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Research Article

Efficacy of Internal Neurolysis for Atypical Facial Pain

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Abstract

Background: Although microvascular decompression (MVD) for trigeminal neuralgia is an established fundamental treatment, approximately 4-5% of cases recur annually despite treatment. Compared with typical trigeminal neuralgia (TTN), atypical facial pain (AFP) with no triggers and persistent pain is reported to recur more often. The ideal treatment for AFP has not yet been established. Internal neurolysis (IN), in which the trigeminal nerve is physically divided longitudinally, has shown good results in cases of recurrence without vascular compression. In this study, we evaluated the usefulness of IN for treating AFP by analyzing patient outcomes in cases in which IN was administered.

Methods: Fifteen IN patients were enrolled. IN was added to conventional MVD in cases of venous compression, mild arterial compression, or severe adhesions, with the goal of preventing recurrence. Eight patients presented with AFP, and seven had TTN. Both groups were compared in terms of surgical outcomes using the Barrow Neurological Institute Pain Intensity Scale immediately after surgery and 1 year postoperatively. Surgery was performed using a conventional retrosigmoid approach. IN consists of the longitudinal transection of the trigeminal nerve in the cisternal portion, creating grooves that divide the nerve fibers.

Results: Both the TTN and AFP groups showed good outcomes for up to 1 year. No complications or recurrences were observed.

Conclusions: IN is a potential therapeutic option for AFP.

Keywords: Internal Neurolysis; Atypical Facial Pain; Microvascular Decompression; Trigeminal Neuralgia

Abbreviations

IN: Internal Neurolysis; TTN: Traditional Trigeminal Neuralgia; AFP: Atypical Facial Pain; MRI: Magnetic Resonance Imaging; ABR: Auditory Brainstem Response; IP: Interposition; TP: Transposition; V2: Second Branch of the Trigeminal Nerve; V3: Third Branch of the Trigeminal Nerve

Introduction

Internal neurolysis (IN) is a procedure in which the trigeminal nerve is physically grooved longitudinally in the cisternal portion and has been reported to produce good long-term results in cases of recurrent trigeminal neuralgia without vascular compression [1-3]. Microvascular decompression (MVD) for trigeminal neuralgia is a fundamental treatment that moves the offending vessels and is the gold standard technique recognized worldwide [4-6]; however, there is a 4-5% recurrence rate per year after surgery [7]. Recently, the addition of IN to conventional MVD has been reported to be effective in preventing recurrence [8].

Atypical facial pain (AFP) is persistent pain without triggers in the trigeminal territory; however, it can occasionally be difficult to distinguish from typical trigeminal neuralgia (TTN) [9-11]. TTN presents with paroxysmal electric shock pain in the trigeminal nerve territory and is typically triggered by facial washing and eating. Patients with AFP present with persistent pain in the trigeminal nerve territory without any triggers. No established treatment

for AFP yet exists, unlike microvascular decompression which has been shown to be effective against TTN. There are no reports analyzing the effects of IN on AFP levels. This study describes a detailed analysis of cases in which IN was performed for AFP and explores the usefulness of IN for AFP based on a review of the literature.

Materials and Methods

The present study was retrospective in nature. All the surgeries were performed by the first author at a single institution. Fifteen patients who recently underwent IN were included in this study (Table 1). Constructive interference in the steady-state setting of magnetic resonance imaging [12] revealed vascular contact, and surgery was performed either when the effectiveness of medication was reduced, or the patient was unable to take the medication due to drug-induced eruptions. Intraoperatively, IN was added to conventional MVD in cases where the offending vessel was a vein, the degree of compression by the artery was mild, or the adhesion around the trigeminal nerve was severe to prevent recurrence. Eight patients presented with AFP and seven had TTN. Both groups were compared in terms of surgical outcomes using the Barrow Neurological Institute Pain Intensity Scale (BNI) [13] both immediately after surgery and 1 years after surgery (Table 2). Facial numbness, a postoperative complication, was evaluated using the Barrow Neurological Institute Facial Numbness Scale (BNI-N) [13] (Table 2). Surgery was performed with the patient in the lateral recumbent position using a conventional retrosigmoid approach with continuous intraoperative auditory brainstem response (ABR) monitoring. After reaching the trigeminal nerve, adhesions around the trigeminal nerve were sharply dissected, and the offending vessel was identified. To decompress the trigeminal nerve, transposition (TP) was performed to move the offending vessels or interposition (IP) was performed to insert a prosthesis between the offending vessels and the trigeminal nerve, and IN was added. IN consists of longitudinal transection of the trigeminal nerve in the cisternal portion, creating three or four grooves approximately 1 mm in depth that divide the nerve fibers [1-3,8]. The follow-up period was at least 12 months.

Case No.	Age (years)/ Sex	Affected area/ Side	Symptom (Atypical or Typical)	Effect of medication	Follow up period (months)
1	70/F	V3/R	Atypical		16
2	58/F	V2/L	Atypical		15
3	53/F	V2/R	Typical		24
4	57/F	V2/R	Atypical		19
5	47/F	V3/L	Atypical		25
6	75/M	V2/R	Typical		20
7	66/M	V3/R	Typical		18
8	73/M	V3/R	Atypical		20
9	60/F	V3/L	Atypical		24
10	73/M	V2/R	Typical		22
11	83/F	V3/L	Typical		23
12	82/F	V3/L	Typical		18
13	76/F	V3/R	Atypical		20
14	63/M	V3/R	Typical		18
15	59/F	V2/R	Atypical		18

Table 1: Summary of clinical characteristics of fifteen cases treated with internal neurolysis for trigeminal neuralgia.

M: male; F: female; R: right side; L: left side.

V2: second trigeminal nerve branch territory; V3: third trigeminal nerve branch territory.

Case No.	Preoperative BNI	Adhesion around the nerve	Surgical manipulation	Postoperative BNI	Postoperative BNI-N	Other complications
1	IV		IP of vein, IN	I	I	
2	IV		TP of SCA, IN	II	I	
3	V		TP of vein, IN	I	I	
4	IV	–	IP of vein, IN	II	I	
5	IV		IP of vein, IN	II	II	
6	IV	–	IP of vein, IN	III	II	
7	IV	–	TP of SCA, IN	I	I	
8	IV		TP of SCA, IN	III	II	
9	V		TP of SCA, IN	I	I	
10	IV		TP of SCA, IN	III	I	
11	IV		IP of vein, IN	I	II	
12	V		TP of vein, IN	I	I	
13	IV		TP of SCA, IN	I	I	
14	IV		TP of SCA, IN	I	I	
15	IV		TP of SCA, IN	I	I	

Table 2: Summary of surgical results in cases with internal neurolysis for trigeminal neuralgia.
BNI: Barrow Neurological Institute pain intensity scale; BNI-N: Barrow Neurological Institute facial numbness scale.
IP: interposition; TP: transposition; SCA: superior cerebellar artery.

Results

The AFP group was younger than the TTN group, with an average age of 62.5 years for the AFP group and 70.7 years for the TTN group. The AFP group included 7 females and 1 male, the TTN group included 3 females and 4 males, and thus the AFP group included more females (87.5%). The affected side was more commonly on the right side. There were five cases on the right side and three cases on the left side in the AFP group, and five cases on the right side and two cases on the left side in the TTN group. The affected territories were predominantly V3 in both the AFP and TTN groups. Carbamazepine and/or pregabalin were effective in 37.5% of the cases in the AFP group and 100% in the TTN group. Follow-up period was 20.4 months for TTN and 19.6 months for AFP. Intraoperative findings and offending vessels were veins in three cases and SCA in five cases in the AFP group, and veins in four cases and SCA in three cases in the TTN group. Preoperative BNI averaged 4.1 in the AFP group and 4.3 in the TTN group. Postoperative BNI was 1.5 in the AFP group and 1.4 in the TTN group, with excellent results in both groups. At the 1-year postoperative evaluation, both the AFP and TTN groups maintained good results, with a mean BNI of 1.9. No patients in either group required reoperation. There was no difference in facial numbness as a postoperative complication, with six cases of grade I BNI-N and two cases of grade II in the AFP group, and five cases of grade I and two cases of grade II in the TTN group. Moreover, there were no cases of persistent permanent symptoms in either group. Complications, such as hearing loss, cerebral infarction, and cerebral hemorrhage, were not observed in either group.

Representative case

No specifics were noted in the medical history and family history.

Present illness: The patient was a 70-year-old woman who began to have persistent tightening pain in the right V3 area one year ago without any specific trigger. Carbamazepine and pregabalin showed no alleviating effects. The family doctor referred the patient to our department for surgical treatment. BNI was grade 4. MRI showed resonance imaging revealed venous compression (Figure 1). Intraoperative ABR was continuously monitored, and the trigeminal nerve was reached via the right retrosigmoid approach. The trigeminal nerve adhered to the cerebellar tent by a thickened arachnoid membrane, and this adhesion was first dissected. The arachnoid membrane surrounding the vein was dissected, and a Teflon felt® was inserted and fixed between the vein and the nerve to decompress the trigeminal nerve as an interposition (Figure 2A). Subsequently, IN was performed, constructing three 1-mm deep longitudinal grooves in the cisternal portion of the trigeminal nerve (Figure 2B). Immediately after surgery, the BNI was grade 1, with no complications such as facial numbness. The patient was discharged on the 7th day after surgery. Sixteen months after surgery, no recurrence was observed.

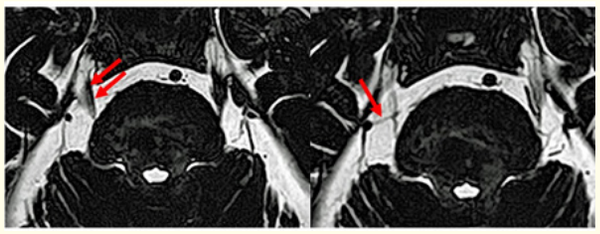

Figure 1: MRI (Constructive interference in steady state).

After dissecting the adhesions around the trigeminal nerve, a transverse pontine vein (arrow) was observed running in contact with the trigeminal nerve from the caudal side.

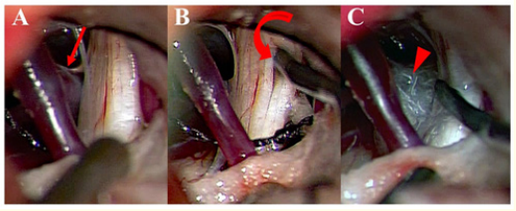

Figure 2: Surgical view.

A: A transverse pontine vein (arrow) contacted and ran caudal to the trigeminal nerve.

B: Internal neurolysis (curbed arrow) was applied to make a groove in the direction of the long axis of the trigeminal nerve.

C: Interposition, which is decompression of the nerve by inserting Teflon felt® (arrow head) between the nerve and the vein, was performed.

Discussion

Recurrence occurs 4-5% per year after MVD for trigeminal neuralgia [7]. Excluding inadequate decompression and new vascular compression, recurrence factors have been noted to include severe adhesions around the trigeminal nerve [14], venous compression [2,15], and mild or no vascular compression [2,16]. We recently added IN to MVD to prevent recurrence in cases in which either severe adhesions were found around the trigeminal nerve, the vein was the offending vessel, or arterial compression was mild. IN for trigeminal neuralgia is speculated to block the transmission of abnormal electrical excitation of afferents from one nerve to another, thereby restricting the entry of abnormal stimuli into the brain stem [1]. There have been reports of good results in recurrent cases and cases without vascular compression, in which IN was performed in addition to MVD [1-3]. One report compared the surgical results of conventional MVD with those of MVD plus IN (MVD plus), with an efficacy rate of 89.9% immediately after surgery and 86.9% at 1 year in the conventional MVD group, and an even higher efficacy rate of 95.1% immediately after surgery and 94.6% at 1 year in the MVD plus group [8]. The postoperative complication rate of facial numbness was higher in the MVD plus group immediately after surgery; however, there was no significant difference between the two groups after 3 months. IN was added to MVD for all consecutive cases of trigeminal neuralgia, including cases of trigeminal neuralgia due to venous compression and a low degree of arterial compression, suggesting that IN may have prevented recurrence [8]. Although there were only 15 cases in the present study, IN demonstrated good outcomes immediately after surgery (100%) and 1 year later (100%), with no cases of recurrence (0%), indicating that the results were excellent and the procedure was safe without the appearance of permanent facial numbness or other complications. However, long-term follow-up is required.

Satoh., *et al*. created 3-dimensional magnetic resonance cisternography and angiography fusion images to evaluate the degree of vascular compression within the trigeminal nerve [17]. They confirmed vascular contact with the trigeminal nerve in 24 (31%) of 78 normal patients without trigeminal neuralgia. It is crucial to consider that pseudopositives are possible in the diagnosis of trigeminal neuralgia. However, none of the normal cases showed severe compression, whereas 50% of the cases in the MVD group showed severe compression, indicating that the degree of vascular compression is an important factor in the development of trigeminal neuralgia [17]. In a report by Maarbjerg., *et al*. [18] that compares MRI findings in the TTN and AFP groups, severe vascular compression was found in 53% of TTN patients and 3% of AFP patients. This finding indicates that the cause of AFP is not necessarily vascular compression and that MVD should consequently be re-evaluated in terms of its potential efficacy to treat AFP.

AFP is persistent pain in the trigeminal nerve territory that appears without any trigger [9-11]; however, the exact pathophysiology is unknown, and no known therapy has been established [9-11]. Wu., *et al*. [19] compared the MVD results for trigeminal neuralgia with those for atypical components and TTN. They found that immediately after surgery, 91.8% of patients with trigeminal neuralgia with atypical components and 93.0% of patients with typical trigeminal neuralgia had good results. However, 60.3% of cases of trigeminal neuralgia with atypical components have recurrence, compared to only 19.9% of TTN cases, indicating a poor prognosis in cases with atypical components [19]. Interestingly, in the present study, AFP was present in more than half (53.3%) of the 15 cases and is more likely in cases in which either severe adhesions were present, veins were deemed as the responsible vessels, or with mild arterial compression. It is important to consider the possibility of performing IN based on an accurate assessment of the degree of vascular compression using MRI as important preoperative information. Further accumulation of atypical facial pain

cases in the future may help characterize the true pathophysiology and establish a treatment method. IN, which blocks neurotransmission, may be useful in the treatment of AFP.

Conclusion

The true pathophysiology of AFP is expected to be further clarified through the accumulation of more cases, which will enable the establishment of a standard treatment strategy. IN is a physical longitudinal transection of the trigeminal nerve that can be performed safely without permanent complications. In this study, IN has shown to exhibit adequate potential in terms of serving as an effective treatment for AFP.

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Conflict of Interest

The authors declare that they have no conflict of interest.

Ethics Approval

The Ethical Committee of the International University of Health and Welfare approved all procedures used in this research

Bibliography

1. Ko AL., *et al*. "Long-term efficacy and safety of internal neurolysis for trigeminal neuralgia without neurovascular compression". *Journal of Neurosurgery* 122.5 (2015): 1048-1057.

2. Sabourin V., *et al*. "Internal neurolysis with and without microvascular decompression for trigeminal neuralgia: case Series". *World Neurosurgery* 143 (2020): e70-e77.

3. Son BC., *et al*. "External neurolysis in microvascular decompression for magnetic resonance imaging-negative idiopathic trigeminal neuralgia". *World Neurosurgery* 157 (2022): e448-e460.

4. Kondo A. "Follow-up results of microvascular decompression in trigeminal neuralgia and hemifacial spasm. *Neurosurgery* 40.1 (1997): 46-51.

5. Jannetta PJ. "Arterial compression of the trigeminal nerve at the pons in patients with trigeminal neuralgia. *Journal of Neurosurgery* 26.1 (1967): 159-162.

6. Mizobuchi Y., *et al*. "Microvascular decompression for trigeminal neuralgia: a prospective, multicenter study". *Neurosurgery* 89.4 (2021): 557-564.

7. Lee A., *et al*. "Trigeminal neuralgia occurs and recurs in the absence of neurovascular compression". *Journal of Neurosurgery* 120.5. (2014): 1048-1054.

8. Liu MX., *et al*. "Treatment of trigeminal neuralgia with "microvascular decompression plus" technique". *Journal of Neurological Surgery Part B: Skull Base*. 82 (Suppl 3) (2021): e295-e299.

9. Clarkson E and Jung E. "Atypical facial pain". *Dental Clinics of North America* 64.1. (2020): 249-253.

10. Kuncz A., *et al*. "Comparison of clinical symptoms and magnetic resonance angiographic (MRA) results in patients with trigeminal neuralgia and persistent idiopathic facial pain. Medium-term outcome after microvascular decompression of cases with positive MRA findings". *Cephalalgia* 26.3 (2006): 266-276.

11. Weiss AL., *et al*. "Atypical facial pain: a comprehensive, evidence-based review". *Current Pain and Headaches Report* 21.2. (2017): 8.

12. Besta R., *et al*. "MRI 3D CISS- a novel imaging modality in diagnosing trigeminal neuralgia - a review". *Journal of Clinical and Diagnostic Research* 10.3. (2016): ZE01-3.

13. Matsuda S., *et al*. "Trigeminal nerve dysfunction after Gamma Knife surgery for trigeminal neuralgia: a detailed analysis". *Journal of Neurosurgery* 113 (2010): 184-190.

14. Ishikawa M., *et al*. "Operative findings in cases of trigeminal neuralgia without vascular compression: proposal of a different mechanism". *Journal of Clinical Neuroscience* 9.2. (2002): 200-204.

15. Shi J., *et al*. "Risk factors for outcomes after microvascular decompression for trigeminal neuralgia". *World Neurosurgery* 136 (2020): e559-e566.

16. Cheng J., *et al*. "Trigeminal root compression for trigeminal neuralgia in patients with no vascular compression". *Acta Neurochirurgica* 157.2. (2015): 323-327.

17. Satoh T., *et al*. "Severity analysis of neurovascular contact in patients with trigeminal neuralgia: assessment with the inner view of the 3D MR cisternogram and angiogram fusion imaging". *American Journal of Neuroradiology* 30.3. (2009): 603-607.

18. Maarbjerg S., *et al*. "Persistent idiopathic facial pain - a prospective systematic study of clinical characteristics and neuroanatomical findings at 3.0 Tesla MRI". *Cephalalgia* 37.13. (2017): 1231-1240.

19. Wu A., *et al*. "Immediate and long-term outcomes of microvascular decompression for mixed trigeminal neuralgia". *World Neurosurgery* 117 (2018): e300-e307.