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The Efficacy and Safety of Microvascular Decompression for Hemifacial Spasm: A Retrospective Analysis of Surgical Outcomes and Complications

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ABSTRACT

AIM: To determine the efficacy and safety of microvascular decompression (MVD) for hemifacial spasm (HFS) by retrospectively reviewing our results.

MATERIAL and METHODS: A total of 55 patients who underwent MVD in our clinic between 2003 and 2017 were retrospectively analyzed. Clinical outcome results, recurrence rates, and surgical complications were noted.

RESULTS: Thirty-six patients were female (65%). The mean age of the patients was 51.3 years. The mean duration of the complaint was 46.4 months. In 45 patients (82%), HFS was completely resolved within the first 6 months after the surgery. Five patients (9%) with recurrent symptoms were reoperated within the first year of the surgery. HFS symptoms of five patients (9%) completely ceased initially, but started again and reoperation was required due to failure of alternative treatments. Delayed facial nerve palsy and hearing loss were noted in one patient for each (2%). Cerebrospinal fluid leak was observed in two patients (4%). No mortality was observed in this series.

CONCLUSION: MVD is a safe and effective option for patients with HFS that is resistant to medical treatment.

KEYWORDS: Hemifacial spasm, Microvascular decompression, Facial nerve, Root entry zone

INTRODUCTION

Hemifacial spasm (HFS) is characterized by tonic–clonic contractions of the muscles around the eye, cheek, mouth, and neck (1). The prevalence of HFS is 14.5 per 100,000 females and 7.4 per 100,000 males (13). Primary HFS occurs essentially due to the vascular compression of the facial nerve at its root entry zone (REZ) in the posterior fossa (6). Pharmacological agents and Botox administration are the medical treatment options for HFS. Microvascular decompression (MVD), a surgical technique developed to relieve the vascular compression on the facial nerve root, was first defined by Jannetta (11), and is commonly accepted as an effective treatment option in HFS patients who are resistant to medical management. MVD is generally indicated in patients under the age of 70 years with radiologically confirmed nerve compression, who neither responded to medical treatment nor benefited from Botox administration. Early cure rates for HFS patients who underwent MVD have been reported to be between 50% and 98% (27). However, complications like facial nerve paralysis (FNP), hearing loss, occipital sensory deficit (OSD), intracranial hemorrhage, epidural hematoma, meningitis, abducens nerve paralysis, wound infections, and cerebrospinal fluid (CSF) leak have been reported (2). In the present work, we evaluated the patients who underwent MDV for HFS at our clinic. The results were documented and revealed early and late outcomes including surgical complications and

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recurrence rates. The efficacy and safety of the procedure in light of the current literature were also discussed.

MATERIAL and METHODS

We retrospectively reviewed the patient data of 55 patients who underwent MVD for the treatment of HFS at our clinic between January 2003 and December 2017. All patients were preoperatively screened with 1 mm T2-weighted (T2W), constructive interference in steady state (CISS), and time-of-flight magnetic resonance imaging (MRI) sequences (Figure 1A). The gender, age, HFS side, structure(s) compressing the nerve, duration of complaints, presence of preoperative FNP, history of preoperative Botox application, number of patients requiring reoperation, level of benefit from MVD (full–partial), familial predisposition, follow-up period, and surgical complications were recorded.

All patients underwent MVD through retrosigmoid approach under general anesthesia. Briefly, patients were placed in lateral decubitus position. The head was fixed by Mayfield three-pin head holder, slightly flexed, turned contralateral to the operative side, and secured on to the operating table with the head parallel to the floor.

Retromastoid suboccipital craniectomy was performed to reveal the posterior and inferior boundaries of the sigmoid and transverse sinuses, respectively. The dura was then opened under the surgical microscope. The lateral medullary cistern was opened to allow CSF release, and the cerebellum was relaxed. Then the cerebellum was retracted supramedially, and the facial nerve was identified. The REZ of both the facial nerve and the brainstem were carefully assessed for compression. The artery and/or veins causing facial nerve compression were mobilized, and the nerve was decompressed away from the offending structures using Teflon pledgets (Figure 1B, C). In HFS cases secondary to a space-occupying lesion, such as epidermoid tumor in this region, vascular pressure relief on the facial nerve was achieved through tumor excision. After meticulous hemostasis was obtained, the dura was closed in a watertight fashion, and cranioplasty was performed using methylmethacrylate (4).

RESULTS

Of the 55 patients, 36 were female (65%) and 19 were male (35%). The mean patient age was 51.3 years (range, 41–69 years old). Thirty-three of the patients had left-sided HFS (60%), whereas 22 of the patients had spasm on the right side (40%). The mean duration of the complaint was 46.4 months (range,1–204 months). One patient had secondary HFS due to the presence of epidermoid tumor that compresses the facial nerve, which was relieved by tumor excision. The mean follow-up period was 75.3 months (range, 12–168 months).

Sixteen of the patients had a history of Botox administration, and five of the patients already had FNP prior to the surgery. None of the patients revealed a family history for HFS.

The anterior inferior cerebellar artery (AICA) was the most common vascular structure that caused facial nerve compression (51 patients, 93%). In 43 of the patients (78%), HFS was completely resolved within the first 3 months postoperatively, whereas in two patients (4%), HFS was completely resolved in 3–6 months after surgery. In 10 patients (18%) whose symptoms either partially (n=5, 9%) or totally (n=5, 9%) ceased, reoperation was required due to recurrent symptoms, specifically in the former (partially healed) group. Although HFS complaints were substantially decreased in the early postoperative period, the patients were reoperated within the first year of the initial surgery as the contractions were then re-exacerbated. In the latter (totally healed) group, whose HFS was completely resolved in the early postoperative period and then started again, the patients were reoperated in case of failure to control recurrent HFS in a 1-year course of alternative treatments. Among these 10 patients (18%) who were reoperated for recurrent HFS, four had complete recovery, whereas five had partial recovery. In one patient, no improvement was observed. One patient, whose HFS was completely resolved during the early postoperative period, required reoperation for CSF fistula 1 year after the first operation and repair of the dura. Eventually, among all 55 patients, 49 patients (89%) had full amelioration of HFS after MVD; five (9%) patients had mild residual symptoms, and one patient (2%) did not benefit from surgery at all.

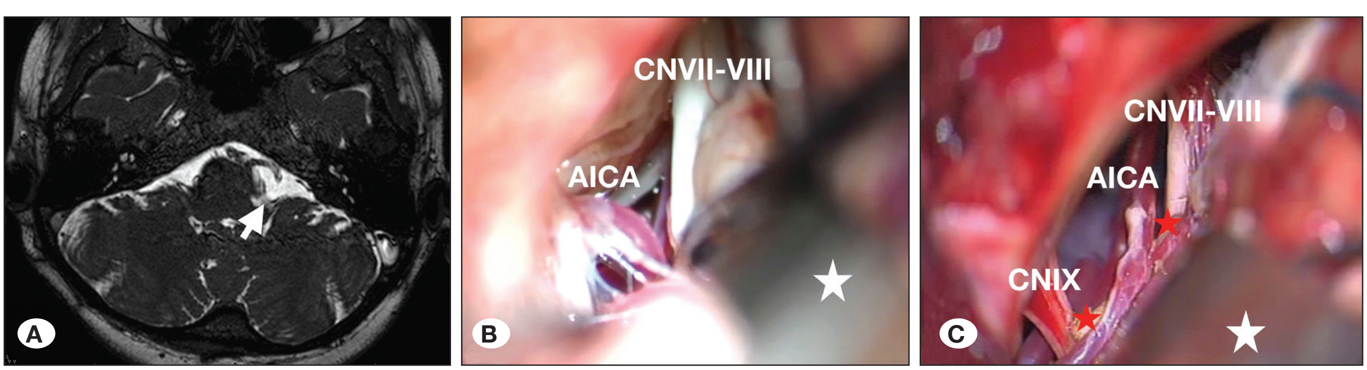

Figure 1: Preoperative CISS MRI and intraoperative microscopic images obtained in a 61-year-old female patient with left HFS who underwent MVD. **A)** Preoperative CISS MRI revealed a left-sided vascular compression of the CNVII at the REZ (white arrow). **B)** Intraoperative microscopic image demonstrating the compression of the CNVII–VIII complex by AICA at the root entry zone (retractor is marked with white star). **C)** The CNVII–VIII complex is decompressed by inserting Teflon pledget between the offending vessel (AICA) and the nerve (red star; retractor is marked with white star). **AICA:** Anterior inferior cerebellar artery.

Postoperative complications included FNP that was permanent in one of the patients (2%) and temporary in two (4%). Similarly, partial hearing loss was observed in two patients, which was permanent in one (2%) and temporary in the other (2%). One of the patients (2%) demonstrated temporary abducens nerve palsy. CSF leak occurred in two patients (4%) (in the early postoperative period in one patient, and 1 year after the surgery in one patient), and four patients (7%) suffered from OSD. None of the patients died after MDV for HFS in our series.

The characteristics of the patients and surgical outcome results are presented in Table I.

DISCUSSION

To date, many papers have reported high success rate of MVD in HFS, reaching up to 91% after the first operation when performed by an experienced surgeon (16). Some other reports revealing long-term results and complication rates with a mean follow-up period of at least 4 years have confirmed the

Table I: The Characteristics of the Patients and Surgical Outcome Results

	Structure that causes compression	Complaint period (month)	Preop CNVII	Preop botox injection	Reoperation	Follow-up period (month)	Complications
1	AICA	30		+		24	
2	AICA+BA	72	+			48	CNVII palsy (permanent)
3	VA	24	+			168	
4	AICA	6				144	OSD
5	AICA+SCA	36				12	
6	AICA	204		+	+	144	
7	AICA+VA	48		+		168	CNVII palsy (temporary)
8	AICA+VA	18	+	+		168	
9	AICA	96			+	24	OSD
10	AICA	168				144	
11	AICA+BA	12				144	
12	AICA	48		+		132	
13	AICA	36		+		24	
14	AICA+VA	18		+		132	
15	AICA+VA	36			+	126	
16	AICA+VA	120			+	126	
17	AICA+VA	84			+	120	
18	AICA	60		+		126	
19	AICA+ VA	9				126	OSD
20	AICA	9			+	120	
21	AICA+VA	12				108	
22	AICA	30		+		120	CNVI palsy
23	AICA+VA	6				120	
24	AICA+PV	30			+	60	CSF leak
25	AICA+VA	6				96	
26	AICA	72			+	108	

Table I: Cont.

	Structure that causes compression	Complaint period (month)	Preop CNVII	Preop botox injection	Reoperation	Follow-up period (month)	Complications
27	AICA+VA	48				96	CNVII palsy (temporary)
28	DOLICHOECTATIC BA+VA	24		+		96	
29	AICA	12				84	
30	AICA	24		+	+	84	
31	PICA	18				72	
32	AICA+VA	60	+			84	
33	AICA+VA	72				72	Partial hearing loss (permanent)
34	AICA+VA+LA	60				48	
35	AICA	72				48	
36	AICA	72				48	
37	AICA+DOLICHOECTATIC BA	36				48	
38	DOLICHOECTATIC BA	60				48	
39	AICA	36				48	
40	AICA+BA	60				48	
41	AICA	18				48	CSF leak
42	AICA	24				48	Partial hearing loss (temporary)
43	AICA	36	+		+	48	
44	AICA+PICA+VA	24				36	
45	AICA	24				36	
46	AICA	36		+		24	
47	AICA	96				24	
48	AICA	12				24	
49	AICA	72				18	
50	AICA	12				12	OSD
51	EPIDERMOID TUMOR+AICA	1				12	
52	AICA	24				12	
53	AICA	60		+		18	
54	AICA	72		+		12	
55	AICA	96		+		12	

AICA: *Anterior inferior cerebellar artery,* ***BA:*** *Basilar artery,* ***CSF:*** *Cerebrospinal fluid,* ***LA:*** *Labyrinthine artery,* ***OSD:*** *Occipital sensory deficit,* ***PICA:*** *Posterior inferior cerebellar artery,* ***PV:*** *Petrosal vein,* ***SCA:*** *Superior cerebellar artery,* ***VA:*** *Vertebral artery.*

efficacy and safety of first MVD for HFS as well (3,12,17,20,25). In the present study, 49 (89%) of the HFS patients were fully healed, whereas five (9%) had partial benefit from the surgery. Only one patient (2%) did not benefit from the MVD.

Overall, delayed FNP is a common complication of MVD for HFS that can occur in 2.8%–15% (7,8,10) of the patients. Although most cases of immediate FNP that develop within the first 24 hours after MVD have been attributed to intraoperative injury to the facial nerve, delayed FNP has been thought to result from direct irritation on the nerve due to Teflon and subsequent facial nerve edema (14,26). Fortunately, most cases of delayed FNP respond well to treatment with neurotropic medication (26). The majority of permanent FNP cases have been reported to occur in the early postoperative period (26). Hence, intraoperative facial nerve monitoring and the use of modern equipment are highly recommended to prevent permanent FNP (26). In line with the previous literature, delayed FNP was noted in three of the patients (5%) in our study; one of which was permanent, whereas the rest of the cases were temporary.

Sensory deficit of the skin around the incision line is another complication of MVD. The lesser occipital nerve (LON) and the larger occipital nerve are the main sensory nerves that are potentially encountered in the surgical field during MVD. Given the more medial route of the larger occipital nerve and the lateral course of LON, the main sensory nerve corresponding to the surgical field during MVD surgery is LON (5,9). Schessel et al. have reported that protecting the LON during MVD surgery lowers the rate of OSD around the postoperative incision line (21), which was noted in four patients (7%) in our series.

Hearing loss has been reported in 2.7%–20% of patients who underwent MVD for HFS (16). Tension on the hearing nerve due to cerebellar retraction as well as neurocompression secondary to Teflon or direct mechanical trauma to the nerve are the most common causes of hearing loss after MVD surgery (26). In the present series, hearing loss was observed in two patients (4%); one of which was permanent, whereas the other was temporary. Monitoring the brainstem auditory evoked potentials is strongly recommended to avoid this complication (23,26).

Abducens nerve paralysis is a complication commonly observed with vascular lesions of the carotid artery and cavernous sinus tumors. Abducens palsy is a rare complication of MVD for HFS (19), with good prognosis (26). Even though the reason behind abducens palsy in patients who underwent MVD is uncertain, it is thought that it may be due to the vulnerability of the nerve to manipulation when compared with the facial nerve. We observed abducens palsy in one of our patients (2%), which was temporary and resolved completely during the follow-up period.

Lower cranial nerve palsies are encountered rarely, in 0.5%–1% of patients who underwent MVD for HFS (22). In the present series, none of our patients experienced paralysis of the lower cranial nerves.

Though MVD is accepted as the gold standard treatment for HFS, the procedure involves risks due to the interference from a very small area and the presence of critical anatomical structures in the region. The mortality rate for the procedure is reported as 0.22%–2%. Mortal complications that have been reported are intracranial hemorrhage, epidural hematoma, and bacterial infections (15,24). For example, CSF drainage is performed in order to relax cerebellum during retraction, but this may lead to hemorrhage due to the laceration of the bridging veins. Hence, avoiding excessive CSF drainage, particularly in elderly patients (26), are highly recommended. We observed no hemorrhagic complications in our series and none of our patients died after MVD for HFS.

CSF leaks are among the rare complications of MVD. Tissue loss in the anatomical layers during muscle dissection and opening of the mastoid air cells that commonly occur while drilling the mastoid bone laterally to observe the sigmoid sinus boundary increase the risk of CSF leak in the postoperative period. Therefore, the opened air cells should cautiously be closed using muscle, fat, and/or bone wax, and attention should be given to preserve the muscle and fascial layers.The dura should be closed in a watertight fashion as well (18,26).

In our daily practices, we generally close mastoid air cells by using bone wax and, in necessary cases, by plugging the temporal muscle fascia as well. We perform water tight duraplasty with the aid of fascia lata or periosteum of the patient. Although lumbar drainage insertion and intermittent CSF drainage are recommended to reduce the CSF pressure to facilitate spontaneous repair in patients with early postoperative CSF leak, we believe that open dural repair is more appropriate in such cases without losing time instead of performing lumbar drainage.

On one hand, postoperative CSF leak was observed in two of 34 patients who were operated before 2012, and cranioplasty was performed in these patients using the patients' own suboccipital bone as replacement. On the other hand, no CSF leak was noted in 21 patients who were operated after 2012 and underwent cranioplasty using methylmethacrylate as described previously by Erbas et al. (4). In the former group of patients, we followed the incisional CSF leaks by resuturing the leak side and inserting a lumbar drain for intermittent CSF drainage that indeed controlled the leak in all cases except for one patient who required reoperation for primary dural repair. In the latter group, we believe that the reason behind the absence of CSF leak is the additional barrier function of methylmethacrylate on the dura, preventing CSF leak by prohibiting the dura to bulge out.

CONCLUSION

Our results confirm that MVD is a safe and effective option in the management of HFS that is resistant to medical treatment, particularly in experienced hands, due to the high success rate of the procedure, the rarity of serious complications or permanent neurological deficits, and low mortality rates.

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REFERENCES

1. Abbruzzese G, Berardelli A, Defazio G: Hemifacial spasm. Handb Clin Neurol 100:675-680, 2011
2. Barker FG, Jannette PJ, Bissonette DJ: Microvascular decompression for hemifacial spasm. J Neurosurg 82:201-210, 1995
3. Dannenbaum M, Lega BC, Suki D, Harper RL, Yoshor D: Microvascular decompression for hemifacial spasm: Long-term results from 114 operations performed without neurophysiological monitoring. J Neurosurg 109:410-415, 2008
4. Erbas YC, Pusat S, Ata GK, Erdogan E: In-situ cranioplasty after microvascular decompression: A technical note. Turk Neurosurg 27(3):479-481, 2017
5. Fujimaki T, Son JH, Takanashi S, Ishii T, Furuya K, Mochizuki T, Ueno T, Nakagomi T: Preservation of the lesser occipital nerve during microvascular decompression for hemifacial spasm. Technical note. J Neurosurg 107:1235-1237, 2007
6. Guclu B, Sindou M, Meyronet D, Streichenberger N, Simon E, Mertens P: Cranial nerve vascular compression syndromes of the trigeminal, facial and vago-glossopharyngeal nerves: Comparative anatomical study of the central myelin portion and transitional zone; correlations with incidences of corresponding hyperactive dysfunctional syndromes. ActaNeurochir (Wien) 153:2365-2375, 2011
7. Han JS, Lee JA, Kong DS, Park K: Delayed cranial nerve palsy after microvascular decompression for hemifacial spasm. J Korean Neurosurg Soc 52: 288-292, 2012
8. Hanakita J, Kondo A: Serious complications of microvascular decompression operations for trigeminal neuralgia and hemifacial spasm. Neurosurgery 22:348-352, 1998
9. Horimoto C, Toba T, Yamaga S, Tsujimura M: Subfascial temporalis dissection preserving the facial nerve in pterional craniotomy-technical note. Neurol Med Chir (Tokyo) 32:36,37, 1992
10. Huh R, Han IB, Moon JY, Chang JW, Chung SS: Microvascular decompression for hemifacial spasm: Analyses of operative complications in 1582 consecutive patients. Surg Neurol 69:153-157, 2008
11. Jannetta PJ: Microsurgical exploration and decompression of the facial nerve in hemifacial spasm. Curr Top Surg Res 2:217-220, 1970
12. Joo WI, Lee KJ, Park HK, Chough CK, Rha HK: Prognostic value of intra-operative lateral spread response monitoring during microvascular decompression in patients with hemifacial spasm. J Clin Neurosci 15:1335-1339, 2008
13. Kemp LW, Reich SG: Hemifacial spasm. Curr Treat Options Neurol 6:175-179, 2004
14. Kim BT, Hwang SC, Chang JC, Shin WH, Choi SK, Byun BJ: Delayed facial palsy following microvascular decompression in hemifacial spasm patients. J Korean Neurosurg Soc 28:1332-1336, 1999
15. Li N, Zhao W, Pu C, Shen J: Delayed hemorrhage following microvascular decompression. Three case reports. Neurol Med Chir (Tokyo) 47:186-188, 2007
16. Miller LE, Miller VM: Safety and effectiveness of microvascular decompression for treatment of hemifacial spasm: A systematic review. Br J Neurosurg 26:438-444, 2012
17. Neves DO, Lefaucheur JP, de Andrade DC, Hattou M, Ahdab R, Ayache SS, Le Guerinel C, Keravel Y: 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, 2009
18. Park JS, Kong DS, Lee JA, Park K: Intraoperative management to prevent cerebrospinal fluid leakage after microvascular decompression: Dural closure with a “plugging muscle” method. Neurosurg Rev 30:139-142,2007
19. Patel SV, Mutyala S, Leske DA, Hodge DO, Holmes JM: Incidence, associations, and evaluation of sixth nerve palsy using a population-based method. Ophthalmology 111:369-375, 2004
20. Samii M, Gunther T, Iaconetta G, Muehling M, Vorkapic P, Samii A: Microvascular decompression to treat hemifacial spasm: Long-term results for a consecutive series of 143 patients. Neurosurgery 50:712-718, 2002
21. Schessel DA, Rowed DW, Nedzelski JM, Feghali JG: Postoperative pain following excision of acoustic neuroma by the suboccipital approach: Observations on possible cause and potential amelioration. Am J Otol 14:491-494, 1993
22. Sindou M, Mercier P: Microvascular decompression for hemifacial spasm: Outcome on spasm and complications. A review. Neurochirurgie 64(2):106-116, 2018
23. Thirumala PD, Krishnaiah B, Habeych ME, Balzer JR, Crammond DJ: Hearing outcomes after loss of brainstem auditory evoked potentials during microvascular decompression. J Clin Neurosci 22:659-663, 2015
24. Xia L, Liu MX, Zhong J, Dou NN, Li B, Sun H, Li ST: Fatal complications following microvascular decompression: Could it be avoided and salvaged? Neurosurg Rev 40:389-396, 2017
25. Yuan Y, Wang Y, Zhang SX, Zhang L, Li R, Guo J: Microvascular decompression in patients with hemifacial spasm: Report of 1200 cases. Chin Med J(Engl) 118:833-836, 2005
26. Zhao H, Zhang X, Tang YD, Zhang Y, Ying TT, Zhu J, Li ST: Operative complications of microvascular decompression for hemifacial spasm: Experience of 1548 cases. World Neurosurg 107:559-564, 2017
27. Zhao H, Zhang X, Tang YD, Zhu J, Ying TT, Yan Y, Li S: Factors promoting a good outcome in a second microvascular decompression operation when hemifacial spasm is not relieved after the initial operation. World Neurosurg 98:872.e11-872.e19, 2017