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Indications and Timings of Re-operation for Residual or Recurrent Hemifacial Spasm after Microvascular Decompression: Personal Experience and Literature Review

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Abstract

We reviewed reports about the postoperative course of hemifacial spasm (HFS) after microvascular decompression (MVD), including in our own patients, and investigated treatment for delayed resolution or recurrence of HFS. Symptoms of HFS disappear after surgery in many patients, but spasm persists postoperatively in about 10–40%. Residual spasm also gradually decreases, with rates of 1–13% at 1 year postoperatively. However, because delayed resolution is uncommon after 1 year postoperatively, the following is advised: (1) In patients with residual spasms after 1 year postoperatively (incomplete cure) or who again experience spasm ≥ 1 year postoperatively (recurrence), re-operation is recommended if the spasms are worse than before MVD. (2) When re-operation is considered, preoperative magnetic resonance imaging (MRI) findings and intraoperative videos should be reviewed to ensure that no compression due to a small artery or vein was missed, and to confirm that adhesions with the prosthesis are not causing compression. If any suspicious findings are identified, the cause must be eliminated. Moreover, because of the risk of nerve injury, decompression of the distal portion of the facial nerve should be performed only in patients in whom distal compression is strongly suspected to be the cause of symptoms. (3) Cure rates after re-operation are high, but complications such as hearing impairment and facial weakness have been reported in 10–20% of cases, so surgery must be performed with great care.

Key words: hemifacial spasm, resolution, recurrence, microvascular decompression, abnormal muscle responses

Introduction

Microvascular decompression (MVD) is a highly effective treatment for hemifacial spasm (HFS),[1–3] but even if the root exit zone (REZ) from the brainstem is adequately decompressed, residual spasms after surgery or early reappearance of spasms are not uncommon.[4–8] Although such spasms after MVD are often milder than before surgery and gradually resolve, spasm intensity and duration until resolution differ among patients, so the clinical course is not always easy to predict.

In addition, the same spasm intensity as before surgery sometimes persists even after surgery, or spasm intensity can decrease and then gradually increase again to worse than before surgery.[6] In such cases, no consensus has been reached on the indications for or timing of re-operation. We therefore decided to review reports on the postoperative course of HFS, including results of our own patients, and to investigate methods of treatment for delayed resolution and recurrence of HFS.

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I. Delayed resolution

When the REZ of the facial nerve is freed from pulsatile vascular compression, ectopic excitation of the facial nerve usually resolves, and facial spasms rapidly disappear.[1–3] Studies to date have reported spasm resolution rates of 59.0–92.1% soon after surgery,[6–18] and our own series of 131 patients who underwent MVD from 2005 to 2009 showed spasm resolution at 1 week after surgery in 78.6% (Table 1).[19]

Many patients thus experience improvements in spasms after MVD, but about 10–40% still experience residual spasms soon after surgery.[6–19] These residual

Table 1 Resolution period of postoperative hemifacial spasm

Study, year (N)	0–3 weeks	1–2 months	3 months	6 months	6–12 months	Total cure rates
Shin et al., (1997)[8] (226)	61.1% (1 week)			21.6%		82.7%
Ishikawa et al., (2001)[6] (175)	62.3% (1 week)	14.9%	8.0%	6.3%	3.4%	94.4%
Hatem et al., (2001)[9] (33)	81.8% (0–3 months)				15.2% (within 3 years)	97.0%
Mooij et al., (2001)[15] (74)	78.4% (immediate)	6.8% (6 weeks)			2.7%	87.8%
Samii et al., (2002)[16] (143)	59.0% (at discharge)			27.2%		92.3%
Yamashita et al., (2005)[18] (60)	85.0% (Day 0)				8.3% (within 16 months)	93.3%
Li, (2005)[7] (545)	92.1% (2 weeks)		3.5%	2.0%	1.4%	99.0%
Kong et al., (2007)[14] (263)	63.7% (1 week)		11.2%		23.8%	87.5%
Joo et al., (2008)[12] (72)	77.8% (1 week)			8.3%		86.1%
Kim et al., (2010)[13] (273)	61.5% (1 week)		9.2%		16.5%	87.2%
Hyun et al., (2010)[10] (1,174)	63.9% (1 week)		10.5%		17.0%	91.4%
Thirumala et al., (2011)[17] (293)	90.8% (at discharge)				1.5% (within 102 months)	92.3%
Jo et al., (2013)[11] (801)	68.9% (1 week)		14.5%		7.9%	91.3%
Tobishima et al., (2014)[19] (131)	78.6% (1 week)				12.2%	90.8%

spasms after MVD are thought to be related to the time required for repair of demyelination of the facial nerve and normalization of excitation of the facial nucleus in the brainstem.[19–22]

In a review by Miller et al.[3] of 5,685 cases of HFS, 80.0% showed spasm resolution at the time of hospital discharge, and 91.1% showed improvement over a median follow-up period of 2.9 years. Li[7] reported residual spasms after MVD in 41 of 545 patients (7.5%), but 37 achieved resolution within 1 year. Ishikawa et al.[6] reported that 88 of 175 patients 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. Median time to resolution was 28 days. In addition, although the presence of postoperative spasms was not significantly associated with patient age, sex, symptom duration, disease side, type of offending vessel, or method of decompression, postoperative spasm was significantly less frequent among patients with postoperative facial paresis. Spasms occurring after MVD may thus depend on a balance between the degree of recovery of excitation of the facial nucleus and minor trauma of the facial nerve.[6]

On the other hand, Shin et al.[8] observed 226 patients over a period of 6 months to 2 years and reported that 37.4% experienced delayed resolution of spasms. They described the relationship between time to resolution and symptom duration by the equation: "time to resolution (days) = 0.014 × symptom duration (years) + 7.83." However, in regard to postoperative spasms and time of delayed resolution, many reports state that prediction before surgery is difficult.[6,7,10,11] Park et al.[23] also found no significant relationship between the six types of compression patterns and postoperative symptom duration.

Intraoperative monitoring of abnormal muscle responses (AMRs) is highly useful as an index to the effectiveness of decompression[10,14,15,18,21,22] In 259 of 293 patients with HFS in whom intraoperative AMRs could be monitored, Thirumala et al.[17] compared the postoperative course between 207 patients in whom AMRs disappeared and 52 patients in whom AMRs persisted. The spasm relief rate at 24 h postoperatively was significantly higher in the AMR-disappeared group (94.7% vs. 67.3%), but during long-term observation over a mean period of 54.5 months (range, 9–102 months), cure rates did not differ significantly between groups (93.3% vs. 94.4%). We found similar results in our series of 131 patients.[19] Although early postoperative spasm relief

rates were lower in patients with persisting AMR, because of long-term delayed resolution, cure rates ultimately resembled those in the AMR-disappeared group.[9,12,17,20]

Meanwhile, Kim et al.[13] monitored intraoperative AMRs in 276 of 299 patients, and compared outcomes over a mean 17.9-month period (range, 12–27 months) between 90 patients in whom AMRs disappeared before the decompression procedure, and 183 patients in whom AMRs disappeared after decompression. At 1 week postoperatively, spasm relief rates did not differ significantly between groups, but ultimate cure rates were significantly lower at 3 months postoperatively (63.3% vs. 74.3%) and at 1 year postoperatively (75.6% vs. 92.9%) in the group whose AMRs disappeared before the decompression procedure. In other words, when AMRs disappear before actual decompression, the subsequent effects of decompression can only be observed visually, without AMRs as an index. The effectiveness of decompression in some cases may therefore be inadequate, with less hope ultimately for delayed resolution.

Because of the possibility for delayed resolution after MVD for HFS, surgical outcomes must be evaluated after some period of time postoperatively. Furthermore, with regard to degree of symptoms, many reports have defined cure as a "disappearance" of facial spasms, whereas reports by Kim et al.,[13] Thirumala et al.,[17] and Jo et al.[11] included minimal spasm or ≤ 10% residual spasm in the definition of cure. Some form of standardized scale for comparing reports is thus necessary. Kondo et al.[24] proposed a method to evaluate surgical outcomes that includes classifying the degree of spasm in four stages, classifying the degree of complications in three stages, and calculating the total score at 1 year post-MVD. This method was presented at the 13th Annual Meeting of the Japan Society for Microvascular Decompression Surgery and is expected to be used in future reporting of MVD outcomes.

II. Indications for re-operation

As mentioned previously, delayed resolution of spasms after MVD is common, but resolution after 1 year is rare. Jo et al.[11] reported spasm resolution in 731 of 801 patients (91.3%) within 1 year postoperatively, but in only 12 patients (1.4%) during the period of 1–3 years postoperatively. Among 393 patients, Zhong et al.[25] reported no further spasm resolution at ≥ 1 year postoperatively. In addition, a review by Miller et al.[3] reported no significant differences in symptoms cure rates at 1 year postoperatively compared to a maximum follow-up period of 5 years postoperatively.

When no improvement or worsening of symptoms is seen after ≥ 1 year postoperatively, then it may be due to "incomplete cure" because compression has not been completely relieved and re-operation for further decompression should be considered. In such cases, MRI-FIESTA (fast imaging employing steady-state acquisition) or contrast-enhanced T_1-SPGR (spoiled gradient echo) should be reviewed to confirm whether decompression of the REZ is incomplete, or whether there are adhesions between the REZ and prosthesis inserted at initial surgery. Even if MRI shows no abnormalities, videos from initial surgery should be reviewed to ensure that compression due to small arteries or veins of the REZ, or on the brainstem side of REZ medial to the lower cranial nerves, has not been missed. Re-operation should be performed if residual compression is suspected. In one of our patients who underwent re-operation after 13 months because of spasms 2 days after initial MVD that subsequently worsened, spasm was relieved by anchoring to the dura mater a branch of the anterior inferior cerebellar artery (AICA) that had been in contact with the REZ (Fig. 1).

In addition, compression or contact by the AICA at the distal portion of the facial nerve can be the cause of "incomplete cure."[25,26] Although the AICA courses between the facial and vestibular nerves, many small branches provide direct flow to the nerves. Branches of important vessels such as the meatal loop, internal auditory artery, subarcuate artery, and recurrent perforating artery around the internal auditory canal are also present.[27] Complete decompression of AICA compression or contact with the distal portion of the facial nerve may therefore prove difficult. Furthermore, because of a high risk of complications such as facial nerve paralysis and hearing loss,[25,28] decompression of the distal portion of the facial nerve should be performed only in patients in whom distal compression is strongly suspected to be the cause of symptoms.

Spasms within 1 year postoperatively indicate the possibility of "incomplete cure," which may be masked by intraoperative facial nerve injury, but spasms after ≥ 1 year postoperatively raise suspicion of "recurrent" spasm due to new compression.[29] The cause is often related to adhesions or granulation around the prosthesis. Recurrence is more likely in cases where transposition of the offending artery was difficult or when decompression was achieved by interposition of a prosthesis between the offending vessel and REZ. In fact, Nagahiro et al.[30] reported recurrences in 2 of 14 patients with HFS due to compression of the vertebral artery, and in 5 of 7 patients with HFS due to compression by the AICA, which coursed between the facial nerve and auditory nerve. Li[7] reported recurrences after

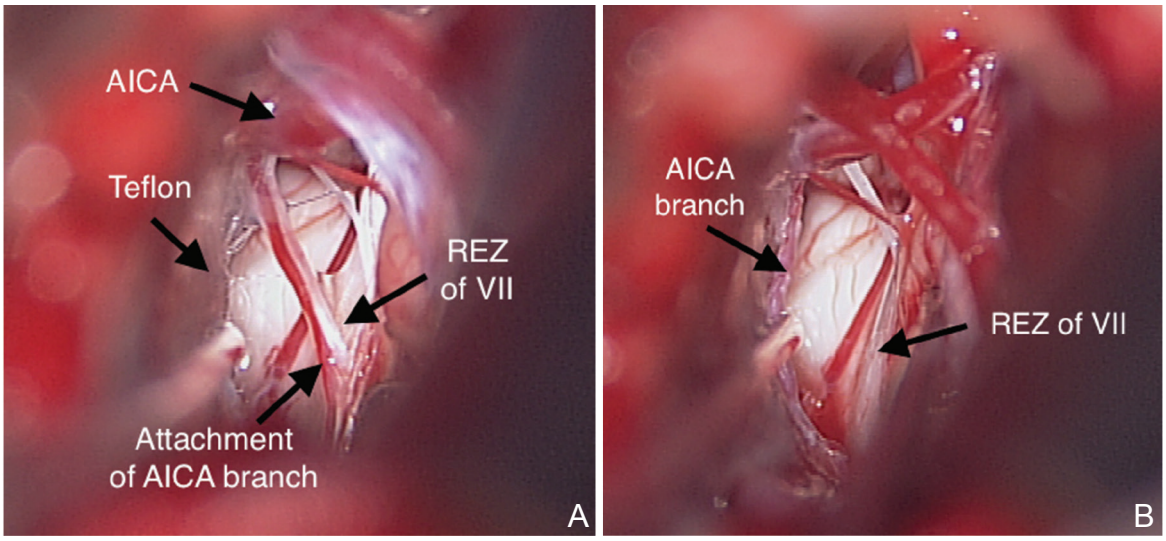

Fig. 1 A: A 21-year-old woman with recurrent left hemifacial spasm. The AICA was fixed to the dura with Teflon® (Meadox Medicals, Oakland, CA, USA), but a branch of the AICA was in contact with the REZ of the facial nerve. B: The AICA branch was transposed to the dura to eliminate contact with the REZ of the facial nerve. AICA: anterior inferior cerebellar artery, REZ: root exit zone.

≥ 1 year postoperatively in 5 of 545 patients. One of these patients underwent re-operation in which symptoms resolved by dissection of firm adhesions between the offending vessel and facial nerve caused by a teflon felt. Park et al.[23] reported improvement in 12 of 13 patients who underwent re-operation, and preoperative MRI had shown recurrent compression in all cases. In addition, a review by Miller et al.[3] reported a recurrence rate of 2.4% and re-operation in 1.2% of cases.

Wang et al.[31] compared 33 patients who underwent re-operation after 1.6 months to 16 years with 243 patients who underwent initial surgery. Venous treatment was significantly more common during re-operation, but postoperative cure rates were not significantly different (85.0% vs. 92.6%). Zhong et al.[25] performed early re-operation at 2–5 days postoperatively in 9 of 11 patients who consented (from among a total of 393 patients) after showing no improvement in symptoms after initial surgery. Spasm was relieved in all cases, for example, by additional decompression of the distal portion of the facial nerve, so their group recommended early re-operation. Engh et al.[28] compared 15 patients who underwent early re-operation within 19 days and 18 patients who underwent late re-operation (4 months to 12 years). With early re-operation, all patients achieved spasm resolution, most often by treatment of a vein in contact with the REZ. The spasm resolution rate was lower (70.8%) in the late re-operation group, but no difference was seen in the incidence of complications between groups.

Re-operation thus appears highly effective, particularly with the high cure rates reported after early re-operation.[25,28,31–33] However, as surgical complications, Zhong et al.[25] reported permanent facial weakness in 15.4% of patients after re-operation, and transient facial weakness in 23.0%, while Engh et al.[28] reported hearing impairment in 12.8%, and facial weakness in 15.4%. In other words, because complications after re-operation are not uncommon, and because the possibility of delayed resolution of spasms must be considered, many reports still recommend that re-operation should be performed only after at least 1 year postoperatively.[5,24,34] Jo et al.[11] recommended a 3-year postoperative observation period, particularly in patients who showed facial nerve indentation and in whom AMRs disappeared during initial surgery.

Conclusion

(1) In patients with spasms persisting after 1 year postoperatively (incomplete cure) or who again experience spasms ≥ 1 year postoperatively (recurrence), re-operation is recommended if the spasms are worse than before MVD. (2) When re-operation is considered, preoperative MRI and intraoperative videos should be reviewed to ensure that no compression due to a small artery or vein was missed, and to confirm that adhesions with the prosthesis are not causing compression. If there are any suspicious findings, the cause must be eliminated. Moreover, because of the risk of nerve injury, decompression of the distal

portion of the facial nerve should be performed only in patients in whom distal compression is strongly suspected to be the cause of symptoms. (3) Cure rates after re-operation are high, but complications such as hearing impairment and facial weakness have been reported in 10–20% of cases, so surgery must be performed with great care.

Conflicts of Interest Disclosure

The authors declare no conflicts of interest and are all members of The Japan Neurosurgical Society (JNS). All authors have registered Self-reported COI Disclosure Statement Forms through the website for JNS members.

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