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# CHARACTERISTICS OF ADAPTIVE CAPABILITIES OF THE AUTONOMIC NERVOUS SYSTEM IN PATIENTS WITH JUVENILE RHEUMATOID ARTHRITIS IN ANDIJAN REGION

**Matkomilov Jamshidbek Akhunovich**

Department of Reabilitolg sport medicine and tradicional medicine

Andijan State Medical Institute, Uzbekistan, Andijan

**Annotation:** Children have a number of features of autonomic homeostasis: some functions of the ANS are not yet sufficiently formed, others are in their infancy, and still others do not differ from those in adults [1, 5, 6, 7]. In this regard, the nature and level of changes in the functional state of the cardiovascular system and the relationship between the autonomous (parasympathetic) and central (sympathetic) circuits of the ANS in patients with JCA are of significant interest. It is these relationships that in many cases determine the disturbances of the autonomic response, changes in the tone of peripheral vessels, and microcirculation disorders, which determine the characteristics of the course and severity of the condition of patients with juvenile rheumatoid arthritis [3, 4]. However, the state of autonomic homeostasis in patients with juvenile rheumatoid arthritis (JRA) has not yet been covered in the literature, which served as the basis for conducting the study.

**Key words:** juvenile rheumatoid arthritis, parasympathetic, sympathetic.

**Relevance.** In patients with JRA, along with specific signs of the disease, complaints characterizing a violation of autonomic homeostasis were dominant: fatigue, sleep disturbance, sweating of the palms and soles, low mood and apathy, headaches and deterioration of memory, vision, etc. These complaints were clinically combined with such symptoms as hyperemia of the face, palms and soles, coldness of the extremities, high frequency of red dermographism, increased pulsation of the cervical vessels, muffled and split heart sounds, systolic murmur at the apex and base of the heart.

Naturally, differentiating these complaints and clinical symptoms from “true” autonomic disorders or those caused by secondary disorders of the higher parts of the central nervous system presents significant difficulties.

**The purpose of the study.** It was necessary to assess the state of autonomic homeostasis (tone, reactivity and security) in patients with juvenile rheumatoid arthritis.

**Material and research methods.** To achieve the goals and objectives of this work, we examined and observed 129 children aged 3-14 years with various clinical forms of JRA.

Electrocardiographic (ECG) studies were carried out in 12 generally accepted leads: I-, II-, III-standard, avR, avL, avF enhanced and U1-U6 chest leads. The study of autonomic homeostasis was carried out according to a unified and standardized research methodology: a) assessment of the initial autonomic tone [1, 2], b) study of autonomic reactivity using cardiointervalography and clinoorthostatic test, c) study of autonomic provision (cardiointervalography in clinoorthostasis). The digital material was processed by the method of variation statistics with the calculation of reliability according to Student-Fisher and the Fisher angular transformation.Результаты и их обсуждение**.**

An assessment of the initial autonomic tone under conditions of relative rest showed a significant predominance of cases of initial sympathicotonia - 73 children (56.6%; $P < 0.001$), a decrease in the proportion of eutonia - 34 children (26.4%; $P < 0.01$) and vagotonia - 22 patients (17.0%; $P < 0.05$) compared with the healthy population of this region [7]. It has been established that in patients with JRA the structure of the heart rhythm differs from that of healthy children. With

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initial eutonia, a certain balance is observed between the adrenergic (AMo) and cholinergic effects (AC) on the heart rhythm. However, in patients with initial eutonia, this balance is disturbed in the direction of an increase in the humoral regulatory circuit and a decrease in the activity of nervous control. These occur against the background of a decrease in the activity of the parasympathetic division of the ANS (AC; P <0.01) and some tension in the compensatory mechanisms in the regulation of heart rhythm. With initial vagotonia, differences in heart rate indicators compared to healthy children (DH = 0.395 ± 0.020 sec; VPR = 3.45 ± 0.121 conventional units; IN1 = 24.8 ± 1.49 conventional units; AMo/Mo =18.8±2.48) was not noted (P>0.05). In the same group of patients, a tightening of the cardiac cycle (M0, P<0.001), a decrease in AMo values (P<0.05) and the AMo/DC ratio (P<0.05) were noted compared to healthy children (Mo=0.755±0 .02 sec; AMo=14.30±1.02%; AMo/DH=39.8±4.38). These data are similar to what happened during the initial eutonia - an increase in the influence of the humoral circuit against the background of a decrease in the central circuit on the heart rhythm. In patients with initial sympathicotonia, there is a further strengthening of the humoral circuit (P<0.001), a maximum decrease in the DH indicator (P<0.01), and a significant increase in the VPR and IN1 indicators (P<0.01) compared to healthy children. These data indicate a state of extreme tension and a deterioration in the quality of blood circulation regulation - the onset of an "emergency" phase in the regulation of heart rhythm and depletion of the compensatory capabilities of the parasympathetic division of the ANS, a significant strengthening of the central circuit and an increase in the degree of centralization of heart rhythm control.

Considering the assessment of the initial autonomic tone by the tension index (TI) under conditions of relative rest does not always accurately reflect the true state of the autonomic tone, we attached importance to the change in autonomic tone during orthostasis (CI), which is presented in Table. 1. reducing the degree of centralization of heart rate control.

**Table 1**

**Dynamics of initial autonomic tone (IVT) in patients with juvenile rheumatoid arthritis in orthostasis (in%)**

| *Initial autonomic tone* | | Dynamics of IVT after orthotest | | | | | |
|---|---|---|---|---|---|---|---|
| | | Eitonia | | Vagotonia | | Sympathicotonia | |
| | | **p** | % | **P** | % | p | % |
| 1 | Eythonia p=34 (26,4%) | 17 | 13,2 | - | - | 17 | 13,2 |
| 2 | Vagotonia p=22 (17%) | 6 | 4,65 | 5 | 3,88 | 11 | 8,53 |
| 3 | Sympathicotonia p=73 (56,6%) | - | - | - | - | 73 | 56,6 |
| **TOTAL p=129 (100%)** | | **2** | **17,85** | **5** | **3,88** | **101** | **78,33** |

It was established (Table 1) that in patients with JRA, the initial autonomic tone of eu- and vagotonia under conditions of relative rest was maintained due to excessive tension in the parasympathetic division of the ANS. This indicates that in 1/2 of the children with JRA, the initial eu- and vagotonias were initially dystonic in nature.

In patients with JRA, during the orthotest, the values of DC and Mo decrease, and the indicators AM0, VPR, IN2 and derivatives of AM0, Mo and DC increase (P < 0.05-0.001). At the same time, pronounced shifts are detected in patients with initial eu- and vagotonia than in sympathicotonia, which is consistent with the law of the initial value: the lower the initial level of work, the greater the shifts. This is also confirmed by a pronounced increase in the IN2/IN1 ratio with eutonia (6.33±0.59; P<0.01) and vagotonia (7.43±0.57; P<0.001) than with sympathicotonia (2 .48±0.22). The results of complex treatment of patients with JCA led to certain favorable changes in the initial autonomic tone - a decrease in the number of cases of sympathicotonia from 56.6 to 43.5% (P < 0.01) and an increase in the proportion of eutonia from 26.4 to 43.5% (P <0.001).

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However, the dynamics of the initial autonomic tone during orthostasis in patients with ei- (17.1%; P>0.05), vago- (9.3%; P>0.05) and sympathicotonia (73.6%; P> 0.05) did not confirm the "favorability of these two shifts" when comparing the specific gravity of the initial autonomic tone during orthostasis before treatment (17.8, 3.88 and 78.3%, respectively). Consequently, the measures taken aimed at specific therapy have a temporary and unstable effect. The results of studying autonomic reactivity (VR) in patients with JRA are presented in table. 2.

**Table 2**

**The state of autonomic reactivity in patients with JRA depending on the initial autonomic tone (according to CIG data)**

| *Initial autonomic tone* | | Vegetative | | Reactivity | | | |
|---|---|---|---|---|---|---|---|
| | | Normal | | hypersympathicotonic | | Asympathetic-tonic | |
| | | p | % | p | % | p | % |
| 1 | Eythonia p=34 | 11 | 32,4 | 17 | 50,0 | 6 | 17,6 |
| 2 | Vagotonia p=22 | 11 | 50,0 | 11 | 50,0 | - | - |
| 3 | Sympathicotonia p=73 | 22 | 30,1 | 45 | 61,6 | 6 | 8,3 |
| **TOTAL n=129** | | **44** | **34,1** | **73** | **56,6** | **12** | **9,3** |

In general, JRA patients responded to orthostatic load with normal values only in 34.1% of cases (77.7% in healthy people; P <0.001) and in 65.9% of cases (in healthy people - 22.3% ; P <0.01) reactions were pathological (56.6% of patients had hypersympathicotonic reactions and 9.3% had asympathicotonic reactions), which significantly differed from the data of healthy children (12.1%, respectively; P <0.001 and 10.2 %; P>0.05).

A comparative analysis of vegetative reactions in patients with JRA showed a decrease in normal reactions with ey- (P<0.001), vago (P<0.01) and sympathicotonia (P<0.001) compared with healthy children of the region, in whom vegetative reactions were observed respectively in 81.7, 71.9 and 76.9%. Among patients, hypersympathicotonic reactions were significantly increased, respectively, with eutonia 50.0%, vagotonia - 50.0% and sympathicotonia - 61.6%, which differ significantly from the data of healthy children (respectively 10.4%; 22.8%; and 7.1%). The incidence of asympathicotonic reactions in patients with eutonia was increased (17.6% versus 7.8% in healthy children; P<0.05) and decreased in patients with initial sympathicotonia (8.22% versus 16.7% in healthy children; P<0 .05).

Regulation of heart rate in patients with JRA depends on the initial autonomic tone. With initial eu- and vagotonia, unfavorable changes in the heart rhythm occur, expressed by a higher heart rate, less adaptive regulatory mechanisms - an increase in the influence of the humoral circuit against the background of a decrease in the influence of nervous mechanisms in the organization of the heart rhythm. Unlike patients with eu- and vagotonia, with sympathicotonia there is a depletion of the parasympathetic part of the ANS, a significant strengthening of the nervous circuit for regulating the heart rhythm, which indicates the onset of an "emergency" phase in the body's compensatory capabilities to ensure and organize the heart rhythm.

JRA patients with autonomic reactivity are characterized in 56.6% of cases by a hypersympathicotonic reaction. Children with initial sympathicotonia are in less favorable conditions. Hypersympathicotonic reactions in these children are due to a significant increase in VPR (39.1±1.64 conventional units; P<0.01), IN2 (804.2±38.2 conventional units; P<0.001 ) subject to less pronounced compensatory parasympathetic reactions - low AC reserves (-23.3% of the original) compared with children with initial ey- (-41.4%; P <0.01) and vagotonia (-69.5 %; P<0.001). These

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data indicate excessive tension in the sympathetic department of the ANS and depletion of the function of the parasympathetic department, which indicates the development of the "exhaustion stage" in the hypothalamic-pituitary and sympathetic-adrenal system (Meyerson, 1983; Baevsky R.M., 1984; Selye G., 1960).

The study of the internal structure of the heart rhythm and the results of COP in patients with JRA indicates the "exhaustion" and reserve capabilities of the sympathetic-adrenal and hypothalamic-pituitary-adrenal systems. Positive changes in autonomic homeostasis after specific therapy occur only in patients with the articular form of the disease, which is not observed in the systemic form of the process. The latter requires further development of treatment methods for JRA in terms of correction of autonomic homeostasis and the use of vegetotropic drugs.

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