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Monitoring of Facial Evoked EMG for Hemifacial Spasm: a Critical Analysis of its Prognostic Value

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Summary

Microvascular decompression (MVD) has come to stay as an effective way of treating hemifacial spasm. But it remains to be seen how much each of the electrophysiological monitoring techniques (intra-operative) are contributing to its increased efficacy. Their role as indicators for re-exploration or recurrence is to be evaluated with more studies. We have used the lateral spread response in those patients who had distinctly abnormal recording on the ipsilateral side, studied the intra-operative changes during MVD and correlated with the outcome of surgery.

38 patients operated for HFS, were selected for intra-operative monitoring of abnormal muscle responses. In 17 patients, there was persistence of abnormal muscle responses in the immediate postoperative period and only 6 of them had mild HFS. Two of 21 patients who had disappearance of abnormal responses had persistent mild HFS; but in all cases, the HFS disappeared within 3 months.

So we found that the intra-operative recording was really not reliable in predicting the immediate postoperative outcome. However the outcome at 3 months suggested that waiting for some time before re-exploration is a better option, especially if the HFS had become mild.

Keywords: Facial evoked EMG; hemifacial spasm; lateral spread response; microvascular decompression.

Introduction

Gardner and Jannetta *et al.* suggested vascular compression caused by arteries or veins crossing the root exit zone of the facial nerve, as the major etiology of hemifacial spasm [1, 9]. Since then microvascular decompression (MVD) has become an accepted surgical technique for the treatment of hemifacial spasm. Subsequently various electrophysiological methods like F-waves of facial muscle, blink reflexes and abnormal muscle responses have been used for intra-operative monitoring [3–6]. Abnormal muscle response recording in facial evoked EMG was elaborated upon by Moller and Jannetta in 1984, as characteristic and specific for HFS [10]. Patients with HFS have an abnormal muscle response that can be elicited by stimulating one branch of the facial nerve and recording electromyographically from muscles innervated by other branches of the facial nerve. A precise intra-operative correlation between decompression of the nerve and disappearance of the abnormal muscle response has been noted. Several authors have reported that intra-operative facial evoked EMG monitoring is useful to identify the blood vessel which is causing the facial spasm and to ensure that decompression of the nerve has been accomplished [2, 8, 13, 14].

However, in our experience, immediate postoperative improvement of hemifacial spasm did not correlate with intra-operative abnormal EMG changes. We report here that usefulness of intra-operative facial evoked EMG is still unreliable and the clinical outcome of patients does not always correlate with the abnormal muscle response.

Patients and Methods

38 patients with hemifacial spasm who underwent microvascular decompression between August 1998 and September 1999, with distinctly abnormal lateral spread response were studied. Intra-operative facial evoked electromyograms were recorded in all of them. Of the 38 patients, 26 were female and 12 were male. The age at operation ranged from 24 to 77 years with a mean of 56 years and 2 months. The duration of symptoms ranged from 4 months to 30 years with a mean of 7 years and 4 months. Microvascular decompression was performed by the same surgeon (TK), through a retromastoid approach in contralateral position. The stimulating needle electrodes were inserted intradermally over the zygomatic branches of the facial nerve and the recording needle electrodes into the mentalis muscle. Intra-operative electromyographic recordings from the mentalis muscle during stimulation of the zygomatic branch of the facial nerve using 0.1 msec pulse wave of intensity $5 \sim 15$ mA was established (Fig. 1). We were able to record the abnormal muscle

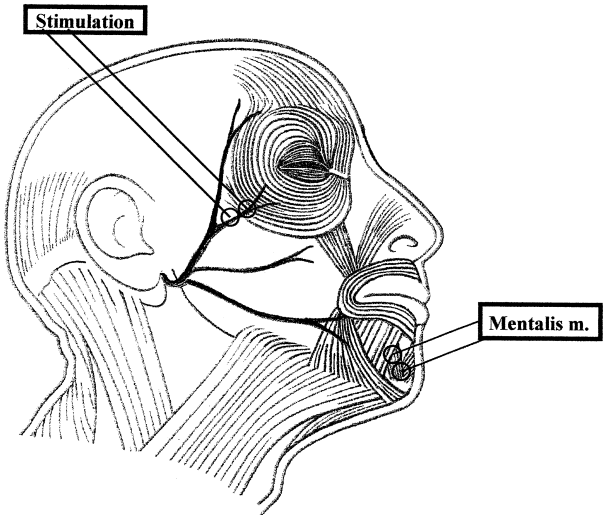

Fig. 1. Schematic illustration shows the stimulating electrodes were inserted over the zygomatic branches of the facial nerve and the recording electrodes into the mentalis muscle

response of the mentalis muscle. It was difficult to record the abnormal muscle response of the orbicularis oculi because of overlapping between the abnormal muscle response and the direct compound muscle potential. No muscle relaxants were used except for those before intubation. The facial evoked EMG was recorded continuously from beginning of the craniotomy to closure of the skin.

Results (Table 1)

Thirty eight patients had distinctly abnormal muscle responses before decompression. Based on the intraoperative change in the muscle response, they were divided into 2 groups.

(1) Cases where the abnormal muscle responses disappeared (Fig. 2).

In 21 cases, the abnormal muscle responses disappeared when the dura mater was opened or immediately after the decompression of the offending vessel(s) was performed. In 2 of these patients, slight hemifacial spasm had persisted postoperatively. Of these 21 patients, 13 were female and 8 male. The mean operative age was 57 years and 11 months. The mean period of symptoms was 5 years and 10 months.

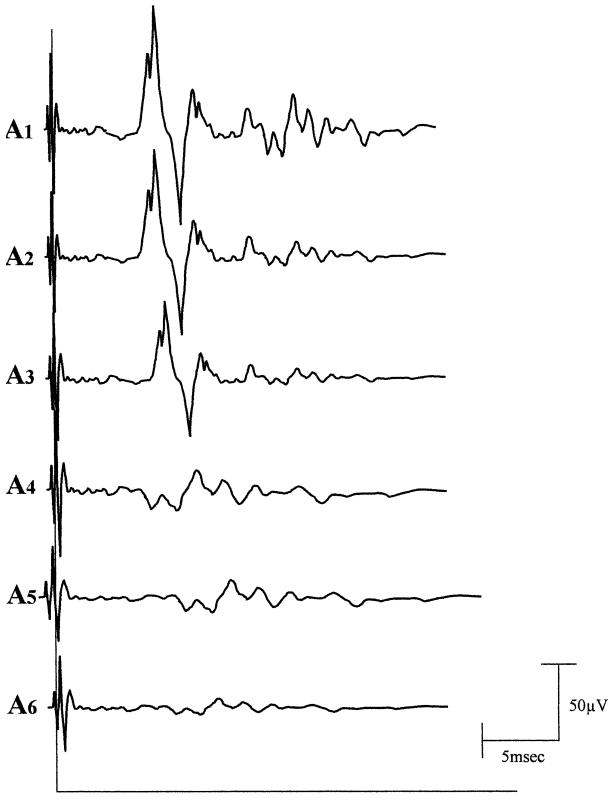

Fig. 2. Intra-operative electromyographic recording (case 1). *A1* Beginning of the craniotomy, *A2* opening of the dura mater, *A3* cerebellar retraction, *A4* interposition of the prosthesis between the compressing vessel and the root exit zone, *A5* suturing of the dura mater, *A6* at the end of operation. The abnormal muscle response, which appeared with a latency of about 10 msec after stimulation, disappeared according to the surgical management

(2) Cases with persistence of the abnormal muscle response (Fig. 3).

In 17 of the 38 cases, the abnormal muscle responses remained even after microvascular decompression. Six of these patients had slight hemifacial spasm in the

Table 1. *Relationship Between the Abnormal Muscle Response and the Patient's Situation*

	Disappearance of the AMR			Remainder of the AMR			Total
Sex & cases	M	F	Subtotal	M	F	Subtotal	
	8	13	21	4	13	17	38
Operative age (year)	53.0	60.9	57.9	58.7	52.9	54.2	56.2
Period of symptoms (year)	4.7	6.4	5.8	4.8	10.7	9.3	7.3
Age at onset (year)	48.3	54.5	52.1	53.9	42.2	44.9	48.9
Persistent HFS after surgery	0	2	2	2	4	6	8

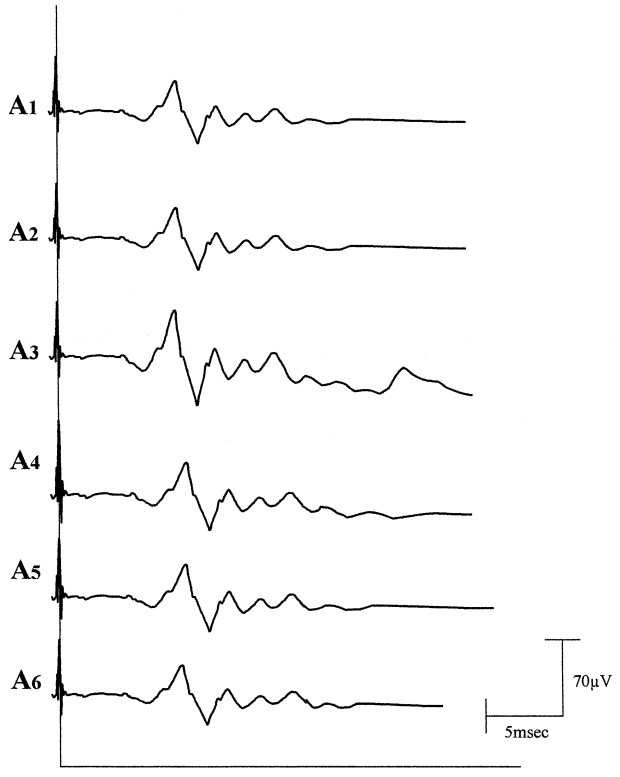

Fig. 3. Intra-operative electromyographic recording (case 2). *A1* Beginning of the craniotomy, *A2* opening of the dura mater, *A3* cerebellar retraction, *A4* interposition of the prosthesis between the compressing vessel and the root exit zone, *A5* suturing of the dura mater, *A6* at the end of operation. The abnormal muscle response remained even after the microvascular decompression procedure

immediate postoperative period. Of the 17 patients, 13 were female and 4 male. The mean operative age was 54 years and 2 months. The mean period of symptoms was 9 years and 4 months.

In cases from both groups, the persistent hemifacial spasm after surgery disappeared completely within 3 months.

Discussion

Since most of cranial rhizopathies are not life threatening, it is vitally important to have a good result with no complications. Microvascular decompression for cranial rhizopathies, after being repopularized with the use of the operating microscope, is being pursued with electrophysiological monitoring such as BSER (brainstem evoked response) and EMG to increase the safety and efficacy. Use of facial evoked EMG intra-operatively during MVD for HFS is based on the hypothesis suggested by Moller *et al.*, that the cause of hemifacial spasm is hyperexcitability of the facial motonucleus [10, 12]. The abnormal muscle response was thought to be as a result of backfiring from the facial motonucleus and hence an index of excitability of the facial motonucleus [11]. Subsequently, many authors have reported that intra-operative facial electromyographic recording is useful for identifying the blood vessel which is causing the spasm and to ensure that the decompression of the nerve has been accomplished [2, 8, 13, 14]. However, in our study, postoperative improvement of hemifacial spasm did not always correlate with the intra-operative changes in the abnormal EMG. Even of the 17 patients in whom the abnormal muscle response had not disappeared during surgery, 11 were free from hemifacial spasm in the immediate postoperative period and all within a period of 3 months.

We found that the clinical outcome of patients did not always correlate with the remainder of the abnormal muscle response. Ishikawa *et al.* suggested that additional surgery should not be performed for at least two years after microvascular decompression, because that period is necessary for the disappearance of the hyperexcitability of the facial motor nucleus [7]. Our results also supports a period of waiting before re-exploration. We think that hemifacial spasm has been caused by total of electrophysiological phenomenon between facial nerve and its motonucleus. Therefore it is unreliable that improvement of spasm after surgery is to be predicted only by the electrophysiological recording of the abnormal muscle response.

In our study, the mean age of onset in females, who had disappearance of abnormal muscle response intra-operatively, was 54 years and 6 months as compared to those with persistent abnormal muscle response, which was 42 years 2 months. And in each group, period of symptoms was 6 years 5 months and 10 years 8 months respectively. Thus we found young females might show poor electrophysiological response to microvascular decompression of the nerve as compared to those in the older age group.

We conclude here that the usefulness of intra-operative facial evoked EMG is still unreliable, and re-exploration in the immediate postoperative period should be withheld.

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Comments

Like the authors of this article, we estimate that disappearance of the abnormal ephaptic lateral spread responses is not a perfectly reliable indicator of an effective or not effective microvascular decompression for hemifacial spasm. Particularly, the persistence of abnormal responses does not mean that the decompression will not be efficacious, at least secondarily.

As a matter of fact, in a series of 33 patients who had intraoperative EMG recordings in frontalis and mentalis muscles after stimulation of inferior and superior branches of the facial nerve, we observed a disappearance of the abnormal spread reponses in only 23 patients. 10 patients had persistent abnormal responses upon closure. Seven of these were cured a few weeks later (2 months on average) and the other three after a follow-up ranging from 12 to 36 months.

On this occasion, we would like to emphasize on the fact that a significant number of patients (about one-third in our series) may have a delayed cure of their clinically-observable spasms, some of them even after more than one year. Therefore it seems to us not justified to propose redoing MVD before having waited for a ≪sufficiently-long≫ period of time, especially when the procedure has been considered really decompressive by the surgeon.

M. Sindou

This is a clinical paper presenting results of a retrospective analysis of the correlation between intra-operative facial evoked electomyograms and results of the treatment of hemifacial spasm by vascular decompression in 38 selected patients. The study shows that intra-operative facial evoked electomyograms have no predictive value for the late outcome in these cases.

The study is another contribution to the ongoing discussion on the role of intra-operative electrophysiological monitoring in neurosurgery.

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