

Original article:

A morphometric study of mandibular foramen and incidence of accessory mandibular foramen in dry adult human mandible and its clinical significance

Maitrayee Mondal, Paramita Mukhopadhyay

Department of Anatomy, North Bengal Medical College and Hospital , Sushrut Nagar, Darjeeling

Corresponding author: Paramita Mukhopadhyay

Abstract

The medial surface of the ramus of the mandible nearly close to the center presents a mandibular foramen which leads into a canal in the body of the mandible. Inferior alveolar vessels and nerve branch of posterior trunk of mandibular nerve passes through this foramen. This foramen leads downwards and forwards within the body of the mandible into a mandibular canal. Inferior alveolar nerve block is a common procedure in surgery for dental operations and operations of the mandible like mandibular implant treatment and osteotomies and teeth extraction. Aim of our study is to find exact location of the mandibular foramen from 30 dry human mandible, on both right and left side i.e. total 60 measurements were taken. The present study also aims to find the incidence of accessory mandible foramen its location and distance from mandibular foramen which maybe the cause of failure of anesthetic techniques and also complications. Angle of the mandible was measured with the help of Goniometer. This study will add to data and provide information about source of morphometric parameters of mandible.

Key Words: Mandibular foramen, Accessory Mandibular foramen, Gonion

Introduction

Mandibular foramen which is situated close to the center of the medial surface of the ramus of the mandible forms a canal in the body of the mandible through which passes inferior alveolar vessels and nerves which are very vital in the anesthetic procedure in dental surgery. ^[1,2,3] The position of the mandibular foramen varies in different ethnic groups and variations from cranio facial growth ^[4]. A knowledge of the position from different anatomical parameters is essential for maxillofacial, dental surgeons, oncologist and radiologists. The incidence of accessory mandibular foramen was also noted which accounted for many failures in anesthetic techniques of dental surgeons and the failure rates were as high as 10-39% ^[5,6].

Aims and objectives

To study the variation of position of mandibular foramen of dry adult human mandible and incidence of accessory mandibular foramen. To measure the width of the ramus of mandible and locate the position of mandibular foramen from different anatomical landmarks.

Materials and methods

The present study was conducted in North Bengal Medical College and hospital in Anatomy Department, Shushrutnagar, Darjeeling. 30 dry human mandibles of unknown age and sex were collected. Both right and left side of each mandible was studied i.e. total 60 sides. Damaged bones were excluded from the study and those bones that were intact, had socket for 3rd molar tooth were collected.

Data was collected with the aid of

1. Sliding Vernier caliper
2. Magnifying glass
3. Probe
4. Goniometer

With the help of probe and with the aid of magnifying glass accessory mandibular foramen was observed. Accessory mandibular foramen were those other than mental, accessory mental foramen, lingual or retromolar foramen^[7]. Accessory mandibular foramen were identified as probe did not pass through the mandibular canal.

Measurements of the following parameters were taken.

1. MF-AB
2. MF-PB
3. MF-MN
4. MF-MB
5. Angle of mandible (Gonion)
6. AB-PB
7. MF-AG

MF-AB : Was measured which was the distance from nearest anterior border (external oblique line) of mandibular ramus to the midpoint of anterior margin of mandibular foramen.

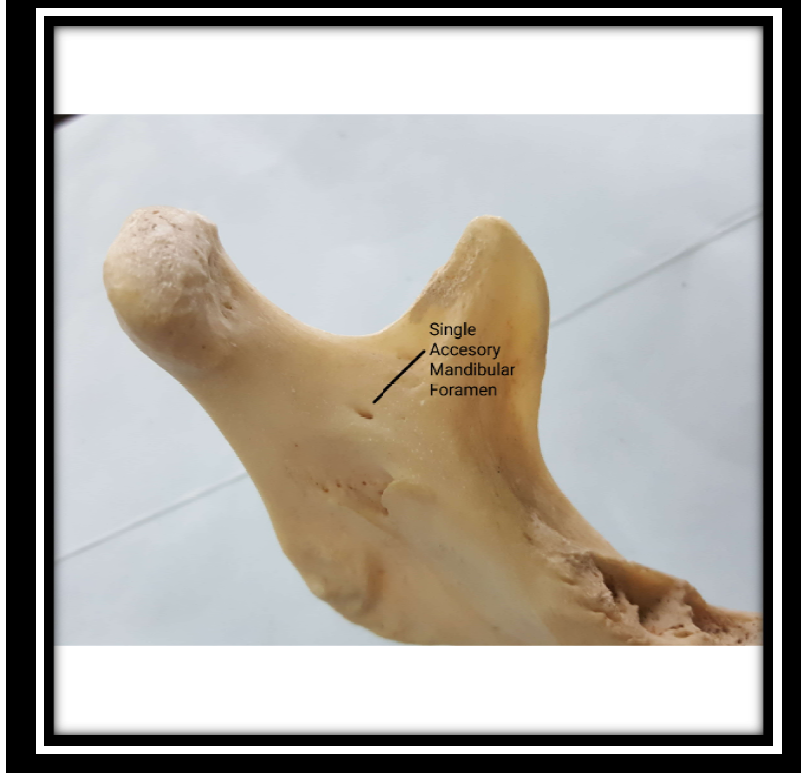
MF-PB : Was measured from the midpoint of posterior point of the mandibular ramus to the nearest point on posterior border of mandibular ramus.

MF-MN: It was measured from the lowest limit of mandibular notch to upper limit of mandibular foramen.

MF-AG: The distance of inferior limit of mandibular foramen to the farthest point of the angle of mandible.

MF-MB : Was measured from upper border of mandibular foramen to the nearest lower border of base of mandible.

Gonion : The angle of the mandible was measured with the help of goniometer. Data was collected in a tabulated sheet and statistically analyzed.





Observation and results

Table 1

Measurements in millimeter from the mandibular foramen to the various landmarks of the mandible

Measurements	Side	Range	Mean	SD
MF-AB	Rt	9	15.86667	2.459792
	Lt	10	16.56667	2.528231
MF-PB	Rt	6	11.4	1.499425
	Lt	5	11.4	1.452703
MF-MB	Rt	11	23	2.665229
	Lt	10	23.3	2.972866
MF-MN	Rt	11	24.06667	2.790789
	Lt	15	23.73333	3.300296
AB-PB	Rt	11	29.96667	2.953471
	Lt	11	30.33333	3.009563
Gonion	Rt	33	121.4333	6.279047
	Lt	32	123.9667	6.930608
MF-AG	Rt	15	20.8	3.02176
	Lt	13	20.56667	3.28721

Table 2

Width of the ramus of mandible in mm

Side	Number	Range	Mean	SD
Right	30	11	29.96667	2.953471
Left	30	11	30.33333	3.009563

Table 3

Incidence of accessory mandibular foramen

	Right	Left	Number	%
Single unilateral accessory foramen	0	6	6	20%
Bilateral single foramen			20	66.667%
Double accessory mandibular foramen	1		1	3.333%
Absent accessory foramen			3	10%

Table 4

Width of mandibular foramen in mm

Number	Right Side (mm)	Left Side (mm)
1	2	2
2	4	2
3	3	3
4	2	2
5	2	3
6	3	2
7	4	4
8	2	2
9	3	2
10	3	2
11	2	2
12	3	2
13	2	3
14	3	2
15	3	2
16	2	2
17	3	2
18	2	3
19	3	2
20	2	3
21	3	2
22	2	2
23	3	2
24	3	2
25	4	2
26	2	2
27	3	3
28	3	4

29	3	2
30	2	3

Discussion

The position of the mandibular foramen differs in different ethnic groups^[8]. It is of great importance in dental procedures and the incidence of accessory mandibular foramen is also important because it accounts for a number of failures rates in anesthetic procedure in dental surgery. So a knowledge and data of the variability is important for dental surgeons, radiologist and oncologist.

In our present study with 30 dry human mandible the mandible foramen was situated at a mean distance of 15.86 mm and 16.56 mm from anterior border of right and left side, and a mean distance of 11.4 mm and 11.4 mm from posterior border. The mean distance from mandibular base was 23 mm and 23.3 mm. In right and left side and from the mandibular notch 24.06 mm and 23.73 mm in right and left side. Our study showed 90% accessory mandibular foramen which was about 95% as stated by V.Janaki^[9]. The accessory mandibular foramen were identified as a probe did not pass through the foramen. 20% of samples showed single unilateral accessory foramen, 66.667% showed single bilateral and 3.333% showed double accessory foramen. Accessory foramen was absent in 10%. The embryological basis of the development of accessory mandibular foramen is stated that initially there are 3 inferior alveolar nerves which supplies the 3 groups of mandibular teeth. Later there is fusion of the nerves and a single inferior alveolar nerve is formed. The failure of fusion of these 3 nerves lead to formation of accessory mandibular canals^[8]. Accessory mandibular foramen may have only blood vessels and devoid of sensory component which hampers the nerve block and accounts for the anesthetic failure.

The average angle of gonion in our study is 122.7°Where as it is 125.6° as stated by Jussura et al and 117.47° as stated by R. Shalini et al. It is stated by Jussarapexioto et al that Go angle is related to AP width of mandibular ramus and to the distance between MF and MB in an inversely proportional relation. Individuals with wider Go angle requires inferior alveolar nerve block with a puncture lower than the conventional one and with a smaller Go angle with a block and puncture higher than the routine one.

Conclusion

The present study will add to data regarding the position of mandibular foramen from different morphometric parameters and incidence of accessory mandibular foramen. A knowledge of it is essential for dental surgeons, radiologist and oncologist^[10,11,12]

Bibliography:

- 1) Shaikh Amjad, Zuberi HR, Azhar Ahmed S. Study of mandibular foramen from different bony landmarks in dry Human mandibles. IP Indian Journal of Anatomy and Surgery of Head, Neck and Brain. April – June 2018; 4 (2) : 40-43.
- 2) Standring S. from Gray's Anatomy, The anatomical basis of clinical practice, 40th edition. Churchill livingstone, Elseiver. 2008 Chapter 31; 530-533
- 3) DATTA A.K. Essentials of Human Osteology. January 1997. The Mandible 132-138
- 4) Jussara Peixoto Ennes and Rafael Monteiro de Mdeiros. Localization of Mandibular foramen and clinical implications. Inter J. Morphol. 2009; 27 (4) : 1305 – 1311.
- 5) Kasat PA, Shyam Kishore K, Bhuiyan PS, Bhosale Y. A study of anatomical variations in the Dry Adult Human mandible. Indian Journal of Clinical Anatomy and Physiology. April – June , 2017; 4 (2) : 136 – 143.

- 6) Shalini R, Ravi Varman C, Manoranjitham R, Veramuthu M. Morphometric study on Mandibular foramen and incidence of accessory mandibular foramen in mandibles of South Indian population and its clinical implication in inferior alveolar nerve block. *Anat cell Biol.* 2016 49 (4) : 241 – 248.
- 7) Pranja Paramita Samanta, Poonam Kharb Morphometric analysis of mandibular foramen and incidence of accessory mandibular foramina in adult human mandibles of an Indian population. *Rev Arg de Anat Clin;* 2013;5 (2) 60 – 66.
- 8) Padmavathi G, Suman Tiwari, Varalakohmi K.L, Roopashree R. An anatomical study of Mandibular and accessory mandibular foramen in dry adult human mandibles of South Indian origin. *IOSR Journal of Dental and Medical Sciences* April 2014; Volume 13, Issue 4 Ver II Pg. 83-88.
- 9) V. Janaki, A Parna Veda Priya K. Study of Anatomical. Variations of mental foramen in dry adult human mandibles in Telengana region, *International Journal of scientific Research.* May 2017, Vol 6 Issue 5, 598-599.
- 10) Nicholson ML. A study of the Position of the Mandibular Foramen in the adult Human Mandible. *The Anatomical Record* 1985; 212:112.
- 11) Umesh P Modasiya, Sanjay Kumar D Kanani. Study of the lingula in dry human mandibles and its clinical significance. *International journal of Anatomy and Research* 2018, Vol 6 (2.2) : 5218 – 5221
- 12) Shah K, Shah P, Parmar A. Study of the location of the mandibular foramina in Indian dry mandibles. *Global Res Anal.* 2013; 2:128-130