Microvascular decompression for hemifacial spasm

Patterns of vascular compression in unsuccessfully operated patients

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To determine the causative factors of unsuccessful microvascular decompression for hemifacial spasm, the follow-up results in 53 patients were assessed retrospectively. The mean follow-up period was 36 months. There were 32 patients who had compression of the seventh cranial nerve ventrocaudally by an anterior inferior cerebellar artery (AICA) or a posterior inferior cerebellar artery. Of these 32 patients, 30 (94%) had excellent postoperative results. Of 14 patients with more severe compression by the vertebral artery, nine (64%) had excellent results, three (21%) had good results, and two (14%) had poor results; in this group, three patients with excellent results experienced transient spasm recurrence. There were seven patients in whom the mental branch of the AICA coursed between the seventh and eighth cranial nerves and compressed the dorsal aspect of the seventh nerve; this was usually associated with another artery compressing the ventral aspect of the nerve ("sandwich-type" compression). Of these seven patients, five (71%) had poor results including operative failure in one and recurrence of spasm in four. The authors conclude that the clinical outcome was closely related to the patterns of vascular compression.

KEY WORDS  •  hemifacial spasm  •  microvascular decompression  •  recurrence  •  vascular compression

Microvascular decompression via retrosigmoid craniectomy is the preferred method for treating hemifacial spasm. However, treatment failure, failure to relieve the spasm, and recurrence of the spasm have been reported. Little work has been carried out to determine the factors causing unsuccessful microvascular decompression. We examined the causative factors in patients who had undergone unsuccessful microvascular decompression in a retrospective study of the relationship between the follow-up results and the pattern of vascular compression.

Clinical Material and Methods

Case Material

Of 68 patients who underwent microvascular decompression for hemifacial spasm in our department from 1983 to 1989, 53 consecutive patients were followed for more than 1 year and were entered into this retrospective study. Computerized tomography scanning with contrast enhancement and venous digital subtraction angiography were performed preoperatively in all patients. Arterial compression to the intracranial facial (seventh cranial) nerve was found in all 53 patients, usually at the root exit zone.

The patients were divided into three groups according to the arteries involved and the degree or direction of arterial compression to the seventh nerve. Group A included 32 patients with the most common and simplest type of compression at the root exit zone from the anterior-caudal direction by an anterior inferior cerebellar artery (AICA) or a posterior inferior cerebellar artery (PICA) (Fig. 1A). In this type of compression an indentation of the nerve was usually found at the compressed root exit zone. Group B included 14 patients who had a tortuous redundant vertebral artery compressing the seventh nerve directly (three cases) or indirectly (11 cases) with an interposed AICA or PICA between the vertebral artery and the nerve (Fig. 1B). In this group, compression of the seventh nerve was more severe than in Group A. Group C included seven patients whose mental branch of the AICA coursed between the seventh and eighth cranial nerves and compressed the dorsal aspect of the seventh nerve. The ventral or caudal part of the seventh nerve was also compressed by the PICA in two patients and by the
proximal portion of the AICA in four patients. Thus, in these six patients, the seventh nerve was “sandwiched” between dorsally and ventrally or caudally situated arteries (Fig. 1C).

Operative Technique

Our operative technique was based on the procedure described by Jannetta, et al. Briefly, a small retromastoid suboccipital craniectomy was performed with the patient in the lateral decubitus position. The seventh nerve and the involved vessels were visualized from the inferolateral direction through a space between the eighth and ninth nerves. In Group A patients, the involved portion of the AICA or PICA was easily transposed and a piece of prosthesis (polyvinyl alcohol sponge, Ivalon) trimmed to the appropriate size was inserted between the artery and the brain stem or root exit zone of the facial nerve. In Group B patients, several large pieces of Ivalon sponge were required to achieve decompression of the seventh nerve. In Group C patients, transposition of the involved artery away from the dorsal aspect of the seventh nerve was difficult because the eighth nerve was located just behind the artery or the artery had small perforators coursing into the internal auditory canal. In one Group C patient who did not manifest “sandwich” compression, several small pieces of Ivalon sponge were inserted between the artery and the dorsal aspect of the seventh nerve. Of the six patients with “sandwich” compression, both compression sites were decompressed by inserting Ivalon sponges between the artery and the nerve in four. In the other two patients, only the ventrocaudal involved artery was decompressed at the initial operation; the results in these two patients were poor, and dorsal decompression was added at a second operation.

Clinical Evaluation

The results following the initial operation were assessed and categorized as excellent (complete disappearance of spasm), good (minimal residual or recurring spasm with the patient satisfied with the results of the operation), or poor (no benefits due to severe residual or recurring spasm). Early recurrence of spasm (within 1 month of the initial operation) was characterized as residual spasm.

The results were evaluated at the time of discharge from the hospital and at outpatient visits or contact with the patients by letter or telephone. Results in four patients who underwent a second operation for recurring spasm were regarded as poor. The remission time from the initial operation to recurrence or last follow-up contact was compared for the three groups by the Kaplan-Meier method. The curves obtained by this method represent the estimated probability of maintaining excellent symptomatic relief through any given time after the initial operation. The generalized Wilcoxon test was used to assess the statistical difference of remission time in the three groups.

Results

The age of the patients in this study ranged from 26 to 74 years (mean 53 years). There were no significant differences in age at onset or at operation among the patients in the three groups. Thirty-five (66%) of the 53 patients were women, including 72% of the 32 patients in Group A. The right side was involved in the
spasm in 86% of patients in Group C, 50% in Group A, and 36% in Group B. There were no marked differences in the clinical features among the groups. In all groups, even Group C, the spasm started in the orbicularis oculi muscle and progressed down the face. Digital subtraction angiography in Group B frequently showed a tortuous redundant vertebral artery on the involved side.

**Spasm Relief**

The mean follow-up period was 36 months (range 12 to 64 months); there was no clear difference in the follow-up periods among the three groups. Most of the patients in each group showed excellent results on the day of discharge following the initial operation: 94% in Group A, 93% in Group B, and 71% in Group C patients. However, the number of patients with recurring spasm progressively increased in Group B and C as shown by the Kaplan-Meier survival curve representing the probability of excellent results (Fig. 2). The estimated rate of cure with excellent results was 93.0% in Group A, 61.1% in Group B, and 0% in Group C. These differences were statistically significant (p < 0.05 and p < 0.001, respectively).

Of the 32 Group A patients, 30 (94%) had excellent results in the follow-up period. In one patient, who had recurrent spasm within a few days of the operation, the results was assessed as poor; although for 3 years the spasm has been milder than preoperatively. The other patient with a good result experienced recurrence of a mild and infrequent spasm after a 27-month spasm-free period. One of two patients who had residual spasm at the time of discharge was classified as excellent at the time of follow-up examination because the residual spasm had completely disappeared at 2 months after discharge.

Of the 14 Group B patients, the postoperative results were graded as excellent in nine (64%), good in three (21%), and poor in two (14%). Among the nine patients with excellent results, three experienced transient recurrence of the spasm starting 6 to 12 months after the operation and lasting for 3 to 6 months. Thereafter, they were free of spasm for more than 24 months, and their results were subsequently assessed as excellent. Three patients with good results experienced recurring mild spasm at 8 to 23 months after the operation; however, the spasms were milder and less frequent than before treatment during a follow-up period of 2 to 4 years. One of the two Group B patients with poor results experienced early recurrence, and the other had late recurrence following a 24-month spasm-free period.

Five (71%) of the seven Group C patients had poor results. Of the six patients who had "sandwich-type" compression, four had recurrence of spasm starting 2 to 18 months postoperatively (average 7.5 months). The one patient without a "sandwich" type of compression experienced mild recurrent spasms at 1 year after surgery; this result was assessed as good because the recurring spasms were mild, infrequent, and localized in the orbicularis oculi muscle during a follow-up period of 2 years.

**Reoperation**

Of eight patients with poor results following the initial operation, four underwent a second operation. The previously placed Ivalon sponges had not slipped in these four patients.

In two patients in Group B, Ivalon sponges were added between the vertebral artery and the brain stem because the previously placed sponges had not effectively decompressed the severe seventh nerve compression by the vertebral artery. In one of these two patients the vertebral artery was covered with a sheet of Teflon felt and retracted by fixing the sheet with Biobond to the dura near the jugular foramen. Following the second operation, these two patients have been spasm-free for 10 and 6 months.

The operative findings in two patients with reoperation from Group C are illustrated in Fig. 1C and Fig. 3. In one patient (Fig. 1C), only the PICA compressing the ventral aspect of the facial nerve was decompressed in the initial operation. However, intradural findings at the second operation (for treatment of recurrence) indicated compression by the AICA at the dorsal aspect of the seventh nerve; the PICA was not touching the seventh nerve because of the previously placed Ivalon sponge. Therefore, an additional Ivalon sponge was inserted between the AICA and the dorsal aspect of the seventh nerve. The patient remains spasm-free 12 months after the second operation. In the other patient, the premeatal segment of the AICA was found to compress the root exit zone of the seventh nerve from the caudal direction and the meatal segment compressed the dorsal aspect of the nerve (Fig. 3). At the

![Fig. 2. Kaplan-Meier curve for estimated probability of maintaining excellent results through any given period following the initial operation. The numbers in parentheses indicate the number of patients available for follow-up study. The estimated rate of cure with excellent results is 93.0% in Group A, 61.1% in Group B, and 0% in Group C.](image-url)
first operation, only compression by the premeatal segment was corrected by placing an Ivalon sponge; however, at the second operation for recurrent spasm, stronger compression with indentation by the meatal segment of the AICA was found at the dorsal part of the nerve (Fig. 3 right). Small Ivalon sponges were added at that site and the patient remains spasm-free 4 years after the second operation.

Complications
No major postoperative complications occurred in this series, with the exception of one Group B patient with Wallenberg's syndrome following the second operation in which Teflon felt was used to reroute the vertebral artery; however, the Wallenberg's syndrome in this patient has gradually improved. Marked prolonged eighth nerve dysfunction following the initial operation occurred in six patients (11%). The incidence of hearing disturbance was higher in Group B (21%) than in Group A (6%) patients, although there was no statistical difference. Prolonged facial paresis was found in four patients (8%). Hearing loss and transient facial paresis were found in three of the four patients who underwent reoperation.

Discussion
Spasm Relief
Reported rates of complete relief from hemifacial spasm following microvascular decompression range from 60% to 87%\textsuperscript{1,2,4,8,10,11} with varying follow-up periods. In our series, the overall rate of excellent results in a mean follow-up period of 36 months was 76%. While unsuccessful cases due to failure of microvascular decompression or late recurrence of spasm have been reported, to our knowledge there have been no comprehensive studies regarding the contributing or causative factors.

Our follow-up results indicate that the types of vascular compression are closely correlated with the surgical outcome. Most of our Group A patients with simple compression had excellent results. In contrast, most of our Group C patients with a "sandwich" type of compression had poor results. The incidence of recurrence, including transient or mild spasms, was also high in Group B patients with vertebral artery compression.

Atypical Hemifacial Spasm
Jannetta, et al.,\textsuperscript{9} applied the term "atypical hemifacial spasm" to cases with a loop of cochlear artery pressing on the posterosuperior aspect of the seventh nerve at the brain stem between the seventh and eighth nerves. The postoperative results in two patients with atypical hemifacial spasm were poor. In both patients hemifacial spasm began in the center of the face and gradually involved the upper face including the frontalis muscle. Our Group C patients had features of atypical hemifacial spasm because one of the compressing arteries was the meatal branch of the AICA coursing between the seventh and eighth nerves. However, none of them manifested atypical progression of the facial spasm. In six of the seven Group C patients, the seventh nerve was interposed between two arterial components. In two patients with poor follow-up results, a compressing artery at the dorsal aspect of the seventh nerve was overlooked or not decompressed because it was not thought to be a major factor in the nerve compression. The fact that decompression of the artery in the second operation resulted in excellent results in both patients suggests that the two arterial components should have been decompressed in the initial operation. However,
three of four patients who underwent decompression at two sites had poor results, possibly because decompression was insufficient for fear of incurring complications such as hearing loss or facial paresis. To obtain excellent or good results in patients with nerve compression at two sites, the seventh nerve should be sufficiently decompressed (for example by carefully wrapping the entire seventh nerve with sponge or a Teflon sheet) despite the high risk of seventh or eighth nerve injury.

Vertebral Artery Compression

While cases of strong vertebral artery compression have been described,\(^{5,7,10}\) the rates of late recurrence of spasm were not a primary topic in these reports. In our series, reoperation in two Group B patients with recurrent spasm revealed that the placement of Ivalon sponges between the compressing vertebral artery and the brain stem near the root exit zone of the seventh nerve had not been enough to decompress the large vertebral artery which had a strong pulsatile force. Different techniques such as rerouting the vertebral artery by using a fenestrated clip\(^1\) or placing tape around the vessel and anchoring it to the dura\(^2\) may be more effective than placing a prosthesis. However, both of these procedures are quite difficult because there is not enough room in the cerebellomedullary cistern to transpose the redundant vertebral artery and the possibility exists of injuring the perforating vessels from the vertebral artery or the PICA to the medulla. One of our Group B patients manifested Wallenberg's syndrome following the second operation.

Conclusions

To improve the long-term results in patients undergoing microvascular decompression for hemifacial spasm, surgeons must carefully evaluate the sources of nerve compression. By this means an optimal approach can be found in order to correct the problem with the least trauma to the involved structures.

References


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