

## Surgical Management for Trigeminal Neuralgia Caused by Trigemino-cerebellar Artery Compression

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### Abstract

The trigemino-cerebellar artery (TCA) originates from the basilar artery and perfuses the trigeminal nerve root and cerebellar hemisphere. In this case report, we identified a TCA compressing the trigeminal nerve in a 65-year-old woman with left trigeminal neuralgia (TN). We discuss the surgical approach to achieve excellent results. A 65-year-old woman was referred to our department due to experiencing paroxysmal electric pain in the left mandibular area, which was triggered by eating. She was initially treated medically by a family doctor, although the effectiveness of the treatment decreased over time. The patient was diagnosed with TN and underwent left microvascular decompression surgery. During the surgical procedure, it was observed that the left superior cerebellar artery (SCA) was in contact with the trigeminal nerve from the cranial side and that the TCA formed a loop that severely compressed the trigeminal nerve and ran between the sensory and motor branches. The SCA was moved to the cerebellar tentorial side and fixed, and the TCA was dissected from the trigeminal nerve, pulled out, and repositioned such that the loop would not press on the nerve. Following the surgery, the patient's left TN disappeared immediately, and she was discharged from the hospital one week later without any neurological deficits. In conclusion, to avoid complications, it is essential to manage the vessels that penetrate the trigeminal nerve with care. One effective and safe surgical procedure involves decompressing the trigeminal nerve by removing the responsible artery and altering its trajectory.

**Keywords:** Trigemino-cerebellar Artery; Trigeminal Neuralgia; Microvascular Decompression; Intraneural Compression

### Abbreviations

SCA: Superior Cerebellar Artery; TCA: Trigemino-cerebellar Artery; TN: Trigeminal Neuralgia

### Introduction

Trigeminal neuralgia (TN) is most commonly caused by the compression of blood vessels, and microvascular decompression is the preferred surgical treatment [1,2]. The superior cerebellar artery (SCA) is the most commonly responsible vessel, accounting

for 75% of cases [3]. While reports of TN due to trigemino-cerebellar artery (TCA) compression are rare, it has been identified as a responsible vessel, along with the anterior inferior cerebellar artery, vertebral artery, basilar artery, and veins [3]. Autopsy studies reported that the TCA is present in 2.3-13.3% of cases [4,5]. The TCA originates from the basilar artery and is distributed to the trigeminal nerve root and cerebellar hemisphere [4,5]. The TCA may come into contact with the trigeminal nerve root during its course and can even penetrate it, leading to TN [5]. When the TCA runs through the trigeminal nerve, surgery for TN can be challenging.

In this report, we present a surgical case involving a 65-year-old woman with typical TN caused by TCA that had penetrated the trigeminal nerve.

### Case Presentation

A 65-year-old woman presented with paroxysmal electric pain in the area of the left second branch of her trigeminal nerve, which was triggered by eating and washing her face two years prior. She had initially responded well to medication prescribed by her family doctor, although the effectiveness gradually declined, prompting her to seek surgical treatment. When she visited our clinic, she exhibited no obvious neurological deficits, except for the paroxysmal electric shock pain triggered by touch. There were no notable medical or family history findings. Magnetic resonance imaging (constructive interference in steady state) revealed contact between the left trigeminal nerve and SCA, along with a small artery within the nerve suspected to be the TCA. Using a retrosigmoid approach with the patient in the right lower lateral recumbent position, surgery was performed with continuous intraoperative auditory brainstem response monitoring. The horizontal fissure was opened to access the trigeminal nerve, which was being compressed by the two superior cerebellar arteries from the cranial side. Additionally, an artery running between the sensory and motor branches of the trigeminal nerve formed a superior convex loop in the nerve, causing severe compression. This artery was found to be a TCA, which was distributed to the cerebellum. The trigeminal nerve was deformed with caudal flexion due to the compression of the arteries. Initially, Teflon tape was wrapped around the two superior cerebellar arteries and moved to the tentorial side for transposition. However, the trigeminal deformity did not improve. To obtain mobility of the TCA, a small branch from the artery to the trigeminal nerve was coagulated with a bipolar forceps and cut. The TCA was then pulled out from the trigeminal nerve and repositioned to relieve the severe compression. Following this procedure, the trigeminal deformity improved completely, and the patient no longer experienced paroxysmal electric shock pain in the area of the second branch of the left trigeminal nerve. The patient was discharged on the seventh postoperative day without any new neurological deficits. One year after the surgery, no recurrence has been observed, and the patient continues to be carefully monitored at an outpatient clinic.

### Discussion

The discovery of the TCA was first made in 1969 in a study using cadaveric brains [6]. The TCA is a branch of the basilar artery that

runs through the trigeminal root and cerebellar hemisphere [4,5]. Marinkovic, *et al.* divided the patients into four segments: pontine, trigeminal, cerebellopontine, and cerebellar [4]. The involvement of the trigeminal segment in the development of TN is well established, and the TCA can cause TN by running around or penetrating the trigeminal nerve [5]. The mechanism behind the vascular penetration of the trigeminal nerve is not fully understood, although it may occur due to entrapment between nerves during the fusion process of the ophthalmic and maxillomandibular nerves before the development of the trigeminal nerve [7].

There is currently no standardized procedure for cases where the responsible vessel penetrates the trigeminal nerve, as in the present case. However, aggressive surgical methods can lead to serious surgical complications [8]. There are two major methods for treating the intraneural vessels that cause TN: interposing Teflon felt wrapped around the offending vessels in the nerve [9] and dissecting the offending vessels, pulling them out, and adhering them to the nerve to relieve pressure on the trigeminal nerve [8,10,11]. There have been six detailed surgical reports of TN cases where an artery penetrated the trigeminal nerve. Zheng, *et al.* [9] previously reported three cases in which the SCA penetrated the trigeminal nerve. To avoid direct contact between the responsible vessel and nerve, they wrapped it with Teflon felt. While TN was controlled in all cases, one patient (33%) experienced facial numbness as a surgical complication, and in another case, recurrence required reoperation. The present case is one of only three detailed reports of the TCA causing TN. Clinical and surgical findings, including those of the present case, are presented (table). The patients' ages ranged from 48 to 82 years, with a mean age of 67.5 years. All patients were female. The affected side included two cases each on the right and left sides, and no particular tendencies were observed in the affected divisions. The duration of symptoms ranged from 2-10 years with an average, of 5.3 years. Jito, *et al.* [8] attempted to decompress the trigeminal nerve by longitudinally dissecting the nerve during vascular penetration of the trigeminal nerve. In Ichimasu, *et al.* study [10], Wakuta, *et al.* study [11], and in the current case report, the responsible artery was dissected and pulled out to alter the vascular trajectory, thereby altering the site of nerve compression to achieve sufficient decompression of the nerve. Surgical results were excellent in all cases (100%), and no complications were observed in any patient. During the surgical procedure in our case, we coagulated and cut the TCA to allow safe and smooth movement

of the artery. Wakuta, *et al.* [11] sacrificed a branch of the cerebellum that was distributed in the TCA to obtain vascular mobility. It is considered acceptable to sacrifice the branch after determining the area of branch perfusion to safely and to adequately move the TCA.

Although few cases have been reported, decompression by dissecting the TCA, pulling it out, and altering the course of the vessel may be a useful surgical approach.

Cases	Age/Sex	Affected side	Affected division	Duration of the symptom (year)	Procedure	Result	Complication
Wakuta 2014	70F	Right	Second	5.0	※	Excellent	None
Jito 2016	82F	Left	Second, Third	10.0	※※	Excellent	None
Ichimasu 2020	53F	Right	Third	4.0	※	Excellent	None
Present case 2023	65 F	Left	Second	2.0	※	Excellent	None

**Table 1:** Summary of a case of trigemino-cerebellar artery penetrating the trigeminal nerve and resulting in trigeminal neuralgia.

※ dissection around artery in trigeminal nerve.

※ Altered coursing of artery.

**Figure 1:** Magnetic resonance imaging (CISS; constructive interference in steady state).

The trigeminal nerve (curved arrow) is compressed by the superior cerebellar artery (arrow, left panel) and trigemino-cerebellar artery (arrowhead, right panel).

**Figure 2:** Surgical findings.

The left panel indicates that the trigeminal nerve is compressed by the superior cerebellar artery (arrowhead) and trigemino-cerebellar artery (double arrowhead).

The middle panel shows that after transposition of the superior cerebellar artery, the trigemino-cerebellar artery (double arrowhead) runs between the motor and sensory branches of the trigeminal nerve.

The right panel shows the trigemino-cerebellar artery (double arrowhead) that was removed and replaced. Decompression of the trigeminal nerve was observed.

## Conclusion

Surgery for TN is a functional neurosurgical procedure, and minimizing the occurrence of complications should be a top priority. Decompression by altering the course of the responsible vessel, which is a relatively straightforward procedure, can be effective. However, it is important to gather more cases and research the optimal procedure for cases in which the responsible artery penetrates the trigeminal nerve.

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## Conflict of Interest

The authors declare that they have no conflict of interest.

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