

Mandibular Nerve: Variations & Clinical Relevance

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Gupta K, Dang B, Batra APS. Mandibular nerve: variations & clinical relevance. *Int J Anat Var.* 2021;14(1):42-44.

ABSTRACT

Many anatomy textbooks describe the mandibular nerve. However, its branching and variations are many and inconsistent between individuals. Also the mandibular region that it supplies has its own variants.

Our review article has taken into consideration articles describing these

anomalous innervations by the mandibular nerve and its branches and their clinical relevance. The many variants have been documented after gathering information from all relevant review articles and case reports.

This thorough review of branching and clinical correlation will be helpful for anesthetists, dentists and surgeons to get success of anesthesia, etiology of pathological processes and prevent surgical mishaps.

Key Words: Mandibular nerve, Inferior alveolar nerve, Lingual nerve, Auriculotemporal nerve, Entrapment, Anesthesia

INTRODUCTION

Mandibular nerve is the largest division of the with cranial nerve i.e. trigeminal. It is a mixed nerve and has a large sensory and a small motor root. It comes out of the foramen ovale of the skull.

It then enters the infratemporal fossa, gives two branches –meningeal or nervous spinosus (sensory) and the nerve to medial pterygoid (motor). The meningeal supplies the duramater of the middle cranial fossa and the latter supplies medial pterygoid, tensor tympani and tensor veilpalatine muscles.

It further divides into two– anterior and posterior divisions. The anterior division is mixed and gives rise to 3 motor- mesenteric, nerves to lateral pterygoid and deep temporal branch and a sensory branch- the buccal nerve, which supplies the skin, gums of the cheek and premolars.

The large posterior division later gives rise to 3 branches – auriculotemporal nerve, lingual nerve and inferior alveolar nerve. The auriculotemporal supplies external ear, temporomandibular joint, and skin of the temple and gives secretomotor fibers to parotid gland.

The inferior alveolar gives a mixed branch before it enters the mandibular canal and innervates the mandibular teeth, gums, lips and skin of the chin, after coming out of the mental foramen.

The terminal, smallest branch, lingual nerve, carries general sensation from the anterior 2/3rds of the tongue, floor of mouth and mandibular gum. It also gives parasympathetic supply to the sublingual and submandibular glands.

Embryology

The mandibular nerve supplies the first pharyngeal arch. F-spondin and T-cadherin released by caudal somite are known to cause neural development. Abnormal neural crest migration will lead to nerve variations [1,2].

Variations in Mandibular nerve and its branches

Mandibular nerve and especially its posterior division have many variations.

Inferior alveolar nerve has intra- and extra osseous branches. Intraosseous branches can be in the form of a single trunk, major and minor trunk or 3 and more branches [3]. It can be in the form of type I- single entity or type II –a plexus [4]. It can also be in the form of A= single unbranched nerve, B= series of individual branches to superior border of mandible, C= fine molar plexus and D=proximal and distal nerve plexus [5]. Multiple extra osseous branches can be in the form of the inferior alveolar nerve splitting and then re-uniting before entering the mandibular fossa [6,7]. They may be related to accessory foramen and canals [7].

Variations of the subdivisions of inferior alveolar nerve may also be present.

Mental nerve may have additional branches. It may form a loop before emerging from the mental foramen as studied by Kieser et al. [8] Y- or T-shaped divergence of mental and incisive nerves may occur [8]. Nerve may re-enter the mandible after a short extraosseous course [9,10]. There may be cross innervation of the incisor teeth by the contralateral mental nerve [9-11].

Incisive nerve may have variations in the form of cross innervation of the incisor teeth by the contralateral nerve [12-14].

Mylohyoid nerve may supply the mandibular teeth via accessory retro mental foramen or via a plexus [15-19]. There may even be an accessory mylohyoid nerve, supplying the mandibular teeth [15-20] or the mylohyoid muscle [21]. The nerve may communicate with the inferior alveolar nerve to form a plexus and then supply the mandibular teeth [16]. Madeira demonstrated this supplementary branch in 13 out of 26 cadavers.

Lingual nerve may have variants in the form of its relation with the third molar region based on race, genetic and individual constitution. Presence or absence of teeth, tone of muscles and connective tissue tension has been found to have no relation with its position [22,23]. It may have communications with the inferior alveolar nerve supplying the teeth and lower labial salivary glands as demonstrated by Racz and Khaledpour in 25% and 7% cadavers respectively [24,25]. It may also have communications with the mylohyoid nerve and thus, may supply the anterior tongue as studied by Racz et al. in 33% cases and by Kim et al. in 12.5% cases [24,26,27]. Collateral branches to lingual gingivae around lower third molar and retromolar region may be found [26,28,29].

Auriculotemporal nerve may have upto 5 roots of origin (Komarnitki et al.) [30]. and may have linking with the inferior alveolar nerve as studied by Thotakura et al. [24,25,31-36].

Buccal nerve may have additional innervation of molar teeth via retromolar foramen and may have communication with the inferior alveolar nerve [6,37-39].

Variants in relation to the maxillary artery may be as follows. Inferior alveolar nerve may originate from 2 or 3 roots and maxillary artery may pass between these roots [40-43]. This has been studied by Roy, Khan and Daimi et al. It may pass between a communicating branch of inferior alveolar and auriculotemporal and a root of inferior alveolar nerve [31]. It may pass between root of inferior alveolar and lingual nerve [24-26,44,45]. It may even pierce lingual nerve or a common trunk formed by lingual and inferior alveolar nerves [31,46,47].

Additional supply of the mandibular region by the great auricular nerve (C2,C3) may be present [6,48]. Facial nerve may communicate with auriculotemporal nerve [49]. Communication of all three nerves of posterior

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Received: Oct16, 2020, Accepted: Jan29, 2021, Published: Feb05, 2021



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division of mandibular nerve ie. auriculotemporal, inferior alveolar and lingual nerve may also be present [50].

There may be anatomical variants in the anatomy of the mandibular canal in form of accessory canals- bifid and trifid which may contain nerves or blood vessels [37]. Langlais et al. studied 6000 radiographs and reported 0.95% incidence of bifid mandibular canals. Sanchis reported 0.35% incidence of these canals. Nortje found 0.9% incidence, while Naitoh et al observed bifid canals in 65% of patients and further divided them into retromolar, dental, forward and buccolingual canals. Divisions of the mandibular canal in high, intermediate and low forms may be seen as well in some people.

Apart from the variations in mandibular canals, mandibular foramen may also show deviation from the normal pattern in its location based on age, sex, gender, race and individual. Accessory mandibular foramina have also been found related to bifid inferior alveolar nerve.

Two or three accessory mental foramen related to accessory mental nerves or mental neurovascular bundle have also been seen [37].

Retromental foramen with the mylohyoid nerve exiting out of this foramen [15,17-19] and retromolar foramen with buccal and accessory branches of inferior alveolar nerve innervating the molar teeth is also present in some cadavers as studied by Carter and Keen in 40% of the human mandibles (3 out of 8) [16].

Clinical Significance

Trigeminal neuralgia is pain along distribution of the trigeminal nerve and its branches. Classical trigeminal neuralgia is due to vascular compromise, while, secondary is due to neurological diseases for example multiple sclerosis or tumours [6]. Pterygospinous foramen replacing the foramen ovale could provoke trigeminal neuralgia too [49].

Temporomandibular joint dysfunction (TMD) is a group of conditions that cause pain and joint dysfunction characterised by masticatory muscle pain, capsulitis and internal derangement of the joint. A medially placed disc of this joint can interfere with the lingual and inferior alveolar nerves that pass close to the medial part of the condyle. TMJ surgery can lead to paraesthesia along auriculo temporal nerve [6]. A successful block can relieve this pain. Condylar and subcondylar fractures can lead to lingual and inferior alveolar nerve anaesthesia, an indication for open reduction of the fracture.

Radiation of pain can occur to the ear in case of diseases that involve the auriculotemporal nerve [6]. Ear pain, fluttering sensation and fullness can occur due to tonic tensor tympani syndrome. Increased activity of tensor tympani is noticed in people with hyperacusis [6].

Tumors can occur in the Meckel's cave where the trigeminal ganglion exists and can erode the bone. Brainstem lesions like glioma and infarction can result in Vth nerve symptoms. Less common lesions include metastasis, cavernous hemangiomas, hemorrhage and arteriovenous malformations [49]. Rarely, retrograde extension of the herpes simplex virus can also occur in the trigeminal nerve.

Entrapment of trigeminal nerve in the infratemporal fossa can lead to TMJ dysfunction, persistent idiopathic facial pain (PIFP) and myofascial pain syndrome (MFPS). Mandibular nerve entrapment can occur while passing between medial and lateral pterygoid resulting in pain during chewing and speech, and trigeminal neuralgia. Buccal nerve compression has been reported by hyperactive temporalis muscle leading to neuralgia. Compression of the masseteric nerve anterior to TMJ is found in excessive condylar translation. Compression of auriculotemporal may lead to neuralgia, paresthesia of TMJ and external acoustic meatus. Entrapment of the lingual nerve may lead to weak taste sensations from anterior 2/3rd of the tongue unilaterally and can affect speech articulation. Chronic compression of the nerves results in muscular paresis and swallowing difficulties. Interruption of the post-ganglionic sympathetic efferent fibers can lead to vaso- and sudomotor paralysis, and the skin becomes red and dry. Pain in facial muscles can also occur during entrapment if communicating fibers are found [49].

Anaesthesia of mandibular nerve and its branches is problematic due to its many anatomical and physiological variants [6] and should be taken into consideration in third molar extraction, mandibular surgery, implant placement and osteotomies. Haematomas can form if any vessel is affected during anaesthesia eg. Maxillary artery, inferior alveolar vessel and external carotid and the veins [6]. Pain and trismus can occur if mucosa is torn during anaesthesia. Other reported complications are ptosis, extraocular muscle paralysis, aphonia, necrosis of skin of chin, diplopia, abducent nerve palsy, atrophy of optic nerve and third molar agenesis.

CONCLUSION

For surgeons, dentists and anaesthetists a thorough understanding of the branching pattern and anomalies of the mandibular nerve and its region is necessary and should be carefully considered to treat the patient right.

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