Is entire nerve root decompression necessary for hemifacial spasm?

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A B S T R A C T

Objective: The root exit zone (REZ) of the seventh cranial nerve has been the target of microvascular decompression surgery (MVD) while searching the neurovascular conflict for treatment of hemifacial spasm for long time. Recently, increasing cases regarding the offending vessel beyond the REZ have been reported. To verify whether a thorough dissection of the nerve may give rise to a better postoperative result without enhancing complications, we conducted a parallel investigation.

Patients and methods: 112 Connective entire-nerve-exposed MVDs were performed and compared to 186 REZ-exposed MVDs performed by the same group of surgeons in 2009. The surgical findings, post-operative outcomes and complications as well as microscopic operating time were examined.

Results: Immediately after the surgery, the outcomes were excellent in 98.2%, good in 1.8% and poor in 0% in the entire-nerve-exposed group, compared to excellent in 92.5%, good in 1.6% and poor in 5.9% in the REZ-exposed group. The difference of outcomes between the two groups were statistically significant ($\chi^2=4.6845$, $P=0.0304$), but not the complications and microscopic operating time. Nine of the 11 poor-outcome patients from the REZ-exposed group were then reoperated on within a few days, and their symptoms disappeared in eight patients. The main reason for the failed surgeries was that the offending vessels beyond REZ were missed.

Conclusions: These findings suggested that the entire-root-decompression technique is recommended while performing MVDs in patients with hemifacial spasm.

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1. Introduction

Since the hypothesis of neurovascular confliction was first proposed in 1930s, the fact that the mechanical effect of a pulsating blood vessel at the root exit/entry zone (REZ) of the cranial nerve was the etiology of hemifacial spasm (HFS) and trigeminal neuralgia has been recognized and the microvascular decompression surgery (MVD) has been regarded as the treatment of choice for the diseases. With popularization of MVDs around the world, more and more authors doubted that the REZ might not be the only conflict site in some cases. Today, it is commonly accepted to explore the entire intracranial V nerve course for the trigeminal case in order to achieve a better postoperative outcome. Nevertheless, for the hemifacial case, the REZ is still emphasized during decompression of the VII cranial nerve. Most of the authors still believe that the offending vessel is in the caudal REZ of the facial nerve. Although some distal-compression cases have been reported in the literature recently, the surgical strategy of entire-cranial-nerve-root decompression of the VII has not been widely accepted so far. After accomplishment of more than 1000 cases of MVDs, we realized that the conflict site was also beyond the REZ in numerous hemifacial cases. Therefore, since June 1st, 2009, we started to modify the MVD procedure and to check the whole intracranial VII nerve root while performing MVD for each HFS case. To verify whether a thorough dissection of VII nerve may give rise to a better postoperative outcome without enhancing complications, we compared these entire-root-decompression operations with that traditional REZ-decompression operations performed earlier in the year by the same group of surgeons.

2. Methods

2.1. Subjects

We focused on 298 patients with HFS who underwent MVD from January through August, 2009 in the Department of Neurosurgery, XinHua Hospital, Shanghai JiaoTong University School of Medicine. Those subjects consisted of 119 males and 179 females. The age of the patient at the time of surgery ranged from 22 to 84 years old. The symptoms occurred in the right side in 131, in left in 167. The history of the disease ranged from 3 months to 25 years. Operative data including photographs and drawings of the observed anatomical findings were recorded for each of the surgery. Those with secondary hemifacial spasm arose from a tumor in the cerebellopontine angle had been excluded from this investigation.
2.2. Division of the intracranial facial nerve root

To precisely define the conflict site, we divided the intracranial root of facial nerve into four segments as referred in the literature. Zone 1, where the nerve emerges to the brainstem surface from the pontomedullary sulcus at the upper edge of the supraolivary fossette; Zone 2, where the root adheres to the surface of the pons before separating from the brainstem; Zone 3, where it is gradually transiting to be narrower; and Zone 4, where the nerve extends distally to the internal meatus (Fig. 1).

2.3. Grouping of patients

The patients were categorized as two groups according to the surgical process. In Group A, only Zone 1, 2 and 3 of the nerve was explored, which was performed between January 1 and May 30, 2009. This group included 186 patients, 74 males and 112 females, with an average age of 52.8 ± 10.7 years. The symptom occurred in the left side in 102, right side in 84. The history of the disease was lasted from 3 months to 25 years, averaged 6.7 ± 4.0 years. In Group B, the whole zones of the nerve root were decompressed, which was performed from June 1 through August 31, 2009. This group included 112 patients, 45 males and 67 females, with an average age of 50.5 ± 9.5 years. The symptom occurred in the left side in 65, the right side in 47. The history of the disease lasted from 5 months to 24 years, averaged 6.5 ± 4.1 years. There was no statistically difference between the two groups in terms of sex, age, side and course.

2.4. Surgery

2.4.1. Group A (only Zone 1, 2 and 3 of the nerve was explored, operated on between January 1 and May 30, 2009)

The patient was placed in a park bench position. The head was fixed in a Mayfield fixation frame. A vertical linear incision was made behind the ear along and medial to the hairline. A round craniotomy of 2 mm in diameter with its anterior edge very close to the sigmoid sinus was performed in the posterior fossa (Fig. 2). The dura was opened in a ‘T’ shape with its tip towards the lower outer quadrant in the surgical area. The dura edge along the bone rim was sutured back. Next, an operative microscope was brought into the field. Cerebrospinal fluid (CSF) was drained sufficiently to relax the cerebellum so that the operation could be performed without the use of retractors. The dissection was started from the caudal cranial nerves. While the arachnoid membrane between the VII–VIII and the caudal cranial nerves being opened, the cerebellum as well as flocculus was gradually raised until the pontomedullary sulcus was visualized. Tracing the offending vessel was begun from the caudal REZ, and then moved to the ventral, dorsal and rostral eventually (Fig. 3a). The vascular relationship was carefully studied to identify the vessel in contact with the VII nerve in those zones (Zone 1, 2 and 3). After the offending vessel was moved away from the nerve, small pieces of shredded Teflon sponge were gently placed between the vessel and the nerve (Fig. 3b). After thoroughly irrigation to make sure there was no bleeding, the dura mater was closed (Fig. 2). A duragen was placed over the suture line. A cranio-plasty of titanium wire mesh was completed. The incision was closed without drainage.

2.4.2. Group B (the whole zones of the nerve root were decompressed, operated on between June 1 and August 31, 2009)

The procedures of craniotomy and closure in Group B were same to that in Group A. However the microscopic manipulations varied. With the deep cerebellopontine angle being exposed, all the arachnoids surrounding the VII–VIII as well as the caudal nerves were opened thoroughly with microscissors and the whole VII–VIII nerves from the brainstem to the internal meatus were checked (Fig. 4). Any artery relevant to the VII nerve was moved away followed by placement of Teflon between the nerve and the artery. Small veins in Zone 1 or 2 were coagulated.

2.5. Evaluation of outcomes

As this study merely focused on the early operative results, the outcomes were evaluated within 2 weeks after MVDs. Based on the literature, it was defined as excellent (total spasm cease), good (spasm remained, but the degree and frequency were improved apparently) and poor (no relief).

2.6. Statistical analysis

The outcome and complications between the two groups were analyzed using Wilcoxon scores (rank sums) and Fisher’s exact test, respectively. The microscopic operating time between the groups was compared statistically with t-test. The level for statistical significance was reported with a P-value of less than 0.05.

3. Results

3.1. Features of offending vessels

3.1.1. Group A

Among the 186 patients of Group A, the offending vessel was identified as artery only in 163, artery associated with vein in 7. It was found in zone 2 and 3 in 53, zone 3 in 49, zone 1 and 2 in 36, zone 1, 2 and 3 in 25, zone 1 in 7. The nerve root was observed to be impressed or shifted by the compression of the offending artery in 143 (76.9%). The offending artery merely contacted with the nerve in 27 (14.5%). The offending vessel was not actually found in 16
Out of the 9 patients who were reoperated on within five days because of the unimproved symptoms, 8 were discovered that the real offending vessel was in zone 4 (Fig. 4), 1 in zone 3 (the decompression of facial nerve had not been sufficient in the first operation).

3.1.2. Group B

Among the 112 patients of Group B, the offending vessel was discovered in all the patients. It was artery only in 107, artery and vein in 5. It was found in zone 2 and 3 in 37, zone 3 in 25, zone 1 and 2 in 22, zone 1, 2 and 3 in 17, zone 1 in 4, only zone 4 in 7 and zone 4 with other zone(s) in 29. In other words, 32.1% was found that the offending vessel involved zone 4. The nerve root was impressed or shifted in 81 (72.3%). The offending vessel was adjacent to the nerve in 31 (27.7%).

3.2. Postoperative outcomes

3.2.1. Group A

Postoperatively, excellent outcome was showed in 172 (92.5%), good in 3 (1.6%) and poor in 11 (5.9%). Of the 11 patients without any improvement, 9 were reoperated on within 5 days and their symptoms were all disappeared after the second operation. Therefore, the final relief rate after the second surgery was 97.3% (181/186), while the poor rate was 1.1% (2/186).

3.2.2. Group B

Among the 112 patients, 98.2% (110) presented as excellent outcome, 1.8% good. No poor outcome was occurred in this group.

Statistically, the outcome of Group B was better than that of Group A following the primary MVD ($\chi^2 = 4.6845, P = 0.0304$).

3.3. Operating time and complications

3.3.1. Group A

It took 14 ± 2 min of microscopic time to complete the decompression in Group A. Postoperatively, some complications were observed, i.e., uncomplicated facial palsy in 5 (2.7%), hearing disorder in 6 (3.2%) and cerebrospinal fluid (CSF) leak in 1 (0.5%), hoarseness and choking in 1 (0.5%).

3.3.2. Group B

It took 16 ± 3 min to perform the microscopic manipulation in Group B. In this group, the uncomplicated facial palsy was found in 2 (1.8%), hearing disorder in 3 (2.7%) and CSF leak in 1 (0.9%). No hoarseness or choking was found.

The difference in complications between the two groups was not statistically significant. Though the operating time under the microscope of Group B looked to be a slightly longer than that of Group A, the difference was also not statistically significant.

4. Discussion

With high curative and low recurrent ratio, MVDs have been believed as the most effective treatment of hemifacial spasm.

Until now, most surgeons have limited their target within REZ while searching the offending vessel during operations although increasing cases concerning the conflict site was identified in regions other than REZ. We used to perform the surgery in a traditional way (expose the region between the REZ of VII nerve and the caudal cranial nerves only). With increasing quantity of the surgery, we noticed that an offending vessel could be discovered in the cistern segment of the VII nerve root and the caudal cranial nerves only. With increasing quantity of the surgery, we noticed that an offending vessel could be discovered in the cistern segment of the VII nerve root in most of those REZ-negative-findings cases. Therefore, we now check the entire intracranial VII nerve root thoroughly, from the brainstem to the meatus, for each MVD.

No doubt the entire-root-exploration technique requires more dissection and those delicate structures, such as VII-VIII and caudal cranial nerves, brainstem and cerebellum as well as arteries, will be more involved, which may take more operating time and risk. Nevertheless, our results showed that the operating time and the postoperative complication were not different statistically between the two groups. The operating time and operative risk depend more on the surgeon’s skill rather than manipulation alone. With the increasing number of MVDs, the surgeon became to be more
sophisticated and the total operating time was shortened accordingly. We are not in pursuit of a small incision, yet a 2-mm-diameter craniectomy is enough in most of cases. As a matter of fact, the size of craniectomy is not really important, but the surgical projection. With appropriate patient position and localization of the craniectomy, a good approach can be obtained which is a precondition for an effective and successful operation.

We hypothesize that there are two important factors contributed to the disease. One is a damaged epineurium, the other is a contacted artery with damaged adventitia. With both the factors, a short circuit breaks out between facial nerve fibers conducted by the sympathetic fibers underneath the lesioned vascular adventitia. An epileptic discharge triggers a facial muscle spasm. Compared to the peripheral segment, the central segment of the VII cranial nerve is more susceptible to be damaged by a pulsed artery. However, the location of REZ of the facial nerve varies between patients, in some cases REZ being very close to the brainstem and in some cases it being more peripheral.17,26 Whatever, the REZ is not the point but the neurovascular confliction, which could be found anywhere along the nerve.

Based on the literature, the cure rate of MVD for hemifacial spasm varied from 70% to 98%.4,27 The majority of the authors believed that there was still the possibility of symptom relief within one year.28 This delayed relief rate has been reported as high as 10%.

Conflict of interest
None declared.

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Ethical approval
None declared.

References