



Isolated Deep Ear Canal Pain: Possible Role of Auricular Branch of Vagus Nerve—Case Illustrations with Cadaveric Correlation

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Glossopharyngeal, nervus intermedius, and vagus neuralgias can all present with ear pain. However, to our knowledge, there have been no reports of otalgia as the only symptom of vagus neuralgia. The seventh, ninth, and tenth cranial nerves have many interneural connections, and the exact anatomy and pathophysiology of these neuralgias are often not clear. Moreover, symptoms due to involvement of any of these nerves can be difficult to attribute solely to 1 of them. The overlapping sensory innervation of the external auditory canal can lead to misdiagnosis in patients suffering from otalgia. This report presents a case of pure otalgia due to vascular compression of the vagus nerve (VN) and considers the microanatomic differences between glossopharyngeal and nervus intermedius neuralgia via cadaveric dissections.

We report 2 cases of external auditory canal pain that continued following microvascular treatment of trigeminal neuralgia. Intraoperatively and at secondary operation, the posterior inferior cerebellar artery was found to be adherent and to penetrate between the fibers of the VN. Following microvascular treatment of the VN, the pain resolved.

■ **CONCLUSION:** This is the first report of vagus neuralgia presenting solely with ear pain. Surgeons should be aware that primary external auditory canal pain can be due to vagus neuralgia via its auricular branch and that such

patients can be misdiagnosed with glossopharyngeal or nervus intermedius neuralgias.

INTRODUCTION

The auricular branch of the vagus nerve (ABVN), or Arnold's nerve, is a general sensory nerve that supplies the deep external auditory canal while the tympanic branch of the glossopharyngeal nerve (TBGN) supplies the tympanic cavity and auditory tube. Some reports have described the nervus intermedius as having a general sensory component and as contributing to the same area as the ABVN.¹⁻⁶

Most frequently, nerve-related ear pain is due to glossopharyngeal neuralgia (GPN). GPN pain is localized to the tympanic cavity or tympanic membrane, base of the tongue, tonsil, or area beneath the angle of the jaw.⁷⁻¹⁰ These painful attacks can occur when drinking cold liquids, sneezing, and coughing or after direct tactile stimulation of the area involved.

Among 87 patients with glossopharyngeal and vagal neuralgia, we encountered only 2 who presented with isolated deep ear canal pain. Usually, these lower cranial nerves neuralgias, including nervus intermedius, are treated surgically by microvascular decompression and the diagnosis is confirmed at surgical inspection of the VII, IX, and X. In some cases, sectioning of the nervus intermedius or vagus nerve (VN) may be required.^{6,9,11-13} In the present cases, the posterior inferior cerebellar artery (PICA) was found to travel between the first and second rootlets of the VN

Key words

- Auricular branch of the vagus nerve
- External auditory canal pain
- Glossopharyngeal neuralgia
- Microvascular decompression
- Nervus intermedius neuralgia
- Vagus neuralgia

Abbreviations and Acronyms

ABVN: Auricular branch of the vagal nerve

FN: Facial nerve

GPN: Glossopharyngeal nerve

PICA: Posterior inferior cerebellar artery

TBGN: Tympanic branch of the glossopharyngeal nerve

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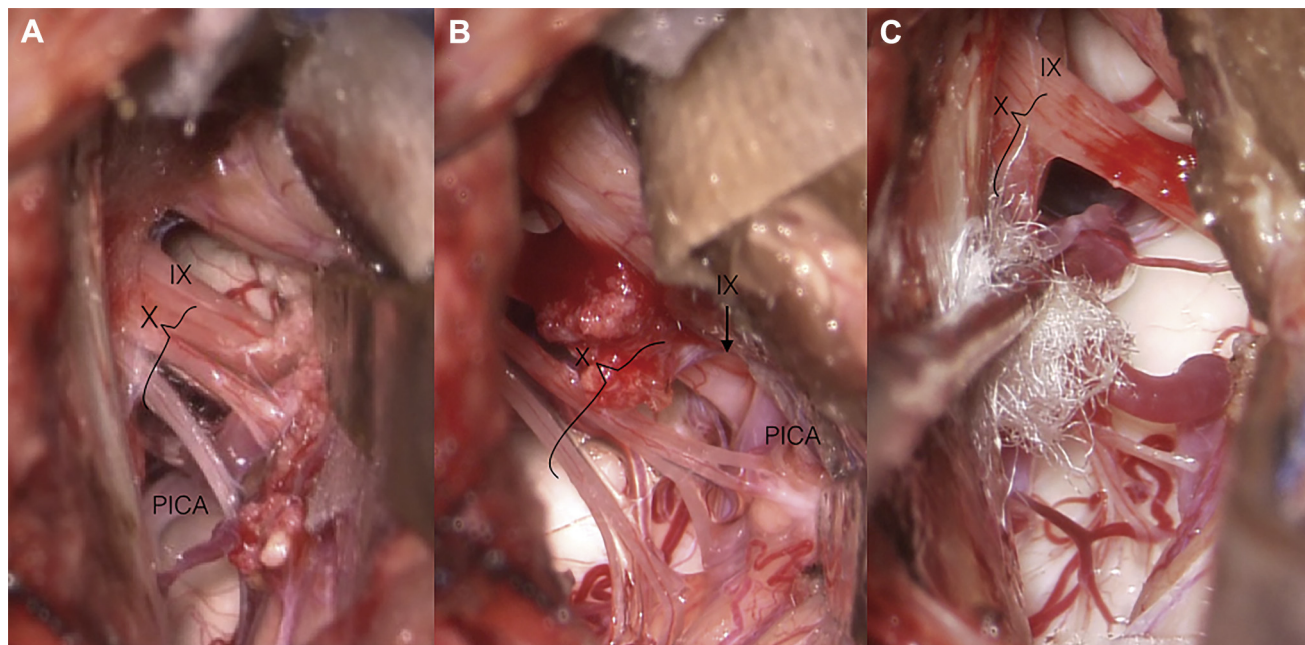


Figure 1. (A) The posterior inferior cerebellar artery (PICA) and glossopharyngeal nerve were found to have dense adhesions with the flocculus and cerebellum. (B) The PICA passing between the first and

second branches of X. (C) After arachnoidolysis, the PICA was translocated from the root entry zone of the X. PICA, posterior inferior cerebellar artery; IX, glossopharyngeal nerve; X, vagus nerve.

and adhered strongly to those structures (Figure 1A and B). No neurovascular conflict was found at inspection of the nervus intermedius. This vascular compression manifested clinically with isolated neuralgic deep ear canal pain. We hypothesize that this pain distribution may be mediated by the ABVN.

CASE ILLUSTRATION

Case 1

A 58-year-old Caucasian female presented with a history of trigeminal neuralgia in the left trigeminal nerve second branch and trigeminal nerve third branch dermatomes that had started 10 years earlier. Microvascular decompression of the trigeminal nerve was performed at another hospital. During the first operation, the surgeon observed no arterial compression and the petrosal vein was sectioned. After the operation, the patient had persistent left ear pain, located in the deep external canal and the lower half of the auricle, near the concha. It was constant and triggered by stress and cold. One year later, the patient underwent glycerol rhizotomy of the trigeminal nerve, which resulted in numbness in a left trigeminal nerve third branch dermatome but no effect on the ear pain. Multiple pain medication trials were conducted, unsuccessfully, including fentanyl patch, hydrocodone, oxycodone, and carbamazepine. When she presented to our institution, it was decided to explore the lower cranial nerves and nervus intermedius via a retromastoid craniotomy. In the cerebellopontine angle, the glossopharyngeal, vagus, and accessory nerves were exposed. The flocculus covered the proximal portion of the nerves, and the PICA was found to be located between the first and second rootlets of the VNs and adhered to those nerves, the flocculus, and cerebellum

(see Figure 1A and B). The adhesions were dissected and freed from the cerebellum. The PICA was transposed with a Teflon sling (Figure 1C). The trigeminal nerve and facial nerves were not manipulated. The patient's ear pain subsided completely immediately after surgery and did not recur after 2 years of follow-up. The patient had no discomfort from the incision scar or any neuralgic pain in the occipital area, ruling out these 2 diagnoses from the differential, retrospectively.

Case 2

A 60-year-old male presented with a 5-year history of severe pain in the ear canal and lower part of the concha. The pain was constant and triggered by swallowing and tactile stimulation of the ear canal. A microvascular decompression of the trigeminal nerve was first performed in another hospital. However, the pain did not subside after surgery. At our institution, the patient was diagnosed with glossopharyngeal or vagal neuralgia and a second operation was offered. In the cerebellopontine cistern, a loop from the PICA was found to cause significant compression on the vagal nerve, again between its first and second branches. The PICA was transposed with a Teflon sling. The nervus intermedius was not manipulated, but no neurovascular conflict was found at inspection. The deep ear and concha pain fully resolved, and no recurrence was found after a 12-month follow-up period.

CADAVERIC FINDINGS

Microanatomic Study of Nerves Around External Auditory Canal

Figure 2 shows the connections among the trigeminal, facial, glossopharyngeal, vagus, accessory, and hypoglossal nerves.

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