

CLINICAL CHARACTERISTICS AND FEATURES OF ULTRASONIC INDICATORS IN YOUNG CHILDREN WITH VENTRICULAR SEPTAL DEFECT IN THE PREOPERATIVE PERIOD

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<https://doi.org/10.5281/zenodo.10849840>

Abstract. *Aim.* To study the perinatal risk factors, somatic status, imaging in early age children with congenital heart disease, interventricular septum defect, for the purpose of determining preoperative tactics.

Materials and methods. 86 children of early age were examined using anamnestic, clinical and instrumental techniques. The main group included 56 children with congenital heart disease, the control group – 30 children without heart disease.

Results. It was revealed while studying obstetric and gynecological anamnesis of children with interventricular septum defect that 78% of pregnancies had pathological course. Analysis of concomitant pathology detected that the most frequent pathology in children of the main group was anemic syndrome (25,5%) and rickets (22,7%). There was hypertrophy of the ventricle: the left in 4,3% of cases, the right – 30,4% or both – 2,2%. Significant increase in enddiastolic and endsystolic volume of the left ventricle and growth of the left auricular size was found.

Conclusions. In the preoperative period, it is necessary to create individual programs for careful preparation regarding anemia and micronutrient deficiency.

Keywords: children, congenital heart disease.

Timely cardiac surgical care for young children can save lives with congenital heart defects (CHD) and reduce infant mortality, since they account for about 20% of all developmental defects [4]. Timely correction of an anatomical defect helps prevent the development of complications and creates conditions for the child to return to a full life [2]. However, heart surgery is traumatic and has a potential risk of postoperative complications. The age of the child also has its own characteristics. The combination of congenital heart disease with an unfavorable comorbid background is important for the outcome of surgical correction of the defect. Factors in the unfavorable course of the intrapartum period can lead to the manifestation of pathological processes in a child in stressful situations, such as heart surgery [1, 2]. The range of these risks affects the subsequent development of the child, which requires the organization of a comprehensive system for the rehabilitation of children [3, 5].

Target. Study of somatic status, ultrasound indicators in young children with congenital heart disease - ventricular septal defect - to determine preoperative preparation tactics.

Materials and methods. 86 young children were examined using clinical and instrumental methods, 56 children with VSD were included in the main group, and 30 without heart disease were included in the control group.

In accordance with the stated goal and objectives, a prospective study of children was conducted until they reached the age of 6 months.

Observation scheme for children with VSD:

- Assessment of the health status of children with VSD
- Retrospective analysis of ante-, peri-, neonatal anamnesis of children
- Dynamic monitoring of children up to 6 months

Physical development assessment was carried out using WHO programs for children under 5 years of age [6]. The following indicators were calculated: body weight-for-age ratio, height-for-age ratio, body weight-for-length ratio, body mass index (BMI).

To assess the degree of heart failure, the classification of N. A. Belokon was used (Table 1)

Table 1

| Degree of HF | Failure | |
|--------------|--|---|
| | Left ventricular | right ventricular |
| I | Signs of heart failure are absent at rest and appear after exercise in the form of tachycardia or shortness of breath | |
| II A | Heart rate* and the number of respiratory movements per minute are increased by 15–30% and 30–50%, respectively, relative to normal | The liver protrudes 2–3 cm from under the costal arch |
| II B | Heart rate* and the number of respiratory movements per minute are increased by 30–50% and 50–70%, respectively, relative to normal; possible acrocyanosis, obsessive cough, moist fine rales in the lungs | The liver protrudes 3–5 cm from under the costal arch, swelling of the neck veins |
| III | Heart rate* and the number of respiratory movements per minute are increased, respectively, by 50–60% and 70–100% or more relative to the norm: clinical picture of pre-edema and pulmonary edema | Hepatomegaly, edematous syndrome (swelling of the face, legs, hydrothorax, hydropericardium, ascites) |

A plain X-ray of the chest organs in a direct projection made it possible to assess the state of the pulmonary pattern and the cardiothoracic index.

Echocardiography (EchoCG) was performed in M and B modes according to standard methods using a 5 MHz sensor on a Logic P7 GE device. EchoCG made it possible to assess the size of the defect, dilatation of the heart cavities, blood discharge during color Doppler mapping, and systolic pressure in the right ventricle. The analysis took into account the following indicators:

- size of the right (RA) and left atrium (LA), mm;
- end systolic size (ESD) and end diastolic size (EDS), mm;
- thickness of the interventricular septum in diastole (IVSD), mm;
- thickness of the posterior wall of the left ventricle in diastole (PLWL), mm;
- left ventricular ejection fraction (EF), %;
- size of the right ventricular outflow tract (RVOT), mm.

Results. Children of the main and control groups did not have significant differences in age, gender, however, the birth weight of the children in the main group was less than in the control group (Table 2).

Table 2

Characteristics of children depending on age, sex and birth

| Parameters | | Main group, n = 56 | Control group, n = 30 | P |
|------------------------|----------|-----------------------|--------------------------|--------|
| Age, M ± m, mec. | | 4,3 ± 3,9 | 4,0 ± 3,5 | > 0,05 |
| Gender | boys, % | 58,3 | 46 | > 0,05 |
| | girls, % | 41,7 | 54 | |
| Birth weight, M ± m, r | | 3040±30 | 3400±20 | <0,01 |

We studied the influence of various maternal history factors on the likelihood of having a child with congenital heart disease. As a result of statistical analysis, the following results were obtained (Table 3).

Table 3

Features of the obstetric anamnesis of mothers of children in the study groups

| Index | Main group, n = 56 | | Control group, n = 30 | | P |
|--|-----------------------|------|--------------------------|------|-------|
| | n | % | n | % | |
| Abortion | 16 | 28,6 | 10 | 33,3 | >0,01 |
| Premature birth | 4 | 7,1 | 2 | 6,6 | >0,01 |
| Acute respiratory diseases during pregnancy | 12 | 21,4 | 5 | 16,6 | <0.05 |
| Exacerbations of chronic diseases (pyelonephritis, colpitis, etc.) | 16 | 28,6 | 4 | 13,3 | <0.05 |
| Anemia | 30 | 53,6 | 9 | 30 | <0,01 |
| Nephropathy | 3 | 5,4 | 2 | 6,7 | >0,01 |
| Threat of interruption Pregnancy | 6 | 10,7 | 6 | 3,3 | <0,01 |
| Complications of the childbirth period (long anhydrous interval, caesarean section, umbilical cord entanglement) | 12 | 21,4 | 3 | 10 | <0,01 |

When studying the obstetric history, it was found that the pathological course of pregnancy was equally often noted both in the main group (71.9%) and in the control group (64.0%), p = 0.09. Exacerbations of chronic diseases, both somatic and gynecological, were significantly more often observed in children of the main group.

Thus, our study identified anamnestic factors that have a statistically significant relationship with the risk of congenital heart disease.

The main complaints of mothers upon admission to the cardiac surgery department for surgical treatment of congenital heart disease were the presence of shortness of breath in the child at rest and during exercise (feeding), sweating, deficiency and insufficient weight gain, frequent respiratory diseases and the appearance of cyanosis when the child cries.

The presence of congenital heart disease in patients of the main group affected the indicators - they had lower body weight and length compared to healthy children.

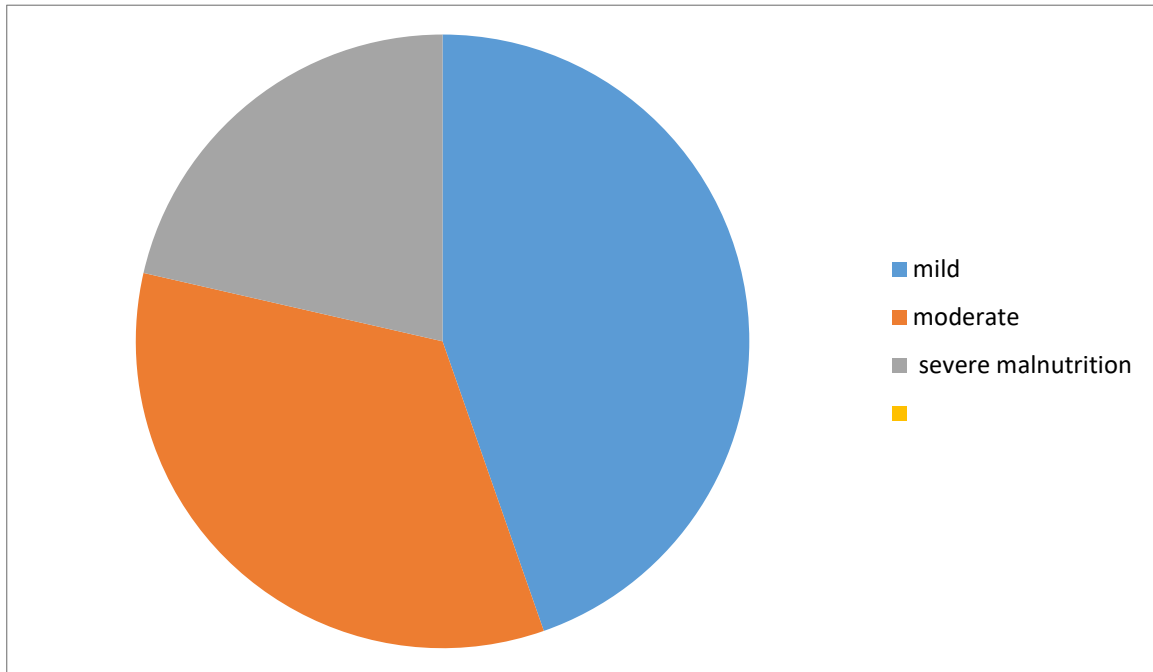


Figure. 1. Protein-energy malnutrition in children with VSD

According to the WAZ (weight-for-age) criterion, in the group of children with VSD, 1.4% (12) of children were diagnosed with severe EBF, 33.9% (19) had moderate insufficiency, and 44.6% (25) had mild insufficiency nutrition (Fig. 1), versus 3.3% (1), 6.7% (2) and 10% (3) in the control group, respectively ($p < 0.001$), respectively).

Peripheral blood analysis data revealed lower values of hemoglobin and quality indicators of erythrocytes in children of the main group compared with those in children of the control group, while the average number of erythrocytes in both groups did not differ significantly (Table 4).

Table 4.

The number of red blood cells, hemoglobin and erythrocyte indices in children of the main and control groups

| Index | Main group, n = 56 average value | Control group, n = 30 average value | P |
|---|-------------------------------------|--|---------|
| RBC (red blood cell count), 10 ¹² /l | 3,9 ± 0,6 | 4,60 ± 0,02 | < 0,001 |
| MCH (average hemoglobin content in erythrocyte), pg | 26,9 ± 2,8 | 29,00 ± 0,09 | < 0,001 |

| | | | |
|--|--------------|-------------|---------|
| MCHC (mean erythrocyte hemoglobin concentration), g/dl | 30,20 ± 1,01 | 34,4 ± 0,5 | < 0,001 |
| MCV (mean erythrocyte volume), fl | 78,1 ± 7,2 | 84,3 ± 3,3 | < 0,001 |
| RDW (red blood cell population variability coefficient by volume), % | 15,6 ± 3,4 | 11,8 ± 1,5 | < 0,001 |
| Hb (level hemoglobin), g/l | 111,9 ± 15,3 | 134,0 ± 0,5 | < 0,001 |

A significant increase in the coefficient of variability of the erythrocyte population by volume was revealed, reflecting anisocytosis in children of the main group compared to children in the control group. The data obtained characterize anisocytosis, hypochromia, a shift of the histogram to the left and indicate a change in the quality indicators of erythron in children with congenital heart disease (VSD).

Hemodynamic features of children in the first year of life requiring surgical treatment of congenital heart disease showed that children of the main group had a non-restrictive type of VSD (average size 0.8 ± 0.3 cm). Before the operation, they had heart failure: degree I - 9 (16.07%) children, degree II A - 42 (76.05%) children, degree II B - 5 (8.9%) children.

The electrical axis of the heart on the ECG was characterized by deviation to the right in 26.3% of children (among children in the control group - 4%, $p = 0.003$), normal position - in 38.8% (in the control group - 6%, $p < 0.001$), vertical position - in 23.8% (in the control - 90%, $p < 0.001$), deviation to the left - in 3.8% (in the control - 0%, $p = 0.433$), indefinite position - in 7.5% (in the control - 0%, $p = 0.121$). In the main group, an increase in the electrical activity of the heart ventricles was found: left - in 3.75% of children, right - in 35%, both ventricles - in 7.5%.

Conduction disorders in the form of incomplete blockade of the right bundle branch were diagnosed in 37.5% of children in the main group, in 24% in the control group ($p = 0.110$); blockade of the left bundle branch occurred in 2.5% of children in the main group only ($p = 0.694$). In 1 child with congenital heart disease (VSD), an atrial rhythm was recorded on the ECG, and in 1 child, a transient Wolff-Parkinson-White phenomenon was recorded.

On a chest x-ray in children with congenital heart disease (VSD), an increase in the pulmonary pattern due to the vascular component was noted; the cardiothoracic index was $61.0 \pm 4.4\%$.

As a result of echocardiography in the main group, a significant increase in end-diastolic and end-systolic volumes was revealed, which reflects dilatation of the left ventricle, an increase in the size of the left atrium due to volume overload of the left sections (Table 6).

Hemodynamic changes in children with ventricular septal defect are as follows: heart failure, pulmonary hypertension, increased size of the left heart, hypertrophic changes in the ventricular myocardium during conservative therapy. All this together determines the early stages of surgical treatment.

Pulmonary hypertension was detected in 35 children (63%), in 10 (20%) - degree I, in (23.75%) - degree II and in 5 (9%) - degree III.

Table 5

Main indicators of echocardiography in examined children

| Index | Main group N =56 | Control group N =30 | P |
|------------------------------|---------------------|---------------------|--------|
| End-systolic size (ESR), cm | 1,8±0,2 | 1,4±0,1 | <0,001 |
| End-diastolic size (EDD), cm | 3,0±0,4 | 2,4±0,1 | <0,001 |
| Left atrium size, cm | 2,1±0,4 | 71±0,3 | <0,001 |
| Right atrium size, cm | 2,2±0,5 | 2,2±0,2 | >0,05 |
| Right ventricle size, cm | 1,1±0,2 | 1,1±0,2 | >0,05 |
| Ejection fraction (EF), % | 71,7±4,7 | 71,6±2,6 | >0,05 |

Thus, significant hemodynamic disturbances in infants indicated the need for surgical treatment of congenital heart disease.

Conclusion. In young children with a ventricular septal defect at the time of surgical treatment, physical development is characterized by low rates and disharmony. The most common concomitant pathology is anemic syndrome, BEBP. The ECG is characterized by changes in the axis of the heart, ventricular hypertrophy. Echocardiography diagnosed enlargement of the left chambers of the heart.

In the preoperative period, it is necessary to carry out individual preparation regarding anemia and BENP.

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