THE USE OF CARDIORHYTHMOGRAPHY IN THE FORMATION OF ARTERIAL HYPERTENSION RISK GROUPS IN ADOLESCENTS

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© **A.N. Biyanov,** PhD, Tutor, the Department of Pediatrics[1];
L.V. Sofronova, D.Med.Sc., Professor, the Department of Pediatrics[1];
E.V. Zubov, PhD, Head of City Child Cardiologic Clinical Diagnostic Center[2]

[1]Perm State Medical Academy named after Academician E.A. Vagner, Petropavlovskaya St., 26, Perm, Russian Federation, 614051;
[2]Children City Clinical Hospital No.3, Lenina St., 13, Perm, Russian Federation, 614051

The aim of the investigation was to assess the availability of cardiorhythmography to distinguish arterial hypertension risk group among adolescents.

Materials and Methods. We examined 59 adolescents with grade I arterial hypertension. The children underwent clinical, laboratory and instrumental examinations. The control group included 20 children comparable with the main group in gender and age, with no previous history of arterial hypertension. We assessed initial vegetative tonus and vegetative responsiveness by cardiorhythmography in all patients.

Results. According to cardiorhythmography findings, the adolescents suffering from arterial hypertension were found to have vegetative tonus changes statistically significantly more frequently compared to healthy children. The changes of vegetative tonus occurred in the form of the increased effect of sympathetic autonomic nervous system and the presence of unfavorable responses on load (hypersympathicotonic and asympathicotonic) due to the changes of regulatory systems functioning in the process of the body adaptive response formation in arterial hypertension.

Conclusion. Cardiorhythmography effectively reveals the body adaptive resource defects on loading and can be used to distinguish arterial hypertension risk groups.

Key words: cardiorhythmography; arterial hypertension; initial vegetative tonus; vegetative responsiveness.

In adults, hypertensive disease is one of the leading causes of cardiovascular events, and since initial manifestations of the disease are formed in childhood, arterial hypertension (AH) risk stratification among children is an urgent medical problem [1, 2].

Just in childhood there first occur different autonomic regulation disorders, which initially have a functional character, and then, however, contribute to AH progression and hypertensive disease development. The study of the initial vegetative tonus (IVT) and vegetative responsiveness (VR) enables to get an idea of the features of vegetative regulation of the cardiovascular system and the organism as a whole. Detected hypersympathicotonia and hypervagotonia with hypersympathicotonic responsiveness enable to distinguish an AH risk group for children [3, 4].

Cardiorhythmographic investigation is the basic method to diagnose autonomic dysfunctions. Moreover, it is used to determine the level of adaptive potential and the risk of cardiovascular event.

The study of the findings of cardiorhythmogram at rest enables to estimate the background vegetative effects on cardiac rhythm, though a complete idea of vegetative regulacon is provided by the investigation under functional load conditions. Orthostatic test is considered to be the most universal test to assess the vegetative regulation resources. The test enables to specify the data on the functional state of cardiovascular system and the range of its adaptation to the loads, and is one of the most important techniques to study circulatory dimensions. It is known that in norm when the recumbent position is changed into erect position there is the activation of the sympathetic nervous system and the mobilization of the circulatory organs that is reflected in the increase of mode amplitude and tension index. In contrast, the variation range value decreases that indicates the reduced level of vagus regulation of cardiac rhythm [3].

The aim of the investigation was to assess the availability of cardiorhythmography to distinguish arterial hypertension risk group among adolescents.

Materials and Methods. We examine 59 adolescents aged from 12 to 15 years (13.60±0.87 years) with grade I AH, among them there were 28 girls and 31 boys. The study included the children with mean arterial pressure (AP) level being equal or exceeding the 95th percentile value for this age, body height and gender, and not exceeding the 99th percentile more than 5 mm Hg. All patients had no signs of target organs damage that made it possible to diagnose grade I AH. Patients with secondary AH were excluded

For contacts: Biyanov Alexey Nicolaevich, phone +7 904-842-09-81; e-mail: big-1279@yandex.ru

from the study. Clinical and laboratory and instrumental examination in addition to clinical test included serum lipid assay, blood sugar level, calcium and creatinin level, 24-hour blood pressure monitoring, electrocardiography, echocardiography, nephrosonography, and ultrasonic investigation of the adrenals. The control group included 20 children comparable with the treatment group in gender and age, with no previous history of AH.

All patients underwent cardiorhythmography on hardware-software system "Valenta" (Russia). Studying the findings we assessed the following indices: initial vegetative tonus, vegetative responsiveness. The patients were examined before noon, an hour after meals, after 10–15-minute rest in comfortable conditions for a child. Before the examination there were performed no medical procedures that could have an effect on vegetative indices.

We calculated the main indices of variation pulsometry according to R.M. Baevsky technique: Mo (mode, s), ΔX (variation range, s), AMo (mode amplitude, %), SI (strain index). As a load we used clinoorthostatic test that gives relevant information on the functional state of cardiovascular system and the range of its adaptation to loads. The test is one of the most important techniques of circulatory dimension study. IVT was estimated by the background SI in the following way: atonia (balanced state of the regulatory systems of autonomic nervous system) — if SI was from 30 to 90 RU; vagotonia — if SI was from 1 to 29 RU; moderate sympathicotonia — SI was from 91 to 160 RU; hypersympathicotonia — if the background SI was over 160 RU. VR was assessed when a patient was brought into erect position, and was characterized by the relationship of SI on the first minute of orthostasis (SI1) to the background SI and was interpreted as normotonic, hypersympathicotonic, and asympathicotonic taking into consideration Widler initial level [4].

The findings were processed using standard analysis of variance in Microsoft Excel (2007), as well as Statistica 6.0 program (StatSoft, USA).

Results and Discussion. The frequency analysis of different changes of vegetative homeostasis according to cardiorhythmography in AH patients (Tables 1 and 2) showed that there were mainly revealed sympathicotonia and hypersympathicotonia in adolescents of the main group. The differences with the control group were statistically

Table 1

Initial vegetative tonus according to cardiorhythmography in adolescents with AH

Initial vegetative tonus	Main group (n=59)		Control group (n=20)		p
	abs. number	%	abs. number	%	
Vagotonia	2	3.4±2.4	10	50.0±11.1	0.001
Atonia	12	20.3±5.2	6	30.0±10.2	0.05
Sympathicotonia	27	45.8±6.5	4	20±8.9	0.05
Hypersympathicotonia	18	30.5±6.0	0	0	0.001

Table 2

Vegetative responsiveness according to cardiorhythmograms in adolescents with AH

Vegetative responsiveness	Main group (n=59)		Control group (n=20)		p
	abs. number	%	abs. number	%	
Normal	16	27.1±5.6	17	85.0±7.8	<0.001
Hypersympathicotonic	25	42.4±6.4	3	15.0±7.8	0.05
Asympathicotonic	18	30.5±6.0	0	0	0.001

significant. In the control subjects atonia or vagotonia was diagnosed in 80% of cases, hypersympathicotonia was not revealed at al.

Only one third of the treatment group patients had normal VR (See Table 2), while among the children with normal AP there were 85% of cases normal VR. Hypersympathicotonic VR was more frequently diagnosed in the main group patients (statistically significant differences with the control group), and sympathicotonic responsiveness was diagnosed in the main group patients only.

There was the decrease of parasympathetic cardiac innervation in relative persistence of the sympathetic one that was reflected by high frequency of hypersympathicotonic VR type in AH children. Moreover, only in AH children against the background of the marked hypersympathicotonia we recorded asympathicotonic VR variant that reflects the significant tension of the controlling systems.

The most adolescents with normal AP had the normal response of autonomic nervous system to stress factor. Hypersympathicotonic VR type was recorded significantly less frequently in this group.

Thus, cardiorhythmography enables to state the initial vegetative tonus in AH adolescents to be characterized by the hypersthenia of the sympathetic part of autonomic nervous system. High frequency of hypersympathicotonic and asympathicotonic response to the load in such patients indicates the adaptive resource insufficiency. The stratification of patients with asympathicotonic and hypersympathicotonia vegetative responsiveness in risk group, and the measures aimed at vegetative dysregulation leveling will enable to prevent AH development in such patients.

Conclusion. Cardiorhythmography is an essential method to determine the adaptive potential level and the risk of cardiovascular pathology including arterial hypertension in adolescents.

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