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Surgical Outcome of Microvascular Decompression for Hemifacial Spasm: Symptom Control and Quality of Life

Resultado Cirúrgico da Descompressão Microvascular no Espasmo Hemifacial: Controle de Sintomas e Qualidade de Vida

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Abstract

Introduction Hemifacial spasm (HFS) is characterized by a segmental myoclonus of the face muscles innervated by the ipsilateral facial nerve. The accepted pathophysiology of HFS suggests that it is a disease process of the nerve root entry zone associated with any neuro-vascular conflict.

Aim Review the surgical results and outcome regarding spasm control, post-operative quality of life and morbidity of microvascular decompression (MVD) for HFS from a Brazilian neurosurgical team.

Method An observational investigation was conducted with data collection from patients with hemifacial spasm treated with MVD from January 2000 to December 2015 in two different centers in the West of São Paulo State, Brazil.

Results A total of 152 patients underwent MVD for the treatment of HFS, ninety-eight (64.5%) female. Eighty-seven (57.2%) patients presented right-side spasms. The most common offending vessel was the posterior inferior cerebellar artery (PICA) with 78 (51.3%) patients. According to clinical presentation, an amount of 144 (94.7%) patients presented total control of symptoms after 36 months of follow-up. Regarding quality of life, a total of 125 (82.2%) patients referred normal quality of life after MVD for HFS and 121 (96.8%) from then were able to return to work or previous occupation. Permanent facial paresis / palsy was observed in 6 (3.6%) patients. There was no surgical mortality.

Conclusion MVD for the treatment of HFS is a safe and efficacious surgical procedure to control spasm. Neurosurgeons experience, adequate patient selection and good anatomical knowledge are fundamental to success of the treatment.

Keywords
- hemifacial spasm
- microvascular decompression

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Resumo

Introdução O espasmo hemifacial (EHF) é caracterizado por mioclonia segmentar dos músculos da face inervados pelo nervo facial ipsilateral. A fisiopatologia aceita da EHF sugere que é um processo da doença da zona de entrada da raiz nervosa associada a conflito neuro-vascular.

Objetivo Revisar os resultados e desfechos cirúrgicos em relação ao controle de espasmo, a qualidade de vida pós-operatória e a morbidade da descompressão microvascular (DMV) para EHF de uma equipe de neurocirurgia brasileira.

Método Realizada investigação observacional com coleta de dados de pacientes com espasmo hemifacial tratados com DMV entre janeiro de 2000 a dezembro de 2015, em dois diferentes centros do Oeste do Estado de São Paulo, Brasil.

Resultados Um total de 152 pacientes foram submetidos a DMV, noventa e oito (64,5%) do sexo feminino. Oitenta e sete (57,2%) pacientes apresentavam espasmos no lado direito. O conflito mais comum foi com a artéria cerebelar inferior posterior (PICA) em 78 (51,3%) pacientes. Um total de 144 (94,7%) pacientes apresentou controle total dos sintomas após 36 meses de acompanhamento. Em relação à qualidade de vida, 125 (82,2%) pacientes referiram qualidade de vida normal após a MVD para HFS e 121 (96,8%) puderam retornar ao trabalho/ocupação anterior. Paresia/paralisia facial permanentes foram observadas em 6 (3,6%) pacientes. Não houve mortalidade cirúrgica.

Conclusão DMV para o tratamento da EHF é um procedimento cirúrgico seguro e eficaz para o controle do espasmo. A experiência dos neurocirurgiões, a seleção adequada dos pacientes e o bom conhecimento anatômico são fundamentais para o sucesso do tratamento.

Palavras-chave
- espasmo hemifacial
- descompressão microvascular

Introduction

Hemifacial spasm (HFS) is characterized by a segmental myoclonus of the face muscles innervated by the ipsilateral facial nerve (1–3), usually starting around the eyes before progressing inferiorly to the cheek, mouth, and neck (4–6). Its prevalence is 9.8 per 100,000 persons with an average age of onset of 40–50 years (7–10). The accepted pathophysiology of HFS suggests that it is a disease process of the nerve root entry zone of the facial nerve (11–13) and the most frequently involved vascular structures are veins, vertebro-basilar artery, anterior inferior cerebellar artery (AICA) and/or posterior inferior cerebellar artery (PICA) (2, 13–15). Clinical examination and imaging modalities such as electromyography (EMG) and magnetic resonance imaging (MRI) are useful to differentiate HFS from other facial movement disorders and for intraoperative planning (16–18). Botulinum toxin A is the standard medical management for HFS, which provides low-risk but limited symptomatic relief (19–21). Microvascular decompression (MVD) is a surgical therapeutic option that provides lasting symptomatic relief by reducing compression of the facial nerve root (22–25).

The aim of the present investigation is to review the surgical results and outcome regarding spasm control, post-operative quality of life and complications of MVD for HFS from a Brazilian neurosurgical team.

Method

Study Delineation

An observational investigation was conducted with data collection from patients with hemifacial spasm treated with MVD from January 2000 to December 2015 in two different centers in the West of São Paulo State, Brazil. Clinical data were obtained retrospectively from the patient records and files. For all patients with the diagnosis of hemifacial spasm and radiological evidence of neurovascular conflict on magnetic resonance image (MRI), the following data were collected: gender, age at surgery, side of pain, type of the conflict, type and number of medications used.

Pre-Surgical Evaluation

Brain MRI was obtained from all patients with HFS accordingly with a specific protocol using a 1.5 Tesla Scanner, Philips, at the Department of Neuroradiology in our institution. All MRIs were analyzed by an experienced neuroradiologist that confirmed the visual radiological diagnosis of neurovascular conflict. High-resolution MRIs were performed to view the cerebellopontine angle anatomy of the patients and to exclude the presence of any organic/expansive lesion.

Surgical Technique

The surgical approach was similar for all patients and neurosurgeons experienced in MVD surgery for HFS performed all procedures. The surgery was done under general anesthesia with a flexible spiral tracheal tube to allow flexion of the neck while securing the airways. All patients were placed in the lateral position with the head supported with a three-pin Mayfield head fixation. A 3- to 4-cm curvilinear incision was made obliquely inside the hairline at the upper retromastoid area. A 1.5- to 2-cm diameter keyhole bone opening or small craniectomy or craniotomy was performed using a 4- and 4-mm extra-coarse power Diamond drill system. The keyhole was located at the inner corner of the transverse sinus and the sigmoid sinus. Before dural opening, precise hemostasis was accomplished with bone wax, Surgicel, and cautery. The mastoid air cells were sealed with bone wax. The dura was opened in an inverted-T fashion and small dural flaps were stitched to make a maximal dural opening (5 to 10 mm). The cerebrospinal fluid (CSF) was gradually aspirated and, under the operating microscope, infratentorial lateral supracerebellar dissection was advanced to expose the petrosal vein (one to three bridging veins). Sufficient arachnoid dissection around the petrosal veins and caudally was performed to carefully expose the facial nerve and any offending vessels around the neural structures from proximal to distal. Any compressing arterial loops or venous contact were carefully dissected and mobilized off the nerve root. A nonabsorbable material was interposed between the offending vessel and the entry zone of the facial nerve. Cerebellar retraction was judiciously used when necessary. Meticulous hemostasis and clean-up of the operating field was often achieved. Watertight dural closure with or without fascial graft was done and cranioplasty completed whenever possible. Cutaneous layers were closed as routinely.

Outcome Assessment and Follow-Up

Three years follow-up investigation was performed in all patients included in the present study. The patients were clinically reassessed at 12, 24 and 36 months after surgery regarding the subjective improvement of pre-operative facial spasm. They were included in four different groups according to percentage of amelioration of spasm, respecting to the following descriptions: (I) total relief (>90% control of spasm) and patient satisfied with operation; (II) partial relief (75–90% control of spasm) and patient satisfied with operation; (III) incomplete relief (50–75% control of spasm) and patient not satisfied with operation; (IV) failure or poor control (<50% control of spasm) and patient not satisfied with operation. A questionnaire on quality of life was also applied to each patient regarding daily activities, including driving, reading (journal and/or books, PC/Cellphones/Tablets), watching TV, depressive feelings, other people avoidance, return to previous work functions and physical activities. Quality of life was graded as follow: (I) normal quality of life and no disability; (II) mild disability and no impairment; (III) moderate disability and functional impairment; and (IV) severe disability.

Ethical Statement

The ethical committee of our institution analyzed the project and approved the performance of our investigations. All patients have given their informed consent for participation in the research study. This study complied with the Declarations of Helsinki and Nuremberg. Informed consent for surgery was acquired from all patients.

Statistical Analysis

The data collected from all patients were organized in tables. The data are expressed as the means ± the standard deviation (SD) for parametric variables and as the median values for nonparametric variables. A normal distribution to sample collected data was assumed. HFS improvement rate was assessed using Kaplan-Meier curves and Montel-Cox chi-square test. The statistical analyses and review of the numerical results obtained in the present investigation were performed by a mathematical team and p-value < 0.05 was considered statistically significant.

Results

In the present study, we operated on 152 consecutive patients. ►**Table 1** shows the clinical characteristics of patients with HFS. ►**Table 2** reveals the main causes of HFS regarding offending vessels. ►**Table 3** reports the efficacy of MVD for HFS according to spasm control. ►**Table 4** shows the outcome of surgery in respect of patient's quality of life. Patients with severe disability presented high grade facial palsy and reported that nerve paralysis was directly affecting their quality of life. ►**Table 5** shows the relation of quality of life after MVD for HFS and depressive feelings, physical activities and return to work or previous occupation. ►**Table 6** reveals the main complications of operated patients. There was no surgical mortality.

Discussion

Hemifacial spasm (HFS) is a movement disorder of the muscles innervated by the facial nerve (cranial nerve VII)

Table 1 Characteristics of patients with HFS

Characteristics	(%)
Age (years)	52.1 ± 10.8
Gender	
Female	98 (64.5)
Male	54 (35.5)
Spasm side	
Right	87 (57.2)
Left	65 (42.8)
Duration (years)	6.8 ± 4.7
Risk factors	
Diabetes	11 (7.2)
Hypertension	42 (27.6)
Alcohol use	17 (11.2)
Smoking	21 (13.8)
Total	152/100

Table 2 Causes of HFS: offending vessels

Offending Vessels	n/%
PICA	78/51.3
AICA	42/27.6
VBA	16/10.5
AICA + PICA	12/7.9
PICA + Vein	4/2.6
Total	152/100

Abbreviations: PICA, posterior inferior cerebellar artery; AICA, anterior inferior cerebellar artery; VBA, vertebral/basilar artery.

(1–3). This movement disorder triggers involuntary short or longer contractions of the facial muscles and usually causes serious psychosocial problems, once affected persons often suffer immensely and tend to increasingly withdraw socially (10). Microvascular decompression (MVD) is a surgical therapeutic option that provides lasting symptomatic relief, and the pioneers of the technique were James Gardner and Peter Jannetta, who proved that reducing compression of the facial nerve root eliminates involuntary movements (26). In our investigation, all patients presented symptoms of HFS associated with at least evidence of neuro-vascular conflict with the corresponding facial nerve.

Female patients are usually more affected with a sex ration of 0.6 (male/female) and left side is the most involved (10, 27–29). HFS is more common in the elderly and is extremely rare in the adolescent (27–29). According to Liu et al. (27), the disease affects patients between the fourth and fifth decades of life and usually presents a mean duration of six years in all operated patients. Additionally, it is also believed that some individuals present risk factors for higher rates of surgical failure or recurrence due to stronger compression of the nerve, such as arterial hypertension, diabetes, and morbid obesity (30, 31). In the present study, most patients were female, were in the fifth decade of life and presented more frequently right sided

Table 3 Outcome of MVD for HFS: Spasm control (n/%)

		12 months	24 months	36 months
I	Total (>90% control)$^{+}$	136/89.5	141/92.8	144/94.7
II	Partial (75%-90% control)$^{+}$	11/7.2	9/5.9	6/3.9
III	Incomplete (50%-75% control)$^{\times}$	4/2.6*	2/1.3	2/1.3
IV	Failure/Poor control (<50% control)$^{\times}$	1/0.6$^{\#}$	0	0
Total		152/100		

$^{+}$: Patient satisfied with operation.
$^{\times}$: Patient not satisfied with operation.
$^{\#}$: Patient was re-operated.
*: Patients were complementarily treated with Botulinum toxin A.

Table 4 Outcome of MVD for HFS: Quality of life (n/%)

		12 months	24 months	36 months
I	Normal	111/73.0	121/79.6	125/82.2
II	Mild disability	27/17.8	21/13.8	19/12.5
III	Moderate disability	11/7.2	8/5.3	6/3.9
IV	Severe disability	3/1.9	2/1.3	2/1.3
Total		152/100		

Table 5 Quality of life after MVD for HFS (n/%) (36 months)

		Depressive feelings	Physical activities	Return to work	Total (36m)
I	Normal	8/6.6	118/77.6	121/96.8	125
II	Mild disability	5/26.3	15/78.9	16/94.7	19
III	Moderate disability	3/50	2/33.3	4/66.7	6
IV	Severe disability	2/100	0/0	0/0	2
Total					152

Table 6 Complications of MVD for HFS

Temporary Complications		Permanent Complications	
	n/%		n/%
Facial paresis/palsy	18/11.8	Facial paresis/palsy	6/3.6
Vertigo/ Nystagmus	13/8.5	Hearing decrease	9/5.9
CSF leakage	4/2.6	Deafness	3/1.97
Wound infection	7/4.6	Mortality	0/0
Total	42/27.6	Total	18/11.8

symptoms with mean duration of 6.8 years before surgery. We also observed that cerebrovascular and atherosclerotic risk factor, such as diabetes type 2, arterial hypertension, alcohol use and smoking, were noted in 7.2–27.6% of patients, but none were statistically associated with recurrence or failure in our investigation.

Primary HFS is associated with neuro-vascular conflicts in the facial nerve, especially its root exit zone (REZ) (1, 2, 7). Negative surgical exploration of the cerebellopontine angle is extremely rare and is verified in only 0% - 2% of cases (32). Miller et al. (33) reviewing 22 papers published from 2000 to 2010 confirmed as source of conflicting vessel the anterior inferior cerebellar artery (AICA) in 37% cases, the posterior inferior cerebellar artery (PICA) in 30% and multiple vascular contacts including vertebro-basilar-artery (VBA) and veins in 23%. Mercier et al. (32) studying 2489 cases from the literature and 340 from their own series reported as the most frequently encountered conflicting vessel the PICA (in 47.2% of the patients on average) followed by the AICA (45.9%), but ranges with these arteries were large between different publications. In our investigation, we found as the most common offending vessel the PICA in 51.3% of cases followed by AICA in 27.6%. Megadolicho vertebral/basilar artery or multiple conflicting vessels, i.e., AICA-PICA or PICA-vein, were found in 10.5%, 7.9% and 2.6% of cases, respectively. We found no case with veins as the only offender vessel.

In many series investigating surgical effectiveness of MVD for HFS, spasm control was observed in 65% - 100% of operated patients (33–35). Miller et al. (33), in 2012, reported complete resolution of spasm in 91.1% of the patients, notably delayed in 11.2%. Sindou et al. (35) affirmed that percentage of patients with total relief ranged between 85% and 90% and spasm control was obtained after a certain delay in as many as in 33% $\pm$ 8% of the patients in many series. Relief remained permanent in all but 1–2% of the long-term followed patients, when effect of MVD was considered achieved (33–35). In the present study, total control of HFS was observed in 144 (94.7%) patients, with 8 (5%) cases presenting delayed improvement during follow of 36 months. One (0.6%) patient showed recurrence of HFS after one year of follow up and was reoperated and evolved with satisfactory result. Our patients with incomplete outcome (50–75% control) and not satisfied with operation after 12 months of follow up (4 cases / 2.6%) were referred to complementarily treatment with Botulinum toxin A. All these four patients with incomplete results presented complex conflicts with megadolicho vertebral/basilar artery coincidentally.

HFS is a movement disturbance that affects profoundly quality of life. It can be disabling and cause visual disfigurement for the patients and normally withdraw individuals from social and working life (28, 36, 37). According to Cheng et al (36), patients with severe HFS symptoms or a higher educational level were at higher risk of worse quality of life. MVD for HFS significantly improves quality of life and ameliorate physical and mental health aspects of patients (28, 36, 37). In our investigation, we observed during follow up progressive raise of patient's quality of life for 36 months. At the end of the study, most of patients referred normal (82.2%) or mild disability (12.5%) in life activities, social interactions, and psychological satisfaction after operation. We also observed that depressive feelings seem more frequent in patients presenting worst disability while physical activity and return to working life more common in patients normal life of mild disability. Kim et al (38) affirmed that HFS patients seem to gain benefits from MVD not only for their facial disfigurement but also for social anxiety symptoms that may be associated with mental health improvements in their quality of life. This looks also true in the present investigation.

MVD for HFS is a functional procedure and should be associated with low rates of clinical and surgical complications. Besides hearing complications, facial palsy (FP) is the most frequent neurological deficit observed after MVD surgery for HFS (33, 35). Immediate FP has occurred as a transient event in 2.7–22.5% and was permanent in 0–8% of the patients according to series (35). Miller et al. (33) reported the average percentage of transient FP in 9.5% and of permanent in 0.9% of cases. Regarding hearing deficits, the reported occurrence is of 1.9–20% of cases (35). Miller et al. (33) showed a permanent loss of hearing function in 2.3%. Episodes of vertigo with nystagmus and some gait imbalances are not infrequent and, according to Sindou et al (35) happened in 5.4% in their series, and remained permanent and to some degree disabling in 1.4%. Cerebrospinal fluid (CSF) leakage is a complication indirectly related with surgeon's experience. Beginning authors experience CSF leakage in $\sim$2.5–10% according to series, 4.7% on average (35), while surgeons with stabilized learning curves present an incidence ranging between 1–2% (35). We present our surgical complications in ►**Table 6**. Mortality is a very seldom complication with less than 0.1% of cases in the literature (33, 35). There was no surgical mortality in the present study.

There are several methodological aspects in the present findings, which should be interpreted in the context of several limitations. First, this study is a non-randomized investigation performed in a highly selected population of a tertiary center. Second, these findings cannot be generalized once some patients lost their follow up due to the continental dimension from Brazil. On the other hand, the present study described the surgical outcomes of a relatively large number of patients that underwent surgery due to HFS for an extended follow-up duration.

Conclusion

MVD for the treatment of HFS is a safe and efficacious surgical procedure to control spasm. Neurosurgeons experience, adequate patient selection and good anatomical knowledge are fundamental to success of the treatment.

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