Case Report

# Anomalous Bilateral Communication between the Inferior Alveolar Nerve and the Auriculotemporal Nerve: A Rare Variation

Nikha Bhardwaj[1], Priya Sahni[2], Abhishek Singhvi[2], Meghanand Nayak[2], Vineeta Tiwari[1]

**Submitted:** 3 Jan 2014
**Accepted:** 20 Feb 2014

[1] *Department of Anatomy, Era's Medical College & Hospital, Sarfarazganj, Hardai road, Lucknow PIN 226003, Uttar Pradesh, India*

[2] *Department of Oral and Maxillofacial Pathology, Vyas Dental College and Hospital Kudi Haud, Pali Road, Jodhpur PIN 342008, Rajasthan, India*

## Abstract

**Branches of the posterior division of the mandibular nerve show various anomalous communications in the infratemporal region. Understanding such communication has relevance in the management of neuropathies and surgical procedures in this region. This study was conducted to explore such communicating branches, anticipating that they might provide information of clinical significance. A total of 15 human cadavers (30 infratemporal regions) were studied to explore such communicating branches in infratemporal region. The branches of the posterior division of the mandibular nerve were carefully dissected, and these branches were studied and analysed for any abnormal course. In one case, a rare type of bilateral communication between the auriculotemporal nerve and the inferior alveolar nerve, forming a loop with no association with any structure, was observed. It is possible that such communicating branches may be associated with delayed regression of the first arch vessels. The clinical implications of these anomalous communications require further detailed study for improved management of neuropathies and surgical procedures.**

***Keywords:*** *mandibular nerve, auriculotemporal nerve, inferior alveolar nerve, variation*

## Introduction

The mandibular nerve is one of three branches of the trigeminal nerve, which exits the cranium via the foramen ovale. In the infratemporal fossa, the mandibular nerve divides into its anterior and posterior divisions. The inferior alveolar nerve (IAN), auriculotemporal nerve (ATN) and lingual nerve (LN) are three branches of the posterior division of the mandibular nerve. The IAN enters through the mandibular foramen in the inferior alveolar canal, innervating the posterior and anterior mandibular teeth. The ATN innervates the temporal fascia, external acoustic meatus, and the temporomandibular joint (TMJ) (1,2).

Various studies have revealed anomalous communications between branches of the posterior division of the mandibular nerve (2–4). These anatomical variations are of great clinical significance in pathological conditions, such as treatment failure of trigeminal neuralgia, which commonly involves the mandibular nerve. Local nerve block collapse or accidental surgical injuries may occur due to such communications. Information of atypical communications of these nerves is essential for the management of lesions in the infratemporal fossa (3).

Branches of the posterior division of the mandibular nerve were studied in 15 human cadavers through infratemporal dissection, and in one cadaver a unique bilateral variation was observed. In this case, the IAN originated from the mandibular nerve by a single root, however, a communication link was present between the IAN and ATN. The ATN also originated from a single root from the mandibular nerve. A possible embryological origin for this variation in the anatomical pattern of these nerves, together with its clinical significance has been discussed.

## Case Report

The posterior branches of the mandibular nerve were studied in 15 human cadavers, bilaterally through infratemporal dissection. The infratemporal region was approached by careful removal of the masseter, the temporalis muscles,

  

the ramus of mandible and the lateral pterygoid. Thereafter the mandibular nerve was exposed, and the IAN, ATN, and LN were traced for any abnormal course. Sections of the communicating branches were taken from both sides for microscopic investigation and to ascertain the neural origin.

A rare bilateral communication between branches of the posterior division of the mandibular nerve was observed in one cadaver. A thick nerve originated approximately 18 millimetres below the emergence of the IAN, just above the mandibular foramen. It ran in a postero-superior direction, deep into the lateral pterygoid muscle to communicate with the ATN (Figure 1). The maxillary artery was present superficially to the lower head of the lateral pterygoid muscle. The middle meningeal artery (MMA) was ascending superficially to the lateral pterygoid muscle, and at the upper border of this muscle the MMA took a deep course to enter the foramen spinosum. The ATN originated from one root, and ran under the lateral pterygoid muscle. The ATN did not form any loop around the MMA, as both the communicating branch and the ATN were separated from the MMA by the lateral pterygoid muscle. The lingual nerve also followed a normal course on both sides of the mandible. To rule out any histological variations in the communicating nerve, transverse microscopic sections were taken from the communicating branch on both sides. Sections were stained with haematoxylin and eosin and this showed that the epineurium surrounded the entire nerve, and was continuous with the perineurium, which divided the nerve into fascicles. Sections also revealed that the endoneurium surrounded each individual nerve fiber (axon), and was surrounded by a clear halo, representing a myelin sheath and that no abnormalities were detected (Figure 2).

## Discussion

Various studies have reported anatomical variations and anomalous communication in the posterior division of the mandibular nerve. The ATN and IAN are mostly identified as having these variations, but bilateral presentation of anomalous communication is rare (2–4). In the present study, we report a rare bilateral anomalous communication between the ATN and IAN.

Anatomical variations in the posterior division of the mandibular nerve can be explained by the process of neurovascular development of the first arch. This nerve and its branches are derived from the neural crest cells in the cephalic region (5). F-spondin and T-cadherin, liberated

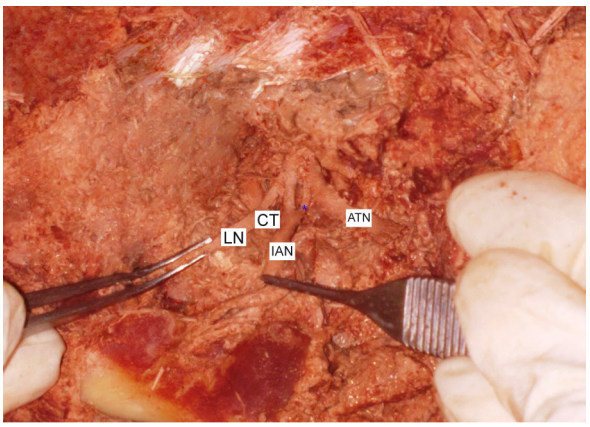


**Figure 1:** Left infratemporal region shows a communicating nerve (marked *) between inferior alveolar nerve and auriculotemporal nerve. ATN: auriculotemporal nerve; CT: chorda tympani; IAN: inferior alveolar nerve; LN: lingual nerve.


**Figure 2:** Haematoxylin and eosin stained transverse section of communicating branch (original 100x magnification). Epineurium surrounding entire nerve was continuous with perineurium which divided nerve into fascicles. Endoneurium surrounding each individual nerve fiber also seen. A: axon; En: endoneurium; Ep: epineurium; M: myelin; P: perineurium.

from caudal somites, are thought to be responsible for neural development (6,7). Abnormal expression of these proteins may be the cause of delayed regression of the first arch vessels, and be responsible for anomalous communications between IAN and ATN.

Thotakura et al. (2) studied 36 specimens for anomalous communication in the posterior division of the mandibular nerve; in one case they observed communication between the ATN and IAN. They considered that this type of communication conveyed post-ganglionic fibers from the otic ganglion, to the IAN, through the ATN, and to the lower labial glands. Although these communications may be post-ganglionic parasympathetic fibers of the otic ganglion, they occur initially as fibers associated with IAN, which later disassociate from IAN, and reunite with the ATN.

The ATN often arises from more than one root, to form a buttonhole around the MMA, whereas the IAN usually arises from one root. However, the possibility of IAN having more than one root of origin has been reported previously (8,9). Gülekon et al. (10) studied 16 cadaver heads looking for variations in ATN, and observed that in 50% of specimens the ATN originated from one root, although in one case, the ATN originated from four roots. Various communications between the posterior branches of the mandibular nerve have been reported, in which communications between IAN and the LN, IAN and the mylohyoid nerve, ATN and the facial nerve, ATN and IAN are common (2–4). A few authors have observed the anomalous communicating branch between the ATN and IAN to form a loop, through which the maxillary artery, or mylohyoid nerve, passes (3,4). In these variations, the maxillary artery or mylohyoid nerve seem to be entrapped, and this may elicit neuralgia. Soni et al. (11) reported an interesting case where the ATN exhibited multiple loops, recognising that such variations in the ATN make it more prone for entrapment. In the present case, we observed that the ATN and IAN arose from a single root. Buttonhole formations of ATN were missing bilaterally, and the link between the MMA and ATN was not established. The maxillary artery and mylohyoid nerve were not entrapped by the loop formed by the communicating branch between ATN and IAN; hence there was no likelihood of neurovascular entrapment due to the presence of the anomalous communicating branch. We assume that neurovascular entrapment is not necessarily associated with anomalous communicating branches.

The IAN frequently traverses between the lateral and medial pterygoid muscles before it enters the mandibular foramen, and this can be a cause for nerve compression and trigeminal neuralgia (1,3). In these cases, the course of the communicating branch is between the lateral and medial pterygoid muscles, and therefore the frequency of nerve compression may be increased.

Anatomical variations in the posterior division of the mandibular nerve are not uncommon, and knowledge of these variables is clinically significant. Further detailed studies are required to explore the possible variations and communications of these nerves for the better management of neuropathies.

## Acknowledgement

None.

## Conflict of Interest

None.

## Funds

None.

## Authors' Contributions

Conception and design and provision of study materials or patient: NB
Drafting of the article: NB, PS
Critical revision of the article for the important intellectual content and final approval of the article: AS
Administrative, technical or logistic support: PS, MTN
Collection and assembly of data: MTN

## Correspondence

Dr Abhishek Singhvi
MDS (Rajasthan University of Health Sciences)
Department of Oral and Maxillofacial Pathology
Vyas Dental College and Hospital Kudi Haud
Pali Road
Jodhpur PIN 342008
Rajasthan, India
Tel: +91 946164 5441
Fax: +0291-272 0784
Email: me.singhvi@yahoo.co.in

## References


1. Berkovitz BK. Infratemporal region and temporomandibular joint. In: Standring S, editor. *Gray's Anatomy: The Anatomical Basis of Clinical Practice*. 39th ed. Edinburgh: Elsevier Churchill Livingstone, 2005:526–530.

2. Thotakura B, Rajendran SS, Gnanasundaram V, Subramaniam A. Variations in the posterior division branches of the mandibular nerve in human cadavers. *Singapore Med J*. 2013;**54(3)**:149–151. doi: 10.11622/smedj.2013051.

3. Anil A, Peker T, Turgut HB, Gülekon IN, Liman F. Variations in the anatomy of the inferior alveolar nerve. *Br J Oral Maxillofac Surg*. 2003;**41(4)**:236–239. doi: 10.1016/s0266-4356(03)00113-x.

4. Roy TS, Sarkar AK, Panicker HK. Variations in the origin of the inferior alveolar nerve. *Clin Anat*. 2002;**15(2)**:143–147. doi: 10.1002/ca.1110.

5. Bronner-Fraser M. Environmental influences on neural crest cell migration. *J Neurobiol*. 1993;**24(2)**:233–247. doi: 10.1002/neu.480240209.

6. Debby-Brafman A, Burstyn-Cohen T, Klar A, Kalcheim C. F-Spondin, expressed in somite regions avoided by neural crest cells, mediates inhibition of distinct somite domains to neural crest migration. *Neuron*. 1999;**22(3)**:475–488. doi: 10.1016/s0896-6273(00)80703-5.

7. Ranscht B, Bronner-Fraser M. T-cadherin expression alternates with migrating neural crest cells in the trunk of the avian embryo. *Development*. 1991;**111**:15–22.

8. Baumel JJ, Vanderheiden JP, McElenney JE. The auriculotemporal nerve of man. *Am J Anat*. 1971;**130(4)**:431–440. doi: 10.1002/aja.1001300405.

9. Pretterklieber ML, Skopakoff C, Mayr R. The human maxillary artery reinvestigated: I. Topographical relations in the infratemporal fossa. *Acta Anat*. 1991;**142(4)**:281–287. doi: 10.1159/000147203.

10. Gülekon N, Anil A, Poyraz A, Peker T, Turgut HB, Karaköse M. Variations in the anatomy of the auriculotemporal nerve. *Clin Anat*. 2005;**18(1)**:15–22.doi;10.1002/ca.20068.

11. Soni S, Rath G, Suri R, Vollala V R. Unusual Organization of Auriculotemporal Nerve and its Clinical Implications. *J Oral Maxillofac Surg*. 2009;**67(2)**:448–450. doi: 10.1016/j.joms.2008.09.012.