

## CHARACTERISTICS OF THE CLINICAL AND BIOCHEMICAL COURSE OF NON-REUMATIC MYOCARDITIS IN CHILDREN

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**Abstract.** This article presents the study clinical and biochemical features of non-rheumatic myocarditis in 30 infants and toddlers . The analysis of the obtained results showed that the clinical course of it depends on cardiovascular insufficiency degree and it was characterized by rhythm and conduction disturbances, reduced contractility and myocardial remodeling. At children with non-rheumatic myocarditis, brain natriuretic peptide ( NT - proBNP ) has a highly informative prognostic indicator for predicting the course of disease and severity assessment of chronic heart failure.

**Keywords:** children, non-rheumatic myocarditis, clinics, brain natriuretic peptide.

Myocarditis is an inflammatory disease of the heart muscle, caused by direct or immune-mediated effects of infection, parasitic or protozoal invasion, chemical and physical factors, as well as arising from allergic and autoimmune diseases. Non-rheumatic myocarditis is defined in children of all ages [ 3, 5, 6, 8, 9, 10].

Clinical studies indicate that myocarditis in childhood can occur under the guise of other diseases, have completely non-specific manifestations and cause life-threatening cardiac arrhythmias and even sudden death [1, 2, 5, 8].

Children may be carriers of the virus for a long time, in some cases the clinical picture of the disease may manifest itself in a later period, and in some cases there may be no symptoms of the disease. Diagnosis of myocarditis in many cases is difficult due to the variability symptoms, a large number of clinical "masks", and the possibility of an asymptomatic course. In some cases, acute myocarditis in children can occur with severe symptoms of severe refractory heart failure that develops with diffuse myocardial damage [2, 5, 7, 8].

In some cases, only a violation of the heart rhythm may be the only manifestation of latent latent carditis. As a rule, the first signs of the disease are detected against the background of SARS or 7-10 days after the disease. An indicator of the severity of patients with myocarditis is also a violation of the central and intrapulmonary hemodynamics [10, 11].

The key signs of myocarditis may be left ventricular dilatation, cardiomegaly, signs acute onset and progressive heart failure, increased cardiospecific enzymes, pathological electro- and echocardiographic changes [ 3, 8, 9].

Based on the foregoing, the study of the clinical features of the course of non-rheumatic myocarditis in young children is timely and relevant.

**The aim of the study:** to study the clinical and biochemical features of the course of non-rheumatic myocarditis in young children.

**Materials and research methods.** The study is based on the data of 30 examined children with a diagnosis of non-rheumatic myocarditis (NM), hospitalized in the Department of Cardiorheumatology of the Republican Specialized Scientific and Practical Center of Pediatrics. The age of the children varied from 2 months to 3 years, the average age was  $1.4 \pm 0.9$  years.

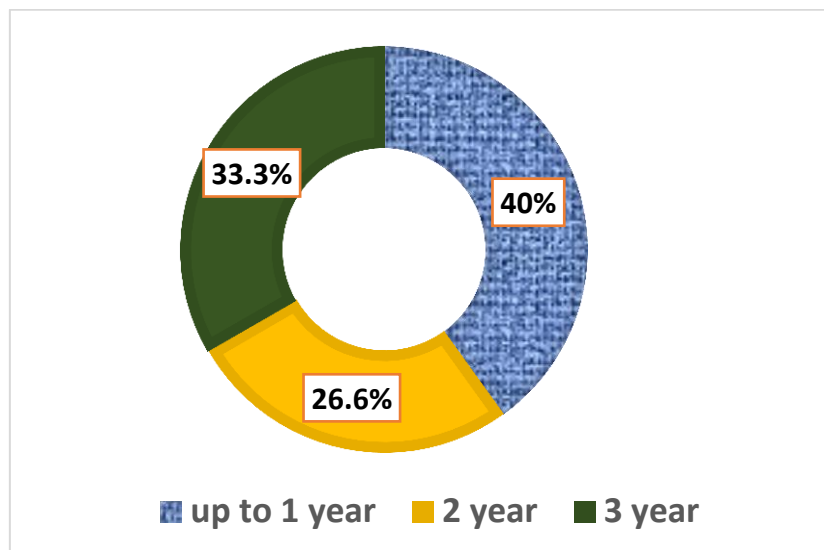
The diagnosis was made on the basis of complaints, anamnesis data (obstetric anamnesis of the mother, anamnesis of the life and illness of the child, previous diseases, the nature of the course and duration of the disease), clinical and functional (ECG, echocardiography) and laboratory methods of examination (general hematological analysis, determination of a marker of heart failure - brain natriuretic peptide Chest x-ray and multislice computed tomography of the chest).

All patients underwent clinical and anamnestic, laboratory (general clinical, biochemical) and instrumental studies (ECG, echocardiography, chest radiography). The determination of brain natriuretic peptide in blood serum was carried out by solid-phase chemiluminescent enzyme immunoassay using IMMULITE 2000 "NT-proBNP" test kits.

For statistical calculations, standard (MS Excel 2000, Statistica 6.0) and specially designed programs. Pearson correlation analysis was used. Differences were assessed using Student's t -test.

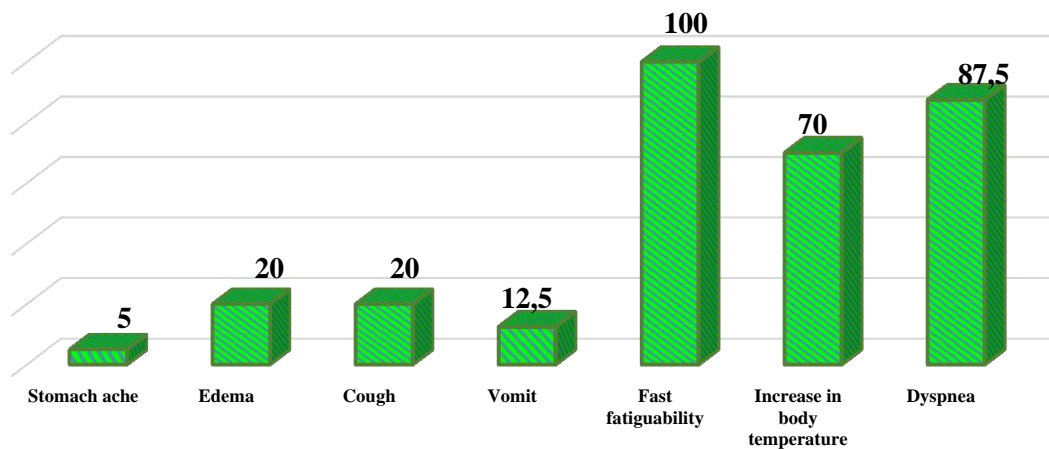
**Research results.** Analysis of the obtained results showed that the disease is more often registered among boys (60% versus 40%). Among those surveyed in terms of age, infants under 1 year of age prevailed (40%), while the number of children in the second and third years of life was 26.6% and 33.3%, respectively (Fig. 1).

As a result of the research, it was found that the clinical features of the course of non-rheumatic myocarditis in young children depend on the degree of cardiovascular insufficiency.



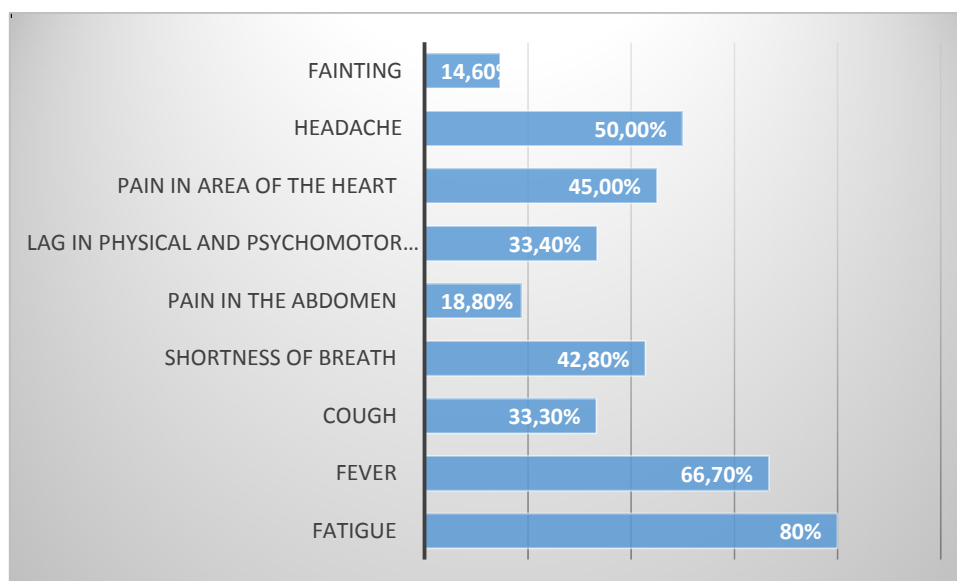
**Fig.1. Distribution of the examined children according to age.**

It was found that the occurrence and nature of clinical symptoms depends on the degree of cardiovascular insufficiency. For children with non-rheumatic myocarditis, the characteristic clinical manifestations were: rapid fatigue (100%), shortness of breath (87.5%), fever (70%), cough (20%) (Fig. 2).



**Fig.2. Clinical signs in children with non-rheumatic myocarditis (%).**

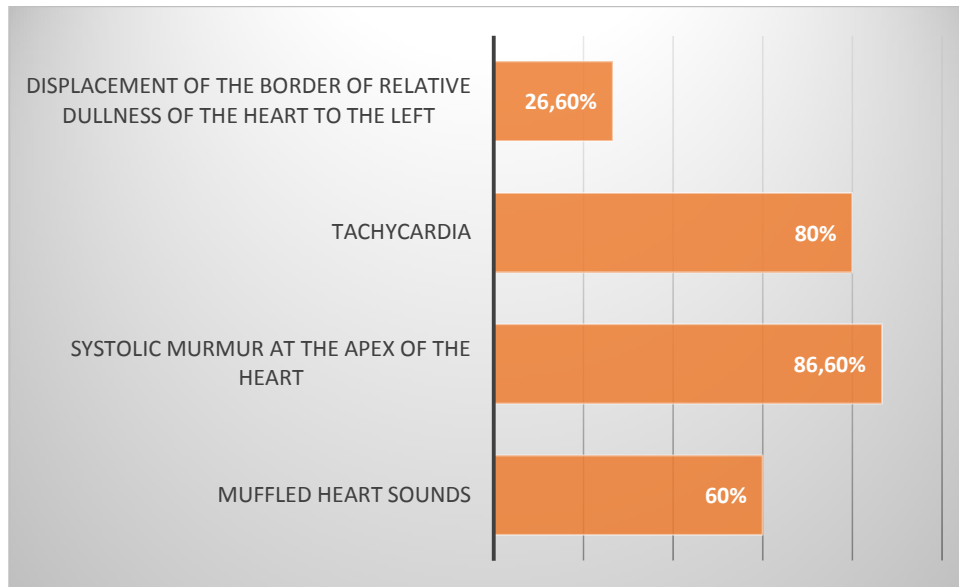
According to the mothers of all the examined children, the main complaints were as follows: fatigue (80%), fever (66.7%), cough (33.3%), shortness of breath (42.8%), pain in the abdomen (18.8%), lag in physical and psychomotor development (33.4%) (Fig.3).



**Fig.3. The main complaints from the words of mothers of children with non-rheumatic myocarditis.**

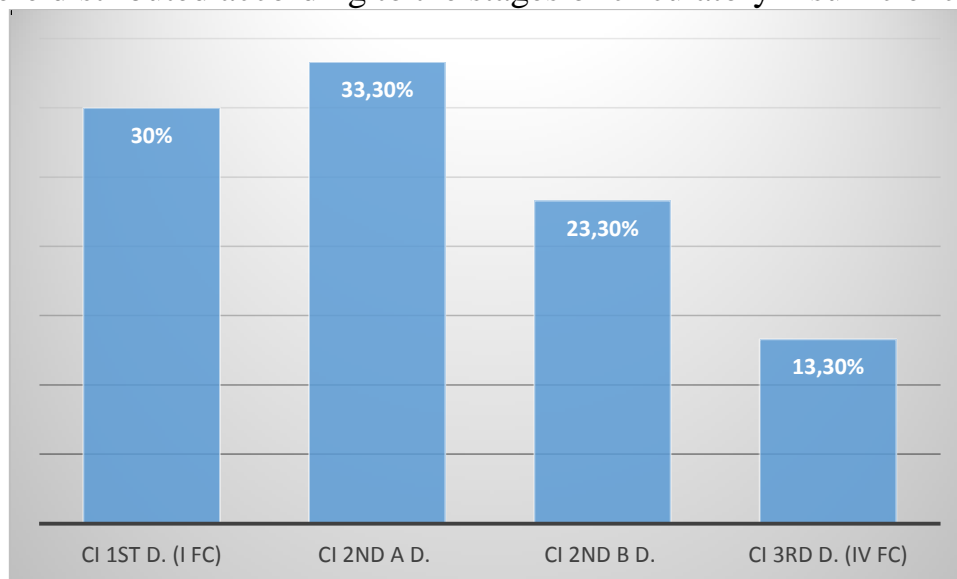
When studying the anamnestic data, it was found that, despite the early age, all children (100%) had frequent acute viral and bacterial infections.

An objective study revealed: muffled heart sounds - 60%, systolic murmur at the apex of the heart - 86.6%, tachycardia - 80%, displacement of the border of relative dullness of the heart to the left - 26.6% (Fig. 4).



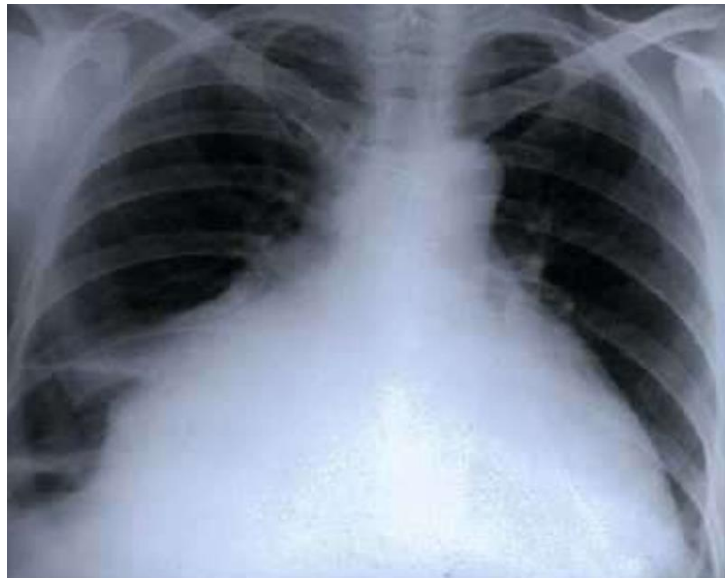
**Fig.4. Objective findings with non-rheumatic myocarditis**

All patients had symptoms of heart failure at the time of examination. To assess the severity of the course of heart failure, children with non-rheumatic myocarditis (Fig. 5) were distributed according to the stages of circulatory insufficiency (CI).



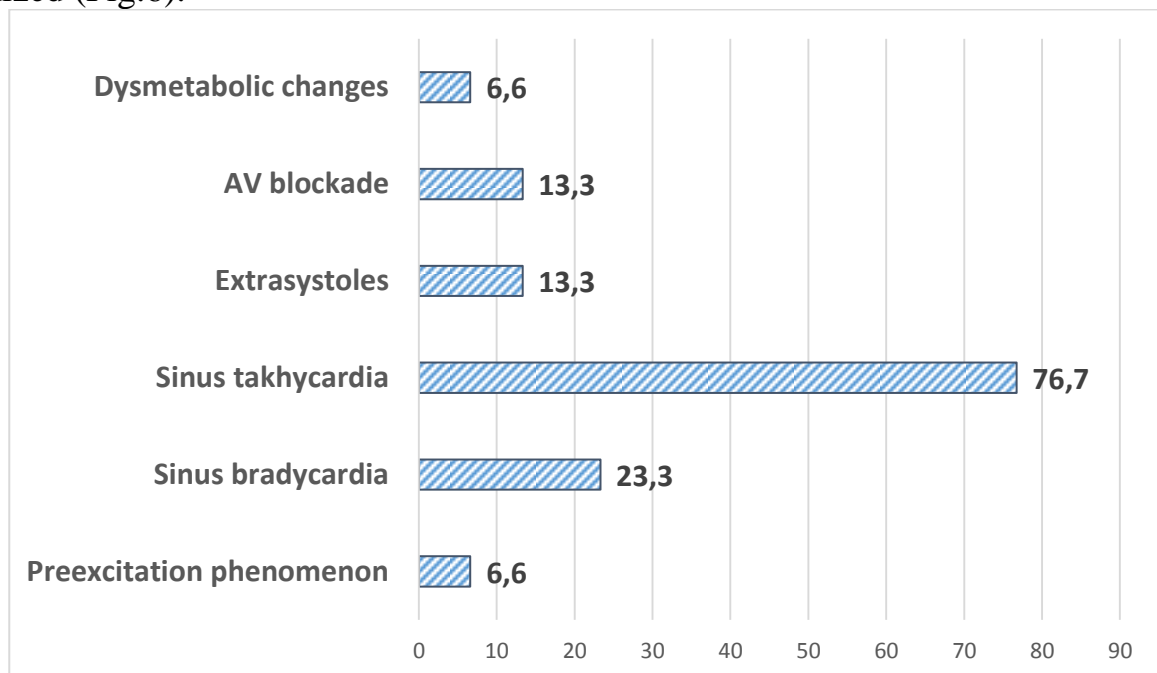
**Rice. 5. Distribution of children with UI by stages of CK (%)**

Among children with NM, CI 1<sup>st</sup> d. (I FC) and CI 2<sup>nd</sup> A d. were registered in the highest degree (II FC) (30.0% and 33.3%, respectively). Children with CI 2<sup>nd</sup> B d. account for 23.3%, and CI 3<sup>rd</sup> d. (IV FC) - 13.3%.



**Fig.6. X-ray of the chest of the patient N., 3 years old. non-rheumatic myocarditis.**

Chest X-ray revealed cardiomegaly in 70% of patients, while the cardiothoracic index averaged  $59.6 \pm 0.3\%$ . In 54%, signs of bronchitis were visualized (Fig.6).



**Fig.7. Electrocardiographic parameters in children with non-rheumatic myocarditis.**

Electrocardiographic changes were nonspecific with a decrease in the voltage of the QRS complex in standard leads, ST-T wave changes. In addition, the analysis of the results of electrocardiographic studies showed the presence of the phenomenon of pre-excitation (6.6%), nomotopic cardiac arrhythmias in the form of sinus

bradyarrhythmia (23.3%) and takhyarrhythmia (76.7%), paired ventricular extrasystoles (13.3%), atrioventricular blockades of varying degrees (13.3%), dystrophic changes (6.6%) in children with non-rheumatic myocarditis (Fig. 7).

Echocardiography in myocarditis may reveal disturbances in local and global myocardial contractility, zones of hypo- and akinesia, systolic and/or diastolic functions, and a decrease in LV ejection fraction [1, 3, 12]. Echocardiography revealed such disorders as an increase in the size of the heart cavities, wall thickness, systolic dysfunction, a decrease in ejection fraction up to 40%, hypokinesia of the LV walls in (100%) children, as well as the presence of additional chords - in 40%, an open oval window - in 20% of children.

To determine the presence of heart failure and assess its severity, much attention is paid to the search for objective criteria, which include determining the content of cardiac markers in the blood. These include brain natriuretic peptide (NT - pro BNP).

Table 1

### Echocardiographic features in children with UI

Echocardiographic signs	Norm	Children with NM	R
End-diastolic volume (EDV) LV (ml)		60.9±4.4	≤ 0.01
End-diastolic size (EDS) LV (mm)	17-25	39.65±1.2	≤ 0.01
Ejection fraction ( % )	>75	51.05±0.94	≤ 0.01

One of the objectives of this study was to determine the significance of natriuretic peptide in the early diagnosis of heart failure in children with non-rheumatic myocarditis.

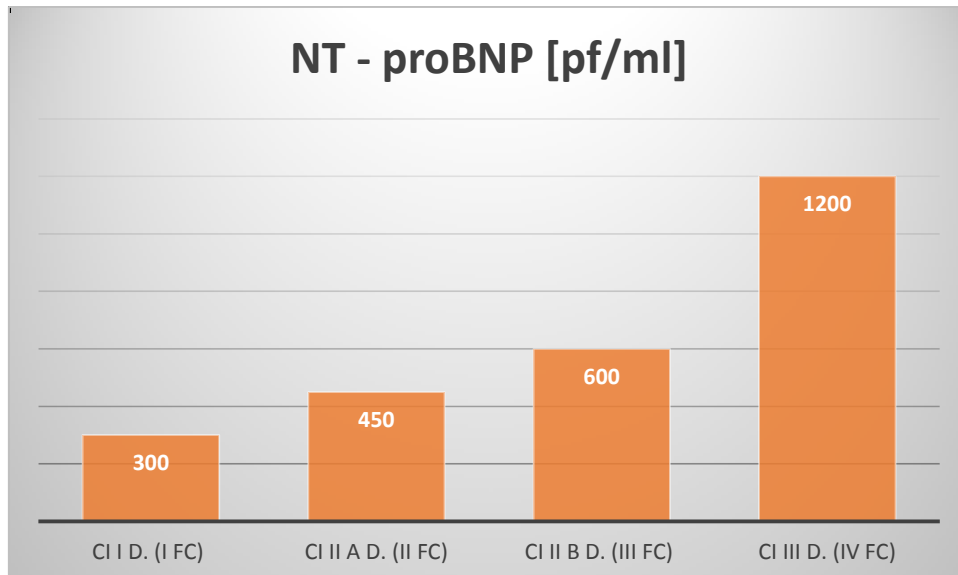
Table 2

### Advantage of NT determination - proBNP before BNP

BNP	NT -proBNP
1. After release, it is excreted from the bloodstream T 21 min.	After secretion, it is determined in the blood for several days T 70-120 min.
2. The presence of a circadian rhythm, the level changes rapidly depending on the state and function of the left ventricle, reflects the state of the myocardium at the time of determination .	Not subject to circadian rhythms. The cumulative level of NT - proBNP reflects the function of the myocardium as a whole, correlating with the degree of cardiac dysfunction (the most objective assessment of the stage of the disease and prognosis) .
3. Relatively low plasma levels do not allow diagnosing HF in the early stages .	High plasma levels allow early detection of myocardial dysfunction .
4. Low plasma stability .	High stability in plasma up to 7 days

	at room temperature.
5. The level depends on the therapy .	Regardless of the therapy.

To assess the prognosis of heart failure in children with non-rheumatic myocarditis, the level of natriuretic peptide (NT - pro BNP ) at all stages of CI (Table 2).



**Rice. 8. The content of NT - proBNP in children with non-rheumatic myocarditis depending on the stage of CI.**

Analysis of the results of studies of NT - proBNP in the blood showed that the level of NT - proBNP was significantly high in children with UI with CI II A d. (II FC), CI II d. (III FC) and reached from 450 to 600 pg / ml, respectively (  $p < 0.001$  ), while in children with CI I d. (I FC) this figure was 300 pg / ml . The highest rate of NT- proBNP was found in CI III d. (IV FC), which amounted to 1200 pg / ml (Fig. 8).

Correlation analysis showed a direct strong relationship between the level of NT- proBNP in the blood and the stage of heart failure ( $r = +0.97$ ). A pronounced increase in this biochemical marker indicates the progression of CI and adverse outcomes of non-rheumatic myocarditis in children.

All this determines that in children with UI, along with functional studies, it is necessary to determine the marker of heart failure – brain natriuretic peptide (NT - proBNP).

**Conclusions.** According to the research results, it can be concluded that:

1. The clinical course of non-rheumatic myocarditis mainly depends on the degree of cardiovascular insufficiency and is characterized by rhythm and conduction disturbances, decreased contractility, and myocardial remodeling.
2. Determining the level of NT- proBNP in blood plasma helps to assess the severity of chronic heart failure and predict the further development of the disease.



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