Case Report

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An abnormal communication between the sensory branches of the mandibular nerve

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Abstract:

Variations and communications between the branches of the mandibular nerve in the infra-temporal fossa is quite common in literature, but not all of these variations have been mentioned in standard anatomical and surgical textbooks. Some of these variations are clinically important with regard to various surgical, dental, and anesthetic procedures performed in this region. During the routine dissection of infratemporal fossa for the undergraduates, we found the presence of an abnormal communication between the auriculotemporal nerve and inferior alveolar nerve on the right side and on the left side, the auriculotemporal nerve was found to have three roots of origin, in addition to an anomalous communication between the inferior alveolar nerve and the lingual nerve. The clinical implications of this variation have been discussed in this report which is essential for successful and uncomplicated surgical, dental, and anesthetic procedures.

Keywords:

Auriculotemporal nerve, inferior alveolar nerve, mandibular nerve

Introduction

The trigeminal nerve is the largest cranial nerve. It gives off three branches as follows: ophthalmic nerve, maxillary nerve, and mandibular nerve. Ophthalmic and maxillary nerves exit the skull through superior orbital fissure and foramen rotundum, respectively. Mandibular nerve exits the skull via foramen ovale and enters into infra-temporal fossa and divides into anterior and posterior divisions. The posterior division gives off mainly sensory branches such as the auriculotemporal nerve, lingual nerve, and inferior alveolar nerve. The auriculotemporal nerve innervates the temporomandibular joint, temporal fascia, and external acoustic meatus. The inferior alveolar nerve enters into the mandibular foramen, runs in the mandibular canal, and innervates the gums and teeth of the lower jaw. Before entering into the mandibular foramen, it gives the motor branch to the mylohyoid muscle. The lingual nerve innervates the mucosa of the anterior 2/3rd of the tongue (Robinson, 2011).

Abnormal communications between the branches of the posterior division of the mandibular nerve have been widely reported in the literature (Thotakura *et al.*, 2013). Infratemporal fossa is one of the sites for the lateral surgical approach to the base of the skull. Hence, an ideal understanding of any unusual communications between the branches of the mandibular nerve is significant to prevent iatrogenic injury (Bailey and Calhoun, 1998). Skull fractures involving the middle cranial fossa could extend into the foramen ovale and damage the exiting nerve, thereby affecting the sensation along the cutaneous distribution of the involved nerve (Jefferson and Schorstein, 1995). Condylar and subcondylar fractures of mandible would result in lingual nerve and inferior alveolar

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nerve anesthesia which is a strict indication for an early open reduction of fracture (Sun *et al*., 2013). A thorough understanding of variations in the branching pattern of mandibular nerve is important for successful manipulation of these conditions.

The inferior alveolar nerve block is a common procedure in dentistry to achieve mandibular anesthesia and has widespread applications in oral surgeries, endodontics, periodontics, and prosthodontics (Malamed, 2012). However, the failure rate of inferior alveolar nerve block is as high as 29%–39% (Madan *et al*. 2002), (Micksell *et al*., 2005). Apart from the technical errors, variations in the branching pattern of mandibular nerve and abnormal communications between them have also contributed to this failure (Wolf *et al*., 2016). The inferior alveolar nerve innervating all mandibular teeth on one side also supplies the mucosa of lower lip and skin over the chin. Accessory or supplementary nerve supply to the mandibular teeth in addition to inferior alveolar nerve could result in failure of anesthesia (Sakkinen *et al*., 2005).

Temporomandibular disorder is a group of musculoskeletal and neuromuscular conditions characterized by masticatory muscle pain and capsulitis and internal derangement of the temporomandibular joint (Sciffman *et al*., 1990). Auriculotemporal nerve provides most of the sensory input to the temporomandibular joint and hence is an important structure in many painful conditions. It is suggested that a successful block of auriculotemporal nerve could relieve the pain in patients with painful temporomandibular joint conditions (Dolon *et al*., 1984), (Okeson, 1995). This makes the ideal understanding of variations and atypical communications between the branches of mandibular nerve essential for the effective management of lesions in the infratemporal fossa and avoiding iatrogenic injuries.

Case Report

The dissection was carried out for the undergraduate students in a 45-year old female cadaver at the Department of Anatomy, JIPMER, Karaikal. The cadaver was donated to the department, and the cause of death was unknown. The infratemporal fossa was dissected on both sides as per the dissection norms. All the branches of the mandibular nerve were traced meticulously. No signs of trauma, incisions, or surgical scars were seen in the head-and-face region.

After dissection, on the right side, an abnormal thin nervous communication was found between the auriculotemporal nerve and inferior alveolar nerve [Figure 1]. After receiving this communicating branch, inferior alveolar nerve gave the nerve to the mylohyoid before entering into the mandibular foramen. The auriculotemporal nerve had two roots of origin from the posterior trunk of the mandibular nerve. After giving a communicating twig to the inferior alveolar nerve, auriculotemporal nerve followed a normal course toward the parotid region. The lingual nerve had a normal origin and course.

In contrast to the right side, the auriculotemporal nerve on the left side was found to have three roots of origin and then followed its normal course [Figure 2]. The middle meningeal artery was enclosed between the medial two roots of the auriculotemporal nerve. The lingual nerve and inferior alveolar nerve had a normal origin and course, but abnormal communication was seen between the lingual nerve and inferior alveolar nerve [Figure 2].

Discussion

Many studies have revealed that there are lots of variations in the branching pattern of the posterior division of mandibular nerve apart from communication between its branches but not all of these variations have been incorporated in standard anatomical textbooks. In the present case report, a unilateral abnormal communication was found between the auriculotemporal nerve and inferior alveolar nerve. In a study done on cadavers, out of 36 specimens dissected, they found communication between auriculotemporal nerve and inferior alveolar nerve in two specimens (Thotakura *et al*., 2013).

In another cadaveric study, communication was observed between auriculotemporal nerve and inferior alveolar nerve in 4 out of 32 specimens dissected (Anil *et al*., 2003). In another study carried out to explore the anomalous communications between the branches of the mandibular nerve, in one cadaver out of 30 specimens dissected, a bilateral communication was observed between auriculotemporal nerve and inferior alveolar nerve (Bharadwaj *et al*., 2014).

In a study done in the Turkish population, in 2 out 20 dissections of infratemporal fossa, a communication was observed between auriculotemporal nerve and inferior alveolar nerve (Peker *et al*., 2003)(Muraleedharan *et al*., 2014) have also reported a communication between inferior alveolar nerve and auriculotemporal nerve. In a study done by (Gulekon *et al*., 2005), in four out of 32 specimens dissected, a communication was observed between auriculotemporal nerve and inferior alveolar nerve.

Communication between inferior alveolar nerve and auriculotemporal nerve could serve as an alternate route for maintaining the functional integrity of the structures innervated (Thotakura *et al*., 2013). However, it may affect the clinical presentation of symptoms arising in the

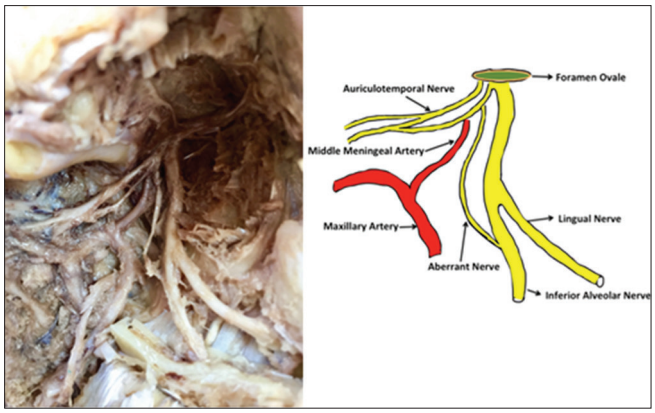

Figure 1: Photograph and schematic representation of the aberrant nerve (communicating twig) on right side between auriculotemporal nerve and inferior alveolar nerve

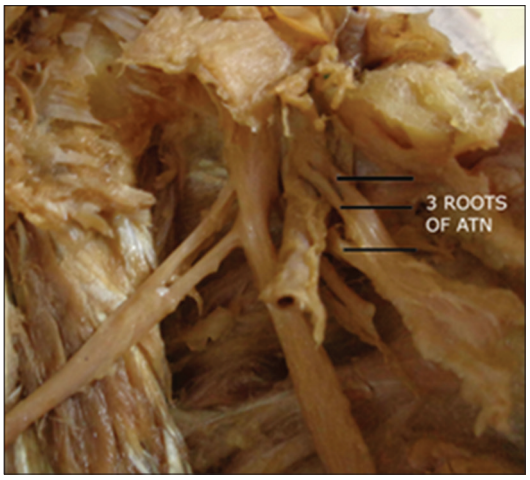

Figure 2: The three roots of the auriculotemporal nerve on the left side and a communication between the lingual nerve and the inferior alveolar nerve

mandibular alveolar region with two different sensory nerves connected.

Inferior alveolar nerve usually has one root of origin. Studies have been done to look for variations in the origin of inferior alveolar nerve. In a study, in one out of 40 specimens dissected, the inferior alveolar nerve had two roots of origin and the second part of the maxillary artery was incorporated between them (Roy *et al*., 2002). (Sharma *et al*., 2011), in 50 infratemporal fossa dissection observed that in one specimen the inferior alveolar nerve had two roots of origin. In the present case, the inferior alveolar nerve has got the bilaterally single root of origin.

The standard Anatomy textbooks have described two roots of origin of auriculotemporal nerve with middle meningeal artery enclosed between the two roots. In a study done it was reported that auriculotemporal nerve had four roots of origin in 3.1% of the specimens, three roots of origin in 9.4% of the specimens, two roots in 37.5% of the specimens and one root in 50% of the specimens (Gulekon *et al*., 2005). In another study, (Komarnitki *et al*., 2012) one, two, three, four, and five roots variants of the auriculotemporal nerve had been described. The variations of the auriculotemporal nerve are significant for faciomaxillary surgeons and dental surgeons as it plays an important role for referred pain from the temporomandibular region. In the present case, an anomalous communication was also observed between the lingual nerve and inferior alveolar nerve on the left side. This is a well-known variation which frequently accounts for the failure to obtain adequate anesthesia in the routine dental procedures (Racz *et al*., 1981), (Huban *et al*. 2015).

Developmental correlation

Anatomical variations in the posterior division of the mandibular nerve could be attributed to the process of neurovascular development of the first arch. The nerve and its branches are derived from neural crest cells in the cephalic region which migrate ventrally through the mesoderm of the mandibular arch. F-spondin and T-cadherin liberated from the caudal somites are thought to be responsible for neural development. Abnormal expression of these proteins inhibits the neural crest cell migration and may lead to variation in these nerves (Drebby-Brafman *et al*., 1999), (Ranscht and Bronner-Fraser, 1991).

Conclusion

Variations and communications between the branches of the mandibular nerve are not uncommon. Sometimes, it may lead to the misinterpretation of the symptoms in the patients due to abnormal communications of the sensory nerves. A thorough understanding of these communications is crucial for surgeons, dentists, and anesthetists for successful and uncomplicated surgical, dental, and anesthetic procedures.

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Conflicts of interest

There are no conflicts of interest.

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