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Original Research Article

A Study of Incidence of Accessory Mandibular Foramina in Dry Human Mandibles of Rajasthan State

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ABSTRACT

Introduction: Any other openings in the mandible other than Mandibular foramen (Mf), sockets of teeth, mental foramen & lingual foramen are known as Accessory Mandibular Foramina (AMf). These foramina may permit the branches of nerve and vessels related with the mandible e.g. the mandibular nerve and inferior alveolar branch of maxillary artery. The local anaesthesia which is used to given during dental extractions might fail, if the branches of Inferior Alveolar Nerve (IAN) pass through these accessory foramina and thus escape the drug. A thorough knowledge of the presence of anatomical variations in human mandible such as the AMf is necessary as it presents various clinical implications. Thus, the objective of this study was to determine the incidence of Accessory Mandibular foramina (AMf) in dry human mandibles of Rajasthan State.

Materials and Methods: Hundred (100) dry human mandibles out of which 79-Dentulous and 21-Edentulous, were studied to find out the incidence of AMF.

Results: It was found that out of 100 mandibles studied, the incidences of AMf were present in 25% mandibles and absent in 75% mandibles. It was present unilaterally- 21% (Dentulous- 18%, Edentulous- 3%) and bilaterally- 4% (Dentulous- 2%, Edentulous- 2%). Also, unilateral AMf frequency was higher than bilateral AMf frequency. A single AMf was seen in 19% (Dentulous- 14%, Edentulous- 5%) but double AMf (all Dentulous) were seen only in 6%.

Conclusion: The anatomical variability of incidence and position of AMf should be considered to avoid nerve damage and incomplete nerve blocks in various surgical procedures.

Key Words: Accessory Mandibular foramina, anaesthesia, incidence, mandible.

INTRODUCTION

The determination of location of Mandibular Foramen (Mf) and the identification of any anatomical variations that relate to it, that is, accessory mandibular foramina and canals, is important to clinicians prior to any surgical interventions. Any other openings in the mandible other than Mf, sockets of teeth, mental foramen and lingual foramen are labelled as Accessory Mandibular foramina (AMf). [1]

The developmental reason for the presence of AMf might lie in the fact that the three IANs develop initially to innervate each of three groups of mandibular teeth. In the later period, there is fusion of the nerves. Incomplete fusion of these three nerves might explain the presence of double mandibular canals. [2]

The presence of two Mf leading to separate mandibular canals on the medial surface of the mandible could have resulted during mesenchymal condensation around the IANs and vessels. Presumably, these two bony canals may have provided two separate channels, one for the IAN and the other for vessels.

This formation was related from its first description with the irrigation and the veined drainage of the temporary teeth´s system and of the alveolar processes in formation. From birth, this canal suffers a gradual obliteration during the first year of life. [3]

The incidence of AMf has been found to be greater on the medial surface than on the lateral surface. [4,5] Many unnamed accessory foramina are present on the lingual side of the mandible which is very variable in their distribution but they are observed more often on the internal surface of the mandible in position above or below the mandibular foramen. [6]

These foramina may permit the branches of nerve and vessels related with the mandible e.g. the mandibular nerve and inferior alveolar branch of maxillary artery. A number of auxiliary nerves to teeth (from facial, mylohyoid, buccal, transverse cutaneous nerve and other nerves) may pass through the AMf. [7]

The AMf are also known to provide the route for tumour spread following radiotherapy. Knowledge of the anatomical details of AMf may then be of significant clinical interest to surgeons and oncologists in clinical practice. [8,9]

AMf may be associated with blood vessels which provide an easy route for the spread of infection. [4]

It has been found in past studies that the presence of AMf on the medial surface makes it more vulnerable to perineural spread following radiotherapy. Thus, the presence of AMf is important for oncologists in planning radiation therapy. [4]

The anatomical variability of incidence and position of AMf should be considered to avoid nerve damage and incomplete nerve blocks in various surgical procedures. These foramina may also be used to give additional local regional anesthesia.

Knowledge of the commonest positions and incidence will be beneficial for oncologists and oro-maxillofacial surgeons in planning graft implants.

Surgeons performing conservative rim resection procedures should keep in mind, tumour involvement in the region of AMf and plan the operative procedures accordingly. [10]

The presence of AMf might be important for orthognathic or reconstructive surgery of the mandible and also during dental implants. [9]

Therefore, the objective of this study was to determine the incidence of Accessory Mandibular foramina (AMf) in dry human mandibles of Rajasthan State.

MATERIALS AND METHODS

The present study was conducted on 100 human mandibles procured from the Department of Anatomy, Mahatma Gandhi Medical College & Hospital, Jaipur, the Department of Anatomy, SMS Medical College & Hospital, Jaipur, the Department of Anatomy, NIMS Medical College & Hospital, Jaipur.

The human mandibles which had sockets for the second and third molar teeth were selected for the study and damaged mandibles were excluded.

The mandibles were examined for the presence of AMf around the Mf on the internal surface of the ramus of the mandible (Fig. 1) with the help of a magnifying lens (Fig.2). If AMf were present, then the numbers of these were categorized in accordance with the side of the mandible.

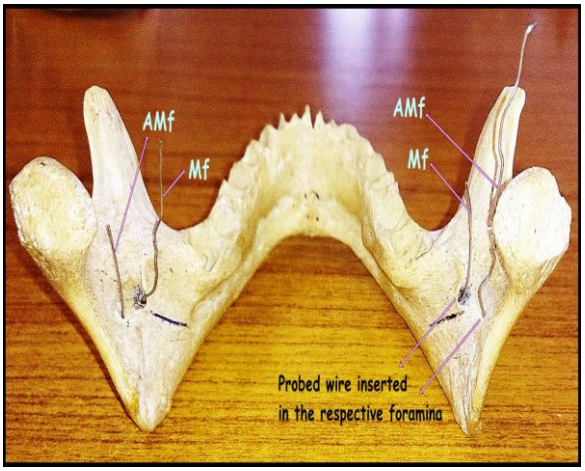

Fig.1:- Picture showing a mandible with inserted probed wires in the Mf and AMf on both the sides of the mandible.

The data was collected and compiled on a standardized table followed by calculation of percentage of all the variants unilaterally as well as bilaterally.

Results of this study were also compared with the reported prevalence in previous studies of other ethnic and geographical areas.

Fig.2:- A Magnifying Lens.

RESULTS

The incidences of AMf around Mf on both sides of the studied mandibles have been depicted in tabulated form in Table 1 whereas Figure 3shows the graphical representation of the observed data.

Table 1:- Incidences (%) of the presence of Accessory Mandibular foramina (AMf) in 100 dry human mandibles.

AMf incidences in the mandibles (%)	Unilateral incidences in mandibles (%)	Bilateral incidences in mandibles (%)	Single AMf incidences in mandibles (%)		Double AMf incidences in AMf (%)	
			19		6	
			No. of Foramina on Right Side	No. of Foramina on Left Side	No. of Foramina on Right Side	No. of Foramina on Left Side
Present (25)	21	4	11	12	4	2
Absent (75)						

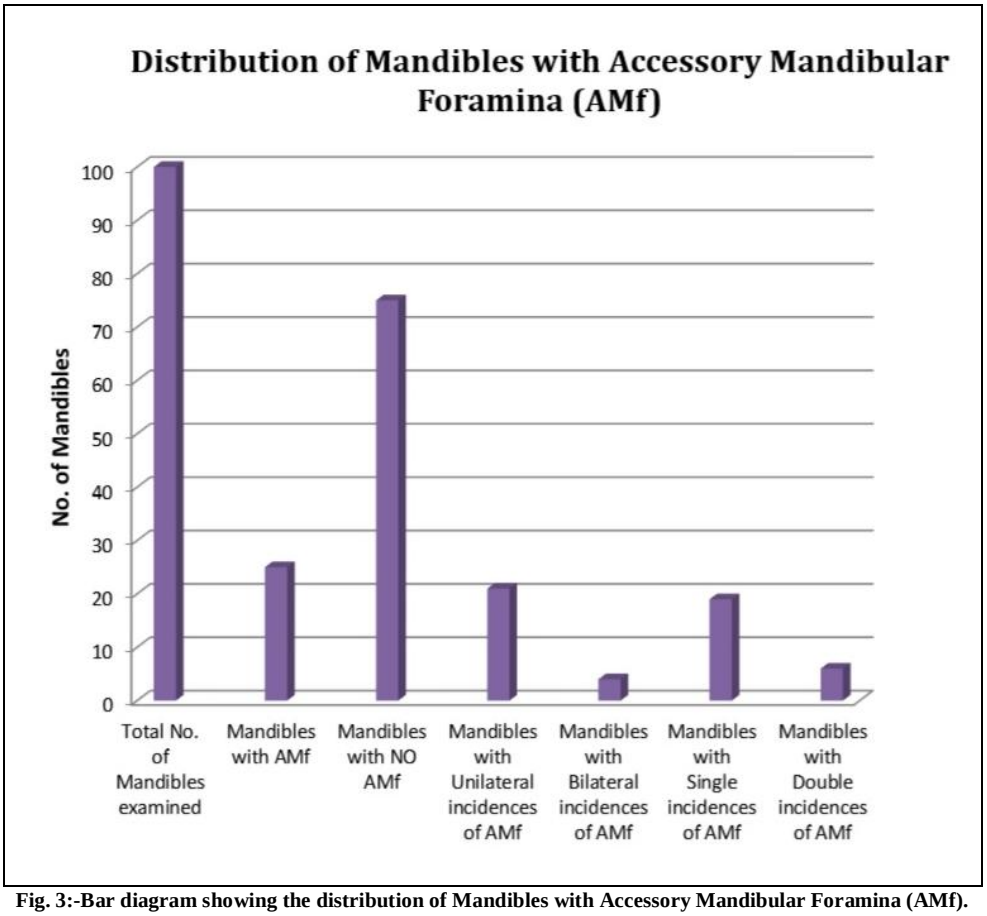

Fig. 3:-Bar diagram showing the distribution of Mandibles with Accessory Mandibular Foramina (AMf).

Table 2:- Comparison of studies on Accessory Mandibular foramina (AMf) by various authors.

Studies conducted by various Authors on AMf	No. of mandibles studied	% of incidence of AMf	% of Unilateral incidences of AMf	% of Bilateral incidences of AMf	% of mandibles	
					Single AMf	Double AMf
Murlimanju et al (2011) [11]	67	16.4	8.9	7.5	13.43	2.99
Freire et al (2012) [12]	222	71.17	47.29	23.87	-	-
Samanta P P et al (2013) [13]	60	16.66	-	-	10	6.66
Gupta et al (2013) [5]	50	48	-	-	-	-
Padmavati G et al (2014) [14]	65	41.5	29.2	12.3	-	-
Singh et al (2014) [15]	28	39.3	17.86	21.43	14.29	3.57
Benjamin et al (2015) [16]	100	9	-	-	6	3
Present study (2015)	100	25	21	4	19	6

It was found that out of 100 mandibles studied, the incidences of AMf were present in 25% mandibles and absent in 75% mandibles. The AMf were present unilaterally in 21% (Dentulous - 18%, Edentulous- 3%) mandibles whereas bilaterally in 4% (Dentulous- 2%, Edentulous- 2%) mandibles. In 19% (Dentulous - 14%, Edentulous- 5%) mandibles, a single AMf (right side- 11%; left side- 12%) was present whereas in 6% (all Dentulous) mandibles, double AMf (right side- 4%; left side- 2%) were present.

DISCUSSION

Reported cases of AMf are very few. Several workers have studied the significance of mandibular accessory foramina as mentioned in Table 2.

According to a study conducted by *Murlimanju et al (2011)* on south Indian population, the AMf were observed in 11 mandibles (16.4%) out of 67 mandibles. They were present unilaterally in 6 (8.9%) mandibles (3 on right side and 3 on left sides) and bilaterally in 5 (7.5%). AMf was single in 9 cases and it was found to be double in 2 cases. Another study conducted by *Freire et al (2012)* on Brazilian population, out of 222 mandibles, 27.93% mandibles had AMf located on medial side, below the Mf and 43.24% had AMf above the Mf. *SamantaP Pet al (2013)'s* study conducted on 60 mandibles from North India, showed that AMf was present in 16.66% of mandibles (single-10% mandibles, double-6.66% mandibles). *Gupta et al (2013)* in her study on 50 mandibles, observed AMf in 48% of mandibles in Punjab region. *Padmavati G et al (2014)* studied 65 adult human mandibles of south Indian origin and incidence of accessory foramina was noted in 41.5% of the mandibles and in 29.2% mandibles it was unilateral and bilateral in 12.3% cases. *Singh and Zaidi et al (2014)* in their study on 28 dry human mandibles in Uttar Pradesh region found that AMf were present in 39.3% of mandibles, bilateral in 21.43% mandibles and unilateral in 17.86% mandibles. The single variant was 14.29%, double variant was 3.57% and triple variant was 3.57%.Another study conducted by *Raghavendra and Benjamin et al (2015)* at Davangere, Karnataka on 100 human dry South Indian mandibles (84- dentulous, 16- edentulous), revealed that the AMf was present in 9% mandibles. In 6% single AMf was present and in 3% double AMf were present.

In the present study, out of 100 mandibles studied, the incidences of AMf were present in 25% mandibles and absent in 75% mandibles. The AMf was present unilaterally in 21% (Dentulous- 18%, Edentulous- 3%) mandibles whereas bilaterally in 4% (Dentulous- 2%, Edentulous- 2%) mandibles. Also, the unilateral AMf frequency was higher than bilateral AMf frequency, which is in conformity with the previous authors except *Singh et al (2014)*, i.e. unilateral- 17.86%, bilateral- 21.43%.In 19% (Dentulous- 14%, Edentulous- 5%) mandibles, a single AMf (right side- 11%; left side- 12%) was present whereas in 6% (all Dentulous) mandibles, double AMf (right side- 4%; left side- 2%) were present. Also, double AMf

frequency was higher than all the authors except *Samanta P P (2013)*, i.e. 6.66%.

Therefore, a proper understanding of the presence or absence of these foramina can provide valuable information regarding the branching pattern of the IAN. When the branches of IAN pass through these accessory foramina, they might escape local anaesthesia and can result in failure of an IAN block. So, dentist and oro-maxillofacial surgeons operating this area should have a prior knowledge of these foramina. [17]

CONCLUSION

The present study concludes that the anatomical variability of incidence and position of accessory foramina should be considered to avoid nerve damage and incomplete nerve blocks in various surgical procedures. It is also beneficial for oncologists and oro-maxillofacial surgeons in planning graft implants. These findings are of great clinical utility in surgical and dental anaesthetic field, regional and racial significances to prevent unwanted spread of infections and tumour cells during radiotherapy via these variants respectively. By pinpointing these anatomical variations, it is possible to take the necessary precautions during surgeries like tooth extraction and avoid damaging the important neurovascular structures.

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