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EXPERIENCE OF USING OZONE THERAPY IN THE COMPLEX REHABILITATION PROGRAM OF COMMUNITY ACQUIRED POLYSEGMENTAL PNEUMONIA ASSOCIATED WITH THE SARS-COV-2 VIRUS

ДОСВІД ЗАСТОСУВАННЯ ОЗОНОТЕРАПІЇ В КОМЛЕКСНІЙ ПРОГРАМІ РЕАБІЛІТАЦІЇ НЕГОСПІТАЛЬНОЇ ПОЛІСЕГМЕНТАРНОЇ ПНЕВМОНІЇ, АСОЦІЙОВАНОЇ З ВІРУСОМ SARS-COV-2

Baranova I. V.
Candidate of Medical Sciences, Associate Professor,
Associate Professor at the Department of Physical and Rehabilitation Medicine
National Pyrogov Memorial Medical University
Vinnytsia, Ukraine

Баранова І. В.
кандидат медичних наук, доцент,
доцент кафедри фізичної та реабілітаційної медицини
Вінницький національний медичний університет імені М. І. Пирогова
м. Вінниця, Україна

Iliuk I. A.
Candidate of Medical Sciences, Associate Professor,
Associate Professor at the Department of Internal Medcine № 2
National Pyrogov Memorial Medical University
Vinnytsia, Ukraine

Ільюк І. А.
кандидат медичних наук, доцент,
доцент кафедри внутрішньої медицини № 2
Вінницький національний медичний університет імені М. І. Пирогова
м. Вінниця, Україна

Postovitenko K. P.
Candidate of Medical Sciences, Associate Professor,
Associate Professor at the Department of Physical and Rehabilitation Medicine
National Pyrogov Memorial Medical University
Vinnytsia, Ukraine

Постовітенко К. П.
кандидат медичних наук, доцент,
доцент кафедри фізичної та реабілітаційної медицини
Вінницький національний медичний університет імені М. І. Пирогова
м. Вінниця, Україна

***Problem statement*:** According to international standards, patients who recover from COVID-19 and have long-term impaired lung function 6–8 weeks after discharge from the hospital should undergo a comprehensive pulmonary rehabilitation program [1, p. 189]. Ozone therapy is the method of pulmonary rehabilitation, which can have a positive effect on the links of the post-COVID syndrome [2, p. 2946].

The aim of the work is to analyze the effectiveness of intravenous ozone therapy in patients with a long course of COVID-19 who had community-acquired polysegmental pneumonia associated with the SARS-Cov-2 virus.

Methods and Materials: 50 people were involved in the study, who were undergoing rehabilitation after community-acquired polysegmental pneumonia associated with the SARS-Cov-2 virus at the municipal institution "City Clinical Hospital № 2" of the city of Vinnytsya. The age of the patients was 41-82 years. According to X-ray and CT-study (during diagnosis), all patients had signs of viral lung disease 40% to 80% respiratory surface area, CO-RADS 4, 5. Patients were assessed for subactive (determination by G. Borg scales, PCFS) and objective (acid saturation, C-reactive protein, feritin, D-dimer, sechovin and creatinine, 6-minute walk test) changes in dynamics (by 1, 10, 20 day of the course treatment).

At the beginning of treatment, patients complained of shortness of breath, weakness, decreased tolerance to physical exertion and work capacity, insomnia or disturbed sleep phases, and emotional lability. The level of SpO2 during physical load (walking along the corridor – 90.0 ± 1.7%) and at rest (93.0±1.2%), the degree of dyspnea was 4.3±1.0 points. The results of the survey of patients on PCFS showed a moderate decrease in vital activity (2 points) 18% of respondents and a significant limitation of conventional daily functions in 82%. Residual signs of blood inflammation were registered in 86% of patients: relative lymphocytosis (42 ± 4%), increased ESR (21 ± 8 mm/h), C-reactive protein (CRP – 1.05±0.26 mg/dl; norm – 0.0-0.5 mg / dl), ferritin women – 324 ± 48) ng / ml, the norm is 159 ng / ml; men – 743 ± 67 ng / ml, the norm is 28–397 ng / ml). The D-dimer level remained moderately high (703 ± 143 ng/mL, normal <443 ng/mL). The glomerular filtration rate was normal.

The course of rehabilitation treatment was started on 28 ± 5 days after the diagnosis of acute respiratory disease COVID-19 according to current clinical protocols of the Ministry of Health of Ukraine No. 762 (updated December 31, 2020) and No. 771 dated April 20, 2021.

The patients were divided into 2 groups (main and control). The groups were represented according to the age, gender, and severity of the disease. The patients of the main group (n = 25) were additionally prescribed combined intravenous ozone therapy (introduction of 200 ml of ozonized 0.9% NaCl solution with a concentration of 20 mg/ml, alternated with the introduction

100 ml of ozonized 0.9% NaCl solution, saturated with the patient's blood (100 ml) with concentration of 30 mg/ml). The rate of introduction of solutions the same – 60–80 dr/min, the course of treatment – 10 procedures. The dose of a single introduction of ozone was 150 mg, and the total for the course of treatment is 1500 mg, which corresponded recommended therapeutic range [3, p. 410]. Saturation of physiological solution with an oxygen-ozone mixture was carried out on a certified ozone therapy device "Ozon UM-80" (Ukraine, registration Ministry of Health of Ukraine № 326 dated May 13, 2009). Statistical evaluation of the data was performed using the Statistica 6.1 program (StatSoft Inc., license No. BXXR901E245722FA).

Results: After 10 days from the start of the treatment 50% of the people in the main group were maintained shortness of breath of a moderate and minor degree (2.8 ± 0.5 points), in the control group – 3.4 ± 0.6 points ($p < 0.05$). But on the 20th day of the treatment data on the G. Borg scale have changed and likely differed in patients with different rehabilitation programs (in the main group – 0.5 ± 0.2 points, in the control group – 2.5 ± 0.3 points, $p < 0.01$). The level of SpO2 at rest almost recovered in all patients after the course of treatment and amounted to 98.0±0.9% in individuals the main group and 95.0 ± 1.6% in patients of the control groups. The probable difference ($p<0.01$) was established for these indicators of patients from the comparison groups after physical exercise (according to the 6-minute walk test) on the 20th day of treatment. At the end of the course of the treatment, normalization SpO2 after exercise recorded at 85% patients of the main group and 25% of persons from the control group ($p<0.01$). In the subjects of the main group, the CRP index decreased by 85% of the initial, and in the comparison group – by 60%. After therapy all patients of the main group had the normal level of CRP , in contrast to single cases of its normalization in the control group. Patients of the main group revealed: level of ferritin decreased by 54% women and 50% men, and the level of D-dimer – by 48%. Complete recovery of coagulation parameters blood properties were observed in 16 people of the main group after a course of ozone therapy and in 8 people after treatment according to the protocol in the control group. Analysis of X-ray data after completion of various treatment regimens showed decrease in the percentage of lung tissue compaction zones in all patients.

At the end of the study 52% patients of the main group had a free gait (without weakness and shortness of breath) at a moderate pace for a fixed time interval. In the control group a similar result was recorded only in 10% of cases. On 20 th day of the study average distance covered by patients the main group was longer (520 ± 30 m) than in the control group.

Conclusions: Application of the course of ozone therapy proposed method (combination of administration of ozonized saline and ozonized saline, bloodsaturated patient) in complex rehabilitation patients after community-

acquired pneumonia associated with SARS-Cov-2 contributes to decreased activity scores inflammatory process (85% of patients), full recovery exercise tolerance (52% of patients) and improved well-being (95% of patients) compared with probably lower results of purely medicinal treatment (respectively 60%, 10% and 24% of patients).

Method showed probable effectiveness on subjective and objective criteria for assessing the condition of patients ($p<0.01$).

Based on the analysis of the results, we can assume: ozone therapy used in the proposed method has a positive effect on the level of C-reactive protein, ferritin and D-dimer, reflecting a decrease activity of the inflammatory process and the normalization of the coagulation properties of the blood.

A feature of the proposed approach to rehabilitation is the diverse impact on links of the pathogenetic process, the absence of drug overload of patients and a small amount contraindications. This program of recovery of the body after COVID-19 is economically justified as a result faster improvement of physical tolerance loading and low cost.

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