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FEATURES OF THE CLINICAL COURSE AND THE STATE OF PHYSICAL AND NEUROPSYCHOLOGICAL STATUS IN CHILDREN WITH THE NATURAL COURSE OF ATRIAL SEPTAL DEFECT

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Abstract. Isolated atrial septal defect (ASD) is one of the most common forms of congenital septal heart anomalies. The key factors determining the clinical course and hemodynamic disturbances in ASD are a persistent left-to-right shunt, which leads to pulmonary overcirculation and pulmonary hypertension (PH), as well as dysfunction of the pulmonary vasculature, resulting in the development of heart failure.

Keywords: atrial septal defect, pulmonary hypertension, heart failure, physical development, neuropsychological status.

RELEVANCE

Over recent decades, the structure of cardiovascular pathology in children has undergone significant changes. Among the wide spectrum of cardiac diseases, congenital heart defects occupy a leading position [2,8].

Atrial septal defect (ASD), both in its isolated form and in combination with other anomalies, is among the most common congenital heart defects [5,7].

Isolated forms of ASD of various types are detected in approximately 1 out of 1,500 live births and account for about 40% of all congenital heart defects. Different variants of this defect may be associated with other congenital anomalies or be part of combined cardiovascular pathology [2,7,8].

The natural course of ASD is determined by the size and location of the defect, the age of the child, the level of adaptive capacity, and the severity of complications [1,3,9].

The key mechanism of hemodynamic disturbance in ASD is a pathological left-to-right shunt from the left atrium to the right atrium. The direction and volume of this shunt are determined by the greater compliance of the right ventricle, anatomical features of atrial positioning, and, to a lesser extent, higher pressure in the left atrium. The magnitude of the shunt mainly depends on the size of the defect and the compliance of the right ventricle [4,7,9].

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Volume overload of the right ventricle leads to its dilation and may be accompanied by the development of tricuspid valve insufficiency. Prolonged left-to-right shunting contributes to pulmonary overcirculation and the development of pulmonary hypertension [1,4,5].

In children with septal congenital heart defects complicated by pulmonary hypertension, endothelial dysfunction of the pulmonary vasculature results in impaired systolic and diastolic myocardial function, often leading to heart failure—one of the main causes of disability and mortality in childhood [1,5,8].

In addition, hypoxic disturbances associated with ASD contribute to the development of multiorgan dysfunction, aggravate an unfavorable perinatal background, and represent an important factor in delayed physical and neuropsychological development in these children [6].

MATERIALS, SCOPE, AND RESEARCH METHODS

The study and data collection were carried out at the Andijan Regional Children's Multidisciplinary Center. To achieve the objectives of this study, children receiving treatment in the cardiorheumatology department were examined, and a retrospective analysis of medical records was also performed. The study included 20 children with isolated

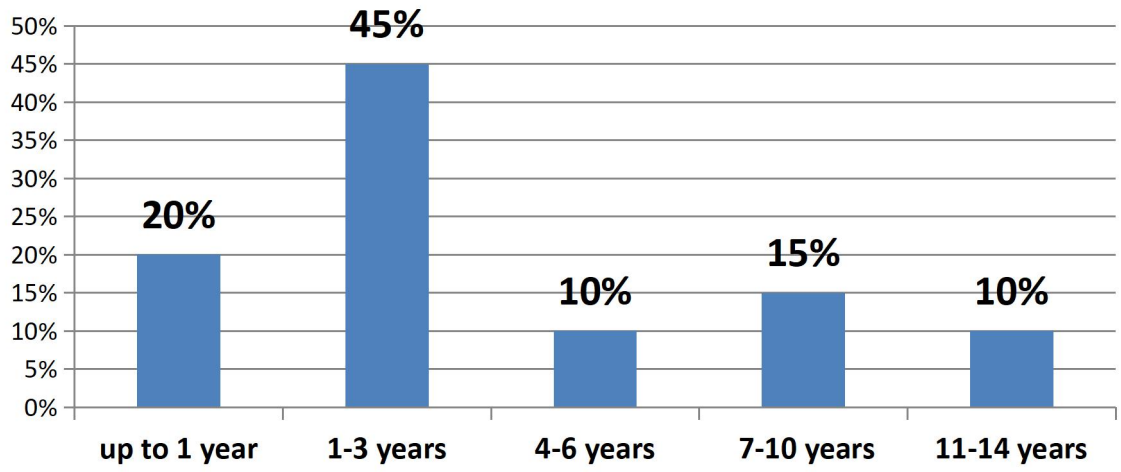
ASD who had not undergone surgical correction.

The examination program included the following methods: anamnestic, clinical, and instrumental, comprising ECG, echocardiography, and radiography.

Assessment of physical development was based on WHO (2014) recommendations, using anthropometric indicators such as body weight and height.

Analysis of gender distribution showed a predominance of girls (55% vs. 45%). The age range of the patients varied from 6 months to 14 years.

Figure 1. Age composition of children



Based on echocardiographic findings, the children were divided into three groups according to the size of the defect, as shown in Figure 2.

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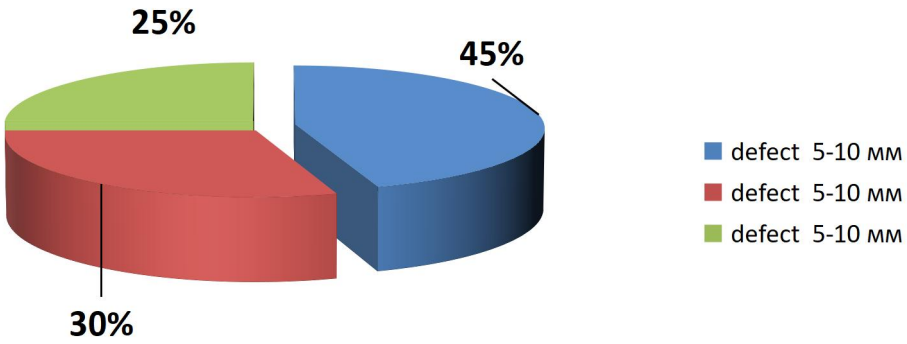
Figure 2. Distribution of children depending on the size of the atrial septal defect



RESULTS

Among the examined children with isolated ASD, the condition at admission was assessed as moderate in severity twice as often (65% vs. 35%). The severity depended on the size of the congenital defect and the presence of complications such as pulmonary hypertension and heart failure.

Within the structure of complications of the natural course of ASD, pulmonary hypertension was identified in 5 children (25%). In these patients, clinical signs of grade IIB heart failure were also observed.

Analysis of complaints presented in the table showed that dyspnea was present in all cases (100%); in one-third of the children, it occurred even at rest, which was associated with large atrial septal defects.

Table 1. Complaints at hospital admission (n=20).

Complaints	abs	%
Shortness of breath at rest	9	45%
Shortness of breath during physical activity	11	55%
Weakness	20	100%
Emergency fatigue	20	100%
Failure to thrive	13	65%
Moaning breathing	3	15%
Cough	3	15%
Chest pain	2	10%
Swelling	2	10%

Grunting respiration and edema were more frequently observed in younger children, whereas pain syndrome predominated in older patients with severe pulmonary hypertension. Physical examination revealed a systolic murmur of moderate intensity and duration along the left sternal border, as well as an accentuated second heart sound over the pulmonary artery. Liver enlargement ranged from 1,5 to 5 cm.

Electrocardiographic examination performed in all children (data presented in Table 2) demonstrated a predominance of signs of overload of both atria and right ventricular hypertrophy. Cardiac rhythm disturbances were most commonly manifested by tachycardia and conduction

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abnormalities, caused by displacement of the conduction system due to hypertrophy of the right heart chambers.

Table 2. ECG findings.

ECG sign	ASD (n=20)
Rightward deviation of the electrical axis	10 (50%)
Normal position of the electrical axis	10 (50%)
Right atrial overload and high electrical activity of the right ventricle	7 (35%)
Atrial overload and right ventricular hypertrophy	9 (45%)
Right atrial and right ventricular hypertrophy	4 (20%)
Right atrial and biventricular hypertrophy	-
Tachycardia	19 (95%)
Bradycardia	1 (5%)
Incomplete right bundle branch block	5 (25%)
First-degree AV block	-
WPW syndrome	1 (5%)

Echocardiography was the key diagnostic method for ASD. In one-third of patients with large defects, dilation of the right atrium and right ventricle was observed, along with minimal tricuspid regurgitation.

Radiographic examination showed that in 8 children (40%), the cardiothoracic index exceeded normal values (56–60%) due to enlargement of the right ventricular shadow. In 5 patients (25%), signs of pulmonary hypertension were manifested by a smoothing of the cardiac waist due to bulging of the pulmonary artery.

Assessment of physical development was performed using the indices “weight-for-age,” “height-for-age,” and “weight-for-height.” Height indicators corresponded to average values; however, significant deviations were found in body weight. Values below −2 Z-scores (−2 SD) were observed in 2 infants (10%), while values at −1 SD were noted in 1 infant (5%) and in 4 children aged 1–3 years (20%). An additional 3 children older than 4 years (15%) were classified as being at risk for underweight. Overall, in 50% of children, due to insufficient body weight, the morphofunctional status was assessed as disharmonious.

The comprehensive examination program for children with ASD included an assessment of neuropsychological development according to age norms. Analysis of medical history revealed that in the neonatal and early postnatal periods (up to 6 months), children frequently exhibited motor disturbances (60%), increased excitability (45%), muscle tone disorders (35%), and signs of autonomic dysfunction (25%). These clinical findings were confirmed by neurosonography results. According to NSG data, hypoxic central nervous system injury was identified in 85% of patients, while hypoxic-ischemic injury was detected in 15%.

In the majority of examined children (85%), delayed and impaired development of key motor skills was observed, including head control, independent sitting, crawling, standing, and walking, as well as general motor development. In children aged 1–3 years, pre-speech development delay was mild in one-third of cases and moderate in two-thirds.

No significant abnormalities in neuropsychological development were found in children older than 4 years; their development corresponded to age-appropriate norms.

CONCLUSIONS

The presented data confirm the relevance of the problem of congenital heart defects in childhood. An unfavorable somatic status, along with unstable cardiac and cerebral

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hemodynamics, forms a high-risk group not only in terms of the course of cardiovascular pathology but also regarding physical and neuropsychological development. A particularly unfavorable prognostic factor in this condition is the combination of complications such as pulmonary hypertension and heart failure, which may lead to a reduced life expectancy in this category of patients.

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