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## DİSSİRKULYATOR ENSEFALOPATİYALI XƏSTƏLƏRİN AMBULATOR TİBBİ REABİLİTASIYASI ZAMANI FİZİKİ MÜALİCƏ AMİLLƏRİNİN İSTİFADƏ EDİLMƏSİNİN EFFEKTİVLİYİ

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**Xülasə.** Məqalədə dissirkulyator ensefalopatiyalı xəstələrin fiziki müalicə amilləri vasitəsilə müalicəsinin ambulator mərhələsində tibbi reabilitasiyanın effektivliyini aydınlaşdırmaq məqsədilə aparılmış tədqiqat işi haqqında məlumat verilmişdir.

I mərhələdə dissirkulyator ensefalopatiyası olan 90 xəstə üzərində müşahidə aparılmış, xəstələr 3 qrupa bölünmüşdür: 1) kontrol qrupda xəstələr standart farmakoterapiya (xolin-alfosserat, asetil- karnitin) almışlar; 2) müayisə qrupuna daxil edilmiş xəstələrə əlavə olaraq yod-brom vannası təyin edilmişdir; 3) əsas qrupda isə xəstələrə müqayisə qrupundakı müalicədən başqa, dəyişən impulsu aşağı tezlikli və yüksək tezlikli elektrostatik sahənin təsiri təyin edilmişdir (dərindən ossilyasiya və ya "Xivamat-terapiya" methodu. Müalicənin effektivliyi neyropsixoloji göstəricilərin, beyin hemodina- mikasının, lipid mübadiləsinin və həyat keyfiyyəti əlamətlərinin müşahidə edilməsi əsasında qiymətləndirilmişdir.

Reabilitasiyaedici müalicənin yaxın və uzaq dövrlərində əldə edilmiş klinik, biokimyəvi və neyrofizioloji göstəricilərin statistik təhlilindən aydın olmuşdur ki, müalicə prosesinə ambulator (3-cü mərhələ) tibbi reabilitasiya üsulunun əlavə edilməsi orqanizmin pozulmuş funksiyasının - psixosomiyal statusun, kognitiv funksiyaların, beyində qan cərəyanının, lipid mübadiləsi göstəricilərinin yaxşılaşmasına şərait yaradır və bunun nəticəsində xəstələrin həyat keyfiyyəti də əhəmiyyətli dəyişikliklərə uğrayır.

**Açar sözlər:** dissirkulyator ensefalopatiya, tibbi reabilitasiya, yod-brom vannaları, dərindən ossilyasiya üsulu

**Key words:** *dyscirculatory encephalopathy, medical rehabilitation*, *iodobromic baths, deep oscillation technique - Hiwamat Therapy*

**Key words:** *dyscirculatory encephalopathy, medical rehabilitation, iodine-bromine baths, deep oscillation method - "Hivamat-therapy"*

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**EFFECTIVENESS OF THE USE OF PHYSICAL THERAPEUTIC FACTORS IN  
OUTPATIENT MEDICAL REHABILITATION OF PATIENTS  
WITH DYSCIRCULATORY ENCEPHALOPATHY**

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*This article presents the results of a study conducted to evaluate the effectiveness of medical rehabilitation of patients with dyscirculatory encephalopathy in the outpatient phase using physical therapeutic factors.*

*We observed 90 patients with stage I dyscirculatory encephalopathy who were randomly allocated into 3 groups: control, where patients received standard pharmacotherapy (choline alfoscerate, acetylcar-nitine); comparison - where patients were additionally prescribed iodobromine baths and the main, where in addition to treatment in the comparison group patients received variable pulsed low frequency electrostatic field of high intensity (method of deep oscillation - "Hiwamat-therapy"). The effectiveness was monitored by: dynamics of neuropsychological parameters, cerebral hemodynamics, lipid metabolism, assessment of quality of life.*

*Statistical analysis of clinical, biochemical, neurophysiological indicators in the immediate and distant periods after rehabilitation treatment showed that inclusion of physical therapeutic factors in the programs of the 3rd /ambulatory/ stage of medical rehabilitation provides reliable significant ( $p < 0.05$ ) improvement of impaired body functions (psychoemotional status, cognitive functions, brain blood flow, lipid exchange), which results in a significant improvement of life quality. The results we obtained are consistent with the data of domestic and foreign researchers dealing with physical and rehabilitation medicine.*

Cerebrovascular diseases remain an important socially significant pathology. Therefore, despite the achievements of domestic and foreign medicine, the search for new effective methods of prevention, treatment and rehabilitation for the prevention of acute and transient cerebral blood disorders continues [1, 2]. The main directions of

The treatment of this category of patients includes: improvement of cerebral perfusion, correction of cognitive disorders, emotional and behavioural disorders [3, 4]. At the same time, it is known that treatment and rehabilitation measures in the initial forms of the disease significantly delay the development of cognitive and behavioural, motor

(including vestibuloatactic), as well as cerebro-hypertensive disorders [2].

A special role in the treatment of early forms of cerebrovascular disease is assigned to non-medicinal therapies. Scientists of the Pyatigorsk Research Institute of Balneology have proved that the inclusion of physical therapeutic factors in the programs of sanatorium-resort treatment and medical rehabilitation for various chronic pathologies, including cerebrovascular ~~dise~~, provides a significant increase in therapeutic effectiveness [6-8]. Thus, the study of E.V. Vlaminirsky et al. (2019) showed that the combined use of pharmacopreparates and sulfide balneotherapy in patients with dyscirculatory encephalopathy has a positive effect on neuroprotective processes, providing improvement of the patients' cognitive status [9]. A number of authors have shown a regulatory effect of iodine-bromine balneotherapy on cerebral blood supply, psychoemotional status, and adaptation processes in patients with dyscirculatory encephalopathy [10-12].

In recent years, new physiotherapeutic techniques have been developed, including pulsed low-frequency electrostatic fields with proven analgesic, antispastic and anti-edema effects as well as a positive effect on tissue trophism [13, 14].

In order to optimise treatment and rehabilitation measures for cerebro-vascular diseases, it is of interest to study the use of these physical therapeutic factors in rehabilitation programmes for this patient on an outpatient basis.

The aim of this study was to evaluate the effectiveness of medical rehabilitation of patients with dyscirculatory encephalopathy at the outpatient stage using physical therapeutic factors.

**Material and methods of investigation.** In an open, randomized, prospective, controlled study at City Clinical Hospital <sup>1</sup> of Krasnodar there were examined 90 patients with dyscirculatory encephalopathy of stage I, aged 40-65 years (mean age 58.4±4.4). The study involved 90 patients aged 40-65 years (mean age 58.4±3.46 years) with stage I dyscirculatory encephalopathy. Criteria for inclusion in the study: patients with stage I dyscirculatory encephalopathy; age from 40 to 65 years; arterial hypertension of stage I; dyslipidemia, mild to moderate cognitive disorders, informed voluntary consent; consent to processing of personal data. Inclusion criteria: demyelinating diseases; dementia and other psychiatric diseases; history of acute and transient cerebral circulation disorders and acute coronary syndrome; somatic diseases in acute phase. Exclusion criteria: refusal to participate in the study; exacerbation of concomitant chronic diseases.

Patients were randomly divided into three clinical groups statistically comparable in age, sex, severity and duration of the disease, main clinical manifestations, and neurological status, which suggests the validity of their comparison when comparing treatment groups. In the control group, 30 patients received treatment in accordance with clinical guidelines on the background of modifiable risk factors correction: regular physical aerobic exercise (10,000 steps, 5 times a week), cognitive training (3 times a week, for 30 minutes), neurometabolic pharmacotherapy - choline alphoscerate (gliatilin) 400 mg, 2 capsules in the morning and 1 capsule at lunch and acetylcar-nitine (carnitine) 295 mg, 1 capsule 3 times a day. The control group included 30 patients who took additional baths with iodine-bromine water (I - 10 mg/l, Br - 30 mg/l, temperature - 36-37°C, exposure - 10-15 minutes, for the course - 12 baths, every other day). In the main group of the patients, in addition to treatment in the comparison group, 30 patients received physiotherapy: alternating pulsed low-frequency electrostatic field of high intensity using "Hivamat-200" apparatus (Germany) - deep oscillation method (pulsed low-frequency electrostatic field - Hivamat-therapy) on suboccipital, sinocarotid and "collar" zones, applied with a hand applicator of 15 to 15 Hz. 160 Hz, with a ratio of im-

The pulse and pause time is 1:1 (mode 3), with an intensity of 50% and a duration of 15 minutes, 12 treatments, every other day. The course of medical rehabilitation was 6 weeks.

To control the efficiency of the medical rehabilitation, the patients underwent hemodynamic studies of the brachiocephalic arteries and veins by ultrasound Dopplerography on the ULTIMA Pro device (Ukraine). Lipid profile was assessed according to the level of total cholesterol, triglycerides, high and low density lipoproteins. Mini-Mental State Examination, Montreal Cognitive Assessment and Hospital Anxiety and Depression Scale were used to analyze the cognitive status and psychological state of patients. The patients' quality of life was assessed using the Health Status Survey SF-36. Long-term follow-ups were studied after 12 months.

STATISTICA 10.0 software was used for statistical processing of the study results. Data were compared using nonparametric Wilcoxon criterion. The results are presented as mega-diane, lower and upper quartiles, the level of statistical significance is  $p < 0.05$ .

**Results and discussion.** The positive evaluation of clinical neurological manifestations before and after the rehabilitation measures showed the following,

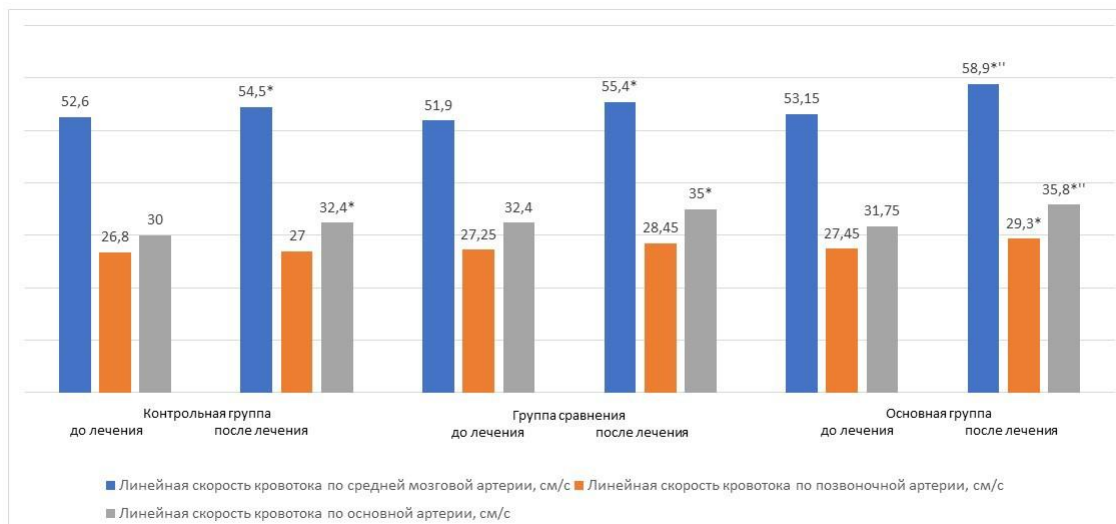
In the main group the use of iodine-bromine baths and "Hiwamat-therapy" on the background of neuroprotective pharmacotherapy resulted in an average improvement rate of 76.4%, which was significantly ( $p < 0.05$ ) higher than in the control group in 53.7% of the scales "Cranialgia", "Vestibuloataxia" and "Cognitive disorders" (Table 1). In the comparison group, neurological phenomena were reduced in 66.9% of cases.

When physical therapeutic factors were included into the rehabilitation programmes, there was a significant improvement of cerebral blood supply, as shown in Figure 1: Significant increase of the linear velocity of the blood flow (at the initial indicators that correspond to the conventional age-standard values in both carotid and vertebro-basilar basins) according to ultrasound Doppler sonography data along the middle cerebral artery was registered in 22% of the control group patients, in 26% of the control group patients and in 40% of the main group patients; Blood flow along the vertebral artery improved in 23% of the control group patients, 27% of the control group patients and 33% of the main group patients; an increase in the linear velocity of blood flow along the main artery was registered in 23% of the patients in the comparison group.

**Table 1.** Dynamics of neurological syndromes in patients with stage I dyscirculatory encephalopathy

Indicators	Control group, n=30		Comparison group, n=30		Main group, n=30	
	Until abs. (%)	after abs. (%)	Until abs. (%)	after abs. (%)	Until abs. (%)	after abs. (%)
Cranialgia	28 (93,3%)	12 (40%)*	28 (93,3%)	8 (26,7%)*	29 (96,7%)	6 (20%)*"
Vestibuloatak-See	25 (83,3%)	14 (46,7%)*	25 (83,3%)	11 (36,7%)*	26 (86,7%)	8 (26,7%)*"
Intracranial hypertension	14 (46,7%)	9 (30%)	14 (46,7%)	7 (23,3%)	14 (46,7%)	5 (16,7%)*
Cerebrasthenia	29 (96,7%)	10 (33,3%)*	29 (96,7%)	7 (23,3%)*	30 (100%)	5 (16,7%)*
Cognitive violations	27 (90%)	12 (40%)*	28 (76%)	8 (26,7%)*	28 (76%)	6 (20%)*"

Note: Significance of differences before and after treatment \* -  $p < 0.05$ ; between main and control group " -  $p < 0.05$ .



**Figure 1.** Dynamics of basic Doppler blood flow in patients with stage I dyscirculatory encephalopathy

*Note: Significance of differences before and after treatment \* -  $p < 0.05$ ; between the main and control groups ' -  $p < 0.05$ .*

The patients in the control group, 27% in the comparison group and 30% in the main group.

The rehabilitation treatment had a significant positive effect on the psychological testing indicators (Table 3). Improvement of cognitive functions (attention, concentration, orientation, ~~only~~ **only** functions) averaged 31.4% ( $p < 0.01$ ) in 90% of cases in the main group under the influence of the conducted treatment, whereas in the comparison group improvement was registered in 77% of cases by 21.5% ( $p < 0.05$ ), in the control group positive tendency was observed in 77% of patients.

The calculation of statistical indices of the State Anxiety and Depression Scale demonstrated a decrease in personality and response anxiety: by 14.3% in the control group ( $p < 0.05$ ), by 14.5% in the comparison group and by 31.5% ( $p < 0.05$ ) in the main group.

A quality-of-life study was conducted to confirm the long-term effectiveness of the therapy, which showed an improvement in physical and mental health across

The scales in the main group and comparison group were statistically significantly higher than those of the control group. The increase of total physical health index in the main group patients was 20% ( $p < 0,05$ ), in the comparison group - 14%, psychological health - 41% ( $p < 0,05$ ) and 38% ( $p < 0,05$ ), respectively, with a clear tendency to improve these parameters in the comparison group (Table 2).

**Discussion.** The study once again states that the inclusion of natural and preformed physical factors in treatment and rehabilitation programmes contributes to the optimisation of therapeutic measures. The use of adequate pharmacotherapy, which has a normalising effect on the blood supply and metabolism of the brain - (choline alfoscerate - gliatiline and acetylcarnitine - carnitine), helped to improve cognitive functions (visual-constructive / ~~executive~~ **executive** skills, delayed reproduction, attention, orientation). Iodobromic baths, providing normalisation of inhibitory-excitatory processes in the brain cortex, stimulation of reparative regeneration processes contributed to

**Table 2.** Dynamics of psychological testing in patients with stage I dyscirculatory encephalopathy

Indicators (M, min-max)	Control group, n=30		Comparison group n=30		Main group n=30	
	Until	after	Until	after	Until	after
<b>Montreal Cognitive Test</b>						
Visually constructive / executor-available skills	4,2 [4,0-4,8]	4,5 [4,2-4,9]*	4,4 [4,2-4,8]	4,8 [4,1; 4,9]*	4,1 [4,0; 4,7]	4,9 [4,8;5,0]*
Deferred playback	3,1 [2,8-3,8]	3,5 [3,1-4,3]	3,0 [2,9-3,7]	4,1 [2,9-4,7]*	3,1 [3,04-4,2]	4,8 [4,1-4,9]* "
Attention	4,1 [3,3-4,4]	5,2 [4,1-5,5]*	4,0 [3,5-4,7]	5,4 [4,7-5,6]*	4,2 [3,8-4,8]	5,8 [4,9-6,0]*
Orientation	5,2 [4,4-5,5]	5,5 [5,1-5,6]	5,0 [4,7-5,2]	5,3 [5,0-5,7]	5,1 [4,8-5,3]	5,8 [5,2-6,0]*
<b>Hospital Anxiety and Depression Scale</b>						
Personal anxiety	48,0 [47,0-49,0]	40,0 [40,0-2,0]*	50,0 [48,0-50,0]	43,0 [42,0-44,0]*	48,5 [48,0-52,0]	30,0 [29-32,0] **
Reactive anxiety	50,0 [49,0-52,0]	44,0 [40,0-48,0]*	51,0 [50,0-52,0]	44,0 [42,0-46,0]*	51,0 [50,0-52,0]	38,5 [38,0-40,0]**
<b>Health Status Survey SF-36 Quality of Life Questionnaire</b>						
The total amount of measuring physical health	44,5 [43,1-45,8]	48,2 [46,4; 48,8]*	42,8 [40,9-44,1]	48,9 [46,6-49,4]*	42,9 [41,5-49,8]	51,7 [46,7-55,4]*
The total mental health measure vi	33,9 [31,9-35,1]	43,4 [41,1; 45,4]*	34,7 [32,2-34,3]	47,9 [42,9-48,1]*	34,5 [31,9-35,1]	48,7 [44,9-50,1]*

Note: Significance of differences before and after treatment \* -  $p < 0.05$ ; between the main and control groups " -  $p < 0.05$ .

improvement of patients' psycho-emotional status. Application of Hiwamat-therapy (deep oscillation method) based on an alternating electrostatic field in patients with dyscirculatory encephalopathy improved cerebral perfusion due to sympatholytic effect on neuromuscular structures, cervical nodes and plexi, and reduction of venous dysge-mia.

Our findings æ consistent with those of other researchers in the field of physical and rehabilitative medicine. Positively

The positive influence of Hiwamat-therapy (pulsed low-frequency electrostatic field) on various pathogenetic mechanisms of chronic ~~infectious~~ diseases in children was found in the work of Razumov A.N. et al. (2019). At the same time, the authors explain the improvement of general physical performance in children even in the long-term observation period by the improvement of tissue blood flow and blood supply under the influence of Hiwamat-therapy [16]. In the study J. Ziemska et al. (2019) report high therapeutic efficacy of balneotherapy, especially when combined with

climate therapy, manifested by a reduction in the duration of treatment [17]. S. Cheleschi et al. (2020) determined the anti-inflammatory, antioxidant, chondroprotective and immunosuppressive effects of sulphide balneotherapy at the cellular level (effects on keratinocytes, chondrocytes and peripheral blood cells) in musculoskeletal and skin pathologies in an experiment [18].

On the whole, the high effectiveness of the developed method of medical rehabilitation of patients with stage I dyscirculatory encephalopathy is, firstly, due to the integration of pharmacological and biological effects of therapeutic factors, secondly - their ability to influence several pathogenetic mechanisms of the pathological process, thirdly - by strengthening under their influence the pharmacological potential of the drugs and fourthly - by a mini

The treatment of the patients with dyscirculatory encephalopathy has been delayed. This is especially true in older age groups with comorbid pathology, which includes the cohort of patients with dyscirculatory encephalopathy we observed.

Thus, the developed treatment complex provides reduction of vestibuloatactic, liquor-hypertensive, cognitive and anxiety-depressive disorders, improvement of cerebral perfusion in patients with dyscirculatory encephalopathy, resulting in significant improvement of their quality of life. Inclusion of physical therapeutic factors into medical rehabilitation programmes for patients with stage I dyscirculatory encephalopathy at the out-patient stage contributes to significant improvement of the rehabilitation efficiency.

*The authors declare that there is no conflict of interest.*

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#### **EFFICIENCY OF USE OF PHYSICAL TREATMENT FACTORS IN AMBULATORY MEDICAL REHABILITATION OF PATIENTS WITH DISCIRCULATORY ENCEPHALOPATHY**

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**Summary.** The article presents the results of a study carried out to assess the effectiveness of medical rehabilitation of patients with discirculatory encephalopathy at the outpatient stage using physical therapeutic factors.

90 patients with stage I discirculatory encephalopathy were observed. They were randomly assigned into 3 groups: the control group, where the patients had a standard pharmacotherapy (choline alfoscerate and acetyl carnitine ); the group of comparison where the patients were additionally prescribed iodine-bromine baths and the main group where in addition to the treatment in the group of comparison, the patients underwent an alternating pulsed low-frequency electrostatic field of high tension (deep oscillation method, "Hivamat-therapy"). The efficiency control was the dynamics of indicators of Doppler ultrasound, electroencephalography, lipid metabolism, psychological testing, and quality of life.

Statistical analysis of clinical, biochemical, neurophysiological indicators in the immediate and long-term periods after rehabilitation treatment showed that the inclusion of physical therapeutic factors in the programs of the third outpatient stage of medical rehabilitation provides a reliably significant ( $p < 0.05$ ) restoration of disordered body functions (psychoemotional status, cognitive functions, cerebral blood flow, lipid metabolism), the result of which is a significant improvement in the quality of life. The results obtained by us are consistent with the data of national and foreign researchers involved in physical and rehabilitation medicine.

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