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Microvascular Decompression: An Effective Approach for Trigeminal Neuralgia Caused by a Dolichoectatic Basilar Artery after Multiple Treatment Failures

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Abstract

Trigeminal neuralgia (TN), characterized by recurrent episodes of intense facial pain, poses diagnostic and therapeutic challenges. TN can be triggered by many factors, with rare cases (< 0.05% of the general population) associated with vertebrobasilar dolichoectasia (VBD). Our study analyzes a 74-year-old male patient with 10 years of constant unbearable left-sided facial pain, unresponsive to medications and multiple glycerol rhizotomies, performed in other centers which prompted the patient to seek care at our clinic. The confirmation of left-sided VBD by magnetic resonance imaging, computed tomography angiography, and the patient's overall satisfactory health status favored open surgery with microvascular decompression (MVD). We performed a retrosigmoid suboccipital craniotomy to reach the cerebellopontine angle, ensuring that it is the dolichoectatic basilar artery applying compression to the trigeminal nerve. We inserted a shredded Teflon implant into the trigeminal cistern following its opening. Care was exercised to ensure that there were no remaining factors causing compression. Postoperatively, pain relief was achieved, sustained at an 8-month follow-up. Treating TN arising from VBD can be difficult. The patient's overall health status and assessment play a key role in determining the appropriate course of treatment. Opting for MVD is the optimal and most effective choice, regardless of age, according to the recent literature. In cases where surgery is not feasible, the treatment options will involve medications and less invasive therapeutic approaches such as peripheral rhizotomies or stereotactic radiosurgery. Our case highlights the efficacy of MVD in addressing TN associated with VBD, underscoring the need for advanced treatment modalities and expertise in managing complex cases.

Keywords
- trigeminal neuralgia
- vertebrobasilar dolichoectasia
- microvascular decompression
- peripheral rhizotomies
- surgical intervention
- neuropathic pain

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Introduction

Trigeminal neuralgia (TN), is a chronic, infrequent condition marked by recurring episodes of sharp facial pain in the area covered by the trigeminal nerve.[1] The International Headache Society categorizes TN into three types: classic, secondary, and idiopathic. Classic TN involves cases caused by neurovascular compression. Secondary TN caused by multiple sclerosis, tumors, and skull-base deformities. Idiopathic TN is diagnosed when classic or secondary causes cannot be proven.[2] A rare cause of TN is vertebrobasilar dolichoectasia (VBD), with a prevalence ranging from 7.6 to 18.8% among stroke patients and 0.05% in general population. It is characterized by significant expansion, elongation, and tortuosity of the basilar artery (BA) and vertebral artery (VA). The cause of VBD is uncertain; however, it is believed to be linked to atherosclerosis, hypertension, collagen vascular disease, Marfan's syndrome, Fabry's disease, neurofibromatosis type I, among others.[3,4] Of the available surgical interventions, microvascular decompression (MVD) is the treatment considered as first choice in classical TN. MVD has been extensively reported in the literature and its clinical efficacy has been widely recognized.[5] In the present study, we describe a patient who developed TN caused by VBD and was successfully treated by MVD after the failure of pharmacologic treatment and multiple peripheral glycerol injections in other medical centers.

Case Presentation

We present the case of a 74-year-old male patient who came for first time to our clinic with severe, continuous, left-sided facial pain. The pain was described as sharp, strong, shooting, and unbearable affecting the left lower part of the face. His complaints started 10 years ago. He was treated with carbamazepine (in increasing doses up to 1,200 mg), without effect on the pain. Therefore, magnetic resonance imaging (MRI) was ordered which showed a dilated BA, and multiple periventricular confluent lesions in the white matter of both cerebral hemispheres, classified as Fazekas-III (►**Fig. 1**).

The patient visited various hospitals, where glycerol rhizotomies were performed (six times) in two hospitals with little or no effects on the pain. Due to the failed treatments and the persistent extreme, debilitating pain, the patient decided to visit our clinic.

Upon admission, the patient presented a satisfactory health status but exhibited uncontrolled hypertension (165/86 mm Hg). In response to the medical history (MH), we ordered a computed tomography angiography (CTA) to explore potential vascular compression affecting the cranial nerve (CN) V. The findings revealed a left-sided dolichoectatic BA (►**Fig. 2**). Considering these results in conjunction with the MH, the favorable health status and unsuccessful previous treatments, we concluded that the optimal course of action was to proceed with MVD.

After the induction of general anesthesia, a retrosigmoid suboccipital craniotomy, approximately 20 mm in diameter, was executed to access the cerebellopontine angle (transverse-sigmoid junction).[6] Following dural incision and suction of cerebrospinal fluid (CSF), using a neurosurgical microscope, it was confirmed that the blood vessel applying pressure to the root entry zone (REZ) of the left trigeminal nerve, specifically at the caudolateral area, was identified as

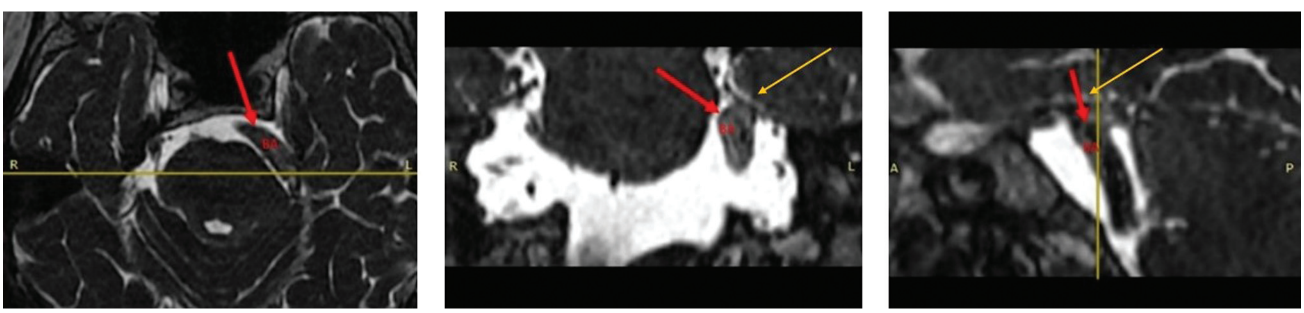

Fig. 1 Preoperative magnetic resonance imaging of the patient, revealing a dilated basilar artery (red arrow) compressing the cranial nerve V (orange arrow), and multiple periventricular confluent lesions (Fazekas-III).

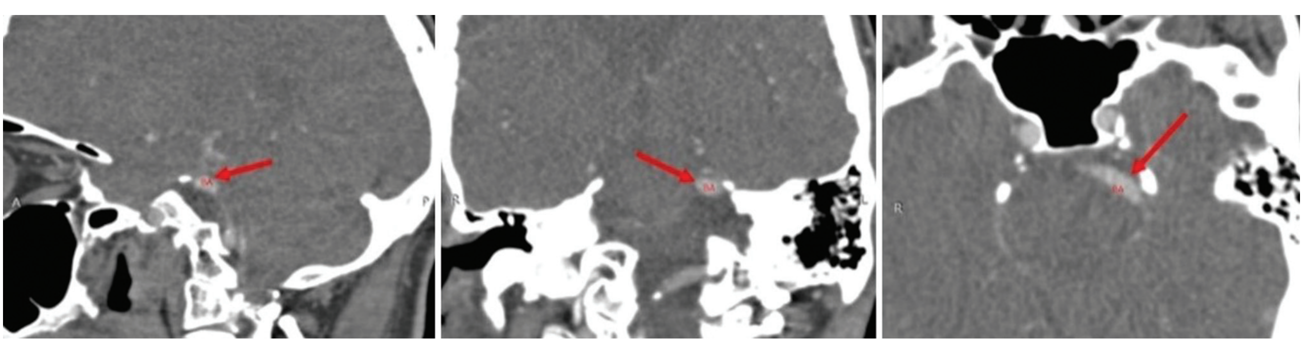

Fig. 2 Preoperative computed tomography showcasing the dilated basilar artery (red arrow).

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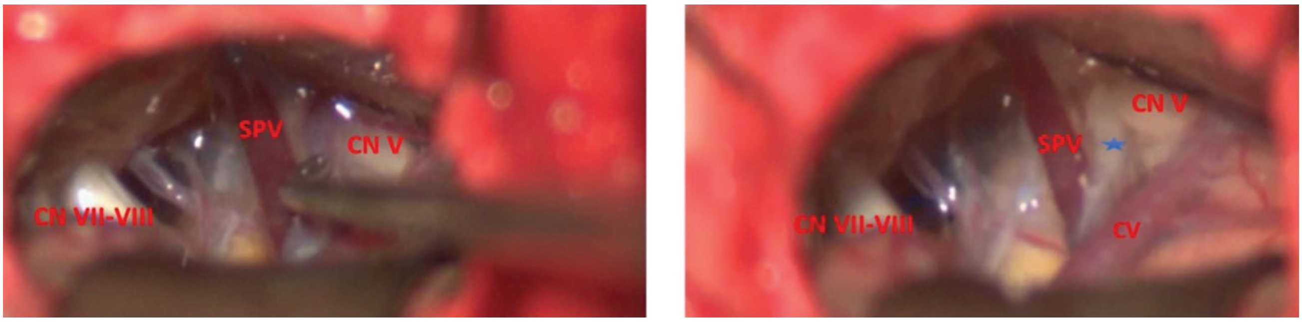

Fig. 3 Initial intraoperative view after cerebrospinal fluid evacuation. Careful dissection sparing the SPV with only a small tributary vein sacrificed (blue star). CN, cranial nerve; SPV, superior petrosal vein.

the dolichoectatic BA. A comprehensive evaluation of the entire path of the trigeminal nerve revealed no other vessels causing compression (►**Fig. 3**).

First, the cerebellum was gently retracted to confirm the REZ. In an effort to reduce postoperative swelling, preservation of a cortical vein and the superior petrosal vein (SPV) was prioritized, sacrificing only a minor branch of the SPV to enhance visibility during the surgical procedure. The trigeminal cistern was opened, and a meticulous dissection was carried out to separate the adhesions between the BA and the CN V, allowing superior mobilization of the BA to create adequate space for the placement of a shredded Teflon implant (►**Fig. 4**).

Due to the larger size of the artery, a greater amount of Teflon was required which led us to use fibrin glue for better fixation of the implant and the near structures (►**Fig. 5**). Postoperatively, a control CT scan was unremarkable, the patient experienced complete relief from pain, on 8-month follow-up, there were no recurrence of pain or neurological deficits (►**Figs. 6** and **7**).

Discussion

TN represents a neuropathic pain condition characterized by sudden, stabbing pain episodes occurring spontaneously or upon stimulation in a specific area of the face. Severe cases have been linked to a diminished quality of life and, in extreme situations, even suicide according to Cruccu et al.[7] TN is rare, affecting approximately 4 to 13 individuals per 100,000 annually.

According to Förster et al, who conducted a study comparing CT with CTA and MRI with magnetic resonance angiography on 18 patients, it might be beneficial to utilize both imaging techniques.[8] Based on the literature and the

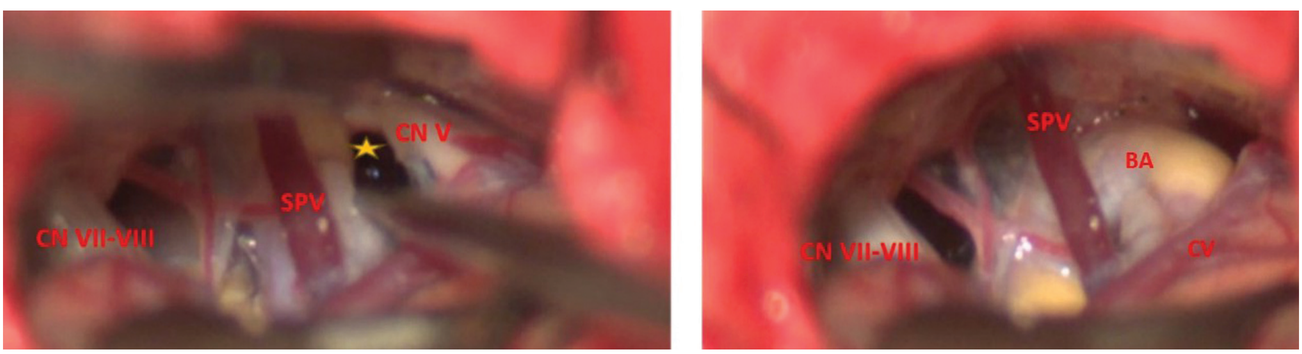

Fig. 4 Opening of the trigeminal cistern (yellow star) and mobilization of basilar artery. CN, cranial nerve; SPV, superior petrosal vein.

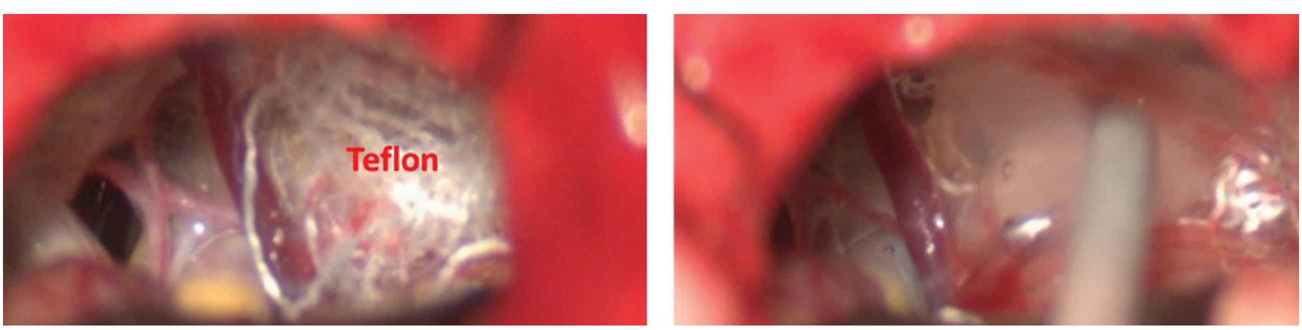

Fig. 5 Shredded Teflon implant placed between the artery and nerve with a drop of fibrin glue for fixation.

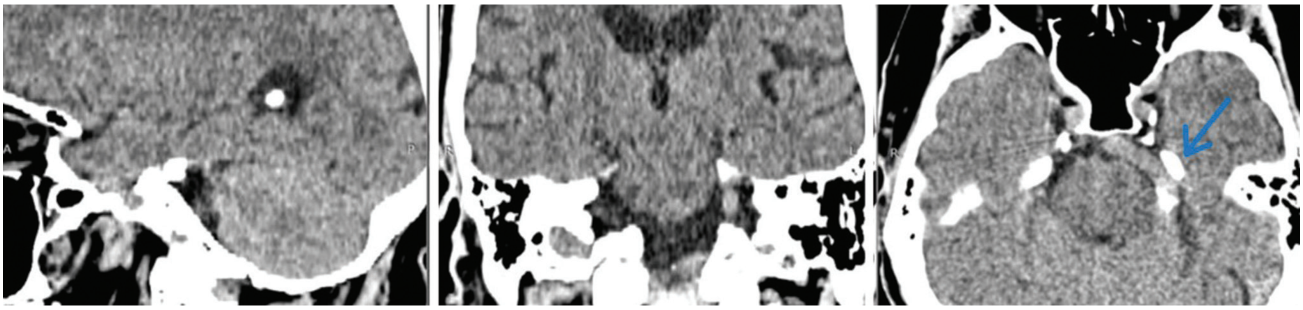

Fig. 6 Early postoperative control computed tomography. Teflon implant shown with the blue arrow.

fact that the MRI of our patient was performed 4 years prior, we decided to perform an additional CTA before choosing the most appropriate treatment.

First-line treatment for TN includes anticonvulsants (i.e., carbamazepine). Patients who do not respond adequately to medications due to persistent pain or unacceptable side effects can receive a dosage increase, additional medications or conversion to a different agent (i.e., phenytoin), or have transcutaneous, percutaneous, radiotherapy, and open surgical options available. Patient selection criteria must be performed before deciding the most suitable treatment plan. Percutaneous, radiosurgical, and open surgical therapies are most effective in patients with type 1 TN (paroxysmal, severe pain attacks), while patients with type 2 TN (continuous, severe pain) have higher recurrence and a shorter pain-free interval.[9] MVD is a nondestructive, invasive surgical option offering the highest rate of permanent pain resolution and the lowest risk of sensory impairment as described by Jones et al.[1]

VBD is an arteriopathy characterized by dilation of the VA and BA. The mechanisms leading to VBD are not fully understood.

Literature suggests associations between VBD and various vascular risk factors such as age, male gender, hypertension, diabetes, obesity, and smoking. In this case, only hypertension and gender-related association were noted. The connection between VBD and atherosclerosis may be attributed to turbulent blood flow within the dilated vessel.[10] Trigeminal nerve compression by vessels is predominantly right sided (62%), while dolichoectatic vertebrobasilar artery (VBA) compressions are more common on the left side (63%). This left side prevalence might be due to the dominance of the left VA in most patients, as noted by Meckel and confirmed through imaging.[11] Clinically, VBD often presents asymptomatically, with vascular events or compression syndrome occurring in some cases.[10]

Fig. 7 Patient's visit for his 8-month follow-up after the operation, without neurological deficit and recurrence of pain.

MVD is the most effective treatment for TN, if the cause is vascular compression and the patient is suitable for general anesthesia and surgery. If MVD is not appropriate, partial caudolateral rhizotomy of the CN V is recommended. In our case, MVD is challenging due to greater size of the BA. While numerous decompression techniques exist, a standard method has not been established. In general, two different modalities are utilized for isolating the BA, namely, the interposition and transposition methods.[6,12–14] In our case, we used the interposition technique. By introducing shredded Teflon implants in the conflicting neurovascular area, the BA loop was separated from the CN V. However, despite attempts to alleviate compression of the VBA using the interposition technique, consistent success is not assured due to the VBA's tortuosity and dilation. Following insertion of Teflon, there is risk of persistent pulsatile pressure impacting the nerve. Excessive volumes of Teflon could exert further pressure on the nerve. Thus, considering intraoperative conditions, if inadequate relief or exacerbation of trigeminal nerve compression is observed, pursuing VBA transposition becomes essential to achieve a satisfactory decompression. When partial caudolateral rhizotomy is performed, attention should be paid to spare the ophthalmic and motor fibers.[13,15,16]

According to Rheaume et al, the first meta-analysis comparing the efficacy of three standard surgical treatments, MVD, percutaneous rhizotomy (PR), stereotactic radiosurgery for recurrent TN after a prior surgery, showed that MVD has the best results in initial pain relief. MVD and PR had similar long-term effects, establishing them as superior options for the treatment of recurrent TN.[17]

MVD demonstrates immediate pain relief in 90% of cases, maintaining efficacy in 75% after 15 years. The effectiveness of this procedure for cases involving dolichoectatic BA remains unevaluated. According to the literature, common neurological complications post-MVD include hypoesthesia (0–10%), hearing impairment (0.8–4.5%), ataxia (0.2–2.7%), facial palsy (0–1%), and diplopia (0.5–1%). CSF leakage is reported in 2 to 17% of cases, typically transient in nature.[10] Yet, in our case, the patient had no complications.

A prospective study and systematic review with meta-analysis compared MVD effectiveness and complications in young and elderly patients (mean age 73.0 ± 5.9 years and American Society of Anesthesiologists [ASA] Grades 1–4 physical status score), exhibiting that age is not a contraindication for MVD in elderly patients, but ASA score less than 4 is recommended by Sekula et al.[18] In our case, the patient, aged 74 years, had an ASA score 3 and a single comorbidity of uncontrolled hypertension, which designated him as a valid candidate for MVD according to recent literature.

Conclusion

In our study, we aim to highlight that when vascular compression is the primary cause, MVD surpasses repeated, less effective, and less invasive treatments with proper patient selection. TN stands as an exceptionally debilitating and distressing condition in medicine, necessitating adequate treatment, physician training, and advanced equipment.

Conflict of Interest
None declared.

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