

Surgical anatomy of nervus intermedius: optimizing its identification at the brainstem for treatment of geniculate neuralgia and other cerebellopontine angle surgeries



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RHOTON PROGRAM

INTRODUCTION

The nervus intermedius (NI) contains 3 types of fibers: general somatic afferent sensory, special visceral afferent, and general visceral efferent fibers. The diagnosis of geniculate neuralgia represents a challenge due to this complex nervous network. Thus, the anatomical configuration of the NI at the cerebellopontine angle may lead to intraoperative misinterpretation in identifying the nerve requiring sectioning or decompression. The aim of this study was to analyze the microsurgical anatomy of the NI and its relationship to the venous complex and surrounding structures.

MATERIALS AND METHODS

Seven formalin-fixed, latex-injected cadaveric heads (14 sides) were dissected. For illustrative purposes and to expose the lateral aspect of the brainstem, a retrosigmoid combined with posterior petrosal and translabyrinthine approaches were performed. The origin of the NI, its position related to the facial (CN VII) and vestibular (CN VIII) nerves at the brainstem, and its relationship to the regional venous network were systematically evaluated.

RESULTS

The nervus intermedius (NI) was identified in all specimens. A single origin was observed in 10 sides (71.4%), whereas multiple origins were present in 4 sides (28.6%) (Figure 1). Among the single-origin group, in 7 sides (70%) one or more bundles arose from the vestibular nerve, whereas in 3 sides (30%) they arose directly from the brainstem. In the multiple-origin group, a total of 16 bundles were identified: 8 (50%) originated from the vestibular nerve, 1 (6.2%) from CN VII, and 7 (43.8%) from the brainstem.

The position of the NI at the brainstem was consistently anterior, inferior, and medial to the vestibular nerve and superior and lateral to CN VII at their root entry zones (REZs) (Figure 2). A consistent relationship between the tributaries of the superior petrosal vein (SPV) and the CNs VII–NI–VIII complex was observed (Figure 3). Three main positions of the middle cerebellar peduncle (MCP) vein were identified before its drainage into the cerebellopontine fissure vein. From a technical standpoint, the safest zone for identification of the NI bundles, avoiding excessive manipulation of the vestibular and facial nerves, was at the REZ of the CNs VII–NI–VIII complex after retraction of the flocculus. Following the bundles to their deepest portion allowed clear visualization of their origin and reduced the risk of fiber misinterpretation or inadvertent facial or vestibular nerves injury (Figure 4).

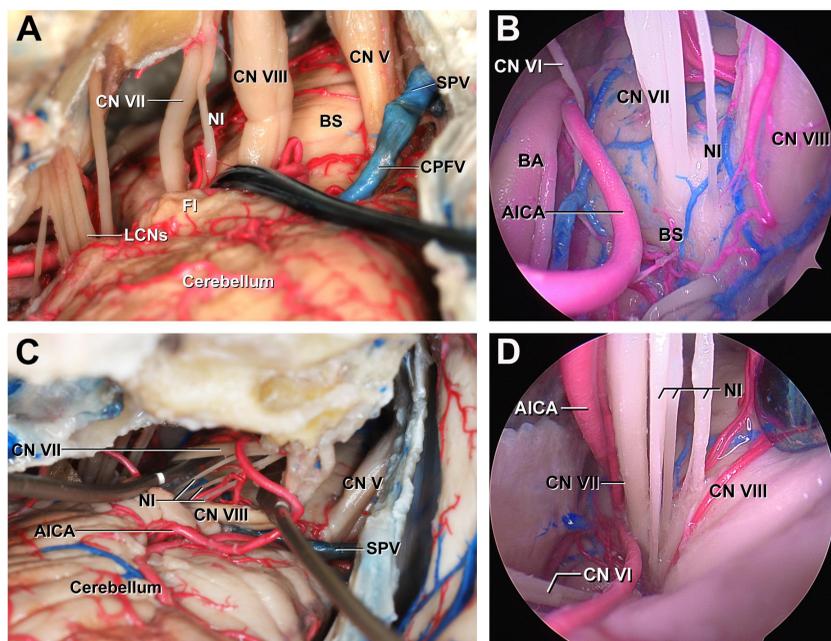


FIGURE 1. Microsurgical and endoscopic views of the single (A, B) and multiple (C, D) origins of the NI. A. Exposure of the cerebellopontine angle (CPA) after retrosigmoid approach, posterior petrosal and translabyrinthine approaches. On this side a single NI bundle originated from the most inferomedial portion of the vestibular (CN VIII) nerve. B. Endoscopic close-up view showing a single NI bundle originating from the brainstem (BS). C. Microscopic view of the multiple origin of the NI. D. Endoscopic view showing one bundle originating from CN VIII and two bundles originating from BS between CN VII and CN VIII. Abbreviations: AICA, anterior-inferior cerebellar artery; BA, basilar artery; BS, brainstem; CN, cranial nerve; CPFV, cerebellopontine fissure vein; FI, flocculus; LCNs, lower cranial nerves; MCPV, middle cerebellar peduncle vein; NI, nervus intermedius; SPV, superior petrosal vein.

RESULTS (CONTINUED)

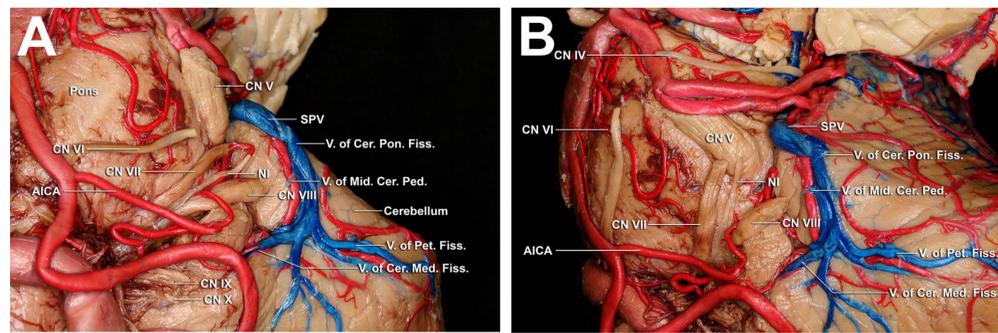


FIGURE 2. Microsurgical anterior and lateral views of the cerebellopontine angle (CPA). A and B. The nervus intermedius (NI) is located inferomedial to CN VIII and superolateral to CN VII. Some of the main tributaries of the superior petrosal vein (SPV) are reported: the vein of cerebellopontine fissure, the vein of petrosal fissure and the vein of the cerebellopeduncular fissure.

Abbreviations: CN, cranial nerve; CPA, cerebellopontine angle; Cer.Med.Fiss., cerebellomedullary fissure; Cer. Pon.Fiss., cerebellopontine fissure; Mid. Cer. Ped., middle cerebellar peduncle; NI, nervus intermedius; Pet. Fiss., petrosal fissure; SPV, superior petrosal vein.

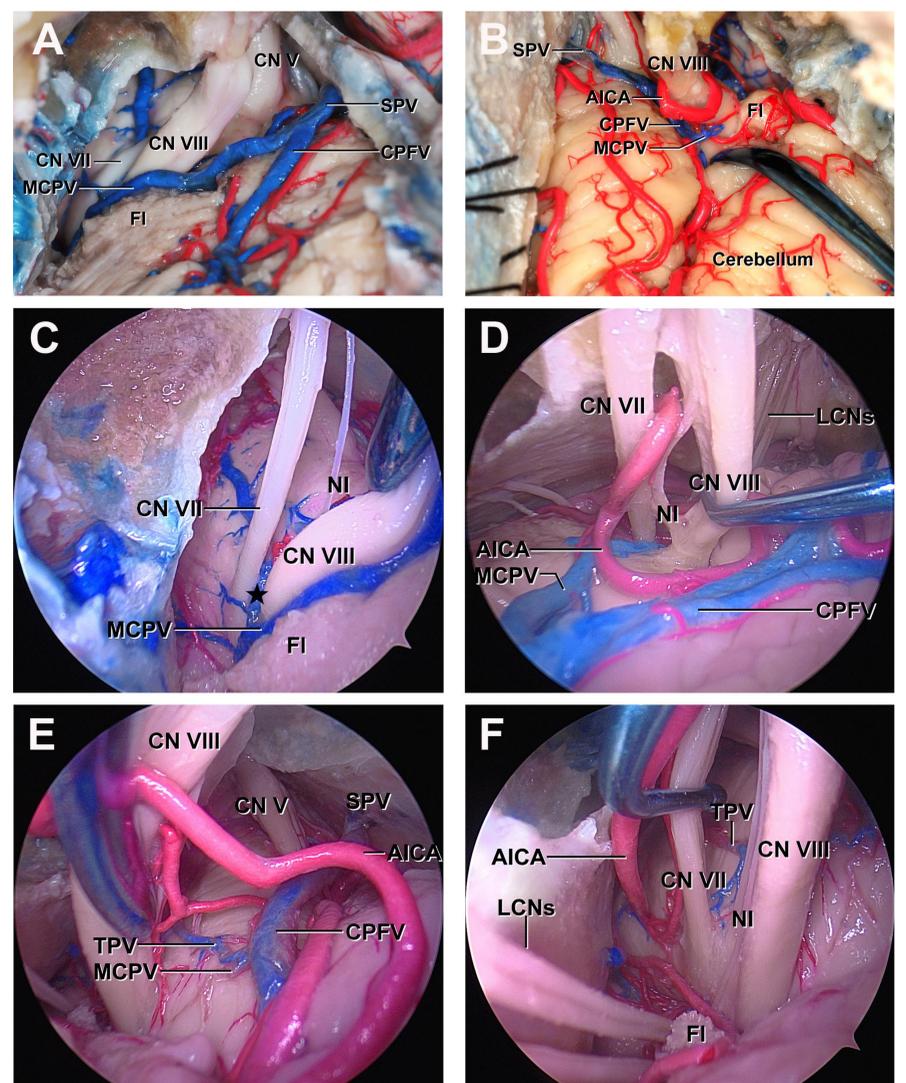


FIGURE 3. Microsurgical and endoscopic views of the venous pattern surrounding the CNs VIII–NI–VII complex. A and B. The middle cerebellar peduncle (MCPV) vein is located posterior to the CNs VIII–NI–VII complex and follows an inferior trajectory. C. Endoscopic view showing the posterior position of the MCPV giving rise to a small vein (black star) located between CNs VIII–NI and CN VII, which runs superiorly to the anastomose with the transverse pontine vein (TPV). D. Endoscopic view of the MCPV running between CNs VIII–NI and CN VII in an inferior direction. E. The MCPV posterior to CN VIII and TPV superior, drain into the cerebellopontine fissure (CPF) vein. F. Endoscopic view of a small venous tributary of the TPV running between CNs VIII–NI and CN VII. Abbreviations: AICA, anterior-inferior cerebellar artery; CN, cranial nerve; CPFV, cerebellopontine fissure vein; FI, flocculus; LCNs, lower cranial nerves; MCPV, middle cerebellar peduncle vein; NI, nervus intermedius; SPV, superior petrosal vein; TPV, transverse pontine vein.

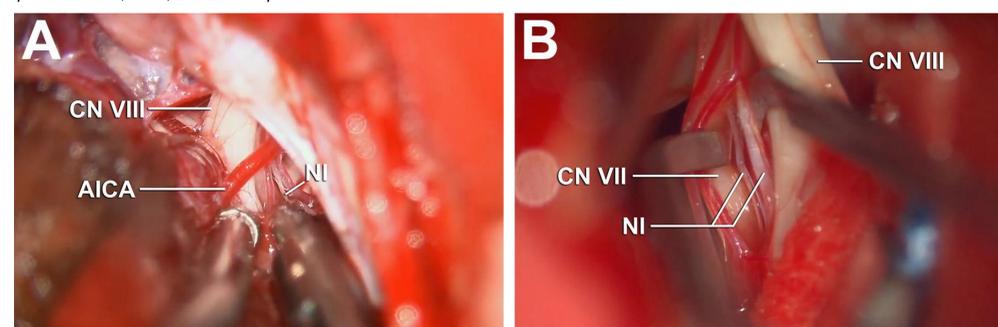


FIGURE 4. Microsurgical intraoperative view of the right and left retrosigmoid approaches. A. The nervus intermedius (NI), visualized as a single bundle located inferomedially to CN VIII, was stimulated and sharply sectioned. B. Left-sided view of the cerebellopontine angle (CPA) showing a multiple origin of the NI at the brainstem between the CN VIII and CN VII. Abbreviations: AICA, anterior-inferior cerebellar artery; CN, cranial nerve; NI, nervus intermedius.

CONCLUSIONS

The surgical anatomy of the nervus intermedius (NI) is intimately related to CNs VII–VIII complex. The origin of the NI was identified inferomedial to the root entry zone (REZ) of the vestibular nerve and superolateral to the facial nerve. Detailed knowledge of the venous anatomy surrounding the CNs VII–NI–VIII complex, particularly the major tributaries of the superior petrosal vein (SPV), is essential for the safe identification and sectioning of the NI in the treatment of geniculate neuralgia.