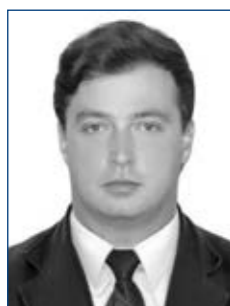


Heart functional indicators in hand workers

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Abstract

Objective of the study was to find out the features of the function of the left ventricle of the heart in systematically trained hand-to-hand fighters.

Methods and structure of the study. The observation was made on 23 well-trained hand-to-hand young men with at least four years of uninterrupted sports experience. The control group included 27 healthy male volunteers who had never been involved in physical culture and sports. The examination included an ultrasound assessment of the heart using an SSD-80 Aloka echocardiograph (manufactured in Japan) with the registration of a number of heart parameters. Mathematical processing of the results was performed by Student's t-test by computer data processing.

Results and conclusions. The examined hand-to-hand fighters showed signs of hypertrophy of the left ventricular myocardium, manifested by an increase in its mass and an increase in the thickness of its posterior wall. However, its overall size and cavity volume remained normal. Hand-to-hand fighters were characterized by a high rate of myocardial relaxation, exceeding this indicator in untrained young men. The results obtained allow us to consider that hand-to-hand combat exercises strongly stimulate the entire body. This ensures the development of a physiologically very beneficial increase in the mass of the left ventricular myocardium while maintaining the optimum of its functional characteristics and the normal volume of its cavity.

Keywords: hand-to-hand combat, heart, left ventricle, hemodynamics, physical training.

Introduction. Regular muscle loads, including training in hand-to-hand combat, ensure the formation of a number of adaptive, functionally beneficial changes in the body [5, 7]. At the same time, rational systematic muscle loads provide a pronounced stimulation of the main physiological and biochemical parameters, primarily in the musculoskeletal system and life support organs [2]. Under conditions of strict dosing of physical activity, they lead to the development of adaptive phenomena in all internal organs, including the cardiovascular system [6].

Of considerable scientific interest is the effect of regular loads in martial arts on myocardial contractility, the volume of the left ventricle of the heart, and the

dynamics of the anteroposterior size of the left ventricular myocardium throughout the cardiac cycle. Their assessment to a large extent can help to assess the dynamics of the functional characteristics of the heart of this category of athletes [9].

It is noticed that in highly trained athletes there is an increase in systolic volume and a change in the size of the left ventricle. At the same time, in beginner athletes, the systolic volume may be even lower than in untrained people [4].

Despite the great physiological significance of heart parameters for sports results, adaptation processes in the heart muscle to systematic sports loads in hand-to-hand fighters have not been studied enough [3].

For a better understanding of the impact of regular training in hand-to-hand combat on the body of athletes, it seems justified to evaluate the morphofunctional parameters of the heart in experienced hand-to-hand combatants [10].

Objective of the study was to find out the features of the function of the left ventricle of the heart in systematically trained hand-to-hand fighters.

Methods and structure of the study. The observation was made on 23 hand-to-hand young men (11 people had the first adult category and 12 young men were candidates for the master of sports of Russia). All athletes were between the ages of 18 and 21. These surveyed regularly trained at least three times a week in the hand-to-hand combat section and had a continuous sports experience of at least four years. The control group included 27 healthy young men (18-21 years old) who agreed to participate in the study and experienced physical activity only during academic physical education classes.

All young men under observation underwent an ultrasound examination of the heart using an ultrasonic device SSD-80 manufactured by Aloka (Japan). Based on the obtained data, the diastolic cardiac volume was calculated [1] and the value of the myocardial mass was determined by the standard method [11].

Mathematical processing of the obtained results was carried out using Student's t-test. The statistical significance of differences in indicators in the compared groups of young men was recorded under the condition $p < 0.05$.

Results of the study and their discussion. In the performed scientific study, the features of the heart

parameters in hand-to-hand fighters were established and compared with those of the boys in the control group (table). Very pronounced differences between both observed groups were found for the morphological characteristics of the myocardium of the left parts of the heart.

The width of the left atrium in melee fighters tended to exceed by 5.0% over that in the control. In athletes, the anteroposterior diastolic size of the left ventricle had a weak tendency to prevail over that in the control (by 3.1%). Also, a slight tendency to exceed the control level was noted in hand-to-hand fighters in terms of reduction in the anteroposterior value of the left ventricle (by 3.7%).

The thickness of the posterior wall of the ventricle in the left heart at the time of diastole in athletes was 15.2% greater than in the control group ($p < 0.05$). The value of the end diastolic volume of their hearts showed a tendency to yield to the control level (by 8.1%), while the magnitude of the stroke volume was comparable in both observation groups.

The index of myocardial mass in athletes was significantly higher (by 17.9%) than in the control group. This indicated a slight adaptive hypertrophy of the myocardium in hand-to-hand fighters, caused by their regular training. However, the presence of signs of hypertrophy did not affect the value of cardiac output, which remains comparable in both groups of the examined young men.

The highest rate of relaxation of the posterior wall of the left heart ventricle, which is an important marker of the functionality of the heart, in hand-to-hand fighters exceeded this indicator by 29.2% in the control group.

Cardiac parameters in the athletes taken into the study

Indicator	Hand-to-hand fighters $M \pm m$, n=23	Control, $M \pm m$, n=27
Stroke volume, cm^3/kg	1,11 \pm 0,15	1,07 \pm 0,09
End diastolic volume of the heart, cm^3/kg	1,85 \pm 0,12	2,00 \pm 0,05
Diastolic thickness of the left ventricle in the posterior wall, cm	1,21 \pm 0,06	1,05 \pm 0,07 $p < 0,05$
Reduction of the anteroposterior value of the left ventricle, %	34,38 \pm 0,75	33,16 \pm 0,69
Anteroposterior diastolic size of the left ventricle, cm	5,30 \pm 0,12	5,14 \pm 0,11
Left atrium width, cm/m^2	1,89 \pm 0,06	1,80 \pm 0,05
Ratio of end diastolic volume to myocardial mass, cm^3/kg	0,72 \pm 0,07	0,93 \pm 0,09 $p < 0,01$
The highest rate of relaxation of the left ventricle in the posterior wall, cm/s	13,4 \pm 1,33	10,1 \pm 0,67 $p < 0,01$
Ejection fraction, %	61,78 \pm 1,26	60,33 \pm 0,72
Myocardial mass, cm^3/kg	2,54 \pm 0,21	2,14 \pm 0,12 $p < 0,05$
Ejection fraction, %	61,78 \pm 1,26	60,33 \pm 0,72

Note: p - significance of differences between groups.



The performed study indicates the comparability of the parameters of the left atrium, as well as the size and volume of the cavity of the left ventricle, in young men of both groups. A similar status had indicators of general hemodynamics and the state of myocardial contractility (except for the highest rate of relaxation of the posterior part of the left ventricle). Under these conditions, the ratio of the end-cardiac diastolic volume to the mass of the myocardium under conditions of regular hand-to-hand combat training turned out to be significantly less than in the control. This should be associated with an increase in the heart muscle of athletes, including in the walls of the left ventricle. The decrease in the ratio of end-diastolic volume to the value of myocardial mass in hand-to-hand fighters to 0.72 ± 0.07 indicates the prevalence of left ventricular hypertrophy in this category of athletes over dilatation of its cavity (see table).

The conducted study gives grounds to assert that hand-to-hand combat leads to the development of a very moderate adaptive hypertrophy of the left ventricular myocardium. This was proved by the found increase in its thickness in the posterior wall and the increased value of its mass at the optimum of its total volume and the volume of its cavity, which did not significantly differ from their values in the control group.

There is a point of view that a high rate of realization of relaxation phenomena in myocytes is characteristic of physically trained people [11]. At the same time, the maximum rate of myocardial relaxation in the posterior wall of the left ventricle during diastole can be considered as a marker of a high level of physical fitness [12]. These literary data are quite consistent with the results of the work performed, which demonstrated a higher level of this indicator in hand-to-hand fighters. At the same time, there is a point of view that this parameter is very dynamic even in the course of one observation [10], which does not allow it to be considered as a reliable indicator for serious conclusions. This circumstance requires further research to clarify this issue among hand-to-hand fighters.

Conclusions. Systematic, feasible training in hand-to-hand combat has a very positive effect on the work of the heart. Regular long-term loads during hand-to-hand combat training form functionally very beneficial changes in the myocardium in athletes. In experienced hand-to-hand fighters, there is a slight increase in the muscle mass of the left ventricle while maintaining its functionality and the size of the cavity volume.

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