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Stages of Rehabilitation in Elderly Patients with Myocardial Infarction in the Post-Hospital Stage

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Abstarct: **Target:** Define metrics to predict performance rehabilitation measures in patients with myocardial infarction (MI) at the stage of early inpatient rehabilitation.

Methods: The study included 68 patients with MI who were transferred to the inpatient rehabilitation unit. Fulfilled clinical and laboratory studies, electrocardiography, echo-cardiography, treadmill and bicycle ergometric stress tests, test 6-minute walk (test 6MX), functional state (FS) was assessed with the definition of functional class (FC) and rehabilitation potential tsial (RP). A complex of therapeutic exercises (LG) No. 3 was prescribed, training on a bicycle ergometer and/or treadmill.

Results: Evaluation of the effectiveness of rehabilitation in patients with MI was carried out as an increase in the distance of the 6MX test with improvement FC, and to improve the FS. In 46% of patients with MI at the beginning of the course of rehabilitation litation noted a drop in systolic blood pressure (SBP) on training loads, however, their correction allowed successfully complete the rehabilitation course. In the group of patients with improvement by one FC and more were lower in the proportion of people with low RP and the level of falling SBP by training loads compared with a group of patients without improvement reduction or with improvement within the same FC ($p < 0.05$). How more pronounced was the fall in SBP during HT ($r = –0.59$; $p = 0.044$) and cycling ($r = -0.83$; $p = 0.042$), the lower was the effectiveness rehabilitation according to the 6MX test. In the group of patients with improved FS by one FC or more, the level of fall in SBP during LT was lower, than in the group of patients without improvement or with improvement within the same FC ($p < 0.05$).

Conclusion: The effectiveness of rehabilitation measures in patients with MI at the stage of early inpatient rehabilitation allows predict the following indicators: the level of falling SBP during cycling (total percentage of correct predictions - 100%); level fall in SBP during HT (less than 15 mm Hg and 15 mm Hg or more) (total percentage of correct predictions - 92.9%) (regression equations for predicting the effectiveness of rehabilitation measures acceptance in patients with MI). The effectiveness of rehabilitation measures in patients with myocardial infarction at the stationary stage Educational Institution "Bukhari State Medical Institute", Department of Cardiology and Internal Medicine 1. Educational Institution "Belarusian State Medical University", Department of Medical Rehabilitation and Physiotherapy, Minsk, Belarus 2.

Key points: myocardial infarction, early inpatient rehabilitation, physical training, blood pressure drop, prediction of rehabilitation effectiveness.

Introduction

Acute myocardial infarction (MI) remains one of the leading causes of death and disability around the world, determining the duration and quality of life of pa- patients [1, 2, 3]. Physical rehabilitation using physical training programs allows a patient with MI to stabilize the clinical course of the disease, restore physical performance, return to professional activities, habitual household stress and social activity. The rational use of physical training increases exercise tolerance, increases the left ventricular ejection fraction, improves the physical condition and quality of life of patients with MI [2]. Recent meta-analyses have confirmed that the use of physical rehabilitation methods is associated with a significant reduction in cardiovascular mortality, recurrent MI and all-cause mortality [4, 5]. It has been shown that the participation of patients with MI in cardiac rehabilitation programs reduces the risk of rehospitalization by 27%, and the risk of death by 43% [1]. medical rehabilitation.

Purpose of the study To determine indicators for predicting the effectiveness of rehabilitation measures in patients with MI at the stage of early inpatient rehabilitation. Materials and methods [6, 7, 8] A prospective dynamic study included 57 patients with MI who were transferred from hospitals to the medical rehabilitation department at the 3b or 4a stages of physical activity. The median age of patients was 61 years (range 56 to 68 years); 40% (23) patients of working age. By gender, the patients were distributed as follows: 67% (38) men and 33% (19) women. Subendocardial MI was diagnosed in 65% (37) of patients, and large-focal MI was diagnosed in 35% (20) of patients. In 26% (15) of patients, MI was recurrent. According to the severity class (CT) of MI, patients were distributed as follows: CT 1 - 2% (1) patient, CT 2 - 74% (42), CT 3 - 19% (11), CT 4 - 5% (3) of patients. Percutaneous coronary intervention was performed in 39% (22) patients, thrombolytic therapy in 7% (4) of patients. Arterial hypertension occurred in 86% (49) of patients, atrial fibrillation in 18% (10) of patients, diabetes mellitus in 21% (12) of patients, mitral and/or aortic valve insufficiency in 25% (14) patients, aortic stenosis - in 11% (6) patients, aorto-history of coronary artery bypass grafting in 5% (3) patients, history of cerebral infarction disease - in 5% (3) patients, overweight and obesity - in 75% (43) patients, chronic heart failure (CHF) H1 - in 56% (32) patients, H2A - in 44 % (25) patients; according to NYHA functional class (FC) 1 - in 4% (2) patients, FC 2 - in 61% (35) patients, FC 3 - in 33% (19) patients, FC 4 - in 2% (1) patients. Original scientific publications of hospitals from which patients were transferred, clinical and laboratory tests, electrocardiography and echocardiography were performed, standard medical therapy. In the inpatient department of rehabilitation, a clinical examination was carried out. treatment with the measurement of heart rate, systolic arterial pressure (SBP) and diastolic blood pressure before exercise, at her height and after exercise. Functional examination including chalo treadmill or bicycle exercise test, 6-minute walk test (test 6MX) before and after the course of rehabilitation. Functional state assessment (FS) with the definition of a functional class (FC) and an assessment of the rehabilitation potential LA (RP) were carried out according to generally accepted criteria [9, 10]. All patients were prescribed a complex of therapeutic exercises (RG) No. 3. Exercises on a bicycle ergometer were 44% (25) patients prescribed, treadmill – 28% (16) patients, bicycle ergometer and treadmill - 16% (9) of patients (appointment was carried out depending on the individual visual tolerance to physical activity according to the generally accepted method [3]).

Statistical data processing was performed using the package clad programs Statistica 8.0 (StatSoft, Inc., USA). The Shapiro criteria were applied.

Wilk, Student, Mann-Whitney, Spearman, Pearson, two-tailed exact test Fisher, logistic regression analysis. The values of the indicators are given in the form of mean value ± standard deviation (M ± s) or median (Me) (25th - 75th percentile). The probability of an error-free forecast equal to 95% ($p < 0.05$) was taken as the critical level of statistical significance. Results and discussion

The RP of the patients included in our study was defined as low in 21% (12) patients, moderate in 77% (44) of patients, high in 2% (1) of patients.

Evaluation of the effectiveness of rehabilitation measures in patients with myocardial infarction was carried out both to increase the distance of the 6MX test with an improvement in the FC of CHF,

and to improve the FS after a course of rehabilitation. Mean±1.96*SE After rehabilitation Before rehabilitation

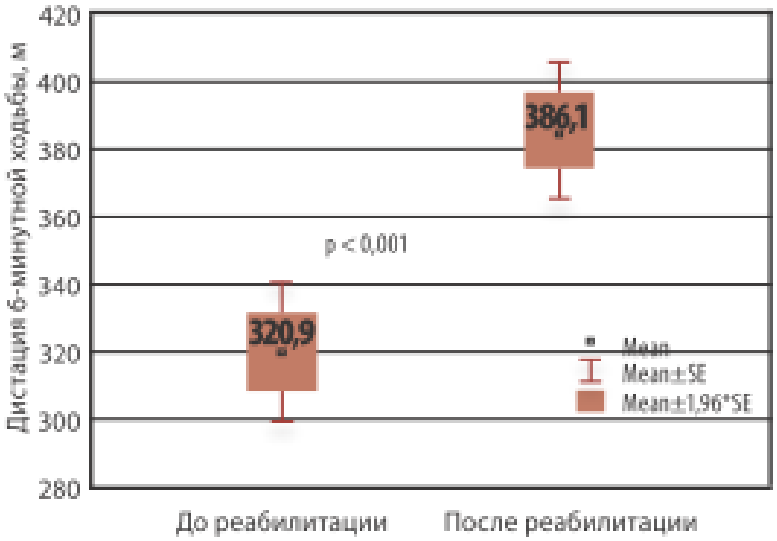

Рисунок 1. Дистанция 6-минутной ходьбы у пациентов с инфарктом миокарда до и после курса реабилитации, в метрах (м)

After a course of rehabilitation measures in patients with MI increased test distance score of 6MX, and increased exercise tolerance

($p < 0.001$) (Figures 1, 2). An increase in the proportion of patients with FC1 ($p < 0.01$) and a decrease in the proportion of patients with FC3 ($p < 0.05$) after a course of rehabilitation according to the 6MX test indicate the effectiveness of rehabilitation measures (figure 2). All patients were divided into two comparable groups: 1) a group of patients with an improvement of one or more FC ($n = 24$); 2) a group of patients without improvement or with improvement within the same FC ($n = 33$). as in the group of patients without improvement or with improvement within the same FC -

33% (11) of patients ($\chi 2 = 8.21$, $p < 0.05$).

load was statistically significantly higher in the group of patients without improvement or with improvement within the same FC and corresponded to 15 (13–20) mm Hg, whereas in the group of patients with improvement by one or more FC - 12 (11–13) mm Hg

($p < 0.05$). The more pronounced the fall in SBP was during LT ($r = -0.59$; $p = 0.044$) and cycling ($r = -0.83$; $p = 0.042$), the lower was the effectiveness of rehabilitation measures according to the 6MX.p test < 0.001 Figure 1. 6-minute walking distance in patients with myocardial infarction before and after rehabilitation, in meters (m) patients with myocardial infarction before and after the course of rehabilitation, functional class (FC) due to an increase in the proportion of patients with FC1 ($p < 0.01$) (Figures 3, 4).In the group of patients without improvement or with improvement in FS within the same FC, the level of fall in SBP during LT was higher compared to the group with improvement in FS by one or more FC ($p < 0.05$) (Figure 5). Despite the fact that at the beginning of the rehabilitation course, patients underwent a trade-mill or bicycle ergometric load test with the determination of physical performance, and the training loads were half the threshold, they as well as on the PH complex No. 3, a drop in SBP by more than 10 mm Hg was noted. 46% (26) patients with MI (during PH - in 21% (12) of patients, during training on a bicycle ergometer - in 24% (6) of patients, on a treadmill - in 50% (8) of patients). The median fall in SBP was 14 (12–20) mm Hg during LT, 14 (12–17) mm Hg during cycling, and 14 (12.5–18) mm Hg during treadmill training. Art. ($p > 0.05$). In our previous studies, it was found that an increase in the level of falling SBP during physical training was associated with the presence of stenosis of the aortic orifice ($r = 0.52$; $p = 0.007$), mitral and / or or aortic heart valves ($r = 0.56$; $p = 0.004$), the presence of zones of hypokinesis ($r = 0.47$; $p = 0.015$) and their number ($r = 0.51$; $p = 0.007$), as well as with a shorter distance of the 6MX test before the start of the rehabilitation course ($r = –0.54$; $p = 0.029$) [6]. The more pronounced the fall in SBP was during cycling ($r = 0.88$; $p = 0.021$) and treadmill training ($r = 0.82$; $p = 0.012$), the more severe was the stage of CHF and the lower was the RP ($r = -0, 83$; $p =$

0.042), and a decrease in the proportion of patients with a decrease in SBP to exercise after a course of rehabilitation indicated the effectiveness of rehabilitation measures [6, 7, 8]. Despite the fact that in our study, in 46% (26) patients with MI at the beginning of the rehabilitation course, a drop in SBP was noted on training loads, the correction of the magnitude of training loads by directly monitoring them during the rehabilitation process made it possible to successfully complete the course of rehabilitation measures. A drop in SBP to training loads reflects an inadequate response of hemodynamics and can be observed when the physical fitness of patients at the previous stage of rehabilitation does not meet the requirements of the motor regimen, their condition worsens at the time of training, and also when training methods are violated [11]. The rational use of physical training with the correction of the magnitude of the loads through medical supervision underlies the effectiveness of the rehabilitation of patients. patients with MI. To predict the effectiveness of rehabilitation measures in patients with MI at the stage of early inpatient rehabilitation, we performed a logical regression analysis, since the dependent sign is a qualitative binary sign (it has only two possible values): 1 (rehabilitation is effective with an improvement of one or more FC) and 0 (rehabilitation is not effective, or improvement is observed within the same FC). To predict the effectiveness of rehabilitation measures based on the results of the 6MX test, the following indicators were independent (explaining) signs: RP, the level of SBP drop during training load, the level of SBP drop during LT, and the level of SBP drop during cycling. Based on the mutual correlation of a number of features, established in the analysis of the correlation matrix, it was decided to build several log regression models with their subsequent evaluation for the quality of object classification. The analysis used the Quasi-Newton estimation procedure, which gives the best results for most applications, with default initial values and step size settings. The use as variables of such indicators as RP, the level of SBP drop during the training load, the level of SBP drop during LT, with sufficient adequacy of the selected models, provided unsatisfactory forecast quality - the total percentage of correct predictions ranged from 56% to 75%. Predicting the effectiveness of rehabilitation measures in patients with MI at the stage of early inpatient rehabilitation was performed according to the indicator “level of SBP drop during cycling”, which provided an overall percentage of correct predictions at the level of 100%. A logit-regression model was built with a continuous variable "the level of systolic blood pressure during cycling". The high value of χ 2 = 7.6381 (for the difference between the chosen model and the model containing only the free term) and the small value of p = 0.006 indicate sufficient adequacy of the chosen model. Regression coefficients b 0 = 333.8552 and b 1 = –26.95882 and regression equation 1 are obtained: $Y = \exp(333.855 – 26.959 \cdot X) / (1 + \exp(333.855 – 26.959 \cdot X))$ where X is the fall level SBP during cycling, mm Hg. In this logit model, value 1 corresponds to a group of patients in whom rehabilitation is effective with an improvement of one or more FC, value 0 corresponds to a group of patients in whom rehabilitation is ineffective, or improvement is observed within the same FC. If the value of the regression equation is ≤ 0.5, then the object belongs to the group of patients in whom rehabilitation is ineffective, or improvement is observed within the same FC, if > 0.5 - to the group of patients in whom rehabilitation is effective with an improvement of one FC and more. The higher the value of the regression equation, the higher the efficiency of rehabilitation measures. patients with MI at the stage of early inpatient rehabilitation was performed according to the indicator "the level of falling SBP during cycling", which provided a total percentage of correct predictions at the level of 100%. To predict the effectiveness of rehabilitation measures for FS, an independent (explaining) sign was the indicator "the level of falling SBP during HT (less than 15 mm Hg and 15 mm Hg or more)". A logit-regression model was built using the indicator "level of fall in SBP during HT (less than 15 mm Hg and 15 mm Hg or more)". The high value of χ 2 = 10.8939 (for the difference between the chosen model and the model containing only the free term) and the small value of $p < 0.001$ indicate sufficient adequacy of the chosen model. Regression coefficients b 0 = 2.948880E + 01 and b 1 = –31.0982 and regression equation 2: $Y = \exp(29.4888 – 31.098 \cdot X)/ (1+\exp(29.4888 – 31.098 \cdot X))$, where X is the level of falling SBP during LH: X = 0 with a decrease in SBP by less than 15 mm Hg, X = 1 with a decrease in SBP by 15 mm Hg or more).

for one FC or more, value 0 - a group of patients in whom rehabilitation is ineffective effective, or improvement in FS is observed within the same FC. If you know value of the regression equation ≤ 0.5, then the object belongs to the group of patients who have some rehabilitation is ineffective or improvement in FS is observed within one and the same FC, if > 0.5 - to the group of patients in whom rehabilitation is effective with an improvement in FC by one or more FC. and by 15 mm Hg and more)" is shown in Figure 7. Thus, the prediction of the effectiveness of rehabilitation measures for FS in patients with MI at the stage of early inpatient rehabilitation was performed according to the indicator "the level of fall in SBP during HT (less than 15 mm Hg and 15 mm Hg and more), which provided a total percentage of correct predictions of 92.9%. Conclusion The effectiveness of rehabilitation measures in patients with MI at the stage of early inpatient rehabilitation makes it possible to predict the following indicators: the level of SBP drop during cycling (the total percentage of correct predictions is 100%);

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