

Research Article

Communicating root of auriculotemporal nerve with inferior alveolar nerve-looping around accessory meningeal artery

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ABSTRACT

Background: The auriculotemporal nerve has been described as having two roots in standard textbooks of anatomy. It lies on the tensor veli palatini muscle while passing backwards behind the lateral pterygoid muscle. It runs behind the temporomandibular joint after passing between the sphenomandibular ligament and the neck of mandible. It ascends over the posterior root of zygoma posterior to superficial temporal vessels. It gives superficial temporal branches and also branches to facial nerve and otic ganglion. The branches to the facial nerve join at the posterior border of masseter. On the face the cutaneous branches supply the tragus, part of the adjoining auricle of the ear and posterior part of temple.

Methods: Variations in the origin of the auriculotemporal nerve have been described by many authors in the past and this prompted the study of the auriculotemporal nerve, its origin and course, in 36 specimens (18 cadaveric heads) in bodies that were allotted for dissection purpose to first year medical students in the department of anatomy in P.E.S Medical College, Kuppam.

Results: It was seen that the auriculotemporal nerve had two roots of origin and they formed a loop to enclose the middle meningeal artery in all the 35 specimens except in one side of the cadaveric heads. In only one half of a cadaveric head it was found to arise by three roots which formed two nerve loops. The first and second nerve roots joined with each other to form a nerve loop. The third root joined with the inferior alveolar nerve and formed the second nerve loop. The accessory meningeal artery passed through the second nerve loop. The normal presentation of two roots enclosing the middle meningeal artery was not present. Instead the accessory meningeal artery was enclosed between the third root and the inferior alveolar nerve. The middle meningeal artery entered the skull through the foramen spinosum as usual but was not enclosed by the nerve roots. The trunk of the auriculo temporal nerve was seen between the middle meningeal artery and inferior alveolar nerve and the study reports the presence of variant nerve loops encircling the accessory meningeal artery.

Conclusion: The variations in the roots of auriculotemporal nerve have been reported in the past and since it is important in the clinical implications of the region especially for the facio-maxillary surgeons and dental surgeons. The incidence of variation has to be documented as this helps in updating the clinical database for surgical procedures and treatment in the region of infratemporal fossa.

Keywords: Auriculo temporal nerve, Nerve loops and accessory meningeal artery

INTRODUCTION

The auriculotemporal nerve has been described as having two roots in standard textbooks of anatomy.¹ It lies on the tensor veli palatini muscle while passing backwards behind the lateral pterygoid muscle. It runs behind the temporomandibular joint after passing between the sphenomandibular ligament and the neck of mandible. It ascends over the posterior root of zygoma posterior to superficial temporal vessels. It gives superficial temporal branches and also branches to facial nerve and otic ganglion. The branches to the facial nerve join at the posterior border of masseter. On the face the cutaneous branches supply the tragus, part of the adjoining auricle of the ear and posterior part of temple.

The chorda tympani nerve passes deep to lateral pterygoid after descending ventrally on the medial surface of spine of sphenoid bone. It lies lateral to the tensor veli palatine and is crossed by the middle meningeal artery, roots of the auriculotemporal nerve and inferior alveolar nerve. It joins the posterior border of lingual nerve at an acute angle. It contains efferent preganglionic parasympathetic fibres which enter the submandibular ganglion. From here postganglionic fibres to the submandibular and sublingual glands are relayed. It is actually the nerve of taste. It contains fibres mainly afferent from the anterior presulcal part of the tongue.

In this study the variations in the auriculotemporal nerve and its relation to its neighbouring structures was examined in 18 cadaveric heads and compared with previous studies. The variations noted have a bearing in clinical anatomy as structures close to the nerve are important in the presentation of clinical symptoms.

METHODS

Cadavers allotted for routine dissection in the department of anatomy P.E.S Medical College during the last two years were used for the purpose. The study was carried out during the time of dissection of the infra-temporal region in each cadaver. Both sides of the eighteen cadaveric heads were dissected in the conventional method using Cunningham manual of practical anatomy as a routine. The infratemporal region was exposed from the lateral side by removing a part of the mandible. The structures were exposed from the lateral side.

RESULTS

The auriculotemporal nerve was seen to be variant in only one half of a specimen (cadaveric head). The nerve arose by three roots and formed two loops. The first two roots joined to form a loop and continued to form the auriculotemporal nerve which ran laterally and upwards behind the temporomandibular joint and ran to supply the temporal region. The second nerve loop was formed by the union of the third root with the inferior alveolar nerve. This loop enclosed the accessory meningeal artery

which passed through the foramen ovale. The normal presentation of two roots enclosing the middle meningeal artery was not present. The middle meningeal artery entered the skull through the foramen spinosum as usual but was not enclosed by the nerve roots. The trunk of the the auriculo temporal nerve was seen between the middle meningeal artery and inferior alveolar nerve and the study reports the presence of variant nerve loops encircling the accessory meningeal artery.

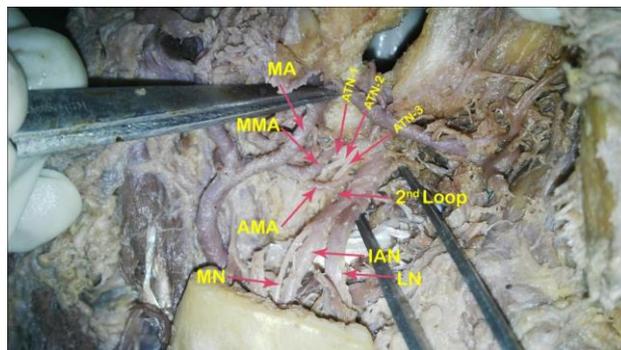


Figure 1: Showing, MA - Maxillary artery, MMA - Middle meningeal artery, AMA - Accessory meningeal artery, MN - Mylohyoid nerve, LN - lingual nerve, IAN - Inferior alveolar nerve, ATN - Auriculotemporal nerve.

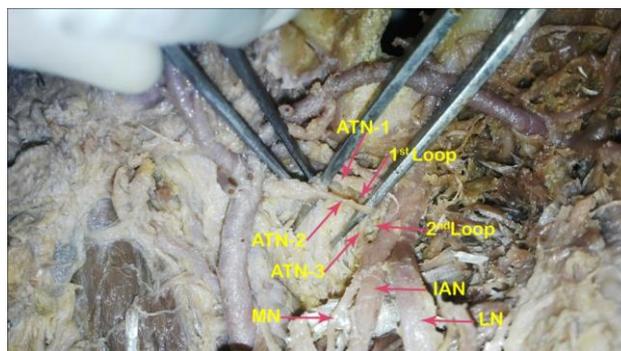


Figure 2: Showing, MN - Mylohyoid nerve, LN - lingual nerve, IAN - Inferior alveolar nerve, ATN - Auriculotemporal nerve.

DISCUSSION

The auriculotemporal nerve has been described in Gray's anatomy¹ as having two roots which encircle the middle meningeal artery. It has been described to have two rami which pass behind the neck of the mandible to join the facial nerve, and filaments from the otic ganglion join the roots of the nerve close to its origin.

Gulekon et al.² observed in 32 dissections (16 cadaveric heads) of the infratemporal fossa that the auriculo temporal nerve had four roots in 3.1%, three roots in 9.4%, two roots in 37.5% and 50% had one root only. They observed a connecting nerve branch between auriculotemporal and inferior alveolar nerves in four

specimens. A four rooted auriculotemporal nerve formed a ganglion like knot. It was not a true ganglion. The present study also had three roots of the auriculotemporal nerve (Figure 1).

Baumel JJ et al.³ described the ATN after a study of 85 dissections of the nerve that the nerve did not form a tight button hole loop around the MMA, instead the roots were widely separated by an elongated V-shaped interval. At their junction the roots form a short trunk which broke up into a spray of branches in line with the posterior border of mandible. The largest branch of the ATN is the superficial temporal ramus. It communicates with the facial nerve by two rami. These rami form the strongest communication between the Vth & VIIth. In the present study also no button hole loop was formed around the middle meningeal artery (Figure 1).

M. Namking et al.,⁴ has described the communication between the facial & ATN in his study of 55 facial sides from Thai cadavers. The CATN patterns were classified on the basis of number of branches which joined the facial nerve. 20.7% of facial nerves received only one CATN, 60.4% received two CATNs, 15.1% received three, 3.8% received several. Further he observed that the facial nerve branches that were joined by CATNs supplied the upper muscles of facial expression and may convey proprioceptive impulses from orbicularis oculi.

In the present study the auriculotemporal nerve was found to communicate by its 3rd root with the inferior alveolar nerve forming a loop. The accessory meningeal artery passes through this loop (Figure 2).

Komarnitki et al.⁵ in a study of ITF in 16 specimens described one, two, three, four and five root variants of ATN and have stated that the variable topography of the auriculotemporal nerve course may play a role in the symptomatology of headaches and localization of pain in the face and masticatory system.

N. Beeser Andersen et al.⁶ The peripheral topography of the SON, STN and the superficial temporal branch of the auriculotemporal nerve (ATN) was investigated in 10 cadavers. They located the ATN at the upper margin of the helix. Its exit point was at the middle part of tragus towards the skull.

Balaji et al.,⁷ reported from a study of 36 specimens that communication was seen in two specimens between the ATN and IAN. In one of the specimens the communicating branch split into two to form a button hole for the passage of MHN. They concluded that the communicating branches convey postganglionic fibres from the otic ganglion. They further concluded that communicating nerves serve as an alternative route for maintaining the functional integrity of the structures innervated.

Mangala M. Pai,⁸ et al. has cited five articles⁹⁻¹³ that describe the development of the mandibular nerve and its branches. The neural crest cells in the cephalic region migrate ventrally through the mesoderm of the mandibular arch. The migration is influenced by multiple cell matrix interactions, contact repulsion and chemorepulsion. Factors that inhibit neural crest cell migration are thought to be liberated from caudal somites. This may lead to variation in the formation of nerve pathways. In their study they encountered three roots of inferior alveolar nerve one each from the posterior division of mandibular nerve, auriculotemporal nerve and lingual nerve. They observed that the second part of maxillary artery was encircled by the roots originating from the mandibular nerve and auriculotemporal nerve. In the present study the union of third root with inferior alveolar nerve may be due to the influence of factors on cell matrix interactions. The factors like F-spondin and T-cadherin have been indicated in the study by Debby-Brafman A et al.¹³

Siessere S et al.¹⁴ attempted to study the variations of mandibular nerve in 20 specimens. They could find a variation in the number of the branches and concluded that clinical situations involving the stomatognathic structures could be explained based on these variations. In the present study the communication with the inferior alveolar nerve may throw light on the sensory functionality of the nerves. It may affect clinical presentation of symptoms arising in the mandibular alveolar region with two different sensory nerves connected.

Relationship of auriculotemporal nerve to superficial temporal artery has been implicated in the treatment of Migraine headaches in a study by Janis Jeffrey E, et al.¹⁵

Brian L. Schmidt et al.,¹⁶ described the distribution of auriculotemporal nerve around the temporomandibular joint in a study of 8 cadaveric heads (16 sides).

Unusual organization of auriculotemporal nerve was reported by Simmi Soni et al.,¹⁷ They reported that the auriculotemporal nerve originated in two roots and called them upper and lower roots from the posterior division of mandibular nerve. They found that the roots were lateral and medial to the middle meningeal artery. In the present case the roots were between AMA and MMA. They also found rootlets in the second root forming multiple loops with the upper lateral root. One of the loops had the middle meningeal artery but in our study the middle meningeal artery was not enclosed in a loop. They have reported that the superficial temporal artery was encircled by the bifurcated trunk of auriculotemporal nerve. There was communicating branch to the facial nerve from this trunk. In the present study the third root of auriculotemporal nerve communicated with the inferior alveolar nerve. The communication with the inferior alveolar nerve was well above the origin of the MHN.

The variations in auriculotemporal nerve have been reported in the past since it has important clinical implications especially for referred pain from the region for the facio-maxillary surgeons and dental surgeons. The incidence of variation has to be documented as this helps in updating the clinical database for surgical procedures and treatment in the region of infratemporal fossa.

List of abbreviations

ATN: Auriculotemporal nerve
 MMA: Middle meningeal artery
 CATN: Communicating auriculotemporal nerve
 ITF: Infratemporal fossa
 SON: Supraorbital nerve
 STN: Supratrochlear nerve
 IAN: Inferior alveolar nerve
 MHN: Mylohyoid nerve

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