ANATOMICAL VARIATIONS IN THE COURSE OF THE INFERIOR ALVEOLAR AND MYLOHYOID NERVES: A CADAVERIC DISSECTION STUDY

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ABSTRACT

Objective: To assess anatomical variations in the course and branching patterns of the inferior alveolar nerve (IAN) and mylohyoid nerve (MHN) in formalin-fixed cadaveric specimens, with implications for dental, anesthetic, and mandibular surgical procedures

Materials and Methods: Thirty head and neck specimens underwent detailed dissection from the infratemporal fossa through the mandibular foramen. The origin and branching patterns of the MHN were traced and digitally documented.

Results: Three variations were identified: (1) medial branching of MHN from the IAN in one specimen, (2) direct origin of MHN from V3 in two specimens, and (3) high origin of MHN in one specimen.

Conclusions: These anatomical variants bear significant clinical implications for mandibular anesthesia and surgical approaches. A thorough understanding of these variations may enhance procedural accuracy and minimize neural complications. Future studies using larger samples and advanced imaging modalities are recommended.

Keywords: *Inferior Alveolar Nerve, Mylohyoid Nerve, Anatomical Variation, Mandibular Nerve Block, Cadaveric Dissection*

INTRODUCTION:

The inferior alveolar nerve (IAN), a major branch of the mandibular division of the trigeminal nerve (V3), provides sensory innervation to the lower teeth, gingiva, and chin. The mylohyoid nerve (MHN), typically arising from the IAN before it enters the mandibular foramen—or occasionally directly from the mandibular nerve—supplies motor innervation to the mylohyoid muscle and the anterior belly of the digastric muscle.[1] While their standard anatomical courses are well-documented, numerous studies have reported clinically significant variations in their origin, branching patterns, and innervation territories.[2]

These anatomical variations have important implications for oral and maxillofacial surgery, particularly in procedures such as inferior alveolar nerve blocks, third molar extractions, dental implant placement, mandibular osteotomies, and treatment of neuralgia or nerve injury.[3]

Failure to recognize atypical nerve pathways can lead to incomplete anesthesia, unexpected postoperative pain, or iatrogenic nerve damage, resulting in sensory disturbances or motor deficits. A thorough understanding of the variable anatomy of the IAN and MHN is essential for optimizing surgical planning and minimizing complications.[4] This study aims to investigate the anatomical course and branching patterns of the inferior alveolar and mylohyoid nerves in cadaveric specimens, with an emphasis on identifying variations that may impact clinical and surgical outcomes.

MATERIALS AND METHODS:

Study Design:

This is an observational dissection study conducted on 30 head and neck specimens provided by the Department of Anatomy. The specimens were formalin-fixed cadavers, carefully preserved for anatomical study. All dissection was performed under appropriate ethical guidelines for anatomical research.

Specimen Preparation:

Each specimen underwent a detailed dissection, starting from the infra-temporal fossa to trace the course of the inferior alveolar nerve and mylohyoid nerve. Special attention was paid to the origin and branching patterns of the mylohyoid nerve. The surrounding anatomical structures were preserved for context and visualization. Digital images were captured during the dissection for documentation and future reference.

Methodology:

a) Identification of Nerves: The mandibular nerve (V3) was exposed by dissection of the infratemporal fossa, and its branches were traced. The inferior alveolar nerve and mylohyoid nerve were carefully followed as they left the mandibular foramen and descended along the mandible.

b) Tracing Nerve Branching: The specific origin of the mylohyoid nerve was noted, whether it arose from the inferior alveolar nerve or directly from the mandibular nerve.

c) Variation Identification: Special emphasis was placed on observing variations in the branching pattern of the mylohyoid nerve, such as its origin from the medial side of the inferior alveolar nerve, its direct origin from the mandibular nerve, and any high origins.

d) Documentation: Digital images were taken throughout the dissection for documentation, and these images were analyzed to observe any variations across the specimens.

Statistical Analysis

All data collected during the dissection were compiled in Microsoft Excel and analysed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY)**.** Descriptive statistics, including frequencies and percentages**,** were used to summarize the origin and branching patterns of the mylohyoid nerve. Where applicable, 95% confidence intervals (CI) were calculated for each anatomical variation to assess the precision of the observed prevalence. Differences in nerve origin between the right and left sides were analysed using the Chi-square test

RESULTS:

The study of 30 head and neck specimens revealed the following variations in the course of the inferior alveolar and mylohyoid nerves:

I. Nerve to Mylohyoid Branching from the Medial Side of the Inferior Alveolar Nerve (1 Specimen): In one specimen, the nerve to mylohyoid branched from the medial aspect of the inferior alveolar nerve, a rare variation. Typically, the mylohyoid nerve arises from the inferior alveolar nerve before it enters the mandibular foramen. The medial origin could influence the surgical approach, especially during mandibular surgeries. (FIG 1)

II. Nerve to Mylohyoid Originating Directly from the Mandibular Nerve (2 Specimens): In two specimens, the nerve to mylohyoid originated directly from the mandibular nerve, bypassing the inferior alveolar nerve. This variation, while uncommon, is important for clinicians performing

mandibular nerve blocks and surgeries, as the presence of this variant could affect anesthesia or nerve preservation. (FIG 2)

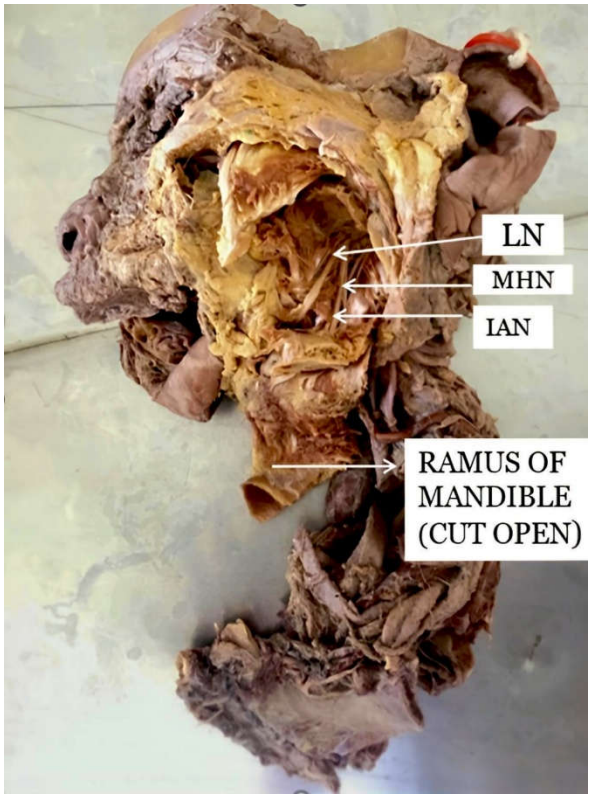

Fig 1: Nerve to mylohyoid branching from medial side of inferior alveolar nerve.

III. Nerve to Mylohyoid Originating Directly from the Mandibular Nerve (2 Specimens): In two specimens, the nerve to mylohyoid originated directly from the mandibular nerve, bypassing the inferior alveolar nerve. This variation, while uncommon, is important for clinicians performing mandibular nerve blocks and surgeries, as the presence of this variant could affect anesthesia or nerve preservation. (FIG 2)

Fig 2: Nerve to mylohyoid emerging directly from mandibular nerve.

DISCUSSION:

Anatomical variations in the inferior alveolar nerve (IAN) and mylohyoid nerve (MHN) carry significant clinical implications, particularly in dental procedures, mandibular nerve blocks, and surgeries involving the lower jaw and floor of the mouth. A thorough understanding of these variations is essential to minimize the risk of iatrogenic nerve injury, enhance the efficacy of local anesthesia, and improve surgical outcomes.[3]

This study identified three primary variations in the anatomical course and branching patterns of the IAN and MHN, each of which has been previously documented but is infrequently observed in routine dissections.

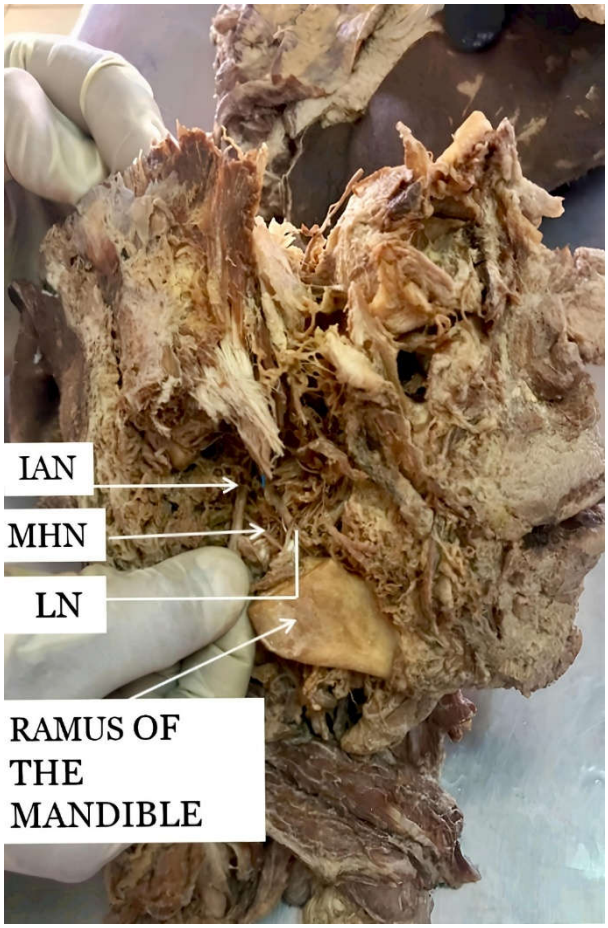

Fig 3: High origin of nerve to mylohyoid.

One variation involved the MHN branching medially from the IAN. This uncommon pathway may increase the risk of nerve damage during mandibular surgeries or nerve blocks if not anticipated. Similar findings were reported by Tóth et al., who emphasized the importance of recognizing this variation for surgical planning.[4]

Another variation observed was the direct origin of the MHN from the mandibular nerve, bypassing the IAN entirely. This anatomical difference can alter both sensory and motor innervation patterns and may lead to inadequate anesthesia during dental procedures. Verma et al. and Yadav et al. also documented this variation, recommending modifications in anesthetic techniques to ensure complete nerve blockade.[5,6]

Additionally, a high origin of the MHN was noted in some specimens. This variation can complicate access during surgical procedures and increase the likelihood of nerve injury. Singh et al. highlighted similar observations and advised careful surgical planning in such cases.[7]

CLINICAL IMPLICATIONS

The presence of anatomical variations in the MHN underscores the need for individualized approaches in dental and maxillofacial interventions. Preoperative imaging or meticulous dissection may be warranted in certain cases to avoid complications. In the context of dental anesthesia, recognizing these variations can significantly improve the effectiveness of nerve blocks and patient comfort, particularly in procedures such as molar extractions, wisdom tooth removal, and management of mandibular fractures. [8,9,10]

LIMITATIONS AND FUTURE DIRECTIONS

This study was conducted on a limited sample size (n = 30), which may not capture the full spectrum of anatomical variability. Future

research incorporating larger sample sizes and the use of advanced imaging techniques such as three-dimensional computed tomography (3D-CT) or magnetic resonance imaging (MRI) could provide a more comprehensive understanding of the anatomical variations in the IAN and MHN. Additionally, clinical studies assessing the functional outcomes of these variations, including postoperative sensory disturbances or muscle dysfunction, would offer valuable insight into their practical significance.

CONCLUSION

This study reinforces the importance of recognizing anatomical variations in the IAN and MHN to optimize surgical and anesthetic outcomes in the mandibular region. Variants such as medial branching of the MHN, direct origin from the mandibular nerve, and high origin must be taken into account during clinical procedures. Further studies with larger cohorts and advanced imaging modalities are essential for improving patient safety and procedural efficacy.

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CONFLICT OF INTEREST: No

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