Functional features of the heart of swimmers

UDC 797.2

PhD **M.A.Grishan**[1]
Dr. Biol., Professor **S.Yu. Zavalishina**[1]
PhD, Associate Professor S**.V. Tokareva**[2]
A.Yu. Skripina[2]
[1]Russian State Social University, Moscow
[2]Southwest State University, Kursk

Corresponding author: alexm-77@list.ru

Abstract

Objective of the study was to evaluate the cardiac activity of young swimmers.

Methods and structure of the study. The scientific work was carried out on 19 young swimmers with at least three years of swimming experience. The control group included 22 young volunteers who had not been involved in sports throughout their lives. In both groups, an ultrasound examination of the heart was performed using the SSD-80 Aloka device (Japan). Statistical processing was carried out by calculating Student's t-test.

Results and conclusions. In trained swimmers, hypertrophy of the left ventricle was noted with an increase in the mass and thickness of its posterior wall, with an optimum of its external size and cavity volume. In swimmers, a physiologically beneficial increase in the mass of the left ventricle was noted with its normal contractility and the optimal size of its cavity. Well-trained swimmers had a higher rate of myocardial relaxation than physically untrained young men.

Keywords: *swimming, ultrasound, myocardium, heart, left ventricle, physical training.*

Introduction. Regular muscle training has a stimulating effect on the entire body [6, 9]. Systematic physical training has a positive effect on its morphological, biochemical and physiological characteristics [4, 11]. In the case of their rational dosing, stimulation of vital processes in all internal organs is achieved [1, 7].

It is very important to study the impact of regular physical activity on the morphology and contractility of the myocardium. Registration of these indicators allows assessing the state of functional capabilities of the heart [3, 8]. For the physiology of sports, the study of the characteristics of the heart in swimmers is of particular importance, since this information contributes to understanding the mechanisms of adaptation of the heart to regular loads in the aquatic environment [2]. Achieving high effectiveness of swimming training is possible only when taking into account the dynamics of cardiac indicators in trainees [12].

Objective of the study was to evaluate the cardiac activity of young swimmers.

Methods and structure of the study. The study was conducted on 19 young swimmers aged 18 to 21 years. All of them regularly for at least three years went in for swimming in the pool for at least 40 minutes per session four times a week. The control group included 22 clinically healthy young men aged 18 to 21, leading a physically inactive lifestyle. All patients underwent an ultrasound examination of the heart using an SSD-80 ultrasound echocardiograph manufactured by Aloka (Japan).

Mathematical processing of the results was carried out by computer by calculating the value of Student's t-test. Differences between the parameters of the compared groups were considered significant at $p<0.05$.

Results of the study and their discussion. Systematic swimming in the pool contributes to positive functional changes in the heart (see table). The most obvious differences between both groups of observation were noted in the parameters of the left parts of the heart. The diameter of the left atrium in swimmers tended to exceed the control level (by 6.1%). In physically exercising, the anterior-posterior size of the left ventricle during diastole was 5.7% higher than the control. The decrease in this indicator tended to prevail among those who went in for swimming (by 6.9%). The thickness of the posterior wall of the left ventricle during diastole was 15.7% higher in swimmers. At the

Recorded indicators in male swimmers taken in the study

Indicator	Swimmers, M±m, n=19	Control, M±m, n=22
Myocardial mass, cm^3/kg	2,57±0,17	2,18±0,12 p<0,05
Ejection fraction, %	61,65±1,34	60,21±0,80
Left atrial diameter, cm/m^2	1,92±0,06	1,81±0,05
Antero-posterior size of the left ventricle in diastole, cm	5,39±0,16	5,10±0,11
Reduction of the anterior-posterior value of the left ventricle,%	35,19±0,78	32,92±0,65
Diastolic thickness of the left ventricle in the posterior wall, cm	1,18±0,10	1,02±0,07 p<0,05
End diastolic volume of the heart, cm^3/kg	1,79±0,11	1,95±0,07
Stroke volume, cm^3/kg	1,11±0,12	1,09±0,08
The highest rate of relaxation of the left ventricle in the posterior wall, cm/s	13,5±1,18	10,0±0,45 p<0,05
Ratio of end-diastolic volume to myocardial mass, cm^3/kg	0,72±0,08	0,92±0,07 p<0,01

Note: p - statistical significance of differences between groups.

same time, the value of the end diastolic volume of the heart in them showed a tendency to yield to the value in the control (8.9%).

Myocardial mass in swimmers was significantly higher (by 17.9%) than in the control group. This indicated the development of some physiological myocardial hypertrophy during swimming loads. Its severity was small, which did not change the magnitude of their stroke volume, which remained comparable in both observation groups. The ratio of diastolic final volume to the mass of the myocardium in swimmers was higher than in the control.

In the posterior wall of the left ventricle, the rate of relaxation prevailed in experienced swimmers over this indicator in physically untrained by 35.0%.

It can be assumed that swimming contributes to the development of left ventricular hypertrophy, as indicated by an increase in the thickness of its posterior wall and an increase in its mass even with the stability of the volume of its cavity, which in the examined athletes corresponded to the values in the control group.

A high rate of onset of myocardial relaxation is typical for people who exercise regularly [11]. The highest rate of development of relaxation of the walls of the left ventricle reflects the time of implementation of this phenomenon during diastole [12]. In our observation, this parameter was increased in swimmers. However, the value of this indicator is very unstable and experiences dynamics even during one ultrasound observation. In this regard, this indicator cannot be considered completely reliable for making final judgments.

Conclusions. Regular swimming has a beneficial effect on the physiological capabilities of the heart. Systematic swimming training contributes to an increase in the mass of the left ventricular myocardium and the preservation of its functionality without the development of signs of dilation in it. Regular swimming exercises lead to a functionally beneficial increase in the rate of left ventricular relaxation.

References

1. Kapilevich L.V. Fiziologicheskiy control tekhnicheskoy podgotovlennosti sportsmenov [Physiological control of sportsmen's technical readiness]. Teoriya i praktika fizicheskoy kultury. 2010. No. 11. pp. 12-15.
2. Korolevich A.N., Davydov V.Yu., Petryaev A.V., Sinitsin A.S. Vzaimosvyaz mezhdu skorostyu plavaniya i silovymi, morfofunktsionalnymi, psikhofiziologicheskimi pokazatelyami v plavanii [Relationship between swimming speed and power, morphofunctional, psychophysiological indicators in swimming]. Izvestiya Tulskogo gosudarstvennogo universiteta. Fizicheskaya kultura. Sport. - 2015. - No. 1. - P. 48-57.
3. Medvedev I.N., Kachenkova E.S. Funktsionalnyye osobennosti serdtsa u legkoatletov [Functional features of the heart in athletes]. Teoriya i praktika fizicheskoy kultury. 2021. No. 8. pp.20-21.
4. Simonenko V.B., Medvedev I.N., Tolmachev V.V. Patogeneticheskiye aspekty arterialnoy gipertonii pri metabolicheskom sindrome [Pathogenetic aspects of arterial hypertension in metabolic syndrome]. Klinicheskaya meditsina. 2011. Vol. 89. No. 1. pp. 49-51.
5. Simonenko V.B., Medvedev I.N., Bryukhovetsky A.G. Diureticheskaya terapiya i funktsionalnaya aktivnost trombotsitov u bolnykh arterialnoy gipertoniyey v sochetanii s abdominalnym

ozhireniyem [Diuretic therapy and platelet functional activity in patients with arterial hypertension in combination with abdominal obesity]. Klinicheskaya meditsina. 2012. Vol. 90. No. 11. pp. 54-56.
6. Karpov V.Yu., Medvedev I.N., Kazakov D.A., Sibgatulina F.R., Shulgin A.M., Krasnov R.B. Physiological Basis of Rehabilitation for Ulnar Neuritis. Biomedical & Pharmacology Journal. 2020. Vol. 13 (2). pp. 585-590.
7. Karpov V.Yu., Medvedev I.N., Romanova A.V., Usov S.S., Kozyakov R.V. Functional Disorders in the Respiratory System in Adolescents with Bronchial Asthma. Indian Journal of Public Health Research & Development. 2019. Vol.10, № 8. pp. 1904-1909.
8. Karpov V.Yu., Medvedev I.N., Komarov M.N., Lapina N.M., Sharagin V.I. Physical Rehabilitation of Adolescents with Bronchial Asthma. Indian Journal of Public Health Research & Development. 2019. Vol.10. № 8. pp. 1910-1914.
9. Makhov A.S., Medvedev I.N., Mikhailova I.V., Alifirov A.I. Psychological satisfaction of parents of young football players with a mosaic form of down syndrome by the quality of sports training. Prensa Medica Argentina. 2019. Vol. 105 (8). pp. 477-482.
10. Makhov A.S., Medvedev I.N. Physiological and morphological peculiarities of children with Down's syndrome: A brief review. Bali Medical Journal. 2020. № 9 (1). pp. 51-54.
11. Medvedev I.N., Karpov V.Yu., Makurina O.N., Eremin M.V., Dorontsev A.V., Sibgatulina F.R., Ivanov D.A. Functional reaction of the cardiovascular system to irritation of vestibular receptors in students engaged in different types of martial arts. International journal of biology and biomedical engineering. 2022. No. 16. pp. 96-104.
12. Medvedev I.N., Savchenko A.P., Kiperman Ya.V. Dynamics of the Intravascular Activity of Platelets in Young Men with High Normal Blood Pressure Regularly Practicing Physical Activity. Biology and Medicine (Aligarh). № 7 (1). BM-069-15.