diagnosis and prevent the injure of neurovascular structures transient through it and thus the complications occurred as a outcome of it.

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