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Preservation of Enlarged Mastoid Emissary Vein during Microvascular Decompression for Trigeminal Neuralgia Accompanied by Abnormal Venous Drainage: A Technical Case Report

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Abstract

During microvascular decompression (MVD) for trigeminal neuralgia (TGN), the mastoid emissary veins (MEV) are routinely sacrificed using the suboccipital retrosigmoid approach. The technical nuances when the MEV is an important collateral venous pathway for the obstructive internal jugular vein (IJV) have not been described thus far. Herein, we demonstrate for the first time a modified surgical technique for MVD to preserve the MEV. A 62-year-old man with a 10-year history of TGN refractory to carbamazepine was referred to our hospital for MVD. Preoperative imaging revealed that the superior cerebellar artery was the offending vessel. Computed tomography angiography also revealed that his contralateral IJV pathway was hypoplastic, and the ipsilateral pathway was severely stenosed by the external compression of the elongated styloid process and the transverse process of the first cervical vertebra. The ipsilateral MEV and the connecting occipital veins were enlarged as the sole collateral pathways of intracranial venous drainage. A modified MVD technique, including an upside-down L-shaped skin incision, layer-by-layer dissection of the occipital muscles, and denuding of the intraosseous part of the MEV, was used to cure the TGN with the preservation of the venous pathway. After surgery, the pain completely diminished without any complications. In conclusion, such technical modifications would be applicable in cases where the MEV needs to be preserved during posterior fossa surgery. Preoperative screening of the venous system is also recommended.

Keywords: collateral, emissary vein, enlarged styloid process, internal jugular vein, retrosigmoid approach

Introduction

Microvascular decompression (MVD) is a widely accepted therapeutic option for drug-resistant trigeminal neuralgia (TGN).[1)] In standard MVD, surgeons often use a vertical linear or S-shaped incision at the posterior side of the mastoid process and almost always sacrifice the mastoid emissary veins (MEV) to secure the surgical corridor for a suboccipital retrosigmoid approach.[2,3)]

Sacrificing these emissary veins is mostly unproblematic, but these veins sometimes play an important role as a collateral venous pathway in cases of stenosis or occlusion of the transverse-sigmoid sinus or the internal jugular vein (IJV), thus threatening surgical safety.[4-6)] The surgical nuances required to preserve such collateral venous pathways in the suboccipital retrosigmoid approach have been scarcely described so far.

Herein, we demonstrate a modified surgical technique using an upside-down L-shaped skin incision, layer-by-layer dissection of the occipital muscles, and denuding of the intraosseous venous part to preserve the MEV in a patient with TGN who was incidentally accompanied by severe IJV stenosis.

Case Report

A 62-year-old man with a history of hypertension was referred to our hospital to consider MVD for TGN. He began experiencing frequent, sharp, paroxysmal pain in his right temple 10 years before the consultation. Five years

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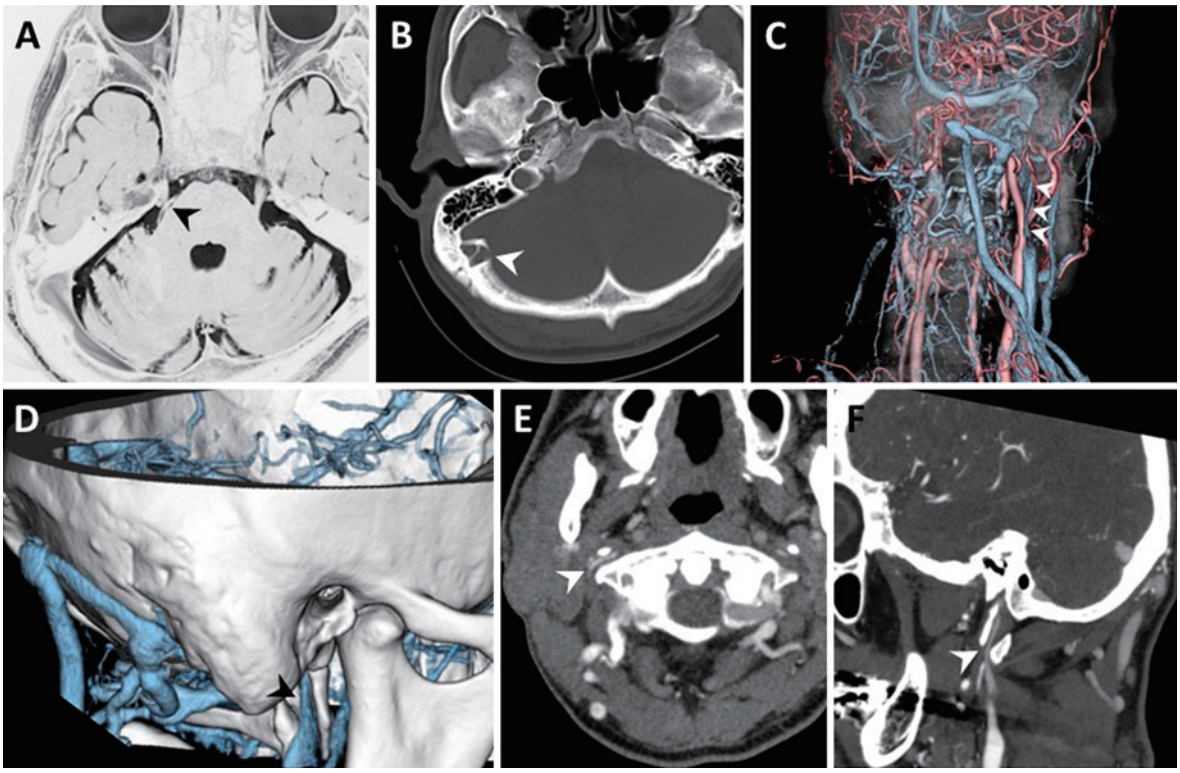

Fig. 1 Constructive interference in steady-state magnetic resonance imaging (MRI, A) showing that the right superior cerebellar artery (SCA) compresses the trigeminal nerve (CN-V, arrowhead). Computed tomography (CT, B) showing the enlarged mastoid emissary canal (arrowhead).
CT angiography (C-F) shows that the right internal jugular vein (IJV) is severely stenosed by the compression of the styloid process and the transverse process of the atlas vertebra (arrowhead). The mastoid emissary vein (MEV) and occipital veins are enlarged.

prior, he was diagnosed with TGN and started on carbamazepine (400 mg/day). Although the medication alleviated his pain and the dosage was later increased to 600 mg/day, his intervals of pain gradually became shorter with the increasing side effect of drowsiness, interfering with his daily activities and work.

Magnetic resonance imaging (MRI) revealed that the offending vessel was the superior cerebellar artery (SCA), which compresses the root of the right trigeminal nerve in the rostral direction (Fig. 1A). Preoperative computed tomography (CT) revealed an enlarged mastoid emissary canal (Fig. 1B). Therefore, CT angiography was conducted, revealing that the contralateral transverse-sigmoid sinus was hypoplastic and the ipsilateral IJV was severely stenosed by the external compression of the elongated styloid process and the transverse process of the first vertebra (Fig. 1C-F). In contrast, the ipsilateral MEV and the connecting occipital vein were enlarged and drained into the external jugular vein, functioning as the sole collateral pathway of intracranial venous drainage (Fig. 1C). Under information about the risk and benefit of surgery, the patient consented to the following surgical procedure.

Under general anesthesia, the patient was positioned in a park bench position on the left side, and an upside-down L-shaped skin incision was made above the transverse-sigmoid junction (Fig. 2A). The scalp flap was elevated inferomedially, and the sternocleidomastoid muscle was retracted anteriorly (Fig. 2B). The splenius capitis muscle was cut separately along the superior nuchal line and retracted inferomedially (Fig. 2C). The occipital vein was identified in the layer between the splenius capitis muscle and superior oblique muscle, and dissection was carefully performed along the occipital vein to identify the MEV and its foramen (Fig. 2D). The longissimus capitis muscle was retracted anteriorly, and the deep layer muscles were detached from the occipital bone to expose the digastric groove and the posterior edge of the mastoid process, in which special attention was paid to avoid injury to the MEV. Using a high-speed diamond drill, all bony structures were removed, leaving the intraosseous part of the MEV to reach the sigmoid sinus (Fig. 2E). The inferior margin of the transverse sinus was also exposed, securing a 1 × 2 cm entry space for the lateral supracerebellar approach (Fig. 2F). After opening the dura, the cerebellum was retracted inferiorly and medially, and the root of the trigeminal nerve and offending SCA were exposed (Fig. 2G). The

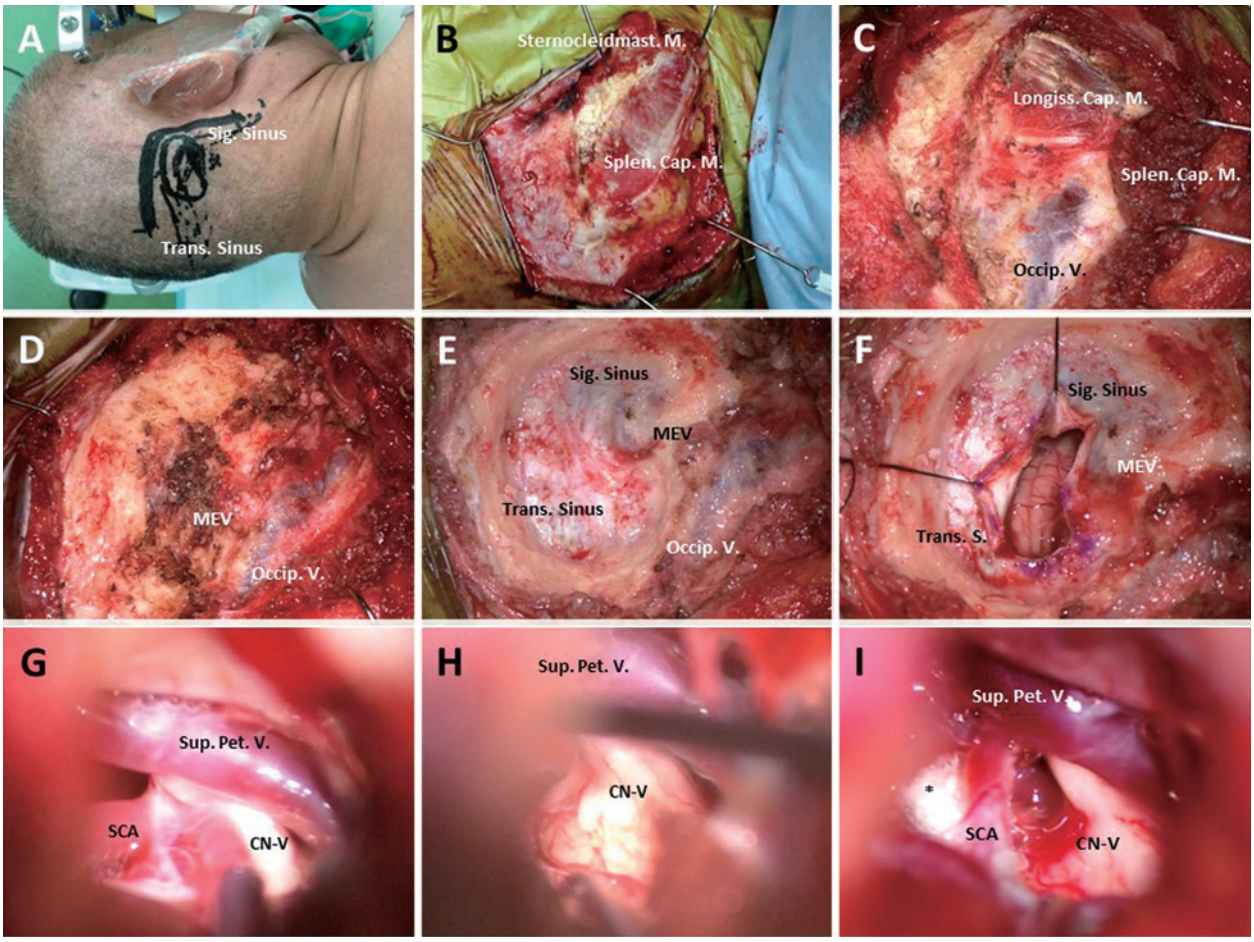

Fig. 2 Intraoperative photographs after positioning (A), scalp flap elevation (B), the identification of the occipital vein (C), identification of the MEV (D), denuding MEV (E), and dural opening (F). Intraoperative photographs after exposure to SCA and CN-V (G), mobilization of SCA (H), and transposition of SCA (I). *; Dacron felt

Abbreviations in Fig. 2

Sig. Sinus, sigmoid sinus; Trans. Sinus, transverse sinus; M., muscle; Sternocleidmast., sternocleidomastoid; Splen., splenius; Cap., capitis; Longiss., longissimus; Occip., occipital; V., vein; MEV, mastoid emissary vein; CN-V, trigeminal nerve; SCA, superior cerebellar artery; Sup., superior; Pet., petrosal

SCA was transposed from the nerve by the insertion of Dacron felt pieces between the pons and the SCA (Fig. 2H and I).

The postoperative course was uneventful, and the patient's pain resolved entirely. Postoperative CT also showed the preservation of the MEV and the connecting venous pathway (Fig. 3). During the 18-month follow-up period, no recurrent pain occurred.

Discussion

We demonstrated the successful preservation of the MEV and venous pathway connection during MVD, in which these veins functioned as an important collateral venous pathway due to severe IJV stenosis.

In the traditional method of MVD, most neurosurgeons prefer to use vertical, linear, or S-shaped skin incisions as described by Jannetta et al.[3] and routinely sacrifice encountered vasculatures, including the occipital artery, occipital vein, and MEV. Although several modified MVD techniques have been developed over the years, including recent less-invasive procedures such as the endoscopic approach,[7-9] surgical nuances to preserve these vasculatures remain scant. Herein, we used an upside-down L-shaped skin incision, layer-by-layer dissection of the occipital muscles, and denuding of the intraosseous part of the vein to preserve these vasculatures. Because the occipital vein is located in the same layer as the occipital artery, this technique has a concept similar to that of exposing and harvesting the horizontal segment of the occipital artery, which is a candidate donor artery in extracranial-intracranial bypass surgery.[10-12] However, because the dural-opening space in this case was narrower than that of the ordinal case, the use of endoscopy might have had merit.

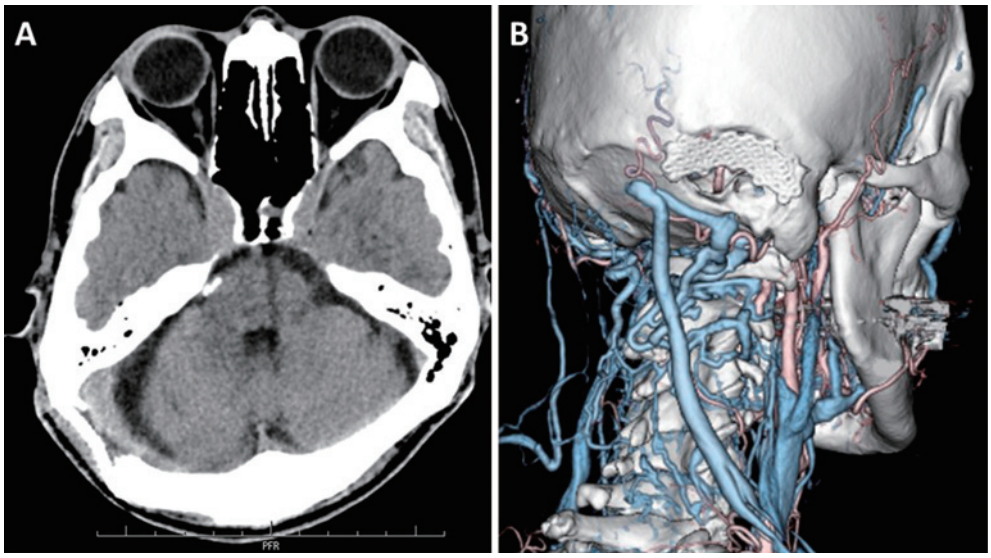

Fig. 3 Postoperative CT (A) and CTA (B) showing the insertion of the Dacron felt and the preservation of the collateral venous pathway.

A surgical indication should still be cautiously considered in a similar case.

Sacrificing the cranial veins, including the emissary veins, is commonly performed in various neurosurgeries; however, it poses proven risks of serious complications.[4,13,14] In the present case, an enlarged MEV was the sole collateral pathway of the IJV, assuming the risk of serious obstruction of intracranial venous drainage. In addition, keeping such enlarged veins intact might have contributed to the avoidance of massive blood loss or other complications, such as subsequent sinus thrombosis and pulmonary embolism due to the migration of bone wax.[15]

Because IJV stenosis has been scarcely investigated so far, the underlying mechanisms are poorly understood. However, a recent study has shown that the elongated styloid process is one of the main causes of IJV stenosis.[16,17] Notably, this phenomenon might not be as rare as previously considered, and approximately 20% of the patients were found to have IJV stenosis.[17] Given these facts, surgeons should conduct evaluation studies of the venous system, such as CT venography, before cranial surgery.

Conclusion

To the best of our knowledge, this report provides the first description of the surgical nuances in MVD to preserve the MEV. This technique would be applicable for posterior fossa surgery in cases in which the MEV needs to be preserved. In addition, preoperative screening of the venous system is recommended before cranial surgery.

Acknowledgments

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Abbreviations

MVD, microvascular decompression; TGN, trigeminal neuralgia; IJV, internal jugular vein; MEV, mastoid emissary vein; MRI, magnetic resonance imaging; CT, computed tomography

Informed Consent

The patient consented to the publication of his images and clinical description.

Conflicts of Interest Disclosure

The authors declare that they have no conflicts of interest. All authors have registered online self-reported COI Disclosure Statement Forms through the website of the Japan Neurosurgical Society.

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