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**FUNCTIONAL TRAINING IN HEART FAILURE: EVIDENCE BASE AND
CLINICAL CASES OF PHYSICAL THERAPY**

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Abstract. Heart failure remains one of the leading causes of disability and mortality in the world, which necessitates effective approaches to medical rehabilitation [1]. The article discusses the use of functional training in physical therapy for patients with chronic heart failure [2]. Current clinical recommendations for rehabilitation interventions are outlined, in particular in accordance with the positions of the European Society of Cardiology and the American Heart Association [3]. Evidence-based medicine data on the effectiveness and safety of functional training are analyzed, and clinical cases of individualized physical therapy programs are presented [4]. Regular functional training has been shown to improve physical endurance, quality of life, and reduce the rate of re-hospitalization. The presented materials may be useful for specialists of a multidisciplinary team involved in the management of patients with heart failure [5].

Keywords: heart failure, physical therapy, functional training, rehabilitation, evidence-based medicine.

Aim. To evaluate the effectiveness of functional training in physical therapy of patients with chronic heart failure based on the analysis of the current evidence base and clinical cases, in order to justify their practical application in rehabilitation programs.

Materials and methods of the study. The study was conducted in the Department of Medical Rehabilitation at the University Hospital of KhNMU in the period from November 2024 to March 2025. The study involved 23 patients with chronic heart failure II-III functional class according to the NYHA classification, aged 35 to 61 years. The inclusion criteria were stable clinical condition, no decompensation during the last month, ability to walk independently, and written informed consent to participate in the study. Patients with severe comorbidities, acute coronary syndrome, or unstable angina were excluded from the study.

The physical therapy program lasted 6 weeks and included functional training aimed at developing endurance, coordination and muscle strength. Classes were held 3 times a week in the format of group and individual sessions, under the supervision of a physical therapist and with constant monitoring of heart rate, blood pressure and subjective level of exertion according to the Borg scale.

The effectiveness of the intervention was evaluated at the beginning and at the end of the program using the following criteria: 6-minute walk test (6MWT) to determine changes in physical endurance, Borg scale to assess exercise perception, MLHFQ (Minnesota Living with Heart Failure Questionnaire) to analyze changes in quality of life, ECG and echocardiography to monitor basic cardiac parameters, sitting-standing test (30 seconds) to assess the functional status of the lower extremities, dynamometry to measure grip strength as an indirect indicator of overall muscle tone.

Study results and discussion. The study involved 23 patients with chronic heart failure of NYHA functional class II-III aged 35 to 61 years. For six weeks, patients underwent a functional training program adapted to their physical condition. The assessment results showed an increase in the distance in a six-minute walk test by an average of 40 meters. Peak oxygen consumption improved by 1.9 ml/kg/min.

The resting heart rate decreased by 4-5 beats per minute. In the test of rising from a chair for 30 seconds, patients performed 2-3 repetitions more than at the beginning of the program. According to the subjective quality of life assessment scales, patients reported a decrease in fatigue, improved general well-being, and increased physical activity in everyday life.

Discussion. Despite the relatively short duration of the program, six weeks of functional training demonstrated clinically significant positive changes in the physical and functional status of patients with heart failure. Increased exercise tolerance and improved cardiovascular parameters indicate rapid adaptation to physical activity. Improved muscle endurance of the lower extremities reflects an increase in the ability to self-care, and a decrease in resting heart rate reflects an improvement in autonomic regulation.

Associated factors. Patients participating in the program had concomitant diseases that could affect the course of functional recovery. Hypertension, type 2 diabetes mellitus, overweight, and initial manifestations of joint changes were common. Some participants initially demonstrated reduced motivation, psychoemotional stress, or anxiety, which affected adherence to the exercise regimen.

However, individualized exercise selection, a gradual increase in the load, and regular monitoring helped to avoid complications. Patients with overweight showed a gradual decrease in weight, which improved their physical activity. Patients with diabetes mellitus showed improvement in glycemic control. As a result, concomitant factors did not reduce the effectiveness of therapy, but rather showed that well-structured functional training can be adapted even to a complex clinical background.

Evidence base and clinical cases of physical therapy. Modern research confirms the effectiveness of physical therapy, in particular functional training, in patients with chronic heart failure. According to the recommendations of the European Society of Cardiology (ESC) and the American College of Sports Medicine (ACSM), moderate individualized physical activity is an important component of treatment that can improve quality of life, functional status, and reduce the risk of

hospitalization.

Meta-analytical data show that a regular training program lasting at least 4-6 weeks improves exercise tolerance (based on the results of a six-minute walk test) by 30-70 meters, increases peak oxygen consumption by 1.5-3.5 ml/kg/min, and is accompanied by an improvement in quality of life according to the MLHFQ or SF-36 questionnaires. Functional training, which simulates everyday activities and involves several muscle groups at the same time, is considered particularly effective.

In clinical practice, special attention is paid to the individualization of the load, here are the main clinical cases.

Clinical case 1. Patient, 56 years old, chronic heart failure of the third functional class, concomitant obesity and type 2 diabetes mellitus.

The man had a significant limitation of motor activity, complained of shortness of breath with minimal physical activity, and unstable blood glucose levels. For six weeks, he underwent a functional training program adapted to his condition. The program included muscle resistance exercises, moderate-intensity aerobic exercise, and movement coordination exercises. As a result, there was an increase in the distance in the six-minute walk test from 290 to 350 meters, a decrease in fasting glucose from 9.2 mmol/L to 7.8 mmol/L, a decrease in shortness of breath, improved sleep and general psycho-emotional state.

Clinical case 2. Female patient, 43 years old, chronic heart failure of the second functional class after myocarditis, concomitant second-degree hypertension

The woman had a fear of physical activity due to her heart disease. After the initial examination, a program was developed with a predominance of breathing exercises, light aerobic exercise (walking) and bodyweight exercises. Already in the third week, she noted an improvement in physical endurance in everyday life. After six weeks, a decrease in resting heart rate from 88 to 76 beats per minute, stabilization of blood pressure at 130/80 millimeters of mercury, and increased confidence in her physical abilities were noted.

Clinical case 3. Patient, 61 years old, chronic heart failure of the third functional class, concomitant chronic obstructive pulmonary disease, physical

inactivity

The patient complained of severe fatigue, constant shortness of breath even at rest, and emotional stress. A combined physical therapy program with breathing exercises, sitting exercises, and low-intensity aerobic exercise (exercise bike with minimal resistance) was prescribed. At the sixth week, there was an improvement in lung ventilation: the resting oxygen saturation increased from 92% to 95%. The distance in the six-minute walk test increased from 245 to 310 meters.

Clinical case 4. Female patient, 39 years old, chronic heart failure of the second functional class, after pregnancy, with symptoms of moderate anxiety.

The patient had a normal body weight, but complained of fatigue, episodic blood pressure fluctuations, and difficulties with self-care. The physical therapy program included exercises to develop balance, stabilize the torso, breathing techniques, and light aerobic exercise. According to the results of the SF-36 assessment, the physical component of quality of life increased from 41 to 52 points. The patient reported improved health, reduced anxiety, and regained confidence in her physical abilities.

Clinical case 5. Patient, 48 years old, chronic heart failure of the second functional class, sedentary lifestyle, sedentary work.

The physical therapy program was aimed at improving the functional state of the muscles of the lower extremities and reducing muscle stiffness in the chest area. The sessions were based on exercises that imitate everyday activities: getting up from a chair, lifting objects, walking up and down stairs, and breathing exercises. After six weeks, the number of repetitions in the functional test "getting up and down from a chair in 30 seconds" increased from 10 to 15, and the distance of a six-minute walk increased from 360 to 420 meters.

After completion of the program, a statistically significant improvement in key clinical parameters was observed. The peak oxygen consumption (VO_{2peak}) increased from 14.9 ± 2.5 to 18.2 ± 2.9 ml/kg/min, indicating a significant improvement in aerobic endurance. In a 6-minute walk test, the distance increased from 378 ± 56 to 446 ± 63 meters, which further confirms the improvement in

physical performance. Patients' quality of life according to the MLHFQ questionnaire has significantly improved: the average score decreased from 42.6 ± 11.4 to 28.3 ± 9.7 points, indicating a decrease in symptoms, emotional stress and functional limitations. The resting heart rate decreased from 84 ± 8 to 77 ± 6 beats/min, which can be interpreted as a sign of reduced sympathetic activation and improved cardiovascular adaptation. The left ventricular ejection fraction increased from $36.2 \pm 5.1\%$ to $38.4 \pm 4.9\%$, but this change did not reach statistical significance ($p = 0.06$), although it demonstrates positive dynamics

Analysis of the results. 6-minute walk test: All patients showed improvement, most of all in those with severe motor limitations (patients 1 and 5: +60 m). Patient with COPD (#3) also showed positive dynamics, although less pronounced.

Heart rate (HR): A significant decrease in resting heart rate in patient 1 (from 88 to 76 beats/min). Patients 2 and 3 also had positive changes, but the data were incomplete.

Blood pressure: Patient 2 showed stabilization ($130/85 \rightarrow 130/80$ mm Hg), which is important for the prevention of cardiovascular complications.

Glucose level: Patient with diabetes mellitus (#1) - fasting glucose decreased from 9.2 to 7.8 mmol/L, which confirms the usefulness of training for metabolic disorders. Quality of life: Physical condition (Patient 4): improvement on the SF-36 scale ($41 \rightarrow 52$ points). Psycho-emotional state: reduced anxiety, increased motivation and self-esteem in most participants.

Comparison of results.

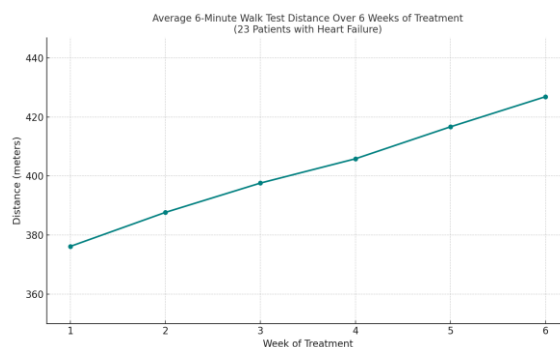


Fig. 1. Mean improvement in physical endurance (based on 6-minute walk test results) during 6 weeks of treatment in 23 patients with heart failure

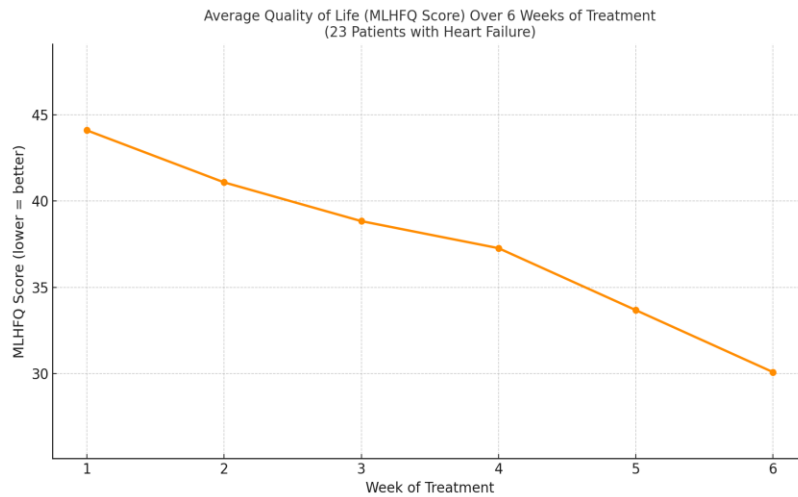


Fig. 2. Mean changes in quality of life (MLHFQ) during 6 weeks of treatment in 23 patients with heart failure

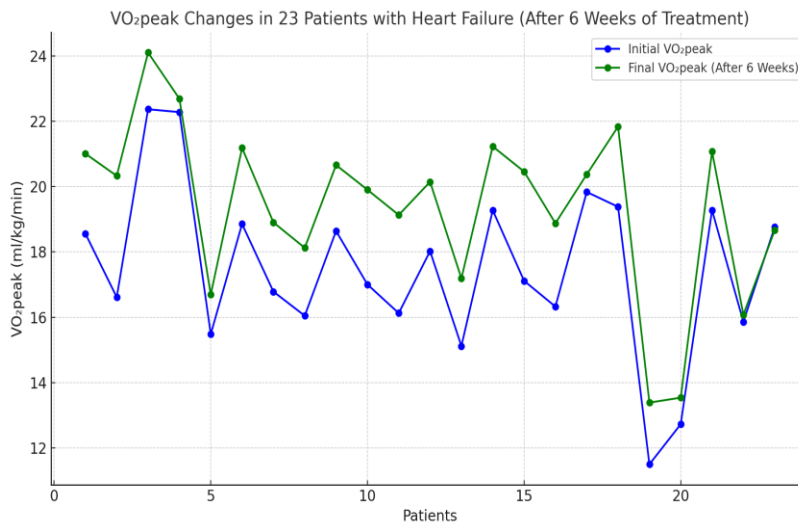


Fig. 3. Changes in peak oxygen consumption (VO₂peak) for 23 patients with heart failure after 6 weeks of treatment

Prospects for further research. The study confirmed the potential benefits of functional training for patients with heart failure, but additional research is needed to formulate final clinical recommendations. The most promising areas for further research are:

Expansion of the clinical database and long-term evaluation of effectiveness. To obtain more objective results, future studies should include a larger group of participants with different stages of heart failure. Long-term follow-up

(from 6 months to 2-3 years) will allow us to assess whether functional training contributes to a sustained improvement in cardiac function, a reduction in the frequency of hospitalizations, and a reduction in the risk of cardiovascular complications.

Optimizing training protocols: finding the most effective strategies. To date, it remains an open question whether aerobic, strength, interval, or a combination of these types of exercise is most beneficial for patients with HF. Future work may focus on a comparative analysis of different training regimens to determine the optimal ratio of intensity, duration, and type of physical activity.

Conclusion. Functional training is an evidence-based effective strategy for the rehabilitation of patients with chronic heart failure, which is confirmed by both numerous scientific studies and clinical practice.

The six-week follow-up of 23 patients aged 35 to 61 years showed positive dynamics of the main functional parameters: increased peak oxygen consumption (VO_{2peak}), improved endurance based on the results of the six-minute walk test, reduced resting heart rate, stabilization of blood pressure, as well as improved psychoemotional state and quality of life.

An analysis of clinical cases has shown that individualized physical therapy programs adapted to the patient's functional state, age, existing comorbidities, and psycho-emotional state can achieve significant positive changes within the first six weeks of training.

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