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ELECTRONEUROMYOGRAPHIC STUDY FOR CARPAL TUNNEL STENOSIS

Takhirov Zh. M.
Asilova S. U.
Nurimov G. K.
Traumatology and Orthopedics , Urgen Branch Tashkent Medical Academy

Abstract
Electroneuromyographic (ENMG) study _ allows you to determine changes in the bioelectrical activity of the hand muscles depending on the degree of carpal tunnel stenosis, and is also an objective criterion for assessing the results of treatment of orthopedic and trauma patients . We observed 45 patients with carpal tunnel stenosis of varying degrees . In this case, stenosis I degree was observed in 8 patients, II degree in 15 patients with conservative treatment and III degree in 22 patients with surgical treatment according to what we developed. EMG studies were carried out in the immediate (before and after treatment) and long-term (after 6 months) periods. In a comparative study of EMG parameters between groups, a significant increase in the amplitude and frequency of oscillations was observed in all leads in patients receiving surgical treatment compared to the group receiving conservative treatment. ($p<0.01$). Analysis of the data obtained showed that after treatment, patients with surgical treatment showed an improvement in the functional state of the hand muscles.

Keywords: Electroneuromyography, carpal tunnel stenosis, bioelectrical activity of hand muscles, degree of disease.

Introduction

ENMG makes it possible to determine changes in the bioelectrical activity of the hand muscles depending on the degree of carpal tunnel stenosis, and is also an objective criterion for assessing the results of treatment of orthopedic and trauma patients

The authors (2,6,11,17,21,23) noted that the time required to conduct an ENMG study is long , and it is also limited in terms of coverage of the study of anatomical structures. The researchers also noted that when metal fixatives are present in patients, there is a risk when conducting the study.

Explorers (3,8,16,18,24,30) indicated that with stenosis of the carpal tunnel at an early stage of the disease due to thin nerve fibers of the median nerve, changes in conductivity are not detected during ENMG; damage to the fibers is noted only at a later stage. The authors also noted that in the early stages of carpal tunnel syndrome, the results obtained from ENMG may have inconsistencies and be uninformative, so clinical tests are very important in the early period.

At the same time, various scientists (7,9,13,20, 26, 29) recognize that currently ENMG is the most informative indicator in the diagnosis of CTS. The study allows you to objectively and accurately assess the degree of damage to the median nerve, based on the parameters of the amplitude of the M-response of the short muscle abductor pollicis (A), the distal latency of the motor fibers of the median nerve (DML), the speed of impulse conduction along the motor (MC) and sensory fibers,

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which allows you to objectively assess the extent of damage. Comparison of the values of these parameters with the parameters of the healthy arm of patients is usually used to determine the severity of the disease and the effectiveness of the treatment.

Thus, taking into account the above, we can say that in the early stages it is necessary to refer to clinical tests, and to EMG studies at the late stage of the disease, which is important for determining the severity of the disease and the effectiveness of the treatment.

The purpose of the study: was study the functional state of the neuromuscular system of the hand with carpal tunnel stenosis before and after treatment.

Materials:

Electroneuromyographic studies were carried out in 45 patients with carpal tunnel stenosis. The patients were divided into 3 groups according to the severity of the course: I degree in 8 patients, II degree in 15 patients and III degree in 22 patients. Patients with grades I and II of stenosis received conservative treatment. Patients with grade III stenosis underwent surgical treatment using the method we proposed.

In order to study the functional state of the neuromuscular system of the hand with carpal canal stenosis, we performed global electroneuromyography (ENMG) by recording muscle electrical potentials. This method allows you to determine changes in the bioelectrical activity of the hand muscles depending on the degree of carpal tunnel stenosis, and is also an objective criterion for assessing the results of treatment of orthopedic and trauma patients .

Bioelectrical activity of the hand muscles was recorded from motor points using surface electrodes at a constant interelectrode distance of 1.5 cm and a stimulus duration of 0.5 m / s. The electrical activity of the muscles of the eminence of the first finger, the deep flexor of the fingers and the short muscle of the hand was studied. Previously, before positioning the electrodes, the skin surface was treated with alcohol, a thin layer of special electrode paste was applied to the electrodes, and they were attached using rubber bands. Then an electrode needle is inserted into the muscle being tested. The electrode itself is connected to an electroneuromyograph, which records the electrical activity of the muscle.

First, the biopotentials of the muscles were studied in a state of extremely voluntary relaxation of the muscles under study, and during flexion and extension movements of the fingers of the injured hand. Then, the potentials of the muscles that are at rest were recorded. After this, extremely slow flexion and extension of the fingers were performed. The main indicators of total bioelectrical activity were determined - the frequency of bioelectrical activity (in hertz) and the amplitude of action potentials (in millivolts) generated during muscle contraction. The muscles in the area of the eminence of the first finger, the deep flexor of the fingers and the short muscle of the hand of the injured hand were studied. The electrical activity of the muscles is recorded as waves or waves. In this case, the data can be visible both on the monitor and recorded on a special paper tape. The obtained results (indicators of amplitude and frequency of oscillations) were compared with data from healthy individuals, and mathematical processing of the results between the studied groups of patients was carried out.

ENMG studies were carried out in the immediate (before and after treatment) and long-term (after 6 months) periods. The results of EMG studies are shown in Table No. 1. In all groups of patients,

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before treatment, a decrease in the oscillation amplitude and oscillation frequency in all leads was found to be up to 2-2.5 times compared to normal values ($p<0.001$).

In the immediate period after treatment, there was a significant increase in ENMG indicators in all groups compared to the initial data ($p<0.001$). In a comparative study of ENMG parameters between groups, a significant increase in the amplitude and frequency of oscillations was observed in all leads in patients receiving surgical treatment compared to the group receiving conservative treatment. ($p<0.01$). Analysis of the data obtained showed that after treatment, patients with surgical treatment showed an improvement in the functional state of the hand muscles. Moreover, despite a significant increase in bioelectrical activity compared to patients in the early stage group , ENMG indicators in patients with surgical treatment were significantly lower compared to normal values.

In the long-term period (6 months after treatment), an increase in the motor activity of patients was accompanied by an increase in the frequency and amplitude of oscillations of biopotentials on ENMG in all studied groups of patients. However, the improvement in bioelectrical activity was more pronounced and approached normal values in patients with surgical treatment. In patients with early stage disease who received conservative treatment, bioelectrical activity after treatment, compared with both the surgical group of patients and normal values, remained significantly reduced ($p<0.001$).

Thus, in patients with carpal tunnel stenosis, the results of EMG studies improved in the direction of increasing the amplitude and frequency of oscillations by significantly higher figures compared to the group of patients who used a complex of conservative initial stage, late stage surgical treatment developed by us. Improved results of EMG studies are associated with the restoration of the functional activity of the damaged hand, with less trauma to the neuromuscular system, as well as a decrease in the incidence of complications during surgical treatment using the method we developed. Comparison of the values of the parameters of the damaged hand with the parameters of the healthy hand of patients is usually used to determine the severity of the disease and the effectiveness of the treatment.

Table 1. Indicators of bioelectrical activity of muscles with carpal tunnel stenosis at different periods of treatment (M ± m)

Duration of the study	Groups of patients n- 45	Elevation of the first finger		Flexor digitorum profundus		Short muscle of the hand	
		Oscillation frequency Hz	Oscillation amplitude mV	Oscillation frequency Hz	Oscillation amplitude mV	Oscillation frequency Hz	Oscillation amplitude mV
	Healthy	74,2±1,3	3,85±0,21	71,5±1,5	4,08±0,19	72,1±1,1	4,19±0,3
Before treatment	I degree II degree III degree	23.9±1.0 22.5±0.49 21.8±0.63	0.88±0.18 0.51±0.032 0.41±0.01	24.09±0.85 24.8±0.42 24.6±0.55	0.82±0.15 0.49±0.06 0 56±0.02	25.6±1.09 25.19±0.53 24.01±0.88	0.85±0.21 0.79±0.03 0.67±0.05
After treatment	I degree II degree III degree	59±0.5 62.5±0.6 63.5± 1.91	2.68±0.4 2.41±0.15 3.52±0.13	62.48±1.05 62.9±1.27 63.8±2.44	3.41±0.83 3.56±0.2 3.61±0.14	65.28±0.82 65.9±0.69 65.1±2.17	3.36±0.02 3.49±0.2 3.76±0.19
Long-term period (after 6 months)	I degree II degree III degree	67,3±1,5 68,5±1,8 69,6±1,4	3,55±0,4 3,01±0,12 3,85±0,14	66,7±1,5 66,8±1,6 67,2±0,8	3,59 ±0,21 3,55±0,18 3,99±0,09	67,46±0,9 68,1±0,68 68,8±1,2	3,58±0,19 3,75±0,12 3,89±0,1

Conclusions

1. The ENMG method makes it possible to determine changes in the bioelectrical activity of the hand muscles depending on the degree of carpal tunnel stenosis, and is also an objective criterion for assessing the results of treatment of patients.
2. ENMG studies showed an improvement in the direction of increasing the amplitude and frequency of oscillations by significantly high numbers in the group of patients who were treated with a complex of conservative initial stages, when compared with patients with a late stage of the disease and after surgical treatment using the method we developed.
3. Improvement in the results of ENMG studies is associated with the restoration of the functional activity of the damaged hand, with less trauma to the neuromuscular system, as well as a decrease in the incidence of complications during surgical treatment developed by us. Comparison of the values of the parameters of the damaged hand with the parameters of the healthy hand of patients is usually used to determine the severity of the disease and the effectiveness of the treatment.

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