



## Effect of Physical Rehabilitation on Hemodynamic Status

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### Abstract

Cardiovascular diseases (hereinafter - CVD) have become the leading cause of death worldwide: for no other reason as many people die every year as from CVD. This problem affects low and middle income countries to varying degrees. More than 80% of deaths from CVD occur in these countries, almost equally among men and women, however, patients who survived after myocardial infarction (hereinafter - MI) are at high risk of death. According to the main facts of the WHO, 17.9 million people died from CVD in 2016, which accounted for 31% of all deaths in the world. In this connection, it is necessary to improve medical rehabilitation (hereinafter - MR), in particular for CVD, especially on an outpatient basis. Competent MR, cardiac rehabilitation in patients with myocardial infarction is associated with improved survival and effectiveness of quality of life, as well as prevention of recurrent MI. There is a legislative framework FZ-No. 323 of 21.11.2011 "On the basics of health protection of citizens in the Russian Federation" concerning medical rehabilitation and "Procedure for organizing medical rehabilitation" No. 1705n of 29.12.2012.

Multiple meta-analysis showed that cardiovascular rehabilitation (hereinafter - CVR) reduces mortality in patients with coronary artery disease. Despite the recommendations and recommending the use of programs for patients with previous MI, patient participation in these programs remains low, which has led to the development of alternative models of medical rehabilitation.

### Purpose of the study

To conduct and study the effect of each method separately, as well as to carry out a comparative analysis of the methods of therapeutic physical activity used in restorative medicine in patients who underwent myocardial infarction on an outpatient basis. Evaluate the effectiveness of remote access cardiac rehabilitation programs. Determine which of the rehabilitation methods is most effective..

### Research objectives

1. To study the hemodynamics of each method in patients with MI before and after MR.
2. To assess the quality of life of patients who underwent myocardial infarction in dynamics: before and after MR.

In our study, we performed MR using the methods of therapeutic physical activity (health path).

Materials and methods of research: The selection of patients with a previous MI and the research part of the work was carried out in the rehabilitation department of the CVMiR "Berezovaya Roscha" FKUZ Medical Unit of the Ministry of Internal Affairs

of Russia in Moscow in the period from January 2017 to December 2019 with a referral diagnosis from the hospital after 2 months of inpatient treatment - "Myocardial infarction", post-infarction period, were examined for participation in the Study.

The patients were performed:

- ECG (heart rate, heart rate) at the beginning and at the end of the MR program (4 months); All study participants were carried out daily;
- measurement of heart rate indicators at rest and after exercise;
- measurement of blood pressure before and after exercise.

### Research results

Patients in our study were distributed according to the WHO age classification as follows: mean age from 51 to 59 years - 13 patients (11.3%), advanced age from 60 to 74 years - 78 patients (67.8%), old age from 75 to 87 years old - 24 patients (20.9%). Thus, there were significantly more elderly patients with previous MI than middle-aged and old-aged patients ( $p < 0.001$ ).

Normal body mass index (hereinafter - BMI) - 18.5 - 25.0 comprised of 3 groups in

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7 patients (6.1%); pre-obesity BMI - 25-30 kg / m<sup>2</sup> was found in 66 patients (57.4%); obesity 1 degree BMI - 30 - 34.9 kg / m<sup>2</sup> was detected in 33 patients (28.7%); 8 patients (6.9%) had grade 2 obesity. Obesity grade 3 (BMI <40 kg / m<sup>2</sup>). There are no significant differences in BMI between groups (p = 0.222).

When examining blood pressure in the studied groups, we did not find a significant difference (p = 0.302).

**Table 1.** Characteristics of patients included in the study groups

Indicators	Group I, n= 42	Group II, n= 37	p
Age	69[61-75]	70[65-76]	0.210
Floor	34/8	34/3	0.380
Growth	173[170-176]	174[170-178]	0.267
Weight	89[85-95]	90[85-95]	0.383
BMI	29.0[28.0-31.3]	29.0[27.0-30.0]	0.080
Heart rate	68[62-70]	68[64-74]	0.064
HELL syst.	130[120-135]	130[120-135]	0.052
BP diast.	80[80-90]	80[75-80]	0.103

Note: Statistical analysis was performed using the Kruskal-Wallis test.

In group I, the blood pressure of the diastasis was not significantly increased. hence there is a tendency. All patients were predominantly elderly, with a predominance of men, height above average, weight and BMI indicating obesity of the 1st degree, heart rate within normal limits, SBP / DBP were average.

The results of physical rehabilitation in patients with myocardial infarction in groups, as well as the dynamics of MR indicators - terrenkur, Scandinavian walking, before and after exercise

Patients of groups I and II who underwent myocardial infarction practiced daily (terrenkur, Scandinavian walking) during MR under the guidance of an exercise therapy doctor. After the completion of the MR course, repeated structural and functional studies were carried out.

**Table 2.** Hemodynamic efficiency of medical rehabilitation by the terrenkur method

Indicators	Before	After	p
Heart rate	68[62-70]	84[75-95]	<0.001
ADsist.	130[120-135]	150[140-160]	<0.001
ADdiast.	80[80-90]	95[90-100]	<0.001

Note: Statistical analysis was carried out according to T - Wilcoxon test

The effectiveness of medical rehabilitation by the terrenkur method, the heart rate from the mean did not exceed the maximum allowable values (p <0.001), SBP / DBP is not a large excess of the maximum values for this category of patients (p <0.001).

The effectiveness of medical rehabilitation by the Nordic walking method The heart rate from the mean value did not exceed the maximum permissible values (p <0.001), SBP / DBP is not a large excess of the maximum values for this category of patients (p <0.001) compared with terrenkur, in Scandinavian walking the maximum SBP is higher by 5.9%.

**Table 3.** Indicators of the recovery time of the hemodynamic effect by the terrenkur method

Indicators	After loading
HR recovery time, min	2,5±1,3
Blood pressure recovery time, min	2,5±0,71
ADdiast.	80[80-90]

Recovery time after terrenkur heart rate (2.5 ± 1.3 min.) And BP (2.5 ± 0.71 min.).

**Table 4.** Hemodynamic efficiency of medical rehabilitation using the Nordic walking method

Indicators	Before	After	p
Heart rate	68[64-74]	85[75-95]	<0.001
ADsist	130[120-135]	150[140-170]	<0.001
ADdiast	80[75-80]	95[90-100]	<0.001

Note: Statistical analysis was carried out according to T - Wilcoxon test

**Table 5.** Hemodynamic efficiency of medical rehabilitation using the Nordic walking method

Indicators	After loading
HR recovery time, min	3,5±1,9
Blood pressure recovery time, min	4,5±0,71

Recovery time after Scandinavian walking, heart rate (3.5 ± 1.9 min.) And BP (4.5 ± 0.71 min.).

This medical rehabilitation involves over 90% of the muscles. Just like in terrenkur, heart rate variability. At the initial stage of this method, an individual approach is mandatory to control the correctness of walking and its dosage in order to neutralize medical contraindications for this group of patients. The principle of gradualness and efficiency comes faster than terrenkur, which indicates the control of this method with remote access. Observe the principles of adequate exercise - this provides for a strict individual load. The simplest method for dosing the heart rate load is the method proposed by A. Viru. For beginners and those with a low level of fitness, it is advisable to start with a terrain course.

Visualization and comparison of each group by the Kruskal-Wallis criterion indicates that the heart rate in group II is higher than group I by 1.1%, the indicator (p = 0.154) each method showed as a balanced load for patients with MI; SBP in groups I and II is 10.7% more (p = 0.001); DBP in groups I and II is 5.3% higher, which indicates the norm for the age category (p = 0.003).

Recovery time in group I heart rate (2.5 ± 1.3 min.), P = 0.114 and BP (2.5 ± 0.71 min.), P = 0.116. A convenient method of rehabilitation for this category of patients with a fast recovery range, but requires maintaining posture during movement and stability of the pace of movement. In group II, heart rate (3.5 ± 1.9 min.), P = 0.114 and blood pressure (4.5 ± 0.71 min.), P = 0.116. This method of rehabilitation in restoring heart rate and blood pressure is less terrenkur and more Nordic walking.

**Table 6.** Hemodynamic efficiency of medical rehabilitation by the terrencourt method

Indicators	Group I, n= 42	Group II, n= 37	p
Heart rate	84[75-95]	85[75-95]	0.154
ADsist	150[140-160]	150[140-170]	0.001
ADdiast	95[90-100]	95[90-100]	0.003

Note: Statistical analysis was carried out using the Wilcoxon Kruskal – Wallis test; \* - significant difference between groups

**Table 7.** Indicators of the recovery time of the hemodynamic effect in the study groups

Indicators	Group I, after load	Group II, after load	p
HR recovery time, min	2,5±1,3	3,5±1,9	0,114
Blood pressure recovery time, min	2,5±0,71	4,5±0,71	0,116

Note: Statistical analysis was carried out according to T - Wilcoxon test

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## Conflict of interests

The authors declare no conflict of interest

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