Biotechnological Communication

BBRC Bioscience Biotechnology Research Communications

Biosc.Biotech.Res.Comm. Vol 13 No (4) Oct-Nov-Dec 2020 Pp 2327-2331

Functional Activity of the Cardiorespiratory System and the General Level of Physical Capabilities Against the Background of Regular Physical Exertion

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ABSTRACT

For men of the second adulthood who had myocardial infarction, a very characteristic decrease in their body's resistance to hypoxia, is a weakening ability to tolerate physical activity and a decrease in the functional capabilities of the cardiovascular system. The tested author's scheme of physiotherapy exercises, including morning exercises, therapeutic exercises during the day, breathing exercises, walking upstairs to 2 floors and dosed walking along a horizontal plane 300 meters, provided for men aged 45-60 years who had myocardial infarction and had increase in their physical capabilities. The study involved 43 men aged 45 to 60 years who had a small focal myocardial infarction in the posterior or anterolateral walls of the left ventricle 5-6 days ago without signs of heart failure. They were randomly divided into two comparable groups - the first experimental group (21 people) and the second experimental group (22 people). The control group consisted of 34 clinically healthy men aged 45-60. Against the background of its use, it was found that they managed to significantly increase the body's resistance to physical exertion and hypoxia, as well as significantly increase the functional activity of their cardiovascular system. The effectiveness of the author's scheme of therapeutic physical culture was significantly higher than the results of applying the traditional scheme in terms of rehabilitation of this patient population. It was also ensured that the volunteers had all the indicators taken into account to the level of clinically healthy people.

KEY WORDS: PHYSICAL THERAPY, MYOCARDIAL INFARCTION, HEART, PHYSICAL ACTIVITY, REHABILITATION, PHYSICAL CAPABILITIES.

INTRODUCTION

Currently, cardiovascular diseases remain highly prevalent among the population of developed countries and are the leading cause of death worldwide, (Medvedev, Kumova, 2007; Skoryatina, Medvedev, 2019). The main share in the prevalence of disease is ischemic heart disease and in particular myocardial infarction. Its frequency in recent years in the world and in Russia is steadily growing. Most commonly found in men – on average 3 to 5 cases per 1000 population (Kovyazina, 2016). Myocardial infarction is still considered a life threatening disease, can lead to serious disability due to a significant deterioration of health and the formation of social exclusion (Strezhneva, 2017; Medvedev, 2018a).

For this reason, much attention is paid to aspects of rehabilitation after myocardial. The basis for the restoration of health and return patients to home, public and professional activities after myocardial infarction is a physical rehabilitation (Kozyreva et al., 2018). From the timeliness of its beginning, the sequence of its implementation and successful use in the process of modern science-based programs on the

ARTICLE INFORMATION

*Corresponding Author: ilmedv1@yandex.ru
Received 12th Oct 2020 Accepted after revision 10th Dec 2020
Print ISSN: 0974-6455 Online ISSN: 2321-4007 CODEN: BBRCBA

Thomson Reuters ISI Web of Science Clarivate Analytics USA and Crossref Indexed Journal

NAAS Journal Score 2020 (4.31) SJIF: 2020 (7.728)

Online Contents Available at: http//www.bbrc.in/
DOI: http://dx.doi.org/10.21786/bbrc/13.4/105

overall effectiveness of rehabilitation in these patients (Medvedev, 2018b; Boldov et al., 2018).

To ensure the effectiveness of physical rehabilitation after myocardial infarction possible only through integrated use of various means of medical physical culture (Stepanova et al., 2018). Currently, many aspects of its use after myocardial infarction remain controversial. This dictates the need to clarify the schemes of application of medical physical culture in this category of patients during their physical rehabilitation. The goal of the present work is to evaluate the effectiveness of the author's prescribed technique of medical physical culture in the course of rehabilitation of patients after myocardial infarctions.

MATERIAL AND METDODS

The present study was approved by the local ethics committee of the Russian State Social University on September 15, 2017 (Protocol No 11). The study involved 43 men aged 45 to 60 years who had a small focal myocardial infarction in the posterior or anterolateral walls of the left ventricle 5-6 days ago without signs of heart failure. They were randomly divided into two comparable groups - the first experimental group (21 people) and the second experimental group (22 people). The control group consisted of 34 clinically healthy men aged 45-60.The first experimental group was engaged in physical therapy according to the traditional scheme, including therapeutic exercises lasting about 30 minutes a day and walking along the corridor and stairs on one floor for 20 minutes a day.

The second experimental group was engaged in the therapeutic physical culture scheme developed by the author, including morning exercises, therapeutic exercises during the day and breathing exercises for a total duration of 1 hour, walking with stops upstairs to 2 floors and dosed walking with stops along the horizontal plane for a gradually increasing distance from 300 meters to 2000 meters. At the beginning, overcoming the daily distance was allowed in 2-3 doses. The total duration of walking lessons per day in the second group was at least 70 minutes. The duration of classes according to the traditional and author's schemes of therapeutic physical culture in both groups was 1.5 months.

Table 1. The results of the rehabilitation of men after myocardial infarction Legend: p - significance of differences in outcome and control, p1 - significance of dynamics of indicators during rehabilitation, p2 - significance of differences in rehabilitation results in both groups of patients.

Indicators	Experimental group 1, M±m, n=21		Experimental group 2, M±m, n=22		Control group, M±m, n=34
	start of observation	end of observation	start of observation	end of observation	
seconds	22.7±0.62 P<0.01	34.2±0.75 P_1<0.01	23.4±0.42 P<0.01	45.8±0.37 P_1<0.01 P_2<0.01	49.9±0.72
Genchi test, seconds	17.1±0.42 P<0.01	24.2±0.29 P_1<0.05	18.1±0.35 p<0.01	32.9±0.48 P_1<0.01 P_2<0.01	39.0±0.51
Orthostatic test, beats per minute	18.5±0.36 P<0.01	16.8±0.41 P_1<0.05	19.1±0.27 P<0.01	12.4±0.34 P_1<0.01 P_2<0.01	12.0±0.26
Test 6 minutes walk, meters	375.0±3.14 P<0.01	827.4±2.28 P_1<0.01	374.0±4.07 P<0.01	1061.3±6.18 P_1<0.01 P_2<0.05	1145.4±7.62
Systolic blood pressure, mmHg.	148.3±0.92 P<0.05	139.1±0.87	146.6±0.72 P<0.05	130.4±0.89 P_1<0.05	128.9±0.68
Diastolic blood pressure, mmHg.	86.8±0.61 P<0.05	80.0±0.57	85.4±0.70 P<0.05	73.7±0.62 P_1<0.05 P_2<0.05	74.0±0.53

RESULTS AND DISCUSSION

The initial state of the indicators in both observation groups turned out to be comparatively impaired and had no statistically significant differences between themselves. When taking into the study, the indicators of the applied samples in patients were comparatively inferior to the level of control - the breath holding time in the Stange sample was more than 2 times, in the Genchi sample more than 2 times. This was accompanied

by a similar increase in heart rate in an orthostatic test outcome in both groups of patients. The distance that patients were able to overcome in the test of 6 minutes of walking at the end turned out to be almost 2.8 times less than this distance in the control group in both experimental groups. Moreover, the levels of systolic and diastolic blood pressure in the outcome in both groups of patients exceeded the control level by approximately 15.6% and 13.5%, respectively.

As a result of the healing effects in both groups, men who had myocardial infarction had a positive dynamics of all the studied parameters. Their changes in the second experimental group were more preferable, which made it possible to approach all considered indicators to the level of control. At the same time, occupations with therapeutic physical culture according to the traditional method contributed to a more modest improvement in the functional state of the cardiorespiratory system and a less pronounced increase in the physical capabilities of patients. The results of the studies are shown in the table 1.

Regular muscular load according to the traditional scheme provided for an increase of the sample Rod at 50.7%, which brought the figure to a lower level of control of 45.9%. Lessons of medical physical culture on the authors' scheme helped to increase the delay time breathing in this sample, 95.7%, ensuring the normalization of this index in the second experimental group. The application of therapeutic physical culture on the traditional pattern increased the provisional rate in the sample of genchi 41.5%, but the achieved results inferior to the control level at 61.1 per cent. Sessions with patients in a medical physical culture according to the author's scheme provided the normalization of the value of this sample due to an increase of 81.8%.

Physical activity on the traditional pattern was followed in the first experimental group the reduction in the rate orthostatic test by 10.1%, but the achieved rate 40.0% inferior to the level of control. Classes conducted with patients in the second experimental group was provided access indicator of the orthostatic test on the control level as a result of his demotion to 54,0%. Classes of therapeutic physical culture has improved the overall physical fitness, which was judged by the test results of 6-minute walk on the traditional scheme 2.2 times (the result is inferior to the control 38.4%), on the author's schema in 2.8 times, which ensured in this case, his normalization.

Therapeutic physical culture, conducted by the traditional scheme, to provide some decrease in blood pressure, whereas the output level of the control group was only in result of application of the author's scheme of medical physical culture.At present, the prevalence of myocardial infarction, ischemic necrosis of a part of the heart muscle that develops as a result of coronary artery thrombosis, remains very high (Medvedev, 2018c). Its occurrence is associated with the death of some cardiomyocytes in the blood supply zone of the occluded artery with the subsequent development of a scar at this site (Vatnikov, Rudenko et al., 2019). Due to the occurrence of cardiomyocyte deficiency in this place, often the contractility of the heart decreases in post-infarction patients, which is the reason for the decrease in their working capacity and the appearance in some of them of varying severity of heart failure (Medvedev, 2018d).

In this regard, it is very important to continue the search for approaches to improving the physical rehabilitation of patients after myocardial infarction, aimed at increasing the degree of restoration of their performance (Vorobyeva, Medvedev, 2019). Moreover, an especially important role in this process is traditionally assigned to increasing the reserve capacity of the heart in such patients. It is recognized that this problem can be most effectively solved by the early activation of these patients and the active use of dosed physical exercises in them (Medvedev, 2019). Early muscle activation contributes to the development in their heart, especially around the necrosis zone, of full-fledged adaptation processes, the strengthening of the forming scar and promotes a persistent positive psychological attitude in patients to recover (Lenchenko, Vatnikov et al., 2019).

More active muscle activity within the framework of the author's scheme of therapeutic physical culture provided greater stimulation of the functional activity of systems and organs, providing higher opportunities for its implementation than traditional classes of therapeutic physical culture. There is no doubt that in the process of its implementation in the second experimental group, more significant changes developed on the part of the nervous, cardiovascular and respiratory systems, metabolic processes and blood composition (Bikbulatova, 2018c). Moreover, the positive dynamics of metabolic processes in the central nervous system, which optimize the coordination of changes throughout the body, played an important role in the upcoming functionally beneficial changes. This contributes to the rationalization of movements and the formation of a dynamic stereotype that helps general recovery (Medvedev, 2018i).

More active muscular work according to the author's scheme, apparently, increased the level of excitability in the nerve cells of the coordinating centers to a greater extent than physical therapy by traditional methods. At the same time, against the background of the author's technique, inhibition processes were more pronounced in the central nervous system, due to which only in this case a physiologically favorable equilibrium was established between excitation and inhibition (Bikbulatova et al., 2018).Apparently under the influence of nervous impulses originating from the Central nervous system, in the course of medical physical culture by the author's scheme in the muscles maximally increased biochemical and biophysical processes that provide reduction. The more successful of muscle activity inevitably there was a significant positive functional shifts in the work of all internal organs (Medvedev, 2018j).

The obtained results give reason to believe that the classes of medical physical culture by the author's scheme has been able to provide patients with myocardial infarction develop greater resistance to hypoxia. Apparently, this is based on a significant increase in the number of mitochondria in their cells and the increase of enzyme activity, primarily aerobic glycolysis. These changes naturally resulted in more pronounced increase total physical capacity, which was judged by the test results of 6-minute walk. Achievement in the application of the copyright scheme a higher level of physical capacity in post-infarction patients provided they have a physiologically beneficial adaptation to daily activity (Medvedev, 2018g).

Based on literature data it is possible to think that the basis of the achieved effect was the development of physiological hypertrophy part of skeletal muscles and thickening of cardiomyocytes, primarily around post-infarction scar, due to the accumulation of protein and mitochondria. It is stimulated in heart patients metabolism, optimizing it processes of depolarization and repolarization. At the same time engaged in a medical physical culture according to the author's scheme, apparently, has resulted in a substantial weakening of the tone of smooth muscle in the walls of arteries of medium caliber. These changes have led to the application of the copyright scheme of medical physical culture resistant to physiologically beneficial to the overall hemodynamic decrease in systolic and diastolic blood pressure (Bikbulatova, 2018b).

It may be thought that the achievement of a more pronounced general recovery of patients who had myocardial infarction during the application of their own methods of physical therapy was possible as a result of strong and gentle stimulation of metabolic processes in the skeletal muscles and myocardium, causing accelerated scarring in the necrosis zone and activating compensation mechanisms in the myocardium around it, surpassing those against the background of dosed muscle loads in the aerobic regimen involving several muscle groups traditional scheme.

CONCLUSION

The functional features of men aged 45-60 who have had myocardial infarction are a decrease in the resistance of their cardiovascular system to hypoxia and a decrease in their body's ability to tolerate physical activity. The developed author's scheme of therapeutic physical culture was able to increase in men aged 45-60 who had myocardial infarction, resistance to physical activity and to hypoxia of their cardiovascular system and the whole organism. The effectiveness of the use of the author's scheme of therapeutic physical culture significantly exceeded the effectiveness of the traditional scheme, since only in the first case, all the considered parameters in post-infarction patients were brought closer to the level of clinically healthy people.

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