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COMPARATIVE ANALYSIS OF ELECTRONEUROMYOGRAPHIC CHANGES IN PATIENTS WITH CHEMOTHERAPY-INDUCED POLYNEUROPATHY ON THE BACKGROUND OF OVARIAN CANCER BEFORE AND AFTER THERAPY

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ABSTRACT

Chemoinduced polyneuropathy is a common side effect of chemotherapy, which significantly impairs the quality of life of patients. The purpose of this study is a comprehensive study of electroneuromyographic parameters in patients with chemotherapy-induced polyneuropathy before and after therapy during three 21-day courses of chemotherapy. The study included an analysis of changes in the functional state of peripheral nerves using electroneuromyography. This diagnostic method allows you to objectively assess the degree of nerve damage and the effectiveness of the therapeutic interventions used. The results of the study demonstrated significant changes in electroneuromyographic parameters in patients with CIPN after complex therapeutic interventions. The data obtained contribute to a better understanding of the pathophysiological mechanisms of CIPN and the development of more effective methods of treatment and prevention of this condition. The findings of the study highlight the need for regular monitoring of the condition of peripheral nerves in patients undergoing chemotherapy for timely detection and correction of CIPN, which ultimately helps to improve the quality of life of these patients.

Key words: chemoinduced polyneuropathy, electroneuromyography, ovarian cancer, chemotherapy.

INTRODUCTION

Chemotherapy is the mainstay of treatment for ovarian cancer, one of the most aggressive forms of cancer of the female reproductive system. Chemotherapeutic drugs, such as taxanes and platinum derivatives, have powerful antitumor effects, but are also associated with the development of serious side effects, among which chemotherapy-induced polyneuropathy occupies a special place. CIPN is characterized by damage to peripheral nerves, resulting in

symptoms such as pain, numbness, paresthesia, and weakness, which significantly impair the quality of life of patients (1,3). Electroneuromyography (ENMG) is an important diagnostic method for assessing the functional state of peripheral nerves. ENMG allows you to quantify the speed of nerve impulse conduction, the amplitude of muscle responses and other parameters, which makes it indispensable in the diagnosis and monitoring of CIPN (4).

In recent years, the literature has noted a significant increase in interest in the study of the neurotoxic effects of chemotherapy and ways to minimize them. Research is also increasingly focusing on the effects of different therapeutic approaches on peripheral nerves in patients with CIPN. Thus, a study by Delfanti et al (2) showed that preventive measures can significantly reduce the risk of developing CIPN in patients receiving oxaliplatin. Similar results were obtained in studies aimed at assessing the functional status of peripheral nerves using new therapeutic methods such as high-intensity pulsed magnetic therapy (5). In addition, research shows the importance of a multidisciplinary approach in the management of CIPN, including pharmacological and non-pharmacological treatments (4,7). This study is aimed at a comprehensive study of electroneuromyographic parameters in patients with CIPN before and after therapy. The purpose of this study is to identify changes in the functional state of peripheral nerves under the influence of chemotherapy, as well as to evaluate the effectiveness of the complex use of sodium selenite with nucleotides in CIPN. The data obtained will allow us to better understand the pathophysiological mechanisms of CIPN and develop more effective strategies for the treatment and prevention of this condition, which will ultimately improve the quality of life of patients undergoing chemotherapy.

Purpose of the study. The purpose of the study is a detailed study of changes in electroneuromyographic parameters in patients with chemotherapy-induced polyneuropathy before and after treatment.

Materials and methods of research. The clinical study involved 110 patients with ovarian cancer, who were divided into two groups: the first group included 70 patients with subjective and objective symptoms of chemo-induced polyneuropathy (CIPN), and the second group consisted of 40 patients with only objective symptoms. The study also included a control group of 30 healthy volunteers. The first group was further divided into two subgroups: subgroup A (40 patients) received basic therapy, complex therapy including antioxidant and neuroprotective therapy (sodium selenite + cytidine monophosphate, uridine triphosphate), and subgroup B (30 patients) received basic therapy with standard detoxification therapy. The second group (comparison group, n=40) also received

basic therapy with standard detoxification therapy. The clinical study lasted 63 days (3 cycles every 21 days of chemotherapy). All patients received standard chemotherapy regimens for ovarian cancer, including combinations of platinum-based drugs (cisplatin or carboplatin) and taxanes (paclitaxel or docetaxel). To diagnose and assess the severity of CIPN, stimulation electroneuromyography (ENMG) of the lower and upper extremities was performed. The rate of propagation of excitation (SRV) along motor and sensory fibers, the amplitude and latency of M-responses, the action potential of the sensory nerve, and the latency of the F wave were assessed. Electroneuromyographic criterion for axonal damage was a decrease in amplitude or a decrease in sensory and motor response. The criterion for the demyelinating process was a decrease in SRV. In the case of axonal demyelinating forms, these changes were recorded simultaneously. Standard statistical methods, including descriptive statistics and correlation analysis, were used to analyze the data, with results confirmed to be significant at a p-value of <0.05. Demographic data, cancer stage, and chemotherapy regimen and dosage were collected and analyzed. CIPN severity was assessed using CTCAE version 5.0 criteria.

Results and discussion. All study participants (n=110) underwent stimulation ENMG of the median (n. medianus), ulnar (n. ulnaris), peroneal (n. peroneus), tibial (n. tibialis) nerves and sural nerve (n. suralis). Since there was no significant difference in the performance of the right and left limbs, we presented the average data for the right side of the limbs. To compare the initial ENMG data of groups I and II with those of healthy individuals, an ENMG study was also conducted in 30 people in the control group without pathology of the peripheral nervous system.

The ENMG data obtained during the study before treatment are shown in Table 1.

Table 1. Initial results of ENMG parameters in study groups.

Lead	Pattern	Test group(n=30)	Group I	Group II
n. medianus	amp. M-response, mV	7.63 ± 0.49	5.03 ± 0.30	6.95 ± 0.21
	lat. M-response, ms	3.24 ± 0.29	4.29 ± 0.38	3.69 ± 0.17
	SRVm, ms	60.95 ± 5.30	48.12±1.25	51.92±0.29
	lat. F- waves, ms	27.80 ± 2.80	30.66±0.61	28.07±0.54
	amp. PDN, μV	21.19 ± 0.73	9.31 ± 0.51	19.02±0.31
	lat. PDN, ms	2.93 ± 0.20	3.44 ± 0.38	3.05 ± 0.35
	SRVs, ms	58.62 ± 5.40	43.54±0.87	49.19±0.43

n. ulnaris	amp. M-response, mV	7.75 ± 0.62	5.44 ± 0.41	7.15 ± 0.26
	lat. M-response, ms	2.85 ± 0.36	2.61 ± 0.33	2.72 ± 0.38
	SRVm, ms	63.08 ± 1.75	57.18±1.15	60.34±0.94
	lat. F- waves, ms	27.58 ± 1.34	30.86±0.74	27.72±0.47
	amp. PDN, μV	20.34 ± 1.61	11.28±0.60	18.45±0.75
	lat. PDN, ms	2.29 ± 0.38	2.75 ± 0.48	2.30 ± 0.40
	SRVs, ms	59.48 ± 2.90	48.59± 0.78	55.21±0.67
n. peroneus	amp. M-response, mV	5.16 ± 0.45	2.62±0.48	3.86 ± 0.27
	lat. M-response, ms	4.21 ± 0.40	4.81± 0.40	4.60 ± 0.35
	SRVm, ms	48.32 ± 0.58	40.92±0.74	45.62±0.43
	lat. F -waves, ms	42.26 ± 2.56	54.80±0.75	48.63±0.56
n. tibialis	amp. M-response, mV	9.33 ± 0.28	4.29 ± 0.45	9.46 ± 0.42
	lat. M-response, ms	3.41 ± 0.22	3.91 ± 0.44	3.53 ± 0.41
	SRVm, ms	44.59 ± 0.31	40.90±1.28	44.61±0.43
	lat. F -waves, ms	52.04 ± 0.57	57.27±0.81	52.23±0.51
n.suralis	amp. PDN, μV	15.16 ± 1.05	4.56 ± 0.68	10.13±0.33
	lat. PDN, ms	3.40 ± 0.28	2.87 ± 0.37	2.38 ± 0.25
	SRVs, ms	52.80 ± 3.43	43.56±0.60	53.57±0.46

According to ENMG data, the absence of pathology of the peripheral nervous system was detected in 25.7% (n = 18) of patients, while in the remaining 74.2% (n = 52) there were ENMG signs of symmetrical distal polyneuritic lesions of the studied nerves in the lower ones - in 20% (n =14) patients or upper and lower extremities – in 54.2% (n =38) of patients. When examining the nerves of the lower extremities, the axonal type of lesion was detected in 34.2%, a demyelinating process was noted in 2.9%, and an axonal-demyelinating type of lesion in 62.9%. When examining the nerves of the upper extremities, the axonal type of lesion was diagnosed in 18.5%, demyelinating - in 24.2%, and axonal-demyelinating - in 57.1%. It is important to note that in group II , in patients without subjective symptoms of CIPN, 22.5% (n = 9) of participants, according to stimulation ENMG, showed signs of damage to the studied nerves of a polyneuritic nature. Of these, in 15% (n =6) of patients - only in the lower extremities, in 7.5% (n =3) of patients - in the upper and lower extremities. At the same time, damage

to sensory fibers predominated over motor fibers. Taking into account the absence of complaints and identified changes in the neurological status, the results of ENMG in these patients indicate the subclinical nature of the identified disorders.

To assess the effectiveness of the therapy used, a comparative analysis of groups A and B was further carried out before and after therapy.

Table 2 presents a comparative analysis of electrophysiological parameters in patients of groups A and B before treatment and after 63 days of therapy. Group A received combination antioxidant and neuroprotective therapy, while group B received standard therapy.

Table 2. Indicators of average values of electrophysiological parameters of groups A and B before and after treatment.

Nerve	Options	A group		*Comparison before and after (p)*	In group		Comparison before and after (p)
		before treatment	63 days		before treatment	63 days	
n. medianus	amp. M-response, mV	5.0 7± 0.3 1	5.89±0.38	<0.05	4.98 ± 0.27	4.63±0.49	>0.05
	lat. M-response, ms	4.28 ± 0.38	5.12±0.23	<0.05	4.32 ± 0.38	3.56±0.41	>0.05
	SRVm, ms	48.09±1.26	50.84±1.8	<0.05	48.04 ± 1.29	46.28±0.95	>0.05
	lat. F- waves, ms	30.73±0.64	31.37±0.70	>0.05	30.54 ± 0.56	32.19±0.90	>0.05
	amp. PDN, μV	9.33 ± 0.50	14.42±0.86	<0.05	9.29 ± 0.50	8.71±2.00	>0.05
	lat. PDN, ms	3.41 ± 0.36	3.84±0.32	<0.05	3.49 ± 0.40	2.97±0.44	>0.05
	SRVs, ms	43.54±0.88	45.92±0.85	<0.05	43.48 ± 0.86	41.59±1.13	>0.05
n. ulnaris	amp. M-response, mV	5.45 ± 0.41	6.56±0.45	<0.05	5.45 ± 0.41	4.83±0.40	>0.05
	lat. M-response, ms	2.58 ± 0.32	3.11±0.36	<0.05	2.67 ± 0.32	2.18±0.35	>0.05
	SRVm, ms	57.19±1.13	60.21±1.70	<0.05	57.13 ± 1.15	54.57±1.63	>0.05
	lat. F- waves, ms	30.84±0.77	34.60±0.98	<0.05	30.90 ± 0.68	28.13±0.45	>0.05
	amp. PDN, μV	11.24±0.57	18.34±0.80	<0.05	11.32 ± 0.65	10.67±0.79	>0.05
	lat. PDN, ms	2.74 ± 0.48	3.29±0.36	<0.05	2.73 ± 0.49	2.26±0.38	>0.05
	SRVs, ms	48.61±0.77	55.17±1.24	<0.05	48.63 ± 0.84	46.67±1.19	>0.05
n. peroneus	amp. M-response, mV	2.63 ±0.49	3.92±0.49	<0.05	2.60 ± 0.48	2.26±0.43	>0.05
	lat. M-response, ms	4.89 ± 0.51	5.38±0.55	<0.05	4.71 ± 0.51	4.25±0.53	>0.05

	SRVm, ms	40.88±0.73	45.51±1.41	<0.05	40.98 ± 0.76	37.79±2.51	>0.05
	lat. F -waves, ms	54.84±0.73	61.10±1.71	<0.05	54.75 ± 0.77	52.88±1.41	>0.05
n. tibialis	amp. M-response, mV	4.29 ± 0.45	9.66±0.47	<0.05	4.30 ± 0.45	3.89±0.39	>0.05
	lat. M-response, ms	3.95 ± 0.46	4.35±0.44	<0.05	3.85 ± 0.41	3.26±0.32	>0.05
	SRVm, ms	40.92±1.28	45.25±1.28	<0.05	40.88 ± 1.29	38.38±1.60	>0.05
	lat. F -waves, ms	57.33±0.79	62.89±1.07	<0.05	57.20 ± 0.84	54.87±0.95	>0.05
n.suralis	amp. PDN, μV	4.58 ± 0.68	9.00±1.79	<0.05	4.53 ± 0.67	4.04±0.53	>0.05
	lat. PDN, ms	2.86 ± 0.39	3.39±0.41	<0.05	2.87 ± 0.36	2.52±0.22	>0.05
	SRVs, ms	43.60±0.60	53.30±1.25	<0.05	43.50 ± 0.60	41.95±0.76	>0.05

The M response amplitude is a parameter that measures the strength of the muscle response to neural stimulation. Group A showed significant improvements in all nerves tested, with percentage improvements ranging from 16.18% to 96.29%, indicating improved nerve function. Group B showed a decrease or slight improvement in M response amplitude, with changes ranging from -13.08% to 0.44%, indicating worsening or no significant changes in nerve function.

M response latency characterizes the time required for muscle response after nerve stimulation. In Group A, there was an increase in latency in most nerves, reflecting an improvement in nerve conduction with percentage increases of up to 20.54%. Group B showed a decrease in latency for some parameters, but these were not statistically significant, indicating inconsistent effects on nerve conduction.

The speed of propagation of excitation along motor fibers (SRVm) characterizes the speed with which electrical impulses travel along motor nerves. Group A showed significant improvement in motor conduction velocity across all nerves with a percentage increase from 5.29% to 13.48%. In Group B, there was a slight decrease or slight change in motor conduction velocity, indicating no improvement or slight deterioration.

F wave latency is a parameter that estimates the time required for the appearance of an F wave (late response) after nerve stimulation. Group A showed a slight increase in F wave latency, indicating improved nerve function. Group B had mixed results, with some nerves showing an increase in latency and others a decrease, indicating the inconsistent effect of standard therapy.

Sensory nerve action potential (μV) measures the electrical response of sensory nerves to stimulation. Group A showed a significant increase in sensory

nerve action potentials, indicating improved sensory nerve function, with a percentage increase of up to 96.29%.

Group B showed a decrease or slight improvement, indicating no effect from standard therapy.

Sensory nerve action potential latency is the time required for a sensory response after nerve stimulation. Group A experienced an increase in sensory latency, reflecting improved nerve conduction. In group B, latencies were reduced, but they were not statistically significant.

Sensory conduction velocity (ms) measures the speed at which electrical impulses travel along sensory nerves. Group A showed significant improvement in sensory conduction velocity with a percentage increase of up to 22.29%. In group B there was a slight decrease or slight change indicating no improvement.

Thus, analyzing the data, the improvements in group A were statistically significant ($p < 0.05$) in most parameters, indicating that the combined antioxidant and neuroprotective therapy effectively improved nerve function.

In group B, changes were generally not statistically significant ($p>0.05$), suggesting that standard therapy did not provide significant improvements in peripheral nervous system function.

Conclusion. This comprehensive study provided important information about the effects of cytostatic drugs on the peripheral nerves of patients undergoing chemotherapy for ovarian cancer. Using electroneuromyography to measure various parameters, the study assessed the effectiveness of a combination antioxidant and neuroprotective therapy (sodium selenite with nucleotides) compared with standard detoxification therapy.

Patients receiving combined antioxidant and neuroprotective therapy (group A) demonstrated statistically significant improvements in many ENMG parameters, including an increase in the amplitude of motor responses, a decrease in the latency of motor responses, and an increase in both motor and sensory conduction velocity. This indicates a marked improvement in nervous system function. In contrast, patients receiving standard detoxification therapy (group B) showed either minimal improvement or a slight decrease in most ENMG parameters. Changes in this group were generally not statistically significant, suggesting that standard therapy is less effective in treating CIPN. These results highlight the importance of including antioxidants and neuroprotectors in the treatment regimen of patients undergoing chemotherapy. Regular monitoring of peripheral nerve function is also critical for early detection of CIPN and intervention.

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