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MODERN METHODS OF EARLY DETECTION OF PREDICTORS OF DEVELOPMENT OF CARDIOVASCULAR DISEASES IN CHILDREN

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ABSTRACT

Cardiovascular diseases are the main cause of disability and premature death in economically developed countries. The share of cardiovascular diseases in the mortality structure reaches 40-60%. The incidence of cardiovascular diseases among children and adolescents increases annually. Increased variability of blood pressure in patients with arterial hypertension at a young age is a factor that aggravates the violation of arterial rigidity. The aim of the study is to develop early diagnostic methods for cardiovascular diseases in children to reduce the incidence of primary and recurrent complications in the future.

Keywords: Cardiovascular diseases, atherosclerosis, children, blood pressure, ambulatory blood pressure monitoring.

INTRODUCTION

Currently, a concept of a single cardiovascular continuum has been developed in cardiology, which is understood as the continuous development of cardiovascular diseases: from risk factors to the development of chronic cardiovascular failure. In this regard, researchers are interested in finding ways to early identify functional changes in the heart and blood vessels in childhood and adolescence at the stage of transitional or borderline conditions, when there are no manifestations of the disease in its classical form [1, 2]. There are data in the literature demonstrating the existence of a close relationship between the frequency of occurrence of cardiovascular complications and the state of the main vessels [3]. The most attractive methods for assessing the state of the arteries are non-invasive, accessible and well-reproducible methods.

MATERIALS AND METHODS

One of the areas of prevention is the detection of preclinical stages of the atherosclerotic process, the formation of which begins in childhood. Meanwhile, to date, the processes of early development of atherosclerosis in children and adolescents have remained insufficiently studied [4].

It is known that single measurements of blood pressure do not reflect its true level [3]. In the diagnosis of hypertension/hypotension and assessment of the effectiveness of therapy, ambulatory blood pressure monitoring (ABPM) has found wide application.

ABPM in outpatient settings was performed in 477 children (307 boys and 170 girls) aged from 9 to 17 years. Patients were referred to ABPM by various specialists: cardiologist, endocrinologist, neurologist and pediatrician; due to blood pressure deviations, both upward and downward, detected during the appointment. This group did not include children with endocrine system pathology. ABPM was performed using the TM-2421 (A&D, Japan) and DR-

102 (Schiller, Switzerland) devices. BP was measured at 30-minute intervals during the day and night using two methods: oscillometric and auscultatory. During the monitoring period, the children were at home, observed the weekend regimen, kept a diary indicating physical activity and complaints (in no case were antihypertensive drugs used).

RESULTS AND DISCUSSION

Single measurements at a pediatrician's consultation do not give a complete picture of the nature of changes in blood pressure in a child and can lead to an incorrect diagnosis, since blood pressure has significant individual variability. It is difficult to diagnose arterial hypertension/hypotension at the early stages of their development, when they are often asymptomatic. The method of daily blood pressure monitoring is characterized by high reproducibility, minimizes the impact on blood pressure of the "white coat" phenomenon, which is often encountered in adolescents, who are characterized by lability of the nervous system. Often, emotional fluctuations in blood pressure lead to overdiagnosis of arterial hypertension and unjustified therapy. Using chronobiological analysis, it was established that blood pressure levels in children have significant individual variability on different days of the week. In this regard, single measurements of blood pressure during a consultation with a pediatrician do not allow for an adequate assessment of the direction and dynamics of blood pressure changes in children, which leads to an inaccurate determination of the types of autonomic dysfunction. In adolescents aged 13–15 years, the average values of the parameters of daily blood pressure rhythms differ by days of the week and are more pronounced in overweight children. It was found that an increase in the body mass index percentile in children and adolescents correlates with an increase in the average levels of systolic and diastolic pressure, time indices, and hypertension area. An increase in the body mass index percentile indicates an increased risk of developing arterial hypertension in children. It has been proven that in school-age children, nocturnal diastolic hypertension is associated with obesity. Increased variability of blood pressure levels at night in children with nocturnal hypertension and normal blood pressure levels during the day is detected only with daily monitoring of blood pressure and allows for an accurate diagnosis of mixed-type autonomic dysfunction syndrome.

The necessary components of the cardiovascular continuum are the imbalance of the endothelial system and the processes of cardiovascular remodeling. This is why the role of structural and functional changes in the arteries increases in the development of diseases of the circulatory system. Violation of the morphological structure of the vascular wall indicates the presence of arterial remodeling, which is a prognostic factor in the development of cardiovascular complications and an independent predictor of future "catastrophes" [3]. Pulse wave propagation velocity is of the greatest importance for assessing arterial remodeling using non-invasive diagnostic methods. For the first time in the population of Russian children, the values of pulse wave propagation velocity and augmentation index were determined during non-invasive oscillometric arteriography. In accordance with the aims and objectives of the study, data from 514 patients aged 3 to 13 years were analyzed, including 363 practically healthy children (184 girls and 179 boys) and 151 with overweight and constitutional-exogenous obesity of I–III degree. Non-invasive oscillometric arteriography was performed on

the TensioMed device (Hungary). Necessary conditions for accurate measurements were rest before the study and rest during the study. Blood pressure indicators had to correspond to normal values.

It was found that the pulse wave velocity and augmentation index do not depend on gender in children. Non-invasive arteriography indices are directly dependent on age and body length. The data obtained in children statistically significantly differ from the standardized norms of pulse wave velocity in adults, and therefore it is necessary to focus on the values corresponding to age.

A reliable relationship was determined between the degree of obesity and increased vascular wall remodeling. The pulse wave velocity depends on the degree of obesity, and with an increase in body weight, its increase is noted.

The pulse wave velocity (PWV) increases most significantly in patients with obesity of grades II and III. In children with varying degrees of obesity, a direct relationship was established between an increase in the PWV index and factors that aggravate arterial remodeling: the level of total cholesterol in the blood serum and liver damage such as fatty hepatosis. The obtained results indicate that in children with increased body weight in combination with hypercholesterolemia, the values of the augmentation index and the velocity of pulse wave propagation along the aorta were higher than in the group without biochemical changes, which once again confirms the fact of vascular remodeling in hypercholesterolemia. It was noted that in children with fatty hepatosis, the indicators of body weight, body mass index, velocity of pulse wave propagation along the aorta and augmentation index were higher than in healthy children.

CONCLUSION

Primary prevention of cardiovascular disease development, carried out in the general population, has proven its effectiveness. The method of non-invasive oscillometric arteriography will make it more effective, since its use will allow identifying high-risk patient groups from the general population. The developed algorithm for diagnosing early markers of cardiovascular disease development in children in outpatient settings has determined new approaches to their therapy, prevention and correction.

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