International Journal of Research in Medical Sciences
Jha S et al. Int J Res Med Sci. 2017 Jul;5(7):3235-3238
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20173021

Case Report

An extraordinary variation in origin of inferior alveolar nerve and its clinical significance: a case report

Shweta Jha*, Gitanjali Khorwal, Sunita Kalra

Department of Anatomy, University College of Medical Sciences, New Delhi, India

Received: 06 May 2017
Accepted: 05 June 2017

***Correspondence:**
Dr. Shweta Jha,
E-mail: jha350@gmail.com

ABSTRACT

Infratemporal fossa is a clinically significant site for delivery of local anaesthesia during dental procedures and maxillofacial surgeries. An extraordinary variation involving formation of inferior alveolar nerve was revealed during routine dissection of infra temporal region for teaching undergraduate medical students. Inferior alveolar nerve was seen to be incongruously originating from two separate roots from the posterior division of mandibular nerve. Furthermore, these two roots of inferior alveolar nerve were divulging unusual relationship with the maxillary artery. Superficial root of inferior alveolar nerve was coursing superficial to second part of maxillary artery and deep root was found to be emerging posterior to this part of maxillary artery. Additionally, deep root was sending a well-defined twig which when traced was found to be communicating with Lingual nerve. This unusual type of variation of Inferior alveolar nerve in this region may result in atypical symptoms of pain, numbness, headaches, interfere with outcome of injection of local anaesthesia and even surgical interventions in the infratemporal fossa.

Keywords: Infratemporal fossa, Inferior alveolar nerve, Mandibular nerve, Maxillary artery

INTRODUCTION

The region which is situated deep to ramus of the mandible is termed as the infratemporal fossa. It consists of a roof, lateral and medial walls but has no definite anatomical floor. Roof is created by infratemporal surface of greater wing of sphenoid and temporal bones and is pierced by foramina namely ovale and spinosum and petrotympanic fissure.

These foramina transmit vital structures including mandibular nerve, middle meningeal vessels, accessory meningeal vessels, lesser petrosal nerve etc. Medial wall of infra temporal fossa is formed anteriorly by lateral pterygoid plate of pterygoid process of sphenoid bone. It contains pterygomaxillary fissure across which structures traverse between infratemporal fossa and pterygopalatine fossa. The lateral boundary of this fossa is contributed by medial surface of ramus of the mandible. The communications of infra temporal fossa include with the temporal fossa deep to the zygomatic arch and the pterygopalatine fossa through the pterygomaxillary fissure**.** The key structures that are present in this region consist of the lateral and medial pterygoid muscles, mandibular nerve, the chorda tympani nerve, maxillary vessels and pterygoid venous plexus. Mandibular nerve, which is the largest division of the Fifth cranial nerve i.e., trigeminal nerve, emerges out of the cranial cavity through foramen ovale present in the roof of this fossa and is positioned between tensor veli palatini muscle medially and lateral pterygoid muscle laterally. The nerve shortly divides into a smaller anterior and a larger posterior division. The anterior division gives off branches to the main muscles of mastication namely masseteric, deep temporal and lateral pterygoid nerves and a sensory buccal branch. The posterior division gives three sensory branches including the auriculotemporal, lingual and inferior alveolar nerves.[1]

The present case report mainly involves inferior alveolar nerve (IAN) which is one of the three sensory branches from posterior division of mandibular nerve. It commonly originates as a singular branch and descends posterior to lateral pterygoid muscle. At the lower border of this muscle the nerve initially traverses between sphenomandibular ligament and the mandibular ramus and afterwards penetrates the mandibular canal via the mandibular foramen. In the mandibular canal, it runs downwards and forwards below the apices of the teeth until below the first and second premolars where it bifurcates into terminal incisive and mental branches.[1]

The infra temporal region is also the potential site for spread of salivary gland neoplasms and is often missed during surgery.[2] The clinical relevance of infratemporal fossa as an area for delivery of local anaesthesia in dentistry and maxillofacial surgery is of paramount importance.[3] The understanding of comprehensive anatomy of neurovascular variations of the infratemporal fossa are significant to neurosurgeons, otorhinolaryngologists, dentists, radiologists and pathologists for prevention of complications while performing surgical procedures.[4]

Associated nerves can be compressed by pulsations of the artery resulting in symptoms such as pain and numbness. Nerve compression has often been implicated as one of the causes of conditions like Trigeminal neuralgia. The risk of arterial damage during anaesthetic procedures is believed to be escalated due to proximity if maxillary artery with branches of mandibular nerve.[5]

It has also been reported by Standring et et al that the inferior alveolar nerve block can be administered trans orally or by the external route through the skin of the face.[6] If there are variations involving formation of this nerve as found in the present report, this might interfere with producing the desired anaesthesia if administered via oral or subcutaneous routes.

Also, since this area is difficult to approach for anatomists and surgeons. Hence normal anatomy and neurovascular variations of this area are crucial. In the present study one such rare variation involving the inferior alveolar nerve is reported.

CASE REPORT

An unusual variation of the inferior alveolar nerve on the left side in the infratemporal region was revealed during the routine dissection in an adult male cadaver for teaching undergraduate medical students in a medical college. Infratemporal fossa was dissected according to instructions described in Cunningham's manual of practical anatomy.[7] Zygomatic arch was divided anterior and posterior to the attachment of the masseter, and turned down along with the masseter muscle stripping it off from the mandible as far as the angle. Temporalis muscle was exposed and reflected upwards by separating the coronoid process from the mandible. Osteotomy of the mandibular ramus was done through an oblique cut from the mandibular notch to the point where the anterior margin of the ramus continues with the body of the mandible. The lateral pterygoid muscle was exposed along with the neurovascular bundle deep to it. After guarded blunt dissection, the lateral pterygoid muscle, the maxillary artery and mandibular nerve and its branches were identified and released from the surrounding tissues. Topographical relations of maxillary artery and mandibular nerve in the infratemporal fossa were studied. Posterior division of mandibular nerve gave auriculotemporal nerve as usual and subsequently divided into lingual nerve and an unusual deep root of inferior alveolar nerve (DR) posterior to the second part of maxillary artery. Besides the deep root, IAN received an additional twig (SR) from mandibular nerve superficial to maxillary artery. Additionally, it was discovered that lingual nerve also was communicating with the deep root of inferior alveolar nerve. The dissection of the same region on the right side did not illustrate any dissimilarity with the usual origin and course of IAN and it originated typically and as a single shoot from the Mandibular nerve (Figure 1).

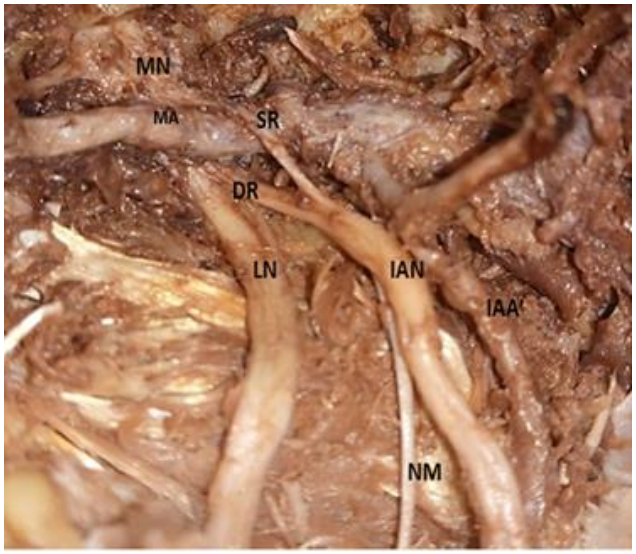

Figure 1: The dissection of left infratemporal region revealing inferior alveolar nerve originating from two roots from posterior division of mandibular nerve. SR: superficial root of inferior alveolar nerve. DR: deep root inferior alveolar nerve. MN: mandibular nerve. IAN: inferior alveolar nerve. LN: lingual nerve. MA: maxillary artery. IAA: inferior alveolar artery. NM: nerve to mylohyoid.

DISCUSSION

In the present case, mandibular nerve divided into lingual nerve and inferior alveolar nerve (DR) deep to the maxillary artery. Also, inferior alveolar nerve received an additional prominent twig from mandibular nerve superficial to maxillary artery as superficial root (SR) and

an unusual deep root of inferior alveolar nerve (DR) posterior to the second part of maxillary artery. Although there are few reported studies in literature describing variations of origin of inferior alveolar nerve but none has reported the anomalous origin and course of this nerve described in the present study.[8-15]

Roy et al in their study on 80 infratemporal fossae, reported only a single case where IAN originated from two roots and the second part of maxillary artery passed through the loop formed by the two roots of IAN.[8] A similar variation has been described by Babu et al., Sharma et al. and Khan et al Yet in another study by Mangala M Pai it has been reported that IAN emerged from 3 roots (SR, DR, AR).[9-11] One each from posterior division of mandibular nerve (SR), one from auriculotemporal nerve (DR) and lingual nerve(AR). They reported that maxillary artery coursed medial to lateral pterygoid muscle and was encircled by nerve loop formed by joining of SR and DR.[12]

Pretterklieber et al reported that maxillary artery pierced the IAN with anastomosis between IAN and lingual nerves.[13] Ortug and Moriggl et al have even reported that maxillary artery was pierced the IAN, but there was no involvement of lingual nerve in their study which is illustrated in the present study.[14] In contradiction to the present finding Khaledpour et al reported that IAN originating from auriculotemporal, mandibular and lingual nerves but maxillary artery did not course between any pair of them.[15]

It is essential for dentists, otorhinolaryngologists, neurosurgeons and maxillofacial surgeons to be acquainted with normal anatomy of infratemporal fossa and its variations. Complications of neurovascular compression such as numbness, regional pain and headaches may arise as a result of such variations.[16] In this case compression of maxillary artery by either the deep root or superficial root may result in tic douloureux and modified sensation of gingival mucosa.[17-18]

Embryological basis

Developmentally, the type of variation discovered in the present case where IAN originates by two divergent roots with maxillary artery traversing in between, probably can crop up during early evolution when migration of neural crest cells in cephalic zone occurs through mesoderm of mandibular arch. During early development, vascular network formed by the maxillary artery serves as a passage for the mandibular nerve to pass through. This type of neural cell crest migration which occurs in the cranial region is guided by multiple cell matrix interactions.[19] Spondin F and Cadherin E are believed to play as important regulatory factors in such migration and cause variations in these nerves.[20,21] The sensory and motor components of Inferior alveolar nerve possibly migrate through distinct pathways. The departure of nerve to mylohyoid (motor component of IAN) for its destination is followed by sensory fibres reassembling to form 2 roots with nerve to mylohyoid originating from deep root.[4]

CONCLUSION

The anomalous origin and course of Inferior alveolar nerve described in the present study is valuable for surgeons during invasive procedures of this difficult region. It is also imperative for dental, oncological and reconstructive procedures in this region. Our study also gives insight into embryological origin of neurovascular structures leading to deviations from the typical patterns.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Reynolds PA. Infratemporal and pterygopalatine fossae and tempero mandibular joint. In: Susan Standring, Neil R Borley, Patricia Collins, Allan R Crossman, eds. Gray's Anatomy. 40th ed. Churchill Livingstone London; 2008:542-543.
2. Dodd GD, Dolan PA, Ballantyne AJ, Ibanez ML, Chau P. The dissemination of tumours of head and neck via the cranial nerves. Radiol Clin North America. 1970;8:445-61.
3. Racz VL, Manos T. Anatomical variants of lingual nerve in human. Anat Anz. 1981;149:64-71.
4. Babu PB, Bhat KR, Nayak VS. Perforation of inferior alveolar nerve by maxillary artery. Rev Arg De Anat Clin. 2011;3(3):124-9.
5. Wolfe KT, Brokaw EJ, Bell A, Joy A. Variant inferior alveolar nerves and implications for local anesthesia. Anesth Prog. 2016;63(2):84-90.
6. Xang M. Neck. In: Standring S, Johnson D, Collins P, Mahadevan V, eds. Gray s anatomy. 40th ed. Churchill Livingstone, London; 2008:446-447.
7. The temporal and infratemporal regions. Romanes GJ, ed. Cunninghams manual of practical anatomy,15th ed. Oxford,New York; 2011:118-126.
8. Roy TS, Sarkar AK, Panicker HK. Variation in the Origin of the Inferior Alveolar Nerve. Clin Anatomy. 2002;15:143-7.
9. Babu PB, Bhat KR, Nayak VS. Perforation of inferior alveolar nerve by maxillary artery. Rev Arg De Anat Clin. 2011;3(3):124-29.
10. Sharma A, Vohra H, Singh P, Sood V. Unusual origin and variation in topographical relation of inferior alveolar nerve in the left infratemporal region. J Indian Med Assoc. 2011;109(2): 96-8.
11. Khan MM, Darwish HH, Zaher WA. Perforation of the inferior alveolar nerve by the maxillary artery: an anatomical study. Br J Oral Maxillofacial Surg. 2010;48(8):645.
12. Pai MM, Swamy RS, Prabhu LV. A variation in morphology of the inferior alveolar nerve with

potential clinical significance. Biomed International. 2010;1:93-5.
13. Pretterklieber ML, Skopakoff C, Mayr R. The human maxillary artery reinvestigated: I. Topographical relations in the infratemporal fossa. Acta Anat. 1991;142(4):281-7.
14. Ortug VG, Moriggl B. Studies about the topography of the maxillary artery within the infratemporal fossa. Anat Anz. 1991;172(3):197-202.
15. Khaledpour C. An anatomic variant of the inferior alveolar nerve in man. Anat Anz. 1984;156(5):403-6.
16. Anil A, Peket T, Turgut HB, Gulekon IN. Variation in anatomy of inferior alveolar nerve. Br J Oral Maxillofacial Sur.2003;41(4):236-39.
17. Krampotic-Nemanic J, Vinter I, Hat J, Jalsovec D. Mandibular neuralgia due to anatomical variations. Eur Arch Otorhinolaryngol. 1999;256(4):205-8.
18. Calvin WH, Loeser JD, Howe JF. A neurophysiological theory for the pain mechanism of tic douloureux. Pain. 1977;3(2):147-54.
19. Bronner-Fraser M. Environmental influences on neural crest cell migration. J Neurobiol. 1993;24(2):233-47.
20. Ranscht B, Bronner-Fraser M. T-cadherin expression alternates with migrating neural crest cells in the trunk of the avian embryo. Development. 1991;111(1):15-22.
21. 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):475-88.

Cite this article as: Jha S, Khorwal G, Kalra S. An extraordinary variation in origin of inferior alveolar nerve and its clinical significance: a case report. Int J Res Med Sci 2017;5:3235-8.