

INDEXES OF HEMODYNAMICS IN A DOSAGE OF PHYSICAL ACTIVITY IN GIRLS AGAINST THE BACKGROUND OF LOW SYSTOLIC BLOOD PRESSURE

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Annotation. *Purpose:* to examine the state of hemodynamics, blood oxygenation levels in girls with hypotensive type neurodystonia in a dosed physical load. *Material:* The study involved 59 women with hypotensive type neurodystonia aged 18-19 years and 14 healthy women the same age. *Results:* It was found that the girls on the background of low systolic blood pressure observed early hemodynamic response from the very first steps (25-50 W) bicycle stress test in the form of increased heart rate, stroke volume, pulse pressure. At the height of the stress test in 76.27 % of girls showed a reduction in blood oxygenation indices and lengthening of the period of recovery. *Conclusions:* The dose of girls in physical activity with hypotension, place high demands on the cardiovascular system, the restructuring of which is accompanied by inadequate oxygen supply systems in operation, adjustment disorder, low capacity for work that requires a non-drug methods of rehabilitation in the form of regular dose of physical activity, breathing exercises .

Keywords: hypotension, bicycle ergometry, hemodynamics, pulse oximetry.

Introduction

Arterial hypotension is viewed as multifactor state revealing blood pressure lowering in the arterial system at different physiological and pathological states. The reason of primary arterial hypotension in 80% cases is the neurocirculatory asthenia (NCA), while the girls have it 4-6 times oftener [2, 5]. Hypotension type of NCA is characterized by polymorphous clinical symptoms and is accompanied by physical and mental efficiency decrease at pre adult age resulting in lack of adaptational syndrome and worsening of life quality [4]. If this type of hypotension happens uncontrolled in the young age it may result in arterial hypertension development, cerebral blood flow disorders, complications during pregnancy and birth, early atherosclerosis etc. [6, 8]. Regarding this learning more about hemodynamic stress-tests of hypotension NCA, the peculiarities of its course and health improvement measures at preadult age by means of measured physical activities is gaining special importance.

Blood circulation system is a sensible indicator of the state of adaptive mechanisms of the whole organism while circulatory dynamics data precisely reflect the regulatory systems tension level especially caused by stress impact of physical exercise [5, 10], accompanied by high oxygen use by working muscles, higher CO₂ emission (carbon dioxide) and metabolites [11]. The factor limiting physical stress is the blood circulation system, its ability to transfer oxygen to working organs and tissues. That is why it is rather interesting to investigate circulatory dynamics and oxygen supply of the stress-test of girls with hypotension NCA type.

Purpose, tasks of the work, material and methods

The aim of work. To study the state of circulatory dynamics data, blood oxygenation level of girls with hypotension type of neurocirculatory asthenia in conditions of limited physical exercise.

Materials and methods of investigation.

59 students aged 17–19 years with hypotension NCA type comprising the main group have been studied. At Physical Education lessons they trained in special medical groups. Control set was made up of 14 practically healthy girls of the same age. The girls belonging to both groups did not do physical exercises on a regular basis. Adaptation reserve state was defined by means of the level of physical exercise evaluation, circulatory dynamics reaction, and oxygen supply during veloergometry test. The latter was conducted at the bicycle ergometer Siemens according to Cornell protocol – phased test, constantly increased every 2 min by 25 W [3]. The girls' general state has been continuously tested during the investigation by electrocardiogram, heart rate (HR) dynamics has also been evaluated by standard methods, arterial blood pressure (ABP), correlation of heart rate to Watts (HR/W), blood stroke volume (BSV), blood minute volume (BMV), pulse pressure (PP) at workload performed [1, 12]. The blood oxygenation level has also been defined by pulse oximeter (UTASOXY-201) at the peak of stress-test and at recovery time.

The results' probability level was evaluated by variation statistics analysis method of the results obtained alongside with statistical programs set Statistica v. 6.1 (USA) and recommendations of O. Y. Rebrova (2002).

Results of the research

The results of investigation showed that 72.88% of girls with hypotension NCA type in the rest state showed signs of constant tachycardia and 20.34% of girls had excessive heartbeat rate only during slight psychoemotional or physical loads, only 6.78% of people had constant heartbeat rate within normal limits.

During the examination systolic and diastolic AT comprised (95,43±1,33) mm column of mercury and (66,82±0,56) mm. The investigations conducted in stress-test conditions for girls of primary group showed the decrease of veloergometry test tension data to (95,45±1,94) W versus (142,86±6,24) W obtained in the group of healthy girls (p<0.001).

The analysis of the blood circulation system on the first levels of veloergometry test discovered among the girls of the main group early hemodynamic reaction in the form of heart rate speeding up, CRM increasing and correlation between heart rate and watt. Getting results predominated similar ones in the control group. So, under the

load of 25 W increase in heart rate was almost the same as in the main group as among girls from the control group, correspondingly, (19,92±1,44) % and (18,73±1,28)%. When loading 50, 75, 100 W in the main group of girls increase in heart rate was, respectively, (38,83±2,52)%, (52,6±1,8)%, (63,1±3,82)% and significantly surpassed the growth rates obtained in the control group, respectively, (32,4±1,64)%, (46,17±1,3)% and (56,88±1,6)% ($p < 0.05$). For a load of 125 W in a main group of girls who have reached it, the increase in heart rate (70,25±4,35)% predominated over the figures obtained among healthy women (81,48±2,68)% ($p < 0.05$). Among healthy individuals only after 100W load was recorded significant growth advantage in heart rate among girls in the control group – (81,48±2,68)%, (90,54±3,14)%, (108,12±4,06) %, (112,42 ± 4,34)%, respectively, 125, 150, 175 and 200 W VEM-test. It is appropriate in the outpatient setting to determine the ratio of HR/W, which in hypotensive type of dystonia is (1,65±0,08) standard units, against (1,06 ± 0,03) standard units ($p < 0.001$) the index of control groups. This index reflects the average myocardial ensure one watt load at which hypotensive type of asthenia is excessive [9].

Index BSV at rest in hypotensive type of dystonia was at 7.64% ($p < 0.05$) lower than the figure obtained in women of the control group (66,72±1,15) ml. The analysis of BSV at different steps of the bicycle ergometer showed that achieving load capacity of 75, 100 and 125 W main group of girls increase this figure amounted, respectively, (10,06±1,32)% ($p < 0.01$) (15,08±1,60)% ($p < 0.05$) and (24,60±1,95)% ($p < 0.05$) as compared with growth in the control group – (5,23±0,74)%, (11,48±1,22)% and (19,59±1,88)%, the growth rate will continue to BSV in healthy girls slightly surpassed metrics with asthenia. This demonstrates the use of accelerated and metabolic deficiency reserve in patients with NCA in terms of the stress test, which limits the power load. Thus, the heart works not only with varying frequency, but with a variable amount of emissions under stress [7].

The resulting dynamics of HR and BSV and their value, indicating that the increase BMV among main group of girls was due to the increasing in both heart rate and BSV; in healthy girls BMV grew mainly due to heart rate during the whole load. Exactly increase in heart rate under conditions of stress test indicates the degree of sympathico adrenal system's activity, increasing metabolic needs and oxygen uptake in the body, especially in skeletal muscle, myocardium and central nervous system [10, 15].

It is known that ABP has two components – a constant, which refers to the average blood pressure and throbbing, which turns the largest pulse pressure. Pulse pressure – reflects the interaction between the contractile function of the left ventricle and the stretch ability of great arteries (direct component), and the magnitude of wave reflection (indirect component) [9, 12]. Changes in heart rate in the main group of girls were accompanied by significant growth in all steps of the PP veloergometry tests – between 25 and 125 W, respectively (20,11±2,13)%, (37,28±1,66)%, (63,80±1,72)%, (64,50±1,45)%, (95,34)%. In the control group, the growth rates of PP at 50, 75, 100 and 125 W load were significantly lower than those obtained in the study group, and were, respectively (11,36±3,1)%, (20,99±2,34)%, (33,85±1,42)%, (69,48±2,12)%. However, the girls in the control group PP loaded 25 W was not significantly changed. A significant increase in PP of main group of girls in terms of the stress test can serve as a predictor of the formation of disadaptation syndrome, the development of more complex cardiovascular disease in the future. It is possible that the rate of PP is more informative, regardless of systolic blood pressure, an indicator of possible risks. The evolution of the PP may be regarded as an indirect marker of arterial tone condition [12].

Indicators of pulsesymetry (PSM) in the main and control groups at rest did not differ significantly among themselves, according, (97,64±0,33)% and (98,18±0,54)% ($P > 0.5$). At the same time, the rate of PSM at the height of a bicycle ergometer 76.27% of the girls fell to the main group (94,35±0,46)% ($p < 0.001$) in the control group – to (95,23±0,38) 21.43% of girls. Thus, reducing oxygenation in terms of physical activity indicates worsening energy production, metabolic disorders in cells and thus reduce efficiency. [13].

In regenerative period hemodynamic control group returned to baseline performance at the 3rd minute. 35.71% of girls at 5th minutes. 50% and 7th minutes. in – 14.29% of individuals. In the study group recovery in most of the girls come later - after 5th minutes. 13.56% of girls after 7th minutes. – In 35.59% of those 10th and – in 44.07% cases, 6.78% – heart rate, blood pressure returned to baseline figures after 15 minutes of recovery period. Indicators of PSM to 10 minutes recovery period in the intervention group increased to (97,58±1,13)% in 71.19% of patients that returned to its original state, the rest (28.81%) of the girls, it happened later – within 12-15 minutes .

Neurohormonal and metabolic disorders of the cardiovascular system's software in NCA manifested inadequate response, first infarction, the ordinary and the more significant stress stimuli nature. In women with signs of NCA, it is expressed early and excessive hemodynamic response to physical stress.

The analysis of heart rate in terms of the stress test reflects not only the functional state of the cardiovascular system, but also the level of regulatory mechanisms – the activity of stress-realizing and stress-limiting systems [15]. Intense or prolonged exercise in autonomic dysfunction impairs oxygen supply working organs and systems - aerobic short period adequate to ensure the future proceeds with a decrease in oxygen tension in the tissues, causing the body energy is mainly due to anaerobic mechanisms, thereby reducing tolerance to physical load [1, 14]. Physical stress in NCA reveals hidden "defects" neurocirculatory mechanisms that are primarily early, excessive and short-term reaction parameters of central and peripheral hemodynamics, aimed at leveling homeostasis [6].

The disintegration of neurohormonal, metabolic regulation at the level of the cerebral cortex, hypothalamus and reticular system leads to dysfunction of the autonomic nervous system, functional disorders of the visceral systems including cardiorespiratory system, especially in terms of physical stress, which in turn launches compensation mechanisms of the patient, which quickly exhausted in this category of people without proper correction.

The extent and dynamics of physiological changes during different intensity and duration of exercise, as well

as the speed and completeness of recovery after physical stress, especially given the low systolic blood pressure, make it possible not only to determine the status of reserve capacity rights, but also to describe its "physiological portrait", give a detailed description of predictive adaptive reserves.

Conclusions.

1. Dosage physical activity among girls with hypotensive type NCA, makes high demands on the cardiovascular system, the restructuring of which is accompanied by inadequate oxygen supply operating systems, adjustment disorder.
2. For rapid assessment of functional reserves of the organism, the effectiveness of health programs carried out at a young age with NCA recommended reduced exercise tolerance in hypotonic type of asthma manifested early hemodynamic response in the form of an increase in the ratio of HR/W, pulse pressure levels under conditions of stress test decrease pulesymetry and extend the recovery period.
3. For rapid assessment of functional reserves of the organism, the effectiveness of health programs carried out at a young age with NCA is recommended bicycle ergometry, determination of the ratio of HR/W, pulse pressure, pulesymetry.
4. In the presence of hypertensive type NCA advisable except drugs, it is mandatory appointment of non-drug methods of rehabilitation, which must include the mode of the day and sleep therapy, dosage systematic exercise, breathing exercises and more.

The prospect of further research. Studies of indices of central and peripheral hemodynamics in terms of the stress test will create the best approach in the physical rehabilitation of young people with signs of NCA.

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