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The Anatomy of Extraoral Mandibular Nerve Block

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Abstract

Effective pain control is one of the most important aspects of dental care and maxillofacial surgery.. Having broad knowledge of anatomy is essential for practicing dentistry. The main difficulty with the traditional approach to the mandibular nerve block is the absence of consistent anatomical landmarks. The Significant advantages of the Mandibular nerve block over Inferior Alveolar nerve block include its higher success rate and the absence of problems with accessory sensory innervation to the mandibular teeth. Extraoral mandibular nerve blocks can be attempted in cases of Trismus . However this approach of MNB is not conventional due to unavailability of surface landmarks . The aim of this study is to specify landmarks in dissected cadaveric specimens that will act as a guide for an easy approach to Extraoral Mandibular nerve block(EOMNB). Our study revealed that, in a case of EOMNB , the average distance from centre of base of tragus to the point of needle entry is 1.44 ± 0.15 cm.The average depth the needle has to pass from the skin surface perpendicularly to reach the trunk of the mandibular nerve for a proper dissipation of dye to occur is 4.26 ± 0.33 cm.

Keywords: Mandibular nerve; Extraoral mandibular nerve block.

Introduction

Effective pain control is one of the most important aspects of dental care and maxillofacial surgery. Having broad knowledge of anatomy is essential for practicing dentistry. The nerves in relation to the parasympathetic ganglia located in the cranial part of the autonomic nervous system, are located very deep e.g. the mandibular nerve is related to the otic ganglion right beneath the oval foramen. The deep location of the nerve in the infratemporal fossa makes it quite inaccessible for mandibular nerve block.

The main difficulty with the traditional approach to the mandibular nerve block is the absence of consistent anatomical landmarks. Multiple authors have described numerous approaches to this often elusive nerve.[1,2] Indeed, reported failure rates for the MNB(Mandibular Nerve Block) are commonly high, ranging from 31% and 41% in mandibular second and first molars to 42%, 38%, and 46% in second and first premolars and canines, respectively,[3] and 81% in lateral incisors.[4] Not only is the Mandibular nerve elusive, studies using ultrasound[5] and radiography[6,7] to accurately locate the nerve bundle revealed that accurate needle location did not guarantee successful pain control specially if the inferior alveolar nerve is approached which seems an easier approach.[8] This difficulty in achieving mandibular anesthesia has over the years led to the development of alternative techniques to the traditional (Halsted approach) inferior alveolar nerve block. These have included the

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Gow-Gates mandibular nerve block,[9] the Akinosi-Vazirani closed-mouth mandibular nerve block,[10] the periodontal ligament (PDL, intraligamentary) injection,[11] intraosseous anesthesia,[12] and, most recently, buffered local anesthetics.[13] Although all maintain some advantages over the traditional Halsted approach, none is without its own faults and contraindications. The introduction of the Gow-Gates mandibular nerve block in 1973 spurred interest in alternative methods of achieving anesthesia in the lower jaw. In 1977, Dr. Joseph Akinosi reported on a closed-mouth approach to mandibular anesthesia.[14] Although this technique can be used whenever mandibular anesthesia is desired, its primary indication remains those situations where limited mandibular opening precludes the use of other mandibular injection techniques. Such situations include the presence of spasm of the muscles of mastication (trismus) on one side of the mandible after numerous attempts at IANB(Inferior Alveolar Nerve Block), as might anesthesia adequate to extirpate the pulpal tissues of the involved mandibular molar. When the anesthetic effect resolves hours later, the muscles into which the anesthetic solution was deposited become tender, producing some discomfort on opening the jaw. During a period of sleep, when the muscles are not in use, the muscles go into spasm (the same way one's leg muscles might go into spasm after strenuous exercise, making it difficult to stand or walk the next morning), leaving the patient with significantly reduced occlusal opening in the morning. If it is necessary to continue dental care in the patient with significant trismus, the options for providing mandibular anesthesia are extremely limited. Inferior alveolar, Gow-Gates or Akinosi techniques of mandibular nerve block cannot be attempted when significant trismus is present. In such cases Extraoral mandibular nerve blocks can be attempted and, indeed, possess a significantly high success rate in experienced hands. Extraoral mandibular blocks can be administered through the sigmoid notch or inferiorly from the chin.[15,16] Because the mandibular division of the trigeminal nerve provides motor innervation to the muscles of mastication, a third division (V3) block will relieve trismus that is produced secondary to muscle spasm (trismus may also result from other causes). However this approach of MNB is not conventional due to unavailability of surface landmarks . The aim of this study is to specify landmarks in dissected cadaveric specimens that will act as a guide for an easy approach to Extraoral Mandibular nerve block.

Aims and Objectives

To identify specific anatomic landmarks for Extraoral Mandibular Nerve Block making use of cadaveric dissection.

Materials and Methods

Ten adult cadavers of both sexes were selected for the study in the department of Anatomy at Malda Medical College. Study period was approximately eight months. It was carefully noted that they were free from any form of maxillofacial deformity. Any cadaver with scar mark over the maxillary region indicative of previous trauma or surgery was also excluded from study.

With the aid of guidance provided by existing literature on Extraoral MNB, 3 ml of yellow *Acryllic* dye was injected into the infratemporal fossa with a 6 inch long needle fitted to a 5 ml syringe. The base of the Tragus was taken as the landmark and the needle was negotiated close to the base of the tragus below the zygomatic arch at an angle of 90 degrees until a bony obstruction was felt. This was repeated on both sides in all 10 cadavers. Then the infratemporal fossa was dissected upto the trunk of the Mandibular nerve close to the foramen ovale. Generous amount of dye around the trunk of the mandibular nerve was noted and taken to be a satisfactory outcome. Presence of dye below the bifurcation of the main trunk of the nerve or too much dissipation of the dye in the overlying skin or

Fig 1: The Anatomical landmarks

muscular layers was considered dissatisfactory and the results were excluded from study. From the satisfactory cases thus obtained (14 cases were satisfactory and 6 cases were excluded) we measured the distance between point of needle entry from the centre of the base of tragus. Depth of the needle to reach the mandibular nerve was also measured. The data thus obtained was evaluated statistically to come to a conclusion.

Tools required

1. Skin marking pen
2. Scalpel

Fig 2: Injection of dye into the trunk of Mandibular nerve in the cadaver

Fig 3: Dissipation of dye over trunk of Mandibular nerve

3. Tooth forceps
4. 5 ml syringe fitted with 6 inch long needle
5. Yellow acrylic dye
6. Plain forceps
7. Chisel hammer
8. Periosteum elevator
9. Osteotome
10. Bone nibbler
11. Scissors
12. Allis' tissue forceps
13. Vernier slide calipers.

Results

After the dissection, we could see that in 12 dissections (60%), the otic ganglion was situated medial to the mandibular nerve, right under the foramen ovale. The otic ganglion also had a flattened, small, and oval form. In 5 (25%) of the specimens dissected we failed to observe any oval structure reminiscent of an otic ganglion, instead there was a fusiform swelling in the trunk of the Mandibular nerve itself close to the point of its exit from the Foramen Ovale. In 3 (15 %) of the specimens no anatomic structure like that of an Otic Ganglion could be located on the medial aspect of the Mandibular nerve. During the course of our dissections in the Infratemporal fossa, our findings mostly corroborated with those of classical literature[17] with regard to the structures found in this region. In all the specimens, the Inferior Alveolar Nerve was found to emerge between the medial and lateral pterygoid muscles; distally the neurovascular bundle of the Inferior Alveolar nerve was found to enter the Mandibular foramen. In all the 20 specimens dissected the Lingual nerve was seen to course anterior to the Inferior Alveolar nerve, before entering the oral cavity between the medial pterygoid muscle and the Ramus of the Mandible. In all specimens barring one , the Chorda Tympani nerve was found to join the Lingual nerve posteriorly ,where the chorda tympani failed to join the Lingual nerve and ran downwards parallel to it, a small nerve fibre however connected the two nerves. No anatomical variation was noted with regard to the trunk of the Mandibular nerve. After piecemeal dissection of the Lateral Pterygoid muscle the trunk of the mandibular nerve was seen lying

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Avg (cm)	S.D.
Tragus to needle entry point (cm)	1.28	1.36	1.55	1.47	1.23	1.59	1.22	1.38	1.24	1.47	1.66	1.52	1.43	1.70	1.44	0.16
Length of needle (cm)	3.96	4.26	4.48	4.29	3.88	4.58	4.13	3.95	3.82	4.28	4.35	5.11	4.25	4.23	4.26	0.33

medial to the muscle, immediately below the foramen ovale. After A brief course of about 4-5 mm the trunk divided into a small anterior and a large posterior division. Both the Inferior Alveolar and the Lingual nerves could be traced from the posterior division.The average distance from centre of base of tragus to the point of needle entry is 1.44 ± 0.15 cm. The average depth the needle has to pass from the skin surface perpendicularly to reach the trunk of the mandibular nerve for a proper dissipation of dye to occur is 4.26 ± 0.33 cm.

Discussion

The classic description of the Otic Ganglion and the Mandibular nerve of humans has remained unaltered for quite sometimes now .In the course of our study we found that Otic ganglia resembling the classic description were found in about 60% of the cases. In 25%, some thickening could be seen adjacent, almost adherent to the mandibular nerve and in 15%, no definite structure could be observed. Our results offer some contradiction to the observations made by *Roitman R. et al,*[18] where the above percentages were 40%, 13%, and 27% respectively. For ages, dentists have endeavored to control pain in their procedures by utilizing a method that blocked the pathway of pain impulses to the brain. When the trunk of the mandibular is blocked areas usually anesthetized are:[19]

1. Mandibular teeth to the midline.
2. Buccal mucoperiosteum.
3. Anterior two thirds of the tongue and floor of the oral cavity.
4. Lingual soft tissues and periosteum.
5. Body of the mandible, inferior portion of the ramus.
6 Skin over the zygoma, posterior portion of the cheek, and temporal regions.

The Significant advantages of the MNB over IANB include its higher success rate,and the absence of problems with accessory sensory innervation to the mandibular teeth.[20]

Indications of MNB

1. Multiple procedures on mandibular teeth.
2. When buccal soft tissue anesthesia, from the third molar to the midline, is necessary.
3. When lingual soft tissue anesthesia is necessary.
4. When a conventional inferior alveolar nerve block is unsuccessful.

Gow-Gates and Akinosi Techniques are standard yet complicated procedures and present to the clinician greater elements and degrees of risk. Gow-Gates advocates the use of an intra-oral technique while utilizing extra-oral landmarks. The dentist must inject in the mouth and at the same time visualize the outside of the patient's head and face regions, in order to carry out this maneuver. The target for the needle point is the neck of the condyle which lies in the upper portion of the pterygomandibular space. In addition, injecting the needle and local anaesthetic into the anterior portion of the temperomandibular joint capsule could also produce damage and prolonged side effects in the form of severe joint dysfunctions. The Akinosi technique also advocates placing the needle and local anaesthetic in the upper portion of the pterygomandibular space. Coupled with this is the disadvantage of not having any hard tissue landmarks that can be utilized as the proceedure is carried out with the patient's mouth closed. If it is necessary to continue dental care in the patient with significant trismus, the options for providing mandibular anesthesia are extremely limited. Inferior alveolar and Gow-Gates mandibular nerve blocks cannot be attempted when significant trismus is present. Extraoral mandibular nerve blocks can be attempted and, indeed, possess a significantly high success rate in experienced hands. Extraoral mandibular blocks can be administered through the sigmoid notch. Mandibular division of the trigeminal nerve provides motor innervation to the muscles of mastication, a third division (V3) block will relieve trismus that is produced secondary to muscle spasm (trismus may also result from other causes. EOMNB is however not very conventional because of limited surface landmarks and related studies. Our study attempts to throw some light on this aspect of MNB. We noted, that the average distance from centre of base of tragus to the point of needle entry is 1.44 ± 0.15 cm. The average depth ,the needle has to pass from the skin surface perpendicularly to reach the trunk of the mandibular nerve for a proper dissipation of dye to occur is 4.26 ± 0.33 cm. Hence these anatomical landmarks can be used as a guidance for efficient MNB from extraoral aspect for providing adequate pain relief.

Conclusion

With this study, we can conclude that there is some variation from standard literature regarding the location and morphology of the Otic ganglion and the Mandicular nerve with its branches. The main focus of this study was to provide adequate surface landmarks for EOMNB and we have been able to do so to a large extent. The major limitation of this study has been the relatively small number of specimens dissected, which can hopefully be compensated by further studies on similar subjects .

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