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Original Research Article

STUDY OF DISTRIBUTION OF VARIOUS ACCESSORY FORAMINA IN 100 HUMAN MANDIBLES OF SOUTH INDIA

Vasantha Kuberappa [1], Tanveer Ahamad Khan *[2].

[1] Assistant Professor, Department of Anatomy, Shimoga institute of medical sciences, Shimoga, Karnataka, India.

*[2] Associate Professor, Department of Anatomy, Shimoga institute of medical sciences, Shimoga, Karnataka, India.

ABSTRACT

Introduction: Any unnamed opening is termed as Accessory foramen. Mandible being the strongest bone of the skull is pervaded by many accessory foramina other than mandibular and mental foramen. In the present study accessory mandibular, mental, retromolar and lingual foramina are distinguished and clinical implications are discussed. The presence of such foramina if not identified during clinical practice may cause complications. Hence our study is done to find out the incidence and distribution of various accessory foramina of mandible among South Indians.

Materials and Methods: The study was done on 100 adult dry human mandibles of South Indian origin obtained from first MBBS students. The location and distribution of various accessory foramina were carefully observed, noted and tabulated.

Results: Accessory foramen was found in 93% of mandibles. Accessory lingual foramen was found in 93 mandibles, with supraspinous foramen in 84%, accessory mandibular foramen in 34%, accessory mental foramen in 12% and retromolar foramen in 6%.

Conclusion: Presence of accessory foramina may cause failure of anaesthesia during inferior alveolar nerve block and haemorrhage during mandibular reconstruction surgeries owing to the neurovascular structures passing through these accessory foramina. The clinicians should be aware about the presence of such accessory foramina during the procedures.

KEY WORDS: Accessory foramina, Mandible, Mental foramen, Mandibular reconstruction , Inferior alveolar nerve, Lingual foramen, Retromolar foramen.

Address for Correspondence: Dr Tanveer Ahamed Khan, Associate Professor, Department of Anatomy, Shimoga institute of medical sciences, Shimoga – 577201, Karnataka, India
E-Mail: tanveerahamedkhan46@gmail.com

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INTRODUCTION

Mandible being the largest and strongest bone of the face is the only movable bone of the skull. It has a very rich vascularity and is pervaded by many foramina of different sizes many of which are unnamed and infrequently described. They may transmit auxiliary nerves to the teeth which are significant in dental anaesthetic techniques. Also it may become a pathway for neoplastic cell proliferation in the trabecular bone of the mandible [1].

All unnamed openings in the mandible are called

as Accessory foramina. Accessory mandibular, accessory mental, retromolar and lingual are the various accessory foramina found in the mandible.

Most of the foramina are found on the inner aspect of the mandible and are named as lingual or genial foramen. They may be superior, inferior or lateral to the genial tubercles. The nerve fibres passing through these foramina provide additional innervations to the anterior mandibular teeth [2,3].

Accessory mental foramina are found on the anterior surface of the body of the mandible around the mental foramen and transmit accessory branches of mental nerve. The knowledge of which will prevent injury to the nerves during periapical surgeries.

The mandibular foramen is present above the centre on the medial surface of the ramus of the mandible. Accessory mandibular foramen may be found around the main foramen. It transmits the branches of inferior alveolar nerve. It is also known to provide route for spread of tumour even after radiotherapy.

Retromolar foramen is present in the middle of retromandibular fossa. Posterior to the third molar tooth there is retromolar triangle and retromolar fossa lateral to it. Retromolar foramen receives a canal that arises from mandibular canal. Presence of this foramen results in failure of anaesthesia during inferior alveolar blockade given during extraction of third molar tooth and various mandibular reconstruction surgeries [4].

Accessory foramina are variable in number and distribution. These accessory foramina have a neurovascular bundle, consisting of an artery, vein and a nerve. The nerve fibres present in these foramina provide additional innervations to the mandibular teeth [5]. Not many anatomical books give a detailed information about these accessory foramina. So this study has been carried out to analyse the incidence and distribution of various accessory foramina among South Indians and discuss their clinical implications.

MATERIALS AND METHODS

Dry adult human mandibles of unknown sex and age were collected for our study. Mandibles with deformities were excluded from the study. Also mandibles from unknown sources (procured online) were excluded.

These mandibles were collected from 1st year MBBS students of SIMS, Shimoga during the period of Nov 2018- Jan 2019.

Mandibles were observed carefully for the number and distribution of accessory foramina and noted. Foramina less than 0.5mm were excluded. A probe was used to confirm the presence of foramina.

Fig. 1: Showing accessory mental foramen on right side.

Fig. 2: Showing accessory mandibular foramen on left side.

Fig. 3: Showing bilateral retromolar foramen.

RESULTS

A total of 100 mandibles were collected and carefully observed for the presence and distribution of various accessory foramina. About 93 mandibles had one or the other foramen. Accessory mental, mandibular, lingual and retromolar foramen, when present were noted and tabulated.

Lingual foramina were found in 93% of mandibles, accessory mental foramina in 12%, accessory mandibular foramina in 33% and retromolar foramina in 6% of mandibles.

Table 1: Incidence of accessory foramina in mandibles.

Name of foramina	Number of mandibles (n=100)	Percentage (%)
Lingual	93	93
Accessory mandibular	33	33
Accessory mental	12	12
Retromolar	6	6

Among 33 mandibles which showed accessory mandibular foramina, 21 were on the right side, 18 on the left and 6 were bilateral.

Out of 12 mandibles which had accessory mental foramina, 6 were on the right side and 6 on the left.

Retromolar foramen were seen in 6 mandibles among which it was bilateral in 3, right side in 3, and 6 on the left side.

Table 2 shows that, out of 93 mandibles with accessory lingual foramen, superior genial foramen were found in 83.87%, inferior genial foramen in 48.38%, right lateral in 54.83%, left lateral in 45.16%, bilateral in 38.7% and midline in 16.12%.

Table 2: Different foramina on lingual surface.

Lingual foramina	Number (n=93)	Percentage (%)
Superior	78	83.87
Inferior	45	48.38
Right lateral	51	54.83
Left lateral	42	45.16
Bilateral	36	38.7
Midline	15	16.12

DISCUSSION

Accessory mandibular foramen refers to all unnamed foramina excluding mandibular and mental foramen. Most often accessory foramina are found on the inner or lingual surface of the mandible and are named as lingual foramina. Fuakami et al. in their study considered accessory foramina on the buccal mandibular surface as accessory buccal foramina [6].

Chapnick(1980) reported an incidence of lingual foramina in 68.9% [7]. In our study, 93% of the mandibles had foramina on the lingual surface.

Hofschneider et al. in their study mentioned that the lingual surface of mandible has foramina which are located in the midline as well as laterally [8].In our study midline foramina had an incidence of 16%. Liang et al. reported midline foramen in 98% of cases. In that 72% were single, 22% were double and 4% were triple foramina. The study also confirmed the presence of well defined neurovascular bundle with branches of lingual nerve and artery at the superior genial foramen. Branches of nerve to mylohoid and submental or sublingual artery and veins enter the inferior genial foramen [9].

Studies done on supraspinous foramen by Shiller and Wiswell [10], Sutton [5], Przystanska and Bruska [11], Nagar M et al. [12] and Liang et al. [9] reported an incidence of 88.9%, 85%, 86%, 72% and 62% respectively. The frequency of infraspinous foramen, in a study was 60% [11] and 38% [9], less than that of supraspinous foramen.

In our study, supraspinous foramina were found in 52% and infraspinous in 48%. In 55% they were found on the right side, 45% on the left side and bilateral in 39%. Supraspinous foramen can be used for local anaesthesia administration as it is a constant finding. Lingual foramina are important in anterior dental surgeries, lowering genial spines in edentulous patients, genioplasty and grafting procedures [9].

Accessory mandibular foramina are those identified on the medial aspect of mandibular ramus, posterior to the mandibular foramen and anterior to the posterior margin of mandibular ramus [13].

The presence of accessory mandibular foramen may be one of the causes of anaesthetic failure in the inferior alveolar nerve block [14] which may cause complications in orthognathic and

corrective surgeries on the mandibular ramus. [15].

Like other foramina, presence of accessory mandibular foramina may become a pathway for neoplastic cell proliferation in the trabecular bone of the mandible [16]. The blood vessels passing through these foramina may cause complications like haemorrhage during dental surgeries.

A study by Suazo Galdnes et al. mentioned the presence of accessory mandibular foramina bilaterally in 19.1% and unilaterally in 23.4% [13]. Padmavathi et al. in their study reported an incidence of unilateral accessory MF in 29.2% and bilaterally in 12.3% [17]. Studies done by Shalini et al. and Thangavelu et al. [18] showed an incidence of accessory mandibular foramina in 32.36% and 45.6% respectively. Samantha et al. in their study found accessory mandibular foramina in 16.6% [19]. S.Umayal et al. in their study reported accessory mandibular foramina in 29% on right side and 24% on left side [20].

In our study, accessory mandibular foramina were seen in 34% of the mandibles with an incidence of 64% on right side, 54% on left and bilateral in 18%.

The embryological basis of the occurrence of accessory mandibular foramina is that, initially there will be 3 inferior alveolar nerves which innervate each of the 3 groups of mandibular teeth. Later these nerves fuse to form a single inferior alveolar nerve. Incomplete fusion of these nerves may lead to the development of accessory foramina [21].

Retromolar foramen is located behind the third molar tooth in the retromolar fossa. The retromolar fossa is present between the anterior border of the mandibular ramus and the temporal crest. It transmits neurovascular bundles to the pulp and periodontium of molar teeth [22].

Scheitmann et al.(1967), in their study on retromolar foramen reported an incidence of 72% [23]. In a study done by Rossi AC et al. [24] on 222 Brazilian human mandibles, retromolar foramen were found in 26.58%. Another study done by Sawyer and Keily on 234 mandibles showed an incidence of 7.7% [4]. A study by Ossenberg on Italian population reported an incidence of retromolar foramen to be 8.1% [25]. Kondera and Hashimoto in their study of retromolar foramen on Japanese population reported an incidence of 19.5% [26].

Pinsolle et al. mentioned the route of spread of infection and metastases from oropharynx through retromolar canal as it facilitates the vascular components.

In our study, incidence of retromolar foramen was found to be 6%, among which 50% were bilateral.

Madeira et al, (2010) suggested that the clinician should be cautious during surgical interventions like endodontic treatment, mandibular reconstructions, extraction of third molars and installation of dental implants about the existence of lateral canals and the accessory innervations provided by the retromolar canal [2].

The study of incidence and distribution of retromolar foramen is important to avoid failure of inferior alveolar nerve and buccal nerve block due to the accessory innervations provided through retromolar foramen.

Accessory mental foramina are those present on the perimandibular surface around the mental foramen. Sekerc et al. in their study termed the accessory foramina on the buccal surface of the mandible as accessory mental foramen as they originate from mental foramen.

Nandakumar and Themozhi reported the incidence of accessory mental foramen as 20% in which 13% were on the right side and 10% were on the left side and in 3% it was bilateral [27].

Another study done by Kamath and Shanmathi showed an incidence of accessory mental foramen to be 77%. [28].

The incidence of accessory mental foramen in the present study was found to be 12%, with an incidence of 50% on each side.

Since the clinical implications about the accessory mandibular foramina is extensive and very little is mentioned in most of the anatomical books and literature about its incidence and distribution, the present study was undertaken.

CONCLUSION

Information about the distribution of various

accessory foramina would be helpful for dentists, oromaxillofacial surgeons and oncologists to reduce the complications associated during surgery. Hence this study gives information about the number and distribution of various foramina in the mandible.

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Conflicts of Interests: None

REFERENCES

[1]. Standring S. Gray's Anatomy. The Anatomical Basis of Clinical Practice. 40th ed.Spain:Churchill Livingstone.Elsevier. 2008;978-81.

[2]. Madeira MC, Percinoto C, das Gracas M, Silva M. Clinical significance of supplementary innervation of the lower incisor teeth: A dissection study of the mylohyoid nerve. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1978;46:608-14

[3]. Mcdonnell D, Nouri MR, Todd ME. The mandibular lingual foramen: A consistent arterial foramen in the middle of the mandible. J Anat 1994;184:363-9.

[4]. Sawyer D.R,Keily ML,:Retromolar foramen :A mandibular variant important to dentistry :Annals of Dentistry :50(1):16-18(1991).

[5]. Sutton RN. The practical significance of mandibular accessory foramina. Aust Dent J 1974;19:167-73.

[6]. Fuakami K, Shiozaki K, Mishima A, Shimoda S, Hamada Y,Kobayashi K. Detection of buccal perimandibular neurovascularisation associated with accessory foramina using limited cone-beam computed tomography and gross anatomy. Surg Radiol Anat 2011;33:141-6.

[7]. Chapnick L. A foramen on the lingual of the mandible. J Can Dent Assoc 1989;7:444-5.

[8]. Hofschneider U, Tepper G, Gahleitner A, Ulm C. Assessment of the blood supply to the mental region for reduction of bleeding complications during implant surgery in the interforaminal region. Int J Oral Maxillofac Implants 1999;14:379-83.

[9]. Liang X, Lambrichts I, Corpas L, Politis C, Vrielinck L, Ma GW, et al. Neurovascular disturbance associated with implant placement in the anterior mandible and its surgical implications: Literature review including report of a case. Chin J Dent Res 2008;11:56-64.

[10]. Shiller WR, Wiswell OB. Lingual foramina of the mandible. Anat Rec 1954;119:387-90.

[11]. Przystanska A, Bruska M. Anatomical classification of accessory foramina in human mandibles of adults, infants and foetuses. Anat Sci Int 2012;87:141-9

[12]. Nagar M, Bhardwaj R, Prakash R. Accessory lingual foramen in adult Indian mandibles. J Anat Soc India 2001;50:13-4.

[13]. Galdames ICS, Matamala DAZ, Smith RL. Is the Conduct of Serres an Anatomical Variation in Adults?. Int J Morphol. 2009;27(1):43-7.

[14]. Kaufman E, Serman NJ, Wang PD. Bilateral mandibular accessory foramina and canals: a case report and review of the literature. Dentomaxillofac Radiol. 2000;29(3):170-5.

[15]. Sanchis, JM, Peñarrocha M, Soler F. Bifid mandibular canal. J Oral Maxillofac Surg. 2003;1(4):422-4.

[16]. Fanibunda K, Matthews JN. The relationship between accessory foramina and tumour spread on the medial mandibular surface. J Anat. 2000;196(1):23-9.

[17].Padmavathi G, Tiwari1 S, Varalakshmi KL, Roopashree R. An Anatomical Study of Mandibular and Accessory Mandibular Foramen in Dry Adult Human Mandibles of South Indian Origin. IOSR J Dent Med Sci. 2014;1(13):83-8.

[18]. Thangavelu K, KannanR, Kumar NS, Rethish E, Sabitha s, Sayeeganesh N.Significance of localization of Mandibular foramen in an inferior alveolar nerve block. J Nat Sci Biol Med 2012;3:156-60.

[19]. Samanta PP, Kharb P. Morphometric analysis of mandibular foramen and incidence of accessory mandibular foramina in adult human mandibles of an Indian population. Rev. Argent. Anat. Clin.2013;5(2):60-6.

[20]. Umayal.S, Karthik GM, et al. Morphological study of accessory foramina in the mandible. Drug invention today vol 10:12;2018:2527-2530.

[21]. Chavez –Lomeli ME, Mansilla Lory J, Pompa JA, Kjaer I, The human mandibular canal arises from three separate canals, innervating different tooth groups. J Dental Res 1996;75:1540-4.

[22]. Sicher,H.Oral Anatomy,3rd ed.St Louis.MO,Mosby 1960:

[23]. Schejtman R, Devoto F. C. & Arias N. H. The origin and distribution of the elements of the human mandibular retromolar canal. Arch. Oral Biol. 1967;12(11): 1261-8.

[24]. Rossi A.C, Freire A.R, Prado B.G, Prado F, B.Botacin P.R & Caria P.H.F. Incidencia del foramen retromolar en mandibulas humana: aspectos etnicos y clinicos. Int. J. Morphol., 30(3):1074-1078, 2012.

[25]. Ossenberg .NS,:Retromolar foramen of the human mandible :Am J.Phys Anthropol 1987:73:119-128.

[26]. Kondera H and Hashimoto I. A case of mandibular retromolar canal; elements of nerve and arteries in this canal. Kaibogaku-Zasshi. 1995; 70: 23-30.

[27]. Hafeez N, Thenmozhi. Accessory foramen in the middle cranial fossa. Res J Pharm Tech 2016;9:1880-2.

[28]. Kamath MK, Shanmathi KS. Perception of orthodontics. Int J Orofacial Res 2017;2:5-7.

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