

ELECTROPHYSIOLOGICAL INVESTIGATION OF HEMIFACIAL SPASM : F-WAVES AND ABNORMAL MUSCLE RESPONSES

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**Tlin Tanrıdağ, M.D. / Dilek İnce Gnal, M.D.
Erkan Karagz, M.D. / Sevinç Aktan, M.D.**

Department of Neurology, School of Medicine, Marmara University, Istanbul, Turkey

ABSTRACT

Objective: The aim of this study was to investigate the mechanism of hemifacial spasm pathophysiologically.

Methods: Patients with hemifacial spasm underwent an electrophysiological study of F-wave parameters of the facial nerves on the spasm side. F/M amplitude ratios, F duration and F frequency of appearance and the presence of abnormal muscle response (AMR) were compared with the asymptomatic side of the face which served as a control group.

Results: Enhancement of F-wave parameters were observed on the spasm side and AMR was present in all cases on the spasm side whereas it was absent on the other side.

Conclusions: Electrophysiological findings suggest the hyperexcitability of facial motor nucleus in hemifacial spasm.

Key Words: Hemifacial spasm, F-wave, hyperexcitability, Facial motor nucleus.

INTRODUCTION

In patients with hemifacial spasm (HFS), involuntary movements of the hemifacial muscles are usually due to vascular compression of the facial nerve. The mechanism of HFS can be hypothesized in two ways. First, it may be due to ephaptic transmission at the compression site. The second possibility is the hyperexcitability of the seventh nerve motor nucleus itself. Different parameters of F-waves have been studied by electrophysiological investigations in patients with HFS (1,2).

MATERIAL AND METHODS

This study was carried out in seven patients with a clinical diagnosis of cryptogenic HFS. There were 4 men and 3 women. Their ages ranged from 44 to 72 years (mean 59.4 years). The patients lay supine on a bed in a quiet room. The study was done while they had no spasms on the face. Medelec Sapphire 4ME(WOKING SURREY, England) was used. A recording electrode was placed on the mentalis muscle and the reference electrode at the base of the mandibula and supramaximal stimulation was applied at the border of the mandibula. Compound muscle action potential (M) and F-waves were differentiated easily by stimulating the mandibular branch of the facial nerve from its most distal part. F/M amplitude ratio, mean F-wave duration and the F-wave frequency of appearance out of consequent 32 stimuli were evaluated. For the amplitude ratios; peak to peak amplitudes of both M and F-waves were taken and for the F-wave duration; the latency differences between take off and final return to baseline were measured.

Abnormal muscle response (AMR) or 'lateral spread' was searched for by replacing the recording electrode on the mentalis muscle but stimulating the zygomatic branch of the facial nerve at the lower edge of the zygomatic bone. The appearance of the action potential was positive for AMR. In normal conditions, AMR cannot be elicited because the nerve we stimulate does not innervate the muscle we record. The study was performed bilaterally and the findings on the asymptomatic side were accepted as controls.

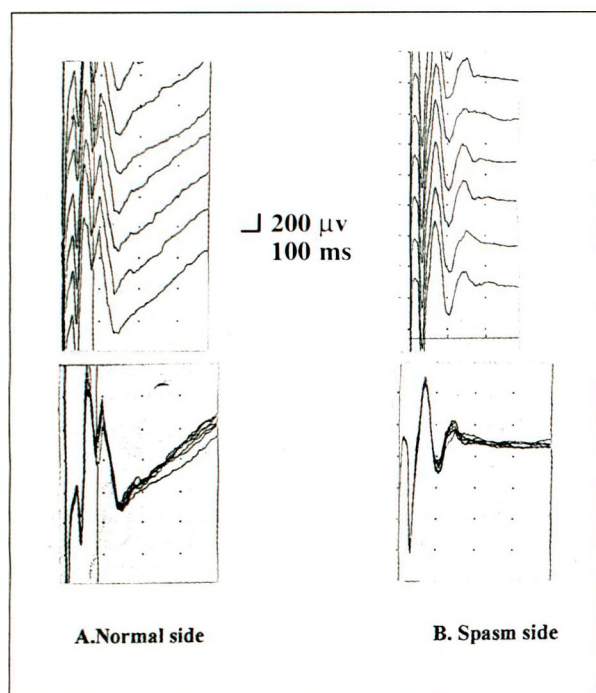
RESULTS

The F/M amplitude ratio was increased in 5 cases on the symptomatic side (mean %4.64) (Fig. 1). In case 2,

Table I. The Electrophysiological findings

	Case 1		Case 2		Case 3		Case 4		Case 5		Case 6		Case 7	
*	right	left	right	left	right	left	right	left	right	left	right	left	right	left
F frequency	26	26	12	2	20	28	10	17	6	16	10	24	9	15
F duration	5,6	6,3	19,6	15,8	11,4	5,8	8,5	10,5	16,2	27,8	15,2	19,4	15	20,2
F/M ratio	1,6	5	17,7	10	20	9	0,8	7,5	5,7	3,7	6,6	10	5	1,5

* The symptomatic side is shown bold

**Fig.1.:** In the same patient, F-wave amplitudes have increased on the spasm side.

A. Normal side

B. Spasm side

it was increased on the asymptomatic side. The F-wave duration was increased in 6 cases on the spasm side (mean 3.1msec.) The F-frequency was increased in 5 cases on the spasm side, was same in 1 case and was decreased in 1 case (Table I).

In all cases AMR was present on the spasm side in about 9.9 msec. latency, whereas it was absent on the asymptomatic side.

DISCUSSION

Motor conduction along the most proximal segment of a nerve can be measured by an F-wave. It is a late muscle response which results from the backfiring of antidromically activated anterior horn cells. Stimulation of the facial nerve antidromically reveals the proximal motor conduction and excitability of the facial motor nucleus. Enhancement of F-wave parameters such as duration, F/M amplitude ratio and frequency of appearance in hemifacial spasm can be related to an increase in the excitability of the facial motor nucleus (3). Ephaptic transmission described as cross talk by Zappia (4) is a result of myelin sheath injury of facial nerve due to vascular compression and it may stimulate a portion or all of the nerve. It may increase F/M amplitude ratio, but the conduction time of the ephapses is below 100-200 µsec. (5). Since the duration of F-waves is between a few milliseconds to greater than 10 mseconds, it alone cannot increase F-wave duration.

AMR is characteristically seen in HFS (6). It expresses the hyperexcitability of facial motor nucleus (7). High F/M amplitude ratios were found to be directly correlated with AMR/M-wave amplitudes.

In a study by Ishikawa, the enhancement of F-wave parameters and the presence of AMR disappeared synchronically in the post-operative stage of decompression (1). In our study, on evaluation of the patients individually, F/M amplitude ratio, F-wave duration and F-frequency were increased in most of the patients. AMR was seen in all the patients on the spasm side but was absent on the asymptomatic side. These findings are compatible with the previous studies. We would like to increase the number of the patients to be able to obtain statistical significance.

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