

# Electroneuromyographic analysis of acute neuropathy of the facial nerve in the aspect of sexual dimorphism

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## ABSTRACT

*Neuropathy of the facial nerve is the most common neuropathy of the cranial nerves, while the proportion of idiopathic lesions (Bell's palsy) accounts for about 50–70% of cases (1, 2, 3). The relevance of studying this disease is caused not so much by its prevalence (20-30 per 100 thousand population), but by the appearance in one third of patients with postneuropathic contracture of mimic muscles with the development of synkinesis and dyskinesias, which manifests itself as a gross defect of facial expression, causes physical and psychological discomfort and can significantly reduce quality of life (1, 2, 4, 5).*

*Electroneuromyography (ENMG) is the most objective method for assessing the functional state of peripheral nerves (3, 6, 7). ENMG is widely used not only to confirm the clinical diagnosis with the establishment of the level and type of damage to the peripheral nervous system, but also to predict the course of the disease, determine indications and contraindications to certain types of treatment, evaluate the effectiveness*

*of therapy. Many neurophysiological laboratories in the world are engaged in the development of informative indicators of ENMG in facial nerve neuropathy, but their recommendations are very contradictory (8, 12).*

**The purpose of the study** is study and evaluate the features of ENMG depending on the severity of the manifestation and course of the facial nerve neuropathy in males and females.

## MATERIALS AND METHODS

Electroneuromyographic (ENMG) examination was carried out in different periods of the disease, using a four-channel electroneuromyograph from the company Neurosoft (manufactured by the Russian Federation).

Used surface stimulation ENMG facial muscles on both sides. All patients underwent repeated electroneuromyographic method. The state of the motor axons of the facial nerve was assessed using standard stimulation ENMG methods with abduction of evoked potentials by cutaneous electrodes.

The number 93 patients were surveyed with various degrees of severity of NFN. All patients were divided into 3 groups according to the severity of facial paralysis (according to the scale of Y.M. Balaban). 47 males and 46 females were examined, the average age of the patients was  $34.8 \pm 3,2$  years for men, and  $33,6 \pm 2,6$  years for women. In 51 (54.8%) cases, the NFN had right-sided, and in 42 (45.1%) cases, left-sided lateralization. The group of patients with mild severity of NFN included 17 (18.2%) patients, with a moderate degree of severity of 45 (48.3%), and with a severe degree of severity 31 (33.3%) patients. The control group consisted of 20 healthy men and women, aged 18 to 65 years, whose average age was  $34.2 \pm 2,8$  years.

It is known that 1-7 days from the onset of the disease NFN, the results of ENMG method may be within the normal range. In this connection, we performed ENMG method for 7-8 days in the acute period of the disease, then in the early recovery period (12-14 days of the disease), late recovery period (31-120 days of the disease) and in the period of complications (later 4 months). The following facial muscles were examined: m. orbicularis oris, m. orbicularis oculi, m. occipitofrontalis. The study was carried out both on the

affected and on the “healthy” side of the face. Studied and compared the amplitude, latency in groups of patients, male and female.

## RESULTS AND DISCUSSIONS

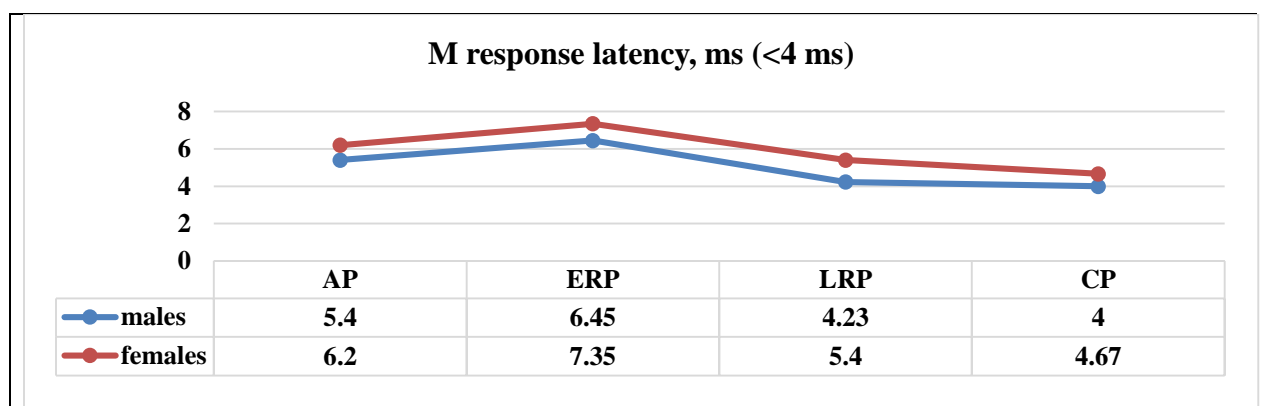
In the AP of the disease in the studied muscle groups, the latency of the M response was significantly longer on the affected side of the FN, compared with the “healthy” side and with the results of the control group ( $P < 0.01$ ). In this case, the latency of the M response was much longer in female patients than male ( $5.43 \pm 0.31$ , and  $4.55 \pm 0.20$ , respectively).

In comparison of the latency of the M response in patients with varying degrees of severity of facial paralysis in AP of the disease showed the following patterns: in the AP of the disease, with mild, moderate and severe severity, the latency of the M response was almost the same and did not have significant differences. The exception was made by females with severe facial paralysis, their latency M response was longer compared with patients with mild lesions of FN ( $5.43 \pm 0.24$  and  $4.9 \pm 0.16$ , respectively). In a mild severity of facial paralysis, the latency indicators of the M response were already within the normal range by the beginning of LRP. In moderate severity, by the beginning of LRP, the

latency of the M response was virtually as normal, and in the CP it had normal patterns. Only in patients with a severe degree of facial paralysis, did the latency of the M response to CP remain twice as long as compared with the control group in both males and females ( $4.0 \pm 0.15$  in men;  $4.1 \pm 0.1$  in women;  $2.3 \pm 0.05$  control group) ( $P < 0.05$ ).

Thus, the study of latency M response of the examined muscles showed that lengthening the latency of the M

response with AP higher than  $5.3 \pm 0.2$  ms. and more, it is unusual to severe facial paralysis and it is longer in female patients; shortening the latency of the M response to the beginning of the ERP by 1 ms. and more, it is seen in an easy degree facial paralysis; elongation latency of the M response to ERP is characteristic of moderate and severe facial paralysis; in moderate and severe facial paralysis, the positive dynamics in restoring the latency of the M response is observed only for LRP disease.



**Fig. 1. Dynamics of the latency of the M-response of the facial muscles in idiopathic DL on clinical periods in terms of gender**

The change in the amplitude of the M response, compared with other ENMG indicators, most clearly demonstrates the degree of disorder of the motor function of the FN in different periods of the disease. Starting with the AP of the disease, the amplitude of the M response m. orbicularis, m.

orbicularisoculi and m. occipitofrontalis was significantly lower on the affected side than healthy and control group ( $P < 0.01$ ;  $P < 0.05$ ). At the same time, no significant difference in the decrease in the amplitudes of the M response between male and female patients with varying

degrees of severity of facial paralysis was found.

A comparative analysis of the amplitude of the M response between the examined muscles showed results which attract attention: For example, the amplitude M of the response m. occipitofrontalis in all groups of severity of facial paralysis, and regardless of the sex of the patients, always had the highest patterns in comparison with m. orbicularis oris, m. orbicularis oculi. On contrary, the amplitude M of the response m. orbicularis oris et oculi in all patients, regardless of the severity of facial paralysis, had the lowest trend.

By the beginning of ERP, we observed a pathological decrease in the amplitude of the M response in all the examined muscles, in all patients with NFN. But the degree of its decline was different depending on the severity of facial paralysis. The most noticeable decrease was seen in patients with severe disorders, both in men and women (for example, the amplitude of the M response of the M. orbicularis oris is  $0.3 \pm 0.05$  mkV and  $0.16 \pm 0.03$  mkV, respectively, in women and men) ( $P < 0.001$ ). Less significant reduction represented in moderate severity

( $0.5 \pm 0.02$  mkV and  $0.46 \pm 0.03$  mkV, respectively, in women and men) and for mild facial paralysis (for example, the amplitude M of the m. Orbicularis oris response is  $0.7 \pm 0.05$  mkV and  $0.63 \pm 0.03$  mkV, respectively, in women and men) ( $P < 0.001$ ).

In the onset of LRP, it is possible to observe a positive dynamic in terms of the growth of the amplitude of the M response in all groups of patients. The maximum increase in the amplitude in all the examined muscles and its approximation to the norm is noted with a mild severity of facial paralysis. And in moderate severity of facial paralysis, both in men and women, the amplitude was low from the norm, but in fact close to the patterns of the AP of the disease. In severe cases of facial paralysis in PVP disease in men, recovery of the amplitude was faster than women ( $0.78$  mkV for men and  $0.59$  mkV for women) ( $P < 0.05$ ).

In patients with mild and moderate severity of prosoparesis, in view of recovery and the absence of complications, no ENMH was performed.

In the software, we observed a recovery of the amplitude of the M response in all patients, including patients with severe facial paralysis. The following phenomenon should

also be noted: in men, we noted a uniform increase in the amplitude of the M response in all the muscles examined, and in women, the maximum amplitude of the M response was fixed at m. orbicularis oculi. Whereas they have an amplitude of m. orbicularis oris and on m. occipitofrontalis were lower.

In CP patients, cases of higher amplitudes of the M response were detected, compared with the contralateral side, which was typical of patients with eye-lip and eye-forehead synkinesis.

Thus, the amplitude indicators of the M response have features and dynamics in all periods of the disease.

Initially, starting from the AP of the disease, a decrease in the amplitude of the M response is noted in all muscles, regardless of the severity of facial

paralysis and the gender of patients. By the beginning of ERP, in all cases of UFN, regardless of the severity of facial paralysis, the amplitude shows of the M response decrease to pathological patterns, while the level of the amplitude decrease depended on the severity of the lesion FN. Thus, the maximum decrease in the amplitude of the M response is observed with a severe degree of facial paralysis. In ERP, in the case of severe facial paralysis, the degree of recovery of the amplitude of the M response is noticeably failed as compared with a mild and severe degree of damage. At the same time, the amplitude recovery approaches the parameters of the AP of the disease. The maximum increase in the amplitude of the M response in patients with severe facial paralysis and signs of contracture may indicate a possible development of pathological synkinesis.

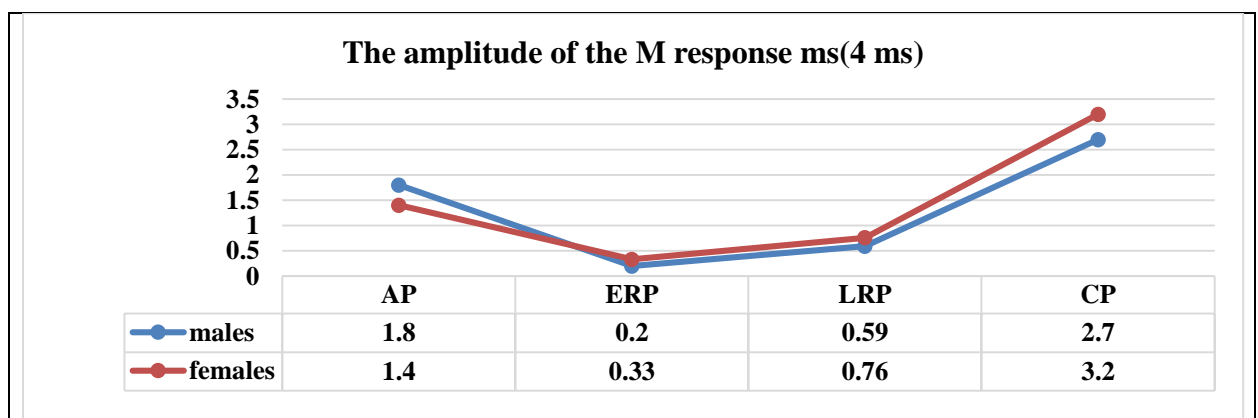


Fig.2. Dynamics of the amplitude of the M-response of the facial muscles in idiopathic NFN on clinical periods in terms of gender

## CONCLUSION

Thus, the ENMG indicators show that, in all periods of the disease in female patients, the latency of the M response was longer compared with male patients. Despite the fact that in the AP, the initial amplitude of the M response was higher in males, but already with the onset of ERP in women, it began to grow faster and outnumbered men in the other periods of the disease. As expected, the latency in the form of its shortening and the amplitude of the M response in the form of its increase directly correlated with the positive dynamics of the recovery period. In this case, differences were found by gender, which were characterized by the presence of dissociation between latency and the amplitude of the M-response in the female group: for men, the latent time is shorter than the amplitude, and for women the latent time is longer than the amplitude for M - response is higher. This may illustrate differences in the process of remyelination with uneven recovery of nerve fibers in women. This may explain for the fact that in females more often the disease is complicated by contracture of the facial muscles.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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