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Research Article

Technical Nuances in Surgery for Recurrent Trigeminal Neuralgia

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Abstract

Background: Trigeminal neuralgia (TN) is caused by the compression of blood vessels against the trigeminal nerve. Microvascular decompression (MVD), in which blood vessels are moved to decompress the trigeminal nerve as a fundamental treatment, is the gold standard performed worldwide. In this study, we report our findings of reoperation and review the precautions for reoperation and procedures to prevent recurrence during the initial surgery.

Materials and Methods: Twenty-five patients (5%) who underwent surgery for recurrent TN among 498 cases of MVD in the past seven years were included. Pre- and post-operative evaluations were performed using the Barrow Neurological Institute (BNI) score. A detailed evaluation of complications was performed.

Results: Satisfactory results were obtained in 92% of the cases. Permanent neurological complications were not observed. The BNI-N evaluation revealed that five patients (20%) had grade I facial dysesthesia, two patients (8%) had very mild sensory disturbances (grade II), and one patient (4%) had moderate sensory disturbance (grade III).

Conclusions: Aggressive surgical treatment should be considered in patients with recurrent TN. To prevent recurrence, minimal Teflon felt and fibrin glue should be used during the initial surgery without bleeding.

Keywords: Recurrence; Trigeminal Neuralgia; Microvascular Decompression

Abbreviations

TN: Trigeminal Neuralgia; MVD: Microvascular Decompression; SCA: Superior Cerebellar Artery; ABR: Auditory Brainstem Response; BNI: Barrow Neurological Institute; BNI-N: BNI Facial Numbness Scale; IN: Internal Neurolysis

Introduction

Trigeminal neuralgia (TN) is a paroxysmal electric pain that occurs on one side of the face due to triggers such as washing the face or eating [1,2]. It is caused by vascular compression of nerves [1,2]. Microvascular decompression (MVD) is the fundamental methodology and the global gold standard for moving offending vessels [1,2]. Although long-term results have been shown to be excellent, a recurrence rate of 5-15% has been reported [3-6]. The causes of TN recurrence include recompression of blood vessels, compression by Teflon granulomas, and adhesion of the trigeminal nerve to the surrounding tissues [3-6]. Re-operation is complicated because it is difficult to obtain a safe and adequate surgical field due to tissue adhesion [7]. There are numerous reports on cases of recurrent TN but few include a detailed review of the surgical techniques and precautions at the time of the initial surgery. Therefore, in this report, we describe a detailed examination of surgical techniques to achieve favorable outcomes in cases of recurrent TN and procedures to prevent recurrence during initial surgery.

Materials and Methods

Cases

In the last seven years, 498 cases of TN have been treated at our institution with a recurrence rate of 5%. To exclude cases of initial surgery that were not cured, cases in which pain reappeared for more than 6 months after the initial TN surgery were included. Thus, 25 patients were included; 16 female and nine male patients, with TN occurring on the left and right side in nine (36%) and 16 (64%) patients. The mean age of the patients was 59 years (range: 43–78 years). The affected areas were the second and third branches of the trigeminal nerve in 19 (76%) and six patients (24%), respectively. The superior cerebellar artery (SCA) was the predominant vessel responsible for initial surgery in 20 patients (80%). The remaining cases involved the vertebral artery in four cases (16%) and the anterior inferior cerebellar artery in one case (4%). The average time between initial surgery and reoperation was 2 years. Regarding symptoms before the initial surgery, the atypical component, which was persistent pain in addition to triggered paroxysmal electric shock pain, accounted for 40% of the cases. Cases that could be followed up for more than 1 year after surgery were included in the study, and the average follow-up period was 1.5 years.

Surgical procedure

Surgery was performed under general anesthesia with the patient in the lateral recumbent position. An incision was made in the surgical scar at the time of the initial surgery. However, since it may be difficult to aspirate CSF from the cerebellar cistern to slacken the cerebellum, as is usually performed during surgery, we inserted a lumbar drain to drain the CSF. This is necessary because the cerebellar surface and skull base dura mater are expected to be severely adhered to each other, complicating access root to the trigeminal nerve. Notably, in all cases, lumbar drainage allowed slackening of the cerebellum and prevented cerebellar damage. During craniotomy, the normal dura mater may not be easily identified due to the presence of solid extradural granulation tissue. Therefore, during reoperation, the craniotomy of the initial surgery was slightly widened in a circumferential fashion to confirm the normal dura mater. A dural incision was made through the normal area and then widened to the granulation tissue area and maximum amount of epidural granulation tissue was removed. However, the incision should be cautiously made under an operating microscope because adhesions between the cerebellar surface and the dura are expected. Since it was difficult to orient the cerebellum due to adhesions between the cerebellum and the pyramidal bone dura mater, the dissection was extended from the brain cistern to confirm the orientation of the lower cranial nerves. Intraoperative ABR was monitored continuously to avoid hearing loss as a complication, and dissection was minimized to prevent damage from the stretching of the seventh and eighth cranial nerves. After reaching the trigeminal nerve, the prosthesis, which was inserted between the trigeminal nerve and the responsible blood vessel during the initial surgery to decompress the trigeminal nerve, was gently removed while monitoring surrounding anatomical structures. The fibers of the prosthesis should be removed carefully, piece by piece, to avoid brainstem damage due to adhesion to the surface of the brainstem. After removing the maximum amount of prosthesis , surgery was completed by dissecting the adhesions around the trigeminal nerve and improving the deformity of the trigeminal nerve caused by the adhesions.

Postoperative evaluation

Pre- and postoperative facial pain was assessed using Barrow Neurological Institute (BNI) score [8]. Postoperative complications were evaluated in detail, but the most common complication, facial dysesthesia, was evaluated with the BNI facial numbness scale (BNI-N) [8].

Results and Discussion

Results

Surgical findings included adhesions and Teflon-felt compression in 10 cases (40%), adhesions and vascular compression in 14 cases (54%), and no vascular compression in one case (4%). The preoperative BNI score was 4-5, with an average of 4.2. Postoperative results showed a BNI of 2-4 with an average of 1.6. The results were excellent in 16 cases (64%), good in seven cases (28%), fair in two cases (8%), and favorable in 23 cases (92%). The BNI-N evaluation of facial dysesthesia showed that five patients (20%) had grade I facial dysesthesia, two patients (8%) had very mild sensory disturbances (grade II), and one patient (4%) had moderate sensory disturbance (grade III). All postoperative facial sensory disturbances were transient and none of the patients had permanent residual deficits. Other complications included wound infection in one patient (4%) and CSF leakage in one patient (4%). There were no cases of hearing disturbances.

Representative case

The patient was a 47-year-old man who experienced paroxysmal electric shock pain triggered by eating in the third branch of the right trigeminal nerve 2 years prior. He underwent right microvascular decompression surgery 1 year and 6 months after the medication became ineffective; the pain disappeared for 1 year but recurred 6 months prior and was treated with medication. As the effectiveness of the medication declined, the patient was referred for surgery. The medical history of the patient was unremarkable and BNI score was grade IV. The patient experienced facial pain that severely limited his daily activities. No other obvious symptoms of neurological deficits were observed. Magnetic resonance imaging (MRI, Constructive Interference in Steady State, Figure 1A) showed no obvious vascularity around the trigeminal nerve, and 3D-MR cisternogram/angiogram fusion images showed no contact between the SCA and the trigeminal nerve. The surgical procedure was performed as described above. Briefly, the trigeminal nerve reached around the trigeminal nerve, however, the trigeminal nerve was not visible due to the Teflon felt (Figure 2A). The Teflon felt covering the trigeminal nerve was gradually removed. The trigeminal nerve and SCA transposed at the time of the initial surgery were identified (Figure 2B). Teflon granulation existed between the trigeminal nerve and the SCA, therefore, it was assumed that the SCA pulsation reached the trigeminal nerve and caused recurrence. Further dissection of the trigeminal nerve was performed to complete the surgery. Facial pain disappeared immediately after surgery. Postoperative BNI was I and the BNI-N was I. The patient was discharged from the hospital on the seventh postoperative day without any new neurological deficits. One year after surgery, no recurrence has been observed.

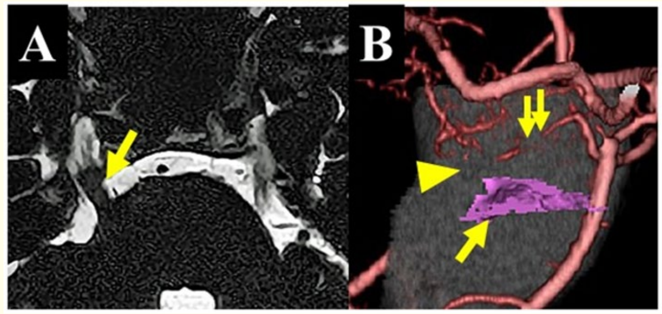

Figure 1

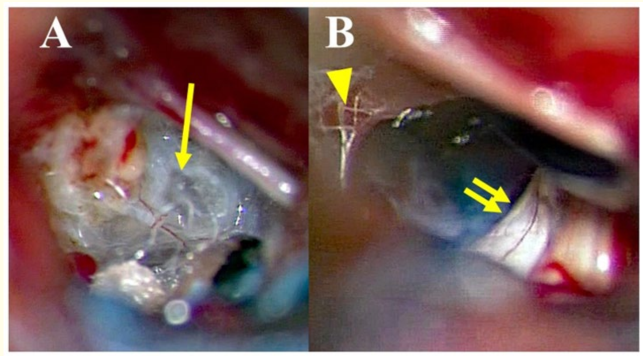

Figure 2

Discussion

Chen., *et al*. [9] performed a meta-analysis of 956 cases and examined recurrence factors after MVD for TN. Studies have shown that recurrence factors include age in the 50s, longer duration of disease, no vascular compression, and atypical facial pain. Our patients had an average age of 59 years, and atypical facial pain was present in 40% of cases.

Wang., *et al*. [10] reviewed 137 cases of reoperation for TN and noted that 27.1% of patients had adhesions and Teflon compression, 46.6% had adhesions and vascular compression, and 26.3% had no vascular compression. In our summary of surgical findings, 60% of the cases had adhesions and vascular compression; i.e., a Teflon felt was placed between the vessels to propagate the pulsation of the vessels. The surgical complications included facial numbness (8.7 %), infection (8.7 %), cerebral infarction (9.5%), and hearing impairment (5.8%), which is the same as the complication rate at the time of the initial surgery. In contrast, 27% of the patients were reported to have facial dysesthesia [11], consequently, surgical manipulation during reoperation requires careful attention. Regarding surgical results, several reports have shown good results, with an improvement of 90% or more, therefore, reoperation is aggressively recommended [12,13]. Similarly, in our study, good results were obtained in 92% of cases without any permanent residual complications.

To prevent recurrence, precautions must be taken during initial surgery. Bleeding should be avoided and fibrin glue and Teflon felt should be used minimally to prevent adhesions [14,15]. Therefore, it is necessary to maintain the space around the trigeminal nerve as wide as possible [7]. Recently, the usefulness of internal neurolysis (IN) for recurrent TN and TN without vascular compression has been reported and its long-term efficacy has been confirmed [16,17]. In addition to recurrent cases, it may also be an alternative for surgery.

Conclusion

In conclusion, surgery for recurrent TN is difficult and risky, but effective and should be aggressively considered based on meticulous surgical planning. Additionally, minimal Teflon felt and fibrin glue should be used during the initial surgery without bleeding to prevent recurrence.

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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.

Submission Statement

This original manuscript has not been submitted elsewhere in part or whole.

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