APPROVED BY:
Chief Medical Officer
State Autonomous Health Care Institution "Kazan War Veterans Hospital", Ministry of Health of the Republic of Tatarstan

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I.A. Fakhrutdinov
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Report

"Application of Magnetic Field in Patients with Pneumonia Caused by the Coronavirus Infection"

Pneumonia caused by the new coronavirus infection, COVID-19, is characterized by such complications as cough, dyspnea, fatigue, sleep disorders, appetite disorders, etc. The search and implementation of new physical rehabilitation methods is an urgent task in modern medicine. One of the safest and most frequently recommended methods of treatment of pneumonia is low-frequency magnet therapy [A.A. Ushakov, 2009; G.N. Ponomarenko, 2016]. A number of authors in their work showed that low-frequency magnet therapy produces anti-inflammatory, anti-swelling, and sedative effects; improves microcirculation, accelerates the time of resorption of lesions caused by infiltrative changes [G.N. Ponomarenko, 2017; V.A. Epifanov, A.V. Epifanov, 2020].

Given the consequences of pneumonia caused by COVID-19 and manifested in the form of respiratory and psychoemotional disorders, it is extremely important to study the efficacy of low-frequency magnet therapy in patients who have suffered pneumonia caused by the new coronavirus infection.

The ***aim*** of the study was to evaluate the effectiveness of low-frequency magnet therapy in the complex medical rehabilitation of patients who had suffered pneumonia during the convalescence period.

Materials and Methods Since 05.06.2020, 52 patients diagnosed with "community-acquired pneumonia caused by the new viral infection, ДН 0-1, (J 16.8)" have been under medical supervision in the reformed Department of Medical Rehabilitation, which is now a day patient department for patients who have suffered pneumonia caused by COVID-19. Secondary diagnosis: Asthenic syndrome, associated with the new viral infection (G 93.3), registered during the convalescence period at the rehabilitation stage. The average age of the patients was 56.2 ± 1.1 years. All patients had a stable physical status when assessed using the Rehabilitation Routing Scale (RRS) (2.9+0.7 points). The developed study design was as follows: double-blind placebo-controlled method.

The following exclusion criteria were defined for the study: lack of rehabilitation potential; 4 and 5 points on RRS (six minute walk test= 150-300 m; exercise tests (bicycle exercise/spiroergometry) = 25-50 W/2-3.9 IU; the patient develops angina after walking from 100 to 500 m on a flat terrain or after walking one flight of ordinary steps at an average pace and under normal conditions; the patient needs physical assistance when performing everyday tasks: dressing, undressing, going to the toilet, eating, etc.); unstable physical and neurological status; severe intoxication, hyperthermic syndrome (body temperature over 37.0 °C); pO2 <95 %; stage II-III cardiopulmonary insufficiency, chronic kidney disease, or stage III or worse liver failure; severe rhythm and conduction abnormalities (multiple group and polytopic ventricular extrasystoles, complete heart block, tachysystolic form of atrial fibrillation), blood diseases; hemorrhagic syndrome, pulmonary bleeding and presence of blood in sputum; pneumothorax, suspected or present neoplasms in the area to be exposed; presence of a pacemaker and foreign metal bodies; psychoorganic syndrome; convulsive syndrome.

The patients were randomized into two groups: *Group I* (treatment Group; 30 subjects) — patients who, in addition to the standard therapy, on the 15th day after discharge from the hospital underwent low–frequency magnetotherapy with ALMAG-02 (Elamed, Russia). The coils of the device were placed along and across the area of the surface projection of the lungs and were regulating the exposure to the magnetic field; frequency — 50-100 Hz, exposure intensity — 20-30 MT, procedure duration — 10-20 minutes, a course of 15-20 daily procedures (15-30 minutes each). *Group II* (control group; 22 subjects) – patients who underwent low-frequency placebo magnetotherapy with ALMAG-02 (Elamed, Russia).

All subjects were given the standard therapy, including exposure to polarized light, ozone therapy, physical therapy, massage, and correction of psycho-emotional state. Patients of both groups were comparable in the following parameters: gender, age, baseline clinical picture, concomitant diseases, and type of standard treatment.

In order to objectively evaluate the treatment effect, the following clinical and instrumental methods and scales were used in accordance with the Temporary Clinical Recommendations of the Ministry of Health of the Russian Federation for Prevention, Diagnosis and Treatment of the New Coronavirus Infection, COVID-19, (version 7 dd 03.06.2020), Temporary Clinical Recommendations for Medical Rehabilitation after the New Coronavirus Infection (version 1.0 dd 21.05. 2020): spirometry with "MIR" spirograph (Italy), ECG, measurement of oxygen saturation in blood, chest expansion, rehabilitation routing scale (RRS), quality of life questionnaire (EQ-5D), Borg Rating of Perceived Exertion. All patients had relevant CT results at admission. The studies were conducted before and after the course of treatment.

The statistical analysis was performed using GraphPadPrism7 program on a personal computer running Microsoft Windows 10. The Wilcoxon signed-rank test was used to evaluate the statistical significance of the differences between the treatment and control groups before and after the treatment.

Findings Upon admission to the outpatient medical rehabilitation department on the base of a day hospital 1.9 % (1 subject) had no changes in CT scan (0); 17.3 % (9 subjects) of patients had mild disorders (CT-1); 53.8 % (28 subjects) had moderate disorders (CT-2); 26.9 % (14 subjects) had severe disorders (CT-3). On admission, 94.2 % (49 subjects) of patients complained of severe weakness, dry cough, decreased exercise tolerance; 88.5 % (46 subjects) of patients complained of irritability and sleep disturbances. The oxygen saturation was within the normal range (98.9±0.2) in all patients.

After the undergone complex medical rehabilitation with the low-frequency magnet therapy, patients from Group I (treatment) showed improvement in terms of weakness (86.7 %, 16 subjects), shortness of breath (76.7 %, 21 subjects), cough (80 %, 24 subjects), sleep disturbances (75.7 %, 25 subjects) (p=0.0016). Patients from Group II (control) also showed improvement in terms of weakness (72.7 %, 16 subjects), shortness of breath (36.3 %, 8 subjects), cough (54.5 %, 12 subjects), sleep disturbances (63.6 %, 14 subjects) (p=0.34).

According to the mMRC (MedicalResearchCouncil) Dyspnea Scale, patients from Group I (treatment) showed a decrease in the severity of dyspnea by 56.0 % (before treatment: 2.0±0.3 points; after treatment: 0.88±0.2 points; p=0.0034); in Group II (control), the obtained results were not statistically significant (before treatment: 2.1±0.2 points; after treatment: 1.9±0.1 points; p=0.012). According to the results of spirometry patients from Group I (treatment) showed improved vital capacity of the lungs (by 16.4 %) (before treatment: 2.49±0.4 l; after treatment: 2.98±0.2 l; p=0.0026); in Group II (placebo-control) — by 1.6 % (before treatment: 2.51±0.3 l; after treatment: 2.55±0.1 l; p=0.31). It should be noted that patients from Group I (treatment) showed a 45.6% increase in chest excursion (before treatment: 2.58±0.5 cm; after: 4.74±0.3 cm; p=0.0006), patients from Group II (control) – a 17.4% increase (before treatment: 2.47±0.6 cm; after: 2.9±0.2 cm; p=0.26).

According to the results of evaluation of the patients' exercise tolerance using the Borg Rating of Perceived Exertion, patients from Group I (treatment group) showed a 64.0 % improvement in the level of dyspnea — from moderate to mild (before treatment: 3.0±0.5 points, after treatment: 1.08±3 points; p=0.0023); patients from Group II (control) showed a 22.6 % improvement (before treatment: 3.1 ±0.3 points; after treatment: 2.4±0.5 points; p=0.12).

As a result of the performed complex medical rehabilitation that included low-frequency magnetotherapy, were found significant improvements in Group I (treatment group) using the Rehabilitation Routing Scale, in particular, a 62.7% decrease in the number of disabilities (before treatment: 3.0 ±0.4 points: after: -1.12± 0.1 points; p=0.0041), and a 13.8% decrease in Group II (control group) (before treatment: 2.9 ±0.5 points: after: 2.5±0.3 points; p=0.21).

When analyzing the health status of patients according to the EQ-5D quality of life questionnaire in association with low-frequency magnetotherapy there were improvements in general mobility by 44.0%, household activity by 26.0%, a decrease in pain / discomfort by 47.9%, anxiety and depression by 42.0%, while no statistically significant changes were found in the placebo-control group (p=0.1).

Thus, the use of low-frequency magnetotherapy in the medical rehabilitation of patients after pneumonia resulted from COVID-19 can improve the general condition and pulmonary function, increase exercise tolerance, and help restore activity in everyday life.

Chief External Expert in Medical Rehabilitation of the Ministry of Health of the Republic of Tatarstan,
Academic Director of the Rehabilitation Center
of the State Autonomous Health Care Institution "Kazan War Veterans Hospital" of the Ministry of Health of the Republic of Tatarstan,
Head of Rehabilitation and Sports Medicine Department of Kazan State Medicine Academy (a branch of the Federal State Budgetary Educational Institution of Further Professional Education "Russian Medical Academy of Continuing Professional Education" of the Ministry of Health of the Russian Federation)
Doctor of Medicine, Associate Professor R.A. Bodrova

Chief External Expert
in Physical Therapy of Kazan Department of Health of the Ministry of Health of the Republic of Tatarstan,
Head of the Physiotherapy Department
of the State Autonomous Health Care Institution "Kazan War Veterans Hospital" of the Ministry of Health of the Republic of Tatarstan T.V. Kuchumova