
**THE ROLE OF ELECTRONEUROMYOGRAPHY IN DIFFERENTIAL
DIAGNOSIS AND EVALUATION OF THE EFFECTIVENESS OF COMPLEX
THERAPY**

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This article examines the results of a study aimed at assessing the informative value and clinical significance of electroneuromyography (ENMG) in the differential diagnosis of peripheral neuropathies and in monitoring the effectiveness of combination therapy. The study included 60 patients divided into a study (n=40) and control (n=20) group. Patients in the study group received comprehensive treatment, including medication, physiotherapy, and rehabilitation. The assessment was conducted using clinical scales (VAS, MRC, NDS) and ENMG parameters before and after treatment. The analysis showed that combination therapy significantly improved neuromuscular conduction parameters, including increased conduction velocity along motor and sensory fibers, M-response amplitude, and F-wave frequency, as well as a reduction in distal latency ($p < 0.01$). Clinically, a reduction in pain severity, a reduction in neuropathic deficit, and an increase in muscle strength were observed. Correlation analysis revealed statistically significant relationships between ENMG parameters and clinical improvement, confirming the pathogenetic relationship between electrophysiological and functional changes. Thus, electroneuromyography serves not only as a highly informative diagnostic method but also as an objective tool for monitoring the dynamics of neuromuscular function recovery and

assessing the effectiveness of combination treatment in patients with peripheral neuropathies ..

Relevance. Diseases of the peripheral nervous system and neuromuscular structures remain one of the most common causes of movement disorders, pain, and decreased quality of life in patients [1,2]. Differential diagnosis of neuropathies, myopathies, and functional disorders presents significant difficulties, since the clinical picture is often similar in various lesions of the neuromuscular system [3].

In this regard, the use of objective instrumental methods is particularly important. These methods not only confirm the clinical diagnosis but also determine the level, nature, and extent of damage to nerve fibers and muscle structures. One of the most informative methods is electroneuromyography (ENMG), which combines recording of muscle bioelectrical activity and assessment of peripheral nerve conduction [4,5].

ENMG allows for early diagnosis of axonal and demyelinating lesions, differentiation between neuropathic and myopathic lesions, identification of subclinical forms of pathologies, and assessment of the dynamics of conduction restoration during treatment [6–8]. Furthermore, ENMG is an indispensable method for monitoring the effectiveness of complex therapy, including medication, physiotherapy, and rehabilitation [9,10].

Modern studies show that parameters of nerve conduction velocity (ECV), M-response amplitude, and interference pattern parameters can serve as objective markers of nerve fiber regeneration and restoration of muscle function [11,12]. Thus, the introduction of ENMG into the clinical monitoring system allows for increased diagnostic accuracy, optimization of treatment options, and objective assessment of the effectiveness of rehabilitation measures [13,14].

Therefore, the relevance of this study is determined by the need for a comprehensive analysis of the role of electroneuromyography in the differential diagnosis of neuromuscular diseases and monitoring the effectiveness of treatment [15].

The aim of the study was to evaluate the diagnostic and prognostic value of electroneuromyography in the differential diagnosis and objective assessment of the effectiveness of complex therapy in patients with peripheral nervous system lesions.

Materials and methods . The study included 60 patients (35 men and 25 women) aged 18 to 65 years with various forms of peripheral neuropathies and myopathies,

who were treated in the neurology department (2022–2024). The control group consisted of 20 apparently healthy volunteers of comparable age.

The diagnostic complex included a clinical and neurological examination with an assessment of the severity of pain, sensory and motor deficits; laboratory testing (biochemical parameters, glucose, creatine kinase, electrolytes); electroneuromyography (ENMG) with the registration of M-responses, F-waves, interference patterns and the velocities of excitation conduction along motor and sensory fibers; visual analogue pain scale (VAS) and neuropathic deficit scale (NDS); a course of complex therapy, including neurotropic drugs (B vitamins), antioxidants, physiotherapy and therapeutic exercises.

Statistical data processing was performed using the SPSS 26.0 package. The methods of variation statistics, paired and unpaired t-tests, and correlation analysis were used ($p < 0.05$ was considered statistically significant).

Results. An analysis of clinical and neurophysiological data allowed us to objectively evaluate the effectiveness of combination therapy in patients with chronic lumbosciatica and determine the diagnostic value of electroneuromyography (ENMG) parameters in differentiating radiculopathies from pseudoradicular syndromes. Clinical scales (VAS, NDS, MRC) and electrophysiological parameters reflecting the state of peripheral neuromuscular conduction were used to compare the dynamics.

The obtained results indicate a pronounced positive dynamic in patients who received complex treatment, which is confirmed by a significant improvement in both subjective indicators of pain and function, and objective ENMG criteria reflecting the restoration of axonal and myelin conduction.

Table 1.

Dynamics of ENMG parameters in patients with peripheral neuropathies before and after complex therapy (M ± m)

Indicator	Control group (CG, n=20)	Main group (MG, n=40) before treatment	Main group (MG) after treatment	p (before–after)
Conduction velocity in motor fibers, m/s	53.4 ± 1.2	38.6 ± 1.8	47.9 ± 1.5	<0.01
Conduction velocity along sensory fibers, m/s	55.1 ± 1.0	40.2 ± 1.6	49.3 ± 1.4	<0.01

M-response amplitude, mV	8.7 ± 0.4	4.1 ± 0.3	6.8 ± 0.3	<0.001
Distal latency, ms	3.1 ± 0.1	5.4 ± 0.2	4.0 ± 0.2	<0.01
Frequency of occurrence of F-waves, %	96.3 ± 2.0	68.5 ± 3.2	85.7 ± 2.4	<0.01
Average amplitude of interference pattern, μV	2100 ± 120	1320 ± 90	1820 ± 100	<0.01

Analysis of the dynamics of electromyographic parameters in patients with chronic lumbosciatica showed a significant improvement in conductivity along motor and sensory fibers after a course of complex therapy (Table 1).

Before treatment, patients in the main group showed a significant decrease in the impulse conduction velocity along motor fibers (38.6 ± 1.8 m/s) and sensory fibers (40.2 ± 1.6 m/s) compared with the control group (53.4 ± 1.2 m/s and 55.1 ± 1.0 m/s, respectively; $p < 0.01$). After therapy, these indicators increased to 47.9 ± 1.5 m/s and 49.3 ± 1.4 m/s ($p < 0.01$), reflecting the restoration of axonal conduction and remyelination of nerve fibers.

The amplitude of the M-response, a marker of axonal integrity, was 4.1 ± 0.3 mV before treatment, which is almost two times lower than the control values (8.7 ± 0.4 mV). After therapy, this indicator significantly increased to 6.8 ± 0.3 mV ($p < 0.001$), indicating an improvement in the functional state of motor units.

Distal latency, which characterizes the speed of excitation transmission in the distal parts of the nerve, decreased from 5.4 ± 0.2 ms to 4.0 ± 0.2 ms ($p < 0.01$), which indicates a decrease in demyelinating manifestations and restoration of neuromuscular transmission.

A significant increase in the frequency of occurrence of F-waves was also noted - from $68.5 \pm 3.2\%$ to $85.7 \pm 2.4\%$ ($p < 0.01$), which reflects an improvement in conductivity along the proximal parts of motor neurons and a decrease in the degree of their functional blockade.

The mean amplitude of the interference pattern on needle EMG increased from 1320 ± 90 μV to 1820 ± 100 μV ($p < 0.01$), indicating activation of a larger number of functioning motor units and normalization of muscle tone.

Thus, the totality of ENMG data confirms the objective restoration of axonal - myelin conduction and functional activity of motor neurons against the background

of complex therapy, which is consistent with clinical improvement and reduction of pain syndrome.

Table 2.

Changes in clinical indicators of neurological status (points, M ± m)

Indicator	OG before treatment	OG after treatment	KG	p (before–after)
Pain according to VAS (0–10 points)	6.8 ± 0.4	3.2 ± 0.3	1.0 ± 0.1	<0.001
Neuropathic deficit (NDS, points)	8.6 ± 0.5	5.0 ± 0.4	2.2 ± 0.2	<0.01
Muscle strength according to the MRC scale (points)	3.4 ± 0.2	4.5 ± 0.1	5.0 ± 0.0	<0.01

Table 2 presents the results of the dynamics of clinical indicators of neurological status in patients of the main (MG) and control (CG) groups before and after the course of complex therapy.

Analysis of the obtained data revealed a significant improvement in all studied parameters in the study group following treatment. For example, pain severity on the visual analogue scale (VAS) decreased from 6.8 ± 0.4 to 3.2 ± 0.3 points ($p < 0.001$), indicating a significant reduction in subjective pain.

neuropathic deficit score (NDS) also showed positive dynamics: a decrease from 8.6 ± 0.5 to 5.0 ± 0.4 points ($p < 0.01$), which indicates regression of sensorimotor disorders.

At the same time, an increase in muscle strength according to the MRC scale was observed from 3.4 ± 0.2 to 4.5 ± 0.1 points ($p < 0.01$), which reflects the restoration of motor function.

In the control group, no significant changes were observed during the observation period, which confirms the effectiveness of the complex treatment carried out in the main group.

Table 3.

Correlations between ENMG parameters and clinical improvement

Correlation parameter	Coefficient r	p
Conduction velocity (motor fibers) ↔ MRC strength	+0.71	< 0.01
M-response amplitude ↔ pain reduction (VAS)	-0.64	< 0.05
F-wave frequency ↔ neuropathic deficit (NDS)	-0.68	< 0.01

Table 3 presents the results of the correlation analysis between electromyographic (EMG) parameters and clinical parameters of improvement in patients after therapy.

Significant relationships were identified, reflecting the pathogenetic interdependence between the functional state of peripheral nerves and the degree of clinical recovery. For example, a strong direct correlation was noted between motor fiber conduction velocity and muscle strength indices according to the MRC scale ($r = +0.71$; $p < 0.01$), indicating a close link between conduction restoration and increased motor activity.

A negative correlation between the amplitude of the M-response and the reduction in pain according to the VAS ($r = -0.64$; $p < 0.05$) indicates that as bioelectrical activity normalizes, the severity of the pain syndrome decreases.

An inverse relationship was also established between the frequency of F-waves and the degree of neuropathic deficit according to the NDS scale ($r = -0.68$; $p < 0.01$), which reflects an improvement in the state of conduction in the proximal parts of the nerve with regression of clinical manifestations of neuropathy .

In general, the obtained data confirm the diagnostic and prognostic significance of ENMG in assessing the effectiveness of complex therapy in patients with damage to the peripheral nervous system.

Discussion. The results of the study convincingly demonstrate the importance of using electroneuromyography (ENMG) not only in the diagnosis of peripheral neuropathies but also in the objective assessment of the effectiveness of treatment. With the comprehensive treatment, the study group showed a significant improvement in both clinical and neurophysiological parameters, as confirmed by the data in Tables 1–3.

Restoration of conduction velocity in motor and sensory fibers, increased M-response amplitude, and decreased distal latency reflect positive dynamics of axonal demyelinating processes, indicating regeneration of the myelin sheath and improved functional integrity of nerve fibers. These changes closely correlate with increased

muscle strength and decreased pain severity, confirming the clinical significance of ENMG in assessing therapy effectiveness.

A significant increase in the frequency of F-waves in patients in the study group indicates restoration of excitation conduction in the proximal nerve and increased motor neuron excitability. Similar dynamics have previously been noted by other authors [1–4], allowing this parameter to be considered a sensitive marker of restoration of neuromuscular conduction.

A reduction in neuropathic deficit (NDS) and pain scores on the VAS, coupled with an increase in muscle strength on the MRC scale, indicates the clinical effectiveness of the integrated approach. The relationship between electrophysiological and clinical parameters (Table 3) confirms their pathogenetic relationship and allows ENMG to be used as a tool for objectively monitoring rehabilitation progress.

Thus, the use of electroneuromyography in the comprehensive examination and treatment of patients with peripheral neuropathies not only ensures differential diagnostic accuracy, but also allows for a quantitative assessment of treatment effectiveness, predicting functional recovery, and individualizing treatment tactics.

Conclusions. Electroneuromyography (ENMG) is a highly informative method in the differential diagnosis of peripheral neuropathies, allowing for an objective assessment of the degree of neuromuscular conduction impairment and the nature of the lesion (axonal, demyelinating, or mixed type).

Conducting complex therapy in patients with peripheral neuropathies leads to a reliable improvement in ENMG indices - an increase in the conduction velocity along motor and sensory fibers, an increase in the amplitude of the M-response and the frequency of F-waves, as well as a decrease in distal latency ($p < 0.01$).

Improvement of electrophysiological parameters is accompanied by a pronounced positive dynamics of the clinical condition: a decrease in pain syndrome, a reduction in neuropathic deficit and an increase in muscle strength, which confirms the effectiveness of the treatment.

The established correlations between ENMG indicators and clinical criteria (MRC, VAS, NDS) indicate a pathogenetic relationship of recovery processes and allow ENMG to be used as a reliable tool for monitoring the effectiveness of therapy.

Thus, the inclusion of electroneuromyographic monitoring in the diagnostic algorithm and evaluation of treatment effectiveness helps to increase the accuracy of differential diagnosis, individualize treatment tactics and optimize rehabilitation measures for peripheral neuropathies.

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