Fully endoscopic microvascular decompression for trigeminal neuralgia

In 2002 Jarrahy et al. published a completely endoscopic surgical technique for a patient with trigeminal neuralgia who underwent successful vascular decompression by this approach. Using this technique the offending vessel was separated from the nerve with minimal brain retraction or dissection of surrounding structures. This report represents the first documented case where the endoscope was used as the exclusive imaging modality for decompression of the trigeminal nerve. From experience, they conclude that the endoscope's superior visualization more accurately identifies neurovascular conflicts, and provides a comprehensive evaluation of the completeness of the decompression. Additionally, this new method minimizes the risks of brain retraction and extensive dissection often required for microscopic exposure. From this study, they conclude that completely endoscopic vascular decompression represents the next step forward in the safe and effective surgical treatment of trigeminal neuralgia [1].

Microvascular decompression for trigeminal neuralgia is a widely accepted treatment for patients with trigeminal neuralgia caused by vascular compression. The neuroendoscope is rapidly becoming a complementary tool in minimally invasive neurosurgery of the ventral anterior skull base. Its adoption in the lateral approach to the posterior fossa has been slower and has been used primarily as an adjunct to conventional microscopic surgical techniques, e.g. endoscope-assisted microsurgery.

Lang et al. described a stepwise, technical commentary on a purely endoscopic MVD of the trigeminal nerve via the retrosigmoid route.

The endoscope provides excellent visualization of the neurovascular relationship. By allowing full visualization of the trigeminal nerve, endoscopy may likely lead to an increase in the number of successful MVDs and a decrease in the number of complications.

They believe endoscopic MVD is a safe and effective method of accessing the trigeminal nerve at the cerebellopontine angle and of performing MVD. This endoscopic technique can be implemented in other neurosurgical and neuro-otological procedures such as resection of cerebellopontine angle tumors [2].

Case series

The clinical baseline data and preoperative MRI imaging data of 112 patients treated by Fully endoscopic microvascular decompression for trigeminal neuralgia from December 2008 to December 2020 in the Department of Neurosurgery, Capital Medical University Affiliated Beijing Shijitan Hospital were retrospectively analyzed, including area ratio of the cerebellopontine angle area (CPA)(healthy side/affected side), trigeminal nerve(TGN)length ratio(healthy side/affected side), TGN angle ratio(healthy side/affected side), and criminal vessel type. A Multivariate Cox proportional hazards model was used to analyze the factors affecting postoperative recurrence. Results: Among the 112 patients in this group, there were 49 males and 63 females. The age ranged from 20 to 82 (59±9) years, and the course of the disease was 0.05 to 30.00 (5.60±5.15) years. The pain was located on the left side in 43 cases (38.39%) and on the right side in 69 cases (61.61%), respectively. All patients

were followed up for more than 1 year, with an average follow-up time of 21.5 months, and 11 cases recurred. Multivariate Cox regression analysis revealed that disease duration≥3 years(HR=9.34, 95%CI:1.12-39.07), CPA area ratio(healthy side/affected side)>1 (HR=27.47, 95%CI:1.69-44.20), criminal vessel type with the vein(HR=35.39, 95%CI:1.26-18.60) and criminal vessel type with arteriovenous (HR=46.07, 95%CI: 2.74-27.75) were the main factors influencing recurrence of MVD surgery (all P<0.05). Conclusion: The disease duration≥3 years, CPA area ratio(healthy side/affected side)>1, and criminal vessel type with vein/arteriovenous are the relevant factors that affect the recurrence rate after the fully neuroendoscopic MVD treatment for trigeminal neuralgia. [3)]

Pak et al. presented the initial experience of fully endoscopic microvascular decompression (e-MVD).

Methods: This retrospective case series investigated e-MVD performed between September 2016 to February 2020 at a single institution. Clinical data including presenting symptomatology, medications, operative findings, postoperative complications, and outcomes were recorded. The five-point Barrow Neurological Institute Pain Intensity Score (BNI) was used to quantify the patients' pain relief.

Results: 25 TN patients (M: F 10:15; mean age of 63 [SD: 10.4]) underwent e-MVD during the study period. All patients had a preoperative BNI score of 5. The left side was affected in 15 patients. Complications occurred in two patients: both experienced hearing loss and one transient facial weakness seven days after surgery. The facial weakness had been resolved by the last follow-up. All patients were completely pain-free (BNI score 1) immediately post-operatively. On the latest follow-up, 22 patients have remained pain-free and 3 patients have recurrent pain that is being controlled with medication (BNI score III).

The study demonstrates that e-MVD is a safe, possibly effective method of performing MVD with the added benefit of providing improved visualization of the operative field for the operating surgeon and the surgical team. Larger prospective studies are required to evaluate if performing e-MVD confers any additional benefits in the long-term clinical outcome of TN patients [4)].

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97 patients with primary trigeminal neuralgia (PTN) underwent fully endoscopic microvascular decompression (MVD) via keyhole approach in Capital Medical University Affiliated Beijing Shijitan Hospital from December 2014 to February 2019 was collected. During fully endoscopic MVD in PTN via keyhole approach, performer use natural clearance without grinding except developed rock bone crest or excessive retraction of the brain tissue, visually and panoramically observe and evaluate the CPA area, accurately identify the responsible vessels, to avoid the omission of responsible vessels or insufficient decompression. And the use of preplaced technology, bridging technology and submersible technology, ensure the efficacy of surgery and reduce the surgical side injuries. Barrow Neurological Institute Pain Intensity Score was used to evaluate the efficacy and identify the recurrence. The surgical efficacy was analyzed. The offending vessels were identified under endoscope in 96 cases. Among them, arterial compression was found in 77 cases, venous compression in 6 cases, and both arterial and venous compression in 13 cases. About the pain outcomes, 87 cases had immediate and complete relief of pain, 5 cases had almost relief of pain, 4 cases had partial relief of pain, and still needed medication control, but the dose was lower than that before operation, and 1 case had no obvious relief of pain. About complications, there were 4 cases of temporary facial numbness, 1 case of temporary hearing loss, both of them recovered after symptomatic treatment. There was no cerebral infarction or hemorrhage, intracranial or incision

infection. All cases were followed up for 3.0-38.0 months with a median period of(22.4±2.2) months. During the follow-up periods, postoperative recurrence occurred in 3 cases. Fully endoscopic MVD for PTN through keyhole approach, provides panoramic view to avoid omission of offending vessels and reduce complications, seemed to be a safe and effective surgical method [5)].

Thirty-one patients who underwent MVD using a fully transcranial neuroendoscopic approach between May 2016 and September 2019 were retrospectively reviewed.

Results: All patients successfully underwent MVD, and immediate pain relief was achieved in all 17 cases of trigeminal neuralgia (TGH) and 3 cases of glossopharyngeal neuralgia (GPN). Hemifacial spasm (HFS) was completely resolved in all 11 patients. No mortality or permanent complication was seen.

The endoscope is a useful tool for confirming vascular conflict identified by the microscope and is helpful in detecting the vessel responsible for neuralgia without retracting the brain and nerves. MVD using a fully transcranial neuroendoscopic approach is an effective and safe alternative to endoscopic-assisted MVD and traditional MVD [6)].

A retrospective study in a single institution of 20 patients with TN who received EVD between April 2018 and October 2019. All patients underwent EVD via the suboccipital retrosigmoid approach without microscopy at any stage. Abnormal muscle response (AMR) and brainstem auditory evoked potentials (BAEPs) were routinely monitored throughout the procedure. Follow-up was conducted by outpatient and telephone interviews. The degree of facial pain was graded using the Barrow Neurological Institute (BNI) pain intensity score; a BNI of 1 was considered as the best result while a BNI of 2 or 3 was considered as a satisfactory result. Follow-up time ranged from 8 to 24 months, with a mean of 18±4.36 months.

Results: All 20 patients with severe preoperative pain (BNI of 5) achieved immediate relief or complete control of pain after surgery (BNI of 1 to 2). Vascular conflicts were observed during surgery in all of the patients. None of the patients experienced hearing loss, facial paralysis, intracranial infection, cerebrospinal fluid leakage, cerebral hemorrhage, or death, following the operation.

When carried out by surgeons with endoscopic experience, EVD can provide a clear surgical field of view and reduce the risk of surgical injury. Our findings indicate that EVD is a safe and effective surgical method for the treatment of TN [7)].

Bohman et al. presented the experience of their first 47 consecutive E-MVDs for trigeminal neuralgia (TN).

All surgeries were performed by a single surgeon (J.Y.K.L.) at the Pennsylvania Hospital at the University of Pennsylvania. Patients prospectively completed pain scales before and after surgery by using the Brief Pain Inventory-Facial outcomes tool. All patients were called on the telephone, and the same outcome tool was administered without reference to their preoperative pain status.

Forty-seven patients (17 men) were identified and enrolled. Forty (85%) had Burchiel Type 1 TN. Vascular compression was observed at surgery in 42 patients (89%). No surgery was aborted or

converted to the microscope. One patient suffered permanent hearing loss, for a permanent neurological morbidity rate of 2%. Overall improvement in pain outcomes was excellent, with a median maximum pain intensity preoperatively of 10 and postoperatively of 0 ($p< 0.0001$). The mean interference with global function scores was 6.2 preoperatively and reduced to 1.0 at the last follow-up ($p < 0.0001$). The mean interference with the facial function was 7.3 preoperatively and reduced to 1.2 at the last follow-up ($p < 0.0001$). The mean follow-up period after surgery was 15 ± 8 months.

On experienced hands, E-MVD offers superb visualization and illumination and is both safe and effective, at least in the short term. A further longer-term study is needed to compare E-MVD to traditional microscopic MVD [8].

A retrospective review of two-year experience from 2011 to 2012, transitioning from using conventional microscopic techniques to endoscope-assisted microsurgery to fully endoscopic MVD, is provided. We also reviewed our preliminary outcomes during this transition. Results. There was no difference in the surgical duration of these three procedures. In addition, the majority of procedures performed in 2012 were fully endoscopic, suggesting the ease of incorporating this solo tool into practice. Pain outcomes of fully endoscopic MVDs appear to be very similar to those of both conventional and endoscope-assisted MVDs. Complications occurred in all groups at equally low rates. Fully endoscopic MVD is both safe and effective. By enhancing the visualization of structures within the cerebellopontine angle, endoscopy may prove to be a valuable adjunct or alternative to conventional microscopic approaches [9].

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