

# THE PECULIARITIES OF MYOCARDIAL CONDITION ESTIMATION IN INTERATRIAL SEPTAL DEFECTS IN CHILDREN OF EARLY AGE

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**ABSTRACT** — 31 children of early age with interatrial septal defect (IASD) were observed concerning their laboratory – instrumental peculiarities of myocardial condition before and after surgical correction. There were 2 groups of patients in dependence of hemodynamics condition and levels of precordial sodiumuretic peptide (NT — proBNP) and myocardial fraction of creatinphosphokinaza (MB — CPhC) data. It was determined that the myocardial condition in children before cardiosurgical correction was exactly correlated with expressiveness of hemodynamic disturbances. After operation there may be the presence of changes in studied biochemical data witnessing the restructure of myocardium. In the late periods it may be connected with heart activity disturbances. It should be advisable to use the definition of levels of NP — proBNP and activity of MP — CPhC in combination with echocardiographic data for estimation of myocardial condition.

**KEYWORDS** — defect, interatrial septum, cardiosurgical correction, children, laboratory data (NP — proBNP, MB — CPhC), myocardium

The timely surgical correction of interatrial septal defect (IASD) leads to normalization of intracardial hemodynamics, positively influences on the condition and further fate of patients. But it is necessary to take into consideration that even qualified cardiosurgical correction may be complicated by different disturbances during postoperative period [1, 2, 3, 4, 7, 8].

It is known that in case of full closure of defect the lethal outcome is 1,5–2% after these operations.

The most frequent reasons are embolia, sepsis and progression of hemodynamic disturbances on the base of remodelling of myocardium [5, 6, 9, 10, 11, 12, 13].

### *The aim of investigation:*

to find out laboratory – instrumental peculiarities of myocardium condition before and after surgical correction of interatrial septal defect in children of early age.

## THE CHARACTERISTIC OF CHILDREN AND METHODS OF INVESTIGATION

35 patients at the age of 1–3 years with congenital heart failure (CHF) – isolated by secondary non-restrictive interatrial septal defect (IASD) of mild size (5–12 mm) were under observation. 31 patients had operative treatment – closure of defect by endovascular (transcatheter) way using Amplatzer Septal Occluder or BioSTAR septalrepairimplant («NMT-Medical», Boston). The other (4) patients had no correction.

### *The methods of investigation included:*

anamnestic, clinical, biochemical, instrumental and statistic. The complex estimation of cardiovascular system condition in children was made in conditions of cardiorheumatological department of N.N. Silishcheva hospital in dynamics in 1 month before operation, in 2 weeks and 6 months after it. Laboratory investigations: there were defined the levels of sodiumuretic peptide (NT-pro-BNP) and activity of MB — creatinphosphokinaza (MB-CPhC) in blood serum using the method of immunoferrment analysis (IFA).

*The instrumental methods were:*

electrocardiography (ECG), echocardiography (EchoCG), dopplerechocardiography (Doppler-EchoCG), taking into attention the features of relocation, dystrophic and hypertrophic changes in myocardium, thickness of walls and size of heart cavities, features of diastolic dysfunction and disturbances of contractive capability.

## RESULTS AND DISCUSSION:

In 70,9% cases the diagnose of CHF was done antenatally, in other cases — 29,1 % — postnatally on the base of complex clinico-instrumental investigation. It was found out that in 19 (61,3%) patients the size of defect was not more than 7 mm, and in 12 (38,7%) — 8–12 mm. In detailed analysis of anamnestic data in 5 children (16,12%) there was determined negative dynamics of defect size (increase in 1–2 mm), but in 4 (12,9%) — positive (decrease in 2–3 mm) during observation, they were not included into further investigation. In 12 children (38,7%) the heart failure was in the stage of initial manifestation, in 9 (61,3%) there was marked clear clinical picture (IASD). It was defined that chronic heart failure (ChHF) manifested clinically in the I stage in 16 (51,61%), II A stage in 15 (48,39%) cases which had coincidence to 1–2 functional classes. The was marked the high frequency of respiratory diseases: recurrent acute respiratory infection in 17 (54,84%), bronchitis in 8 (25,8%), pneumonia in 6 (19,3%).

Clinically before operation in 5 patients (16,12%) there were found out the moderate backward in physical development, paleness of skin in 25 (80,65%), moderate dyspnea in 18 children (58,06%), moderate tachycardia in 15 cases (48,39%), widening of heart borders to the right in 16 patients (51,61%), soft systolic sound in 2–3 intercostal part to the left from the sternum 15 (48,39%).

In the ECG in 20 cases (64,52%) there were marked the rightgram, hypertrophic changes in myocardium in 21 children (67,74%), the features of relocation disturbances in 18 cases (58,06%), dystrophic changes in 10 children (32,26%). In EchoEG there were the significant increase of right parts of the heart in 16 (51,61%), moderate widening of pulmonary artery stem in 13 (45,14%). But the pressure in this vessel and in right ventricle was not higher than 30 mm Hg. According to dopplerEchoCG there was the significant outcome of blood in the left part to the right one in single cases 4 (12,9%). In 15 (48,3%) patients there were defined the disturbance of diastolic function, in other cases 16 (51,61%) — systolic dysfunction of myocardium.

So, clinic-instrumental data showed the presence of features of myocardium remodelling of different stage expressiveness in observed children before operation.

In laboratory investigation there were found out the real increase of levels of precordial sodiumuretic peptide (NT-pro-BNP) ( $p < 0,01$ ) and moderate increase of myocardial fraction activity of creatinphosphokinaza (MB-CPhC) ( $p < 0,05$ ) in comparison with normal one (Table 1).

The detailed analysis of biochemical data allowed to divide children into 2 groups: the first group had 14 patients with significant increase of levels NT-pro-BNP ( $p < 0,001$ ), the second one — 17 patients with moderate changes ( $p < 0,05$ ). Besides it, the children of the first group had the moderate increase of MB-CPhC ( $p < 0,05$ ) activity, and the second group had no such phenomena ( $p < 0,05$ ). It was marked that in the first group CHF was complicated by ChHD II A stage, in the second — mostly by I stage. All patients were operated because of heart failure.

In the early postoperative period in the first group in comparison with the second there were kept clinically moderate expressed features of disturbances in blood circulation: in 5 (35,71%) cases — insignificant dyspnea, moderate widening of heart borders to the right in 11 (78,57%) children. It was confirmed by ECG data, in 11 (78,57%) patients there were registered rightgram, hypertrophic changes in myocardium of right atrium was found in 6 children (42,85%). In EchoCG there were moderately increased the right parts of the heart in 7 (50%). In dopplerEchoCG in most cases 12 (85,71%) there were marked diastolic dysfunction, in half cases — systolic one. The received data witnessed that in children of this group in early postoperative period there may be kept the features of myocardium remodelling which had been before. In the second group clinic-instrumental data were differed greatly in comparison with the normal one. In biochemical data the patients of the first group had the following peculiarities increase of activity levels MB — CPhC in comparison with such ones before defect correction, it may be connected with undergone operation and presence of heart activity disturbances (Table 1). At the same time the levels of NT — pro-BNP decreased, it was the result of normalization of pathological processes in myocardium (Table 1). But in some cases — in 5 patients (35,7%) they remained moderately increased in spite of general tendency to normalization.

In other children there was made the comparison with clinico – instrumental data of remodelling. There was used non-parametric method of range correlation of Spirman, taking into account the coefficient of correlation and criteria of their statistic meaning. The coefficient of correlation was  $r = 0,85$  in  $p < 0,01$ . So, the condition of levels NT — proBNP may be considered as additional criterium for diagnostics of myocardial remodelling in children.

Table 1. The levels of biochemical data in children with IASD

Groups of children	Data	
	MB – CPhC (f/l)	NT – proBNP (pk/ml)
Before operation		
first	49,4±7,1	398±17,1
second	31,5±4,1##	285±17,1###
After operation: in 1–2 weeks:		
first	72,2±8,3**	332 ±15 **
second	39,5±7,2*###	243 ±16*###
In 6 months		
first	33,4±4,7*	260 ±15***
second	28,6±3,6*#	220 ±17*#

\* — meanings of reality in comparison of data before operation and in different periods after operation;  
 \* —  $p > 0,05$ ; \*\* —  $p < 0,01$ ; \*\*\* —  $p < 0,001$ .  
 # — meanings of reality in comparison of data of the first and second group;  
 # —  $p > 0,05$ ; ## —  $p < 0,05$ ; ### —  $p < 0,001$

In patients of the second group in comparison with preoperative period the changes of laboratory data were statistically not correct ( $p > 0,05$ ). In 6 months the patients of this group had the significant positive dynamics in comparison with the first one. It was marked the improvement of condition, disappearance of dyspnea, normalization of heart contractions frequency and respiratory movement.

At the same time the children of the first group had the presence of systolic sound in V point and in the second intercostal part in the left side from the sternum in 12 patients (85,71%). The expressed positive dynamics of changes in ECG in children of the first group there were marked more late periods after operation.

So, it was defined that the myocardial condition in children of the early age with ISAD before cardio-surgical correction clearly correlate with expressiveness of hemodynamic disturbances. In case of normalization of hemodynamics after heart operation there may be preserved the changes of biochemical data levels, which show the incompleteness of pathological processes and changes in myocardium. In late dates it may be the reason of complications and presence of heart activity disturbances. For estimation of myocardial condition it should be advisable to use the definition of levels NP — pro-BNP and activity of MB-CPhC in combination of echocardiographic data.

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