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# Failed microvascular decompression surgery for hemifacial spasm: a retrospective clinical study of reoperations

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**Abstract**
*Background* To investigate the repeat microvascular decompression on hemifacial spasm patients who failed the first MVD.
*Methods* Twenty-six patients underwent late redo MVD in our institution from January 1, 2011 to December 31, 2015. The clinical features, surgical findings, outcomes, and complications of the repeat MVD were analyzed retrospectively.
*Results* Twenty-four (92.3 %) patients were cured immediately after the redo MVD. Delayed relief was found in two (7.7 %) patients; it took 6 days and 2 weeks for them to obtain complete relief. No recurrence was found during follow-up. Surgical complications including three (11.5 %) facial paralysis and one (3.8 %) hearing loss.
*Conclusions* We suggested that repeat MVD can be performed 2 years after the first MVD if the spasm was not resolved. Repeat MVD for HFS is effective.

**Keywords** Hemifacial spasm · Microvascular decompression · Delayed relief · Reoperation

## Introduction

Hemifacial spasm (HFS) is a cranial nerve disease characterized by involuntary contractions of muscles innervated by the ipsilateral facial nerve [1, 25]. Jho and Jannetta raised that the neurovascular compression (NVC) at the root exit zone (REZ) of the facial nerve is the main cause of this disease in the last century and this idea is currently widely accepted [14]. Microvascular decompression (MVD) of the facial nerve is the most common surgical procedure carried out today, with success rates of more than 90 % in some series [2, 12]. About 2.9–50.3 % of patients are reported to obtain relief gradually rather than cured immediately after MVD. This process may take several months or even years, so it is debated what is the suitable time for patients with persistent hemifacial spasm after their first MVD to receive MVD again [7, 15, 22, 33]. In our study, we retrospectively analyzed the clinical features, surgical findings, outcomes, and complications of the repeat MVD for the patients who are not spasm-free more than 2 years after their first surgery.

## Materials and methods

### Research population

This study involved 26 patients who underwent repeat MVD from January 1, 2011 to December 31, 2015 in Nanjing Drum Tower Hospital. All of the 26 patients underwent a failed MVD previously, and 23 of them receive their first MVD at other institutions. In this study, failed MVD was defined as the patients who suffered from persistent hemifacial spasm after their first MVD and the spasm did not improve for at least 2 years during postoperative follow-up.

### Surgery

All of the patients underwent repeat MVD by one chief physician and the surgery was performed under the electrophysiological monitoring of abnormal muscle response (AMR). Under general anesthesia, the patient was placed in lateral

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decubitus position. After durotomy, cerebrospinal fluid was drained sufficiently and the root exit zone (REZ) of the facial nerve was exposed under the microscope. The conflict site of first MVD was reexamined and every suspected offending vessel was separated from the facial nerve root with shredded Teflon implants. After confirming that there was no further compression, the dura mater could be closed, followed by cranioplasty and incision closure.

### Surgical outcomes and complications

All the patients were followed up continuously and the following items were recorded: (i) Outcomes of the surgery: cured immediately, delayed relief [15], invalid and relapse. (ii) Complications: including facial paralysis, cerebrospinal fluid leakage, tinnitus, deafness, hearing loss, intracranial hematoma, cerebral infarction, and so on.

## Results

### Clinical features

This study included nine males and 17 females, aged from 37 to 71 years old when they received the repeat MVD. All of them underwent their first MVD more than 2 years ago. The time between the two operations lasted from 24 months to 67 years (average, 38.7 months). The spasm symptom was located on the left side in 14 and right side in 12 patients (Table 1).

### Findings in redo MVD

During the reoperations, we observed that the most common reason for the failure of a patient's first MVD was misidentification of the exact offending vessel, which accounted for 15 (57.7 %) cases. The Teflon was placed between the REZ and the irrelevant vessels or just one branch of the offending vessels while the most important vessels were missed. The facial nerve root had been decompressed insufficiently in six (23.1 %) patients because the vertebral arteries were too close to the offending vessels or the vertebral arteries were one part of offending vessels. In four (15.4 %) patients, the Teflon implants were placed between the facial nerve and the offending vessels while neurovascular compression (NVC) at the root exit zone (REZ) still existed after the first surgery. Too many Teflon implants were observed in one (3.8 %) patient thus a new compression may have occurred. The AMRs disappeared in all the patients when their operations were finished (Table 1).

### Surgical outcomes

The patients were followed up 8 to 65 months after the operation, with an average time of 43.4 months. Twenty-four (92.3 %) patients were cured immediately after the redo MVD. Delayed relief was found in two (7.7 %) patients. It took 6 days and 2 weeks for them to obtain complete relief. No recurrence was found during follow-up. Surgical complications included three (11.5 %) facial paralyses and one (3.8 %) hearing loss. No serious complications like intracranial hematoma or death occurred in these patients (Table 1).

## Discussion

### When to perform repeat MVD

Currently, neurovascular compression at the root exit zone of the facial nerve was believed to be the etiology of HFS, and MVD was recommend to be an effective treatment as postoperative cure rate was satisfying, ranging from 86 to 96 % in some reports [2, 4, 12, 34]. However, not all of the patients were cured immediately after the surgery, some patients may experience delayed relief for several months or even years [15, 20, 24]. Ishikawa et al. [13] studied 175 HFS patients and 88 of them had spasms after MVD. Residual spasms disappeared after 1 week in 25 %, after 1 month in 50 %, and after 8 months in 90 % of cases. Li [20] reported that 41 of 545 patients (7.5 %) had residual spasms after MVD but 37 achieved complete resolution within 1 year. Jo et al. [15] also reported that 1.4 % of the cured patients experienced delayed resolution at 1–3 years after treatment. Two patients got delayed relief for 3.5 years in Sindou's reports, which was the longest time to date [33].

The etiology of delayed resolution has been debated. When the spontaneous or ectopic excitation by the pulsatile compressive force of the offending vessel disappeared after the surgery, HFS patients got an immediate resolution. In some cases, the complete regeneration of the microinjury of the facial nerve or the gradual stabilization of the facial motor nucleus cost some time, thus these may be the reason for delayed resolution [8, 13, 29, 32]. Some researches [32] suggested that the longer duration of HFS and the severer symptoms would lead to the longer time of delayed resolution.

Due to the existence of delayed resolution, early reoperation for the patients is not recommended by most of the scholars. Hyun [12] believed that even if the residual spasm existed after the first MVD, no judgment and decision regarding retreatments should be done before 12 months after the original surgery. Sindou et al. [33] and some other authors suggested that the treatment of persistent or recurrent patients with HFS should be more than 1 year after the previous MVD [4, 9]. Jo et al. [15]

**Table 1** Results of the study group

| No. | Age at redo MVD (years) | Side | Sex | Time between two MVDs (months) | Surgical findings | Exact compression | Follow-up time (months) | Spasm result | Complications |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 60 | L | M | 67 | Misidentified AICA as offending vessel | AICA+ PICA | 65 | Delay relief (2w) | None |
| 2 | 50 | R | M | 38 | Misidentified PICA as offending vessel | AICA | 63 | Cured | None |
| 3 | 42 | L | F | 37 | Insufficient decompression | VA+AICA | 62 | Cured | None |
| 4 | 61 | L | M | 39 | Misidentified PICA as offending vessel | VA+PICA | 59 | Cured | Hearing loss |
| 5 | 38 | R | F | 47 | Insufficient decompression | VA+AICA | 58 | Cured | None |
| 6 | 55 | R | F | 63 | Misidentified AICA as offending vessel | PICA | 57 | Cured | None |
| 7 | 66 | L | F | 42 | Misidentified AICA as offending vessel | PICA | 57 | Cured | Facial paralysis |
| 8 | 37 | R | F | 34 | Improper placement of Teflon | AICA | 55 | Delay relief (6d) | None |
| 9 | 71 | L | F | 44 | Misidentified AICA as offending vessel | AICA+ PICA | 54 | Cured | None |
| 10 | 49 | L | F | 32 | Misidentified AICA as offending vessel | VA+AICA | 50 | Cured | None |
| 11 | 61 | L | F | 25 | Improper placement of Teflon | PICA | 48 | Cured | None |
| 12 | 59 | R | F | 40 | Misidentified PICA as offending vessel | AICA | 47 | Cured | None |
| 13 | 62 | R | F | 31 | Insufficient decompression | VA+PICA | 47 | Cured | None |
| 14 | 57 | L | M | 30 | Misidentified PICA as offending vessel | AICA | 46 | Cured | None |
| 15 | 56 | R | M | 49 | Misidentified PICA as offending vessel | AICA | 44 | Cured | None |
| 16 | 70 | R | F | 35 | Improper placement of Teflon | PICA | 41 | Cured | None |
| 17 | 58 | L | F | 36 | New compression due to too much Teflon | Teflon | 39 | Cured | Facial paralysis |
| 18 | 52 | L | M | 29 | Insufficient decompression | VA+AICA | 35 | Cured | None |
| 19 | 48 | R | M | 36 | Misidentified AICA as offending vessel | VA+AICA | 32 | Cured | None |
| 20 | 42 | L | F | 38 | Improper placement of Teflon | AICA | 28 | Cured | None |
| 21 | 54 | R | F | 38 | Insufficient decompression | VA+AICA+ PICA | 24 | Cured | None |
| 22 | 39 | R | M | 24 | Misidentified PICA as offending vessel | AICA | 18 | Cured | None |
| 23 | 61 | L | F | 40 | Misidentified PICA as offending vessel | AICA | 17 | Cured | Facial paralysis |
| 24 | 57 | R | F | 34 | Misidentified AICA as offending vessel | PICA | 12 | Cured | None |
| 25 | 45 | L | F | 45 | Insufficient decompression | VA+PICA | 10 | Cured | None |
| 26 | 55 | L | M | 32 | Misidentified PICA as offending vessel | VA+AICA | 8 | Cured | None |

suggested the if the surgeon can confirm intraoperative resolution of the lateral spread response (LSR) and severe indentation, reoperation can be delayed until 3 years after the original MVD and he defined the patients who had residual or recurrent spasms at 3 years after first surgery as failed group.

## Surgical outcomes and complications

In our studies, the 26 patients with persistent hemifacial spasm after their first MVD for at least 2 years and we defined their first MVD as a failure. During the reoperations, we found the failure may be attributed to misidentification of the exact

offending vessels and improper operations in their first MVD. Without good exposure, it was not easy to inspect REZ of the facial nerve. When the vertebral artery combined with small vascular compressions, the accompanying small vessel, beneath the vertebral artery, might be the actual responsible vessel after shifting the vertebral artery [3]. Sometimes, CSF drainage may induce an anatomical shift of neurovascular relationship [26]. All of these causes could affect the surgeon in finding the exact offending vessels. Surgeons without much experience were more likely to miss the most important offending vessels or place the Teflon in a wrong way, resulting in insufficient decompression.

When the persistent spasm lasted more than 2 years after original MVD and there was no improvement, we suggest that compression has not been completely relieved and the first MVD failed. This is the time to make the decision for a reoperation. In our study, 24 (92.3 %) patients were cured immediately and the other two patients obtained spasm relief in 6 days and 2 weeks. The cure rate was excellent. Wang et al. [35] reported that repeat MVD had a cure rate of 85 % in the patients with a first-time MVD failure. Also, Engh et al. [5] suggested that late repeat MVD for HFS is a reasonable treatment option and it is effective in experienced hands.

Facial paralysis, hearing loss, and some other complications like balance problems and CSF leakage are common in MVD for HFS patients [17, 19]. Patients who had repeat MVD did not suffer a higher rate of complications than those who received the surgery only once [5]. In our study, we observed three (11.5 %) facial paralyses and one (3.8 %) hearing loss in the 26 redo MVD patients. Compared to some previous reports [5, 35], there is no significant difference. However, when repeat MVD was performed, local arachnoid's adhesions and unclear brain tissue due to the first MVD will make it difficult for the surgeon to re-explore the REZ of facial nerve. Payner et al. [27] observed that the risk of hearing loss was greatest in patients who underwent repeat MVD. Thus, in addition to AMR, intraoperative monitoring of brainstem auditory evoked potentials (BAEPs) is necessary in order to decrease the danger of hearing loss [23, 28]. Surgeons should operate more gently and carefully during the redo MVD in order to not damage cranial nerves or blood vessels.

### The usage of AMR monitoring

Intraoperative monitoring of AMR is highly useful as an index for the effectiveness of decompression [18, 30]. Sekula et al. [30] reported that the chance of resolving HFS if the AMR is abolished during surgery was 4.2 times greater than if the AMR persisted. AMR can help indicate the identification of offending vessels and confirm whether an adequate decompression has been achieved [6]. Thus, surgeons can avoid unnecessary operative time and reduce postoperative complications. However, it should be noted that the disappearance of AMR during surgery does not mean being definite spasm-free after surgery, and some patients may obtain spasm relief though AMR remains after decompression [10, 21, 34]. Kong et al. [18] reported that AMR was observed during intraoperative facial EMG monitoring in 263 of 300 patients, and 33 patients showed persisting AMR despite decompression. However, 66.7 % of the 33 patients were spasm-free after surgery. Joo et al. [16] also reported that 81.3 % of the patients who had persisting AMR after decompression were cured during the follow-up period. Besides, some patients had remaining spasms even though AMR disappeared after decompression [10, 11]. Thus, there is some limitation of predicting clinical outcome by monitoring AMR in HFS patients. In our study, the AMR disappeared in all of the patients when the operations finished, and the patients have a satisfying surgical outcome. So, we suggest that intraoperative AMR monitoring is helpful in a redo MVD but the most important factor is the surgeons' experience.

Undoubtedly, HFS will affect the patients' quality of life. Shibahashi et al. [31] suggested that the patients who were cured immediately and had no postoperative complications had higher quality-of-life scores. Patients suffering from persistent hemifacial spasm after their first MVD may become anxious and the spasm symptoms may get even worse due to their negative emotions. These patients should be comforted and reassured that most of them will obtain relief during the follow-up. Even if the spasm has persisted for more than 2 years, performing repeat MVD is a good choice.

## Conclusions

In conclusion, the postoperative course of MVD for HFS patients can vary. Some patients obtain relief gradually after the original MVD. We insisted that at least 2 years of follow-up is necessary before performing repeat MVD in patients with a failure. Repeat MVD is effective when done by experienced surgeons and should be performed with the aid of intraoperative monitoring of AMR.

**Compliance with ethical standards**

**Funding** No funding was received for this research.

**Conflict of interest** None.

**Ethical approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. For this type of study formal consent is not required.

**Informed consent** All the patients mentioned in this article gave their consent for inclusion.

## References


1. Barker FG 2nd, Jannetta PJ, Bissonette DJ, Shields PT, Larkins MV, Jho HD (1995) Microvascular decompression for hemifacial spasm. J Neurosurg 82:201–210
2. Campos-Benitez M, Kaufmann AM (2008) Neurovascular compression findings in hemifacial spasm. J Neurosurg 109:416–420
3. Dai Y, Ni H, Xu W, Lu T, Liang W (2016) Clinical analysis of hemifacial spasm patients with delay symptom relief after microvascular decompression of distinct offending vessels. Acta Neurol Belg 116:53–56
4. Dannenbaum M, Lega BC, Suki D, Harper RL, Yoshor D (2008) Microvascular decompression for hemifacial spasm: long-term results from 114 operations performed without neurophysiological monitoring. J Neurosurg 109:410–415
5. Engh JA, Horowitz M, Burkhart L, Chang YF, Kassam A (2005) Repeat microvascular decompression for hemifacial spasm. J Neurol Neurosurg Psychiatry 76:1574–1580
6. Fukuda M, Oishi M, Takao T, Hiraishi T, Sato Y, Fujii Y (2012) Monitoring of abnormal muscle response and facial motor evoked potential during microvascular decompression for hemifacial spasm. Surg Neurol Int 3:118
7. Goto Y, Matsushima T, Natori Y, Inamura T, Tobimatsu S (2002) Delayed effects of the microvascular decompression on hemifacial spasm: a retrospective study of 131 consecutive operated cases. Neurol Res 24:296–300
8. Hatem J, Sindou M, Vial C (2001) Intraoperative monitoring of facial EMG responses during microvascular decompression for hemifacial spasm. Prognostic value for long-term outcome: a study in a 33-patient series. Br J Neurosurg 15:496–499
9. Heuser K, Kerty E, Eide PK, Cvancarova M, Dietrichs E (2007) Microvascular decompression for hemifacial spasm: postoperative neurologic follow-up and evaluation of life quality. Eur J Neurol 14(3):335–340
10. Hirono S, Yamakami I, Sato M, Kado K, Fukuda K, Nakamura T, Higuchi Y, Saeki N (2014) Continuous intraoperative monitoring of abnormal muscle response in microvascular decompression for hemifacial spasm; a real-time navigator for complete relief. Neurosurg Rev 37:311–320
11. Huh R, Han IB, Moon JY, Chang JW, Chung SS (2008) Microvascular decompression for hemifacial spasm: analyses of operative complications in 1582 consecutive patients. Surg Neurol 69:153–157
12. Hyun SJ, Kong DS, Park K (2010) Microvascular decompression for treating hemifacial spasm: lessons learned from a prospective study of 1,174 operations. Neurosurg Rev 33:325–334
13. Ishikawa M, Nakanishi T, Takamiya Y, Namiki J (2001) Delayed resolution of residual hemifacial spasm after microvascular decompression operations. Neurosurgery 49:847–856
14. Jho HD, Jannetta PJ (1987) Hemifacial spasm in young people treated with microvascula decompression of the facial nerve. Neurosurgery 20:767–770
15. Jo KW, Kong DS, Park K (2013) Microvascular decompression for hemifacial spasm: long-term outcome and prognostic factors, with emphasis on delayed cure. Neurosurg Rev 36:297–302
16. Joo WI, Lee KJ, Park HK, Chough CK, Rha HK (2008) Prognostic value of intra-operative lateral spread response monitoring during microvascular decompression in patients with hemifacial spasm. J Clin Neurosci 15:1335–1339
17. Kalkanis SN, Eskandar EN, Carter BS, Barker FG 2nd (2003) Microvascular decompression surgery in the United States, 1996 to 2000: mortality rates, morbidity rates, and the effects of hospital and surgeon volumes. Neurosurgery 52:1251–1262
18. Kong DS, Park K, Shin BG, Lee JA, Eum DO (2007) Prognostic value of the lateral spread response for intraoperative electromyography monitoring of the facial musculature during microvascular decompression for hemifacial spasm. J Neurosurg 106: 384–387
19. Lee MH, Jee TK, Lee JA, Park K (2016) Postoperative complications of microvascular decompression for hemifacial spasm: lessons from experience of 2040 cases. Neurosurg Rev 39:151–158
20. Li CS (2005) Varied patterns of postoperative course of disappearance of hemifacial spasm after microvascular decompression. Acta Neurochir (Wien) 147:617–620
21. Li J, Zhang Y, Zhu H, Li Y (2012) Prognostic value of intraoperative abnormal muscle response monitoring during microvascular decompression for long-term outcome of hemifacial spasm. J Clin Neurosci 19:44–48
22. Marneffe V, Polo G, Fischer C, Sindou M (2003) Microsurgical vascular decompression for hemifacial spasm. Follow-up over one year, clinical results and prognostic factors. Study of a series of 100 cases. Neurochirurgie 49:527–535
23. McLaughlin MR, Jannetta PJ, Clyde BL, Subach BR, Comey CH, Resnick DK (1999) Microvascular decompression of cranial nerves: lessons learned after 4400 operations. J Neurosurg 90:1–8
24. Miller LE, Miller VM (2012) Safety and effectiveness of microvascular decompression for treatment of hemifacial spasm: a systematic review. Br J Neurosurg 26:438–444
25. Moussa R, Harfouche D, Samaha E, Rizk T, Nohra G, Okais N (2006) Microsurgical facial nerve decompression for hemifacial spasm. J Med Liban 54:146–151
26. Neves DO, Lefaucheur JP, de Andrade DC, Hattou M, Ahdab R, Ayache SS, Le Guerinel C, Keravel Y (2009) A reappraisal of the value of lateral spread response monitoring in the treatment of hemifacial spasm by microvascular decompression. J Neurol Neurosurg Psychiatry 80:1375–1380
27. Payner TD, Tew JM Jr (1996) Recurrence of hemifacial spasm after microvascular decompression. Neurosurgery 38:686–691
28. Polo G, Fischer C, Sindou MP, Marneffe V (2004) Brainstem auditory evoked potential monitoring during microvascular decompression for hemifacial spasm: intraoperative brainstem auditory evoked potential changes and warning values to prevent hearing loss–prospective study in a consecutive series of 84 patients. Neurosurgery 54:97–106
29. Ray DK, Bahgat D, McCartney S, Burchiel KJ (2010) Surgical outcome and improvement in quality of life after microvascular decompression for hemifacial spasms: a case series assessment using a validated disease-specific scale. Stereotact Funct Neurosurg 88:383–389
30. Sekula RF Jr, Bhatia S, Frederickson AM, Jannetta PJ, Quigley MR, Small GA, Breisinger R (2009) Utility of intraoperative electromyography in microvascular decompression for hemifacial spasm: a meta-analysis. Neurosurg Focus 27:E10
31. Shibahashi K, Morita A, Kimura T (2013) Surgical results of microvascular decompression procedures and patient's postoperative quality of life: review of 139 cases. Neurol Med Chir (Tokyo) 53: 360–364
32. Shin JC, Chung UH, Kim YC, Park CI (1997) Prospective study of microvascular decompression in hemifacial spasm. Neurosurgery 40:730–735
33. Sindou MP (2005) Microvascular decompression for primary hemifacial spasm. Importance of intraoperative neurophysiological monitoring. Acta Neurochir (Wien) 147:1019–1026
34. Tobishima H, Hatayama T, Ohkuma H (2014) Relation between the persistence of an abnormal muscle response and the long-term clinical course after microvascular decompression for hemifacial spasm. Neurol Med Chir (Tokyo) 54:474–482
35. Wang X, Thirumala PD, Shah A, Gardner P, Habeych M, Crammond D, Balzer J, Burkhart L, Horowitz M (2013) Microvascular decompression for hemifacial spasm: focus on late reoperation. Neurosurg Rev 36:637–644