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The Role and Clinical Significance of Minor Anomalies in the Development of the Heart in Children with Myocarditis

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Abstract The article presents current literature data on the role and clinical significance of minor anomalies in the development of the heart in the pathogenesis of cardiovascular pathology. In the presented literature sources, materials on violations of the conduction system of the heart against the background of connective tissue dysplasia are considered. The questions of the influence of different morphological variants of anomalies of the development of the heart on the functional state of the cardiovascular system in various cardiovascular pathologies are disclosed.

Keywords Myocarditis, Minor anomalies in the development of the heart, Connective tissue dysplasia

1. Introduction

Myocarditis is the most common pathology in childhood. The etiological structure of myocarditis is diverse. The disease can occur after exposure to almost all infectious agents pathogenic to humans. There are allergic myocarditis (drug, serum, post-vaccination), toxic, in autoimmune conditions (diffuse connective tissue diseases), as well as as a result of myocardial damage by physical, chemical and biological agents. [11,12,13,14,15]

In the structure of diseases of the cardiovascular system in children, a significant place is occupied by conditions associated with the syndrome of connective tissue dysplasia [1,2,4,15,12]. Currently, according to the recommendations, it is customary to distinguish between hereditary syndromes of connective tissue dysplasia and dysplastic phenotypes (DF), which have a multifactorial nature. Phenotypic signs of connective tissue dysplasia are manifested by constitutional features and small developmental anomalies. It should be noted that many anomalies in themselves have no clinical significance and act as stigmas. [12,15]. Moreover, a deep relationship was determined between the number of phenotypic features, the severity of external dysplastic changes and changes in the connective tissue framework of internal organs, i.e. internal phenotypic manifestations with the formation of multiple organ pathology. [1,2,14,15]

In the literature of recent years, the results of examination of children with connective tissue dysplasia are sufficiently consecrated. The data obtained were characterized as multiple organ disorders, more often in the cardiovascular, nervous, musculoskeletal systems. In addition to the complex of external phenotypic signs of connective tissue dysplasia syndrome, each examined patient had signs of several disorders of organs and systems. From this it follows that connective tissue dysplasia can be considered as a synonym for the concept of hereditary connective tissue disorders. [1,2,5,8,10]

The syndrome of connective tissue dysplasia of the heart was first introduced into the classification of diseases of the cardiovascular system in 1990 in New York Association of Cardiologists [15]. In case of CTD of the heart, its connective tissue frame is involved in the pathological process. It is represented by changes in the heart valves (atrioventricular, semilunar, Eustachian valve) in the subvalvular apparatus, the septum of the heart and the main vessels. [14,15]

Yu.M. Belozerov (1993) and S.V. Gnusaev (1995) in clinical practice, instead of the term DTS of the heart, another option was proposed - minor anomalies in the development of the heart (MARS). According to the definition of these authors, MARS due to morphological changes in the architectonics of the heart and great vessels does not lead to hemodynamic dysfunction of the cardiovascular system. [6]. The clinical significance of MARS in the structure of cardiovascular pathology in children is peculiar and different. So, according to the conclusion of a number of experts, it is necessary to consider only specific anomalies that have a definite clinical significance in conjunction with a systemic connective tissue defect. [10,12,15]

According to the results of scientific publications in recent years, a close relationship between signs of systemic

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involvement and minor anomalies in the development of the heart has been sufficiently convincingly proven only in cases of atrial septal aneurysm (AISA), prolapse of the valve leaflets, borderline expansion of the main vessels, asymmetry of the tricuspid and aortic valve (ATAV), false chords of the left ventricle (LVHL) and abnormal left ventricular trabeculae (ATLV) located in the basal and cardiac segments of the left ventricle, as well as multiple (three or more) false chords and abnormal trabeculae. [15]

Studies conducted in adult cardiac patients associated with the influence of various morphological variants of abnormally located chords (APC) in the left ventricle revealed a violation of the rhythm and conduction. The data obtained indicated that the syndrome of early excitation of the left ventricle was significantly more common in patients with basal attachment of abnormally located chords and a chord thickness of 5 mm or more. According to the author, this may be due to the fact that the place of attachment of the chord is in close proximity to the AV node, and thick abnormally located chords contain elements of the conduction system of the heart - Purkinje cells. Thus, APX can act as an additional pathway for impulse conduction. [14,15]

There are divergent opinions regarding the clinical significance of minor cardiac anomalies. Various facts on this problem have accumulated enough in recent years and numerous studies already give reason to talk about their role in the formation of heart pathology. It has been established that certain forms can serve as risk factors for the development of organic pathology. These are infective endocarditis, thromboembolism, heart failure and arrhythmias. [4,5,6,8,15]

Purpose of the study. Features of the clinical symptoms of myocarditis in children depending on age, the presence of small anomalies of the connective tissue, treatment tactics for varying degrees of severity of clinical manifestations and course, prevention of the consequences of myocarditis.

2. Material and Research Methods

During the observation of patients undergoing inpatient treatment in the 4th city children's hospital in Tashkent, 168 children were diagnosed with myocarditis, of which 88 children were aged 1-6 years and 80 were aged 7-14 years. For the diagnosis of myocarditis, the criteria proposed by the NYHA (New York Heart Association, 1973) were used, where large criteria were highlighted (past infection, the appearance of signs of the disease within 10 days after it, congestive heart failure, cardiogenic shock, complete AV blockade, changes on ECG, increased activity of myocardial enzymes) and minor criteria (laboratory confirmation of the disease, tachycardia, weakening of the 1st tone, gallop rhythm, results of subendomyocardial biopsy). Endomyocardial biopsy is associated with a risk of complications and is recommended only for patients with an extremely unfavorable course of the disease or in case of ineffective therapy [8,9,10].

Despite the high information content, myocardial biopsy in children is used to a limited extent.

History data and a combination of two major or one major plus two minor criteria are sufficient to establish a diagnosis.

The study included 168 children, including 88 children aged 1 to 6 years (I-th group) and 80 children aged 7-14 years (II-th group), who were diagnosed with non-rheumatic carditis. In the I-th group of observed 48 children were of early age (1 - 3 years), 40 children were of preschool age (3 - 6 years). The observation was carried out for 2 years.

3. Results

The most common etiological cause of myocarditis are viruses: adenoviruses and enteroviruses, including Coxsackie viruses; cytomegalovirus, influenza viruses, etc. Bacterial myocarditis develops much less frequently than viral ones, but almost any bacterial agent can cause the development of the clinical picture of myocarditis. Postponed intestinal infections take the second place after acute viral infections in the etiological causes of myocarditis in children.

Serological blood tests in 45 (51%) preschool children and 40 (50%) school-age children confirmed the presence of specific immunoglobulins to herpes simplex viruses, cytomegalovirus, adenovirus, respiratory syncytial infection, of which 2 pathogens were identified in 8 children. In 20 (25%) school-age children (II-th group) and 36 children of the I-th group (41%), chronic foci of infection (chronic tonsillitis, sinusitis, caries) were diagnosed, of which 10 were under the age of 3 years. (21%) people, the remaining 26 (65%) children were aged 3-6 years. In 20 (25%) children of the II-th group, signs of myocarditis were detected after an acute intestinal infection, when immunoglobulins to Shigella flexneri, Shigella zonne, Salmonella enteridis were determined in the blood.

Staphylococcus aureus, Streptococcus hemolyticus were isolated during bacteriological examination of pharyngeal and nasal mucus. In history, 20 (23%) preschool children and 10 (12.5%) school-age children had an allergic mood of the body (exudative diathesis, eczema, food and drug allergies).

The clinical picture of myocarditis was largely determined by the etiology, prevalence and depth of the pathological process, the variant of its course. It should be noted that the signs of myocarditis in most cases appear with a decrease in the clinical manifestations of the underlying disease, and in some cases 10-20 days after the disease [14,15].

Signs of myocardial damage in observed children were diagnosed more often during the period of convalescence in preschool children after 10-15 days, and in school-age children - 15-20 days after an acute infectious disease.

Clinical manifestations of the disease are generally nonspecific. Children become lethargic, restless, complain of general weakness, moan at night, appetite decreases, sometimes nausea and vomiting. Often there is an obsessive

cough, aggravated by a change in body position, cyanosis, shortness of breath join. Certain complaints are made mainly by children of the older age group: shortness of breath (in mild forms only during physical exertion), chest pains of a diverse nature, pastosity, and cough are often disturbed.

The boundaries of the heart in myocarditis in most cases are expanded. The apical impulse is weakened or not determined at all. On auscultation, muffled tones are noted, while the more the heart is enlarged, the muffled. Rhythm disturbance is auscultatory perceived as tachycardia, tachyarrhythmia, bradycardia, bradyarrhythmia. The gallop rhythm is more often heard with cardiomegaly. Systolic murmur is not typical, heard in half of children with acute carditis, is functional.

Manifestations of myocarditis can vary from mild forms without signs of heart failure to the clinical picture of severe circulatory failure, complex arrhythmias and conduction disorders. The severity and duration of clinical symptoms depend on the severity and course of the disease. The duration of the disease directly depends on the degree of myocardial damage: with minimal changes, complete recovery is possible, with significant damage to the myocardium, a syndrome of dilated cardiomyopathy is formed - cardiomegaly, dilatation of the heart cavities, and a decrease in myocardial contractility [9,10,11].

The detection of small heart anomalies in the observed children was carried out according to the algorithm proposed by A.A. Bova, 2001 [15]:

1. Complaints, mainly as a manifestation of dysfunction of the autonomic nervous system.
2. Determination of external "small" developmental anomalies (asthenic type, dolichostenomelia, kyphoscoliosis, excavation of the sternum, etc.).
3. Auscultatory signs ("click", noise over the region of the heart, arrhythmias).
4. ECG monitoring.
5. Echocardiography.
6. Dosed physical activity, non-invasive electrophysiological study of the heart.
7. Studies of organs and systems to identify internal "small" anomalies (X-ray, ultrasound, psychological status determination, etc.).

Echocardiography (EchoCG) is an important component in the diagnosis of heart pathology, it allows to determine the size of the heart cavities, ventricular dilatation, myocardial hypokinesia, decreased left ventricular ejection fraction, left ventricular myocardial hypertrophy, signs of pulmonary hypertension, as well as the presence of structural changes (presence of MAC).

All children with myocarditis showed signs of dilatation of the heart cavities with impaired myocardial contractility, which confirmed the presence of an inflammatory process in the myocardium.

Echocardiography in the presence of signs of an inflammatory process of the myocardium revealed signs of MAS in young children: an open oval window - in 23 (26%) children, a false chord and the presence of trabeculae of the left ventricle - in 35 (39.7%), mitral valve prolapse up to 2mm - in 10 (11.3%). In school-age children, echocardiography against the background of signs of myocarditis revealed the following MAS: the presence of a false chord and trabeculae of the left ventricle - in 21 (26.25%), mitral valve prolapse - in 4 (5%) children.

Thus, during an echocardiographic study in preschool children, the presence of MAS was diagnosed in 68 (77.3%) cases. It should be noted that MACs were detected in 38 (79%) infants and 30 (50%) adolescents, which confirms the possibility of age-related remodeling of heart structures. In school-age children, an echocardiogram revealed the presence of MAS in 25 (31.25%) children.

When analyzing the antenatal period, all children with MAS were found to have had maternal infections during pregnancy, threats of abortion, severe toxicosis, pyelonephritis, arterial hypertension, in 18 (37.5%) young children, perinatal damage to the central nervous system (PPCNS) and others Clinical manifestations of myocarditis and the course of the disease depended on the age of the child, the presence of concomitant pathology. So in young children, myocarditis proceeded in 4 (8.3%) cases, it was severe, when signs of myocardial damage were detected against the background of a previous infectious disease, the course of myocarditis was subacute in the remaining (44 - 91.7%) cases - moderate form . It should be noted that a severe form of myocarditis with a subacute course was in children with MAS, and a moderate form with an acute course was observed in 70.8% of cases in children with myocarditis occurring against the background of MAS. In adolescents, severe myocarditis with a subacute course was observed in 2 (5%) children when myocarditis and concomitant MAS were diagnosed. In the majority of children (25–62.5%), myocarditis proceeded in a moderate form with an acute course, of which 18 (72%) children had signs of MAS, and in 13 (32.5%) children, the disease proceeded in a mild form, when 77% of children had myocarditis without concomitant MAS. In school-age children, myocarditis in 50 (62.5%) cases proceeded in a moderate form, where 25 (31.25%) children had myocarditis and MAS. In the remaining cases, 30 (37.5%) myocarditis proceeded in a mild form, the course of the disease was acute in all cases of observation.

The conducted observations showed the influence of minor developmental anomalies on the clinical manifestations and course of myocarditis in children, which depended not only on the presence of MAS, but also on the age of the child, when dysplastic changes in the heart in early and adolescence can contribute to a more severe course of cardiovascular pathology.

Treatment of non-rheumatic carditis includes two stages: stationary - in the acute period and polyclinic - during maintenance therapy.

In the acute period, therapy is used aimed at the impact of the etiological factor: antibacterial and antiviral agents (acyclovir, ganciclovir, herpevir, cycloferon). The use of antibiotic therapy is indicated in cases of chronic foci of infection, positive bacteriological analyzes of the mucus of

the throat and nose. Preference was given to oral antibiotics from the group of semi-synthetic inhibitor-protected penicillins (amoxacillin, augmentin), as well as cephalosporin drugs (megacef, cefaclor, cefixime, etc.). Used for anti-inflammatory and immunosuppressive purposes glucocorticoids in diffuse myocardial lesions with heart failure, with a subacute onset of the disease (harbingers of a chronic process), with damage to the conduction system.

In order to reduce the inflammatory process in the myocardium, nonsteroidal anti-inflammatory drugs (pyrazolone drugs, indomethacin, brufen, voltaren, etc.) were used, which are the basis of pathogenetic therapy. Non-steroidal anti-inflammatory drugs were used for 2-3 weeks. In the future, if there is a risk of a protracted course of the disease, it is advisable to use the appointment of 4-aminoquinolines (delagil, plaquenil) up to 4-6 months in order to limit the amount of cardiosclerosis.

In the treatment of myocarditis, therapy is important, aimed at normalizing metabolic disorders in the myocardium, and treating heart failure. Maintain a normal level of oxygen in the blood, if necessary, additional oxygenation. In severe heart failure, inotropic drugs (dopamine, dobutamine) were used. Diuretics were prescribed to reduce preload in case of excessive content of extracellular fluid.

Currently, metabolic therapy is of great importance in the treatment of various pathological conditions in children [35]. As a result of tissue hypoxia, ATP synthesis, energy transport from the site of production to the effector structures of cells is disrupted, and energy utilization is disrupted. Riboxin, thiotriazaline, levocarnitine (Elkar) can be used to improve metabolic processes in the myocardium [36,37].

Cardiotrophic therapy and magnesium preparations are indicated in the treatment of not only myocarditis, but also MAS, since magnesium is part of the basic substance of the connective tissue and is necessary for the proper formation of collagen fibers. Under conditions of magnesium deficiency, the ability of fibroblasts to produce collagen is impaired. In addition, magnesium has a membrane-stabilizing effect, retains potassium inside the cell, and prevents sympathicotonic influences, which makes it possible to use it for the treatment of cardiac arrhythmias.

Children with MAS are shown magnesium, potassium preparations, to improve metabolic processes, elcar, coenzyme, vitamins B1, B2, B6, E, C, folic acid, which stimulate collagen formation, and correctors of impaired synthesis and catabolism of glycosaminoglycans - chondroitin sulfate and glycosaminoglycans. Therapy with these drugs should be carried out not only in the presence of a disease, but also for prophylactic purposes, which contributes to the normal formation of connective tissue and an adequate response of the body to the impact of a damaging factor.

After myocarditis, the children were under the supervision of a pediatrician, a pediatric cardiorheumatologist: for 4 months after discharge from the hospital, they were examined once a month, then for a year - once a quarter, after that - once every 6 months, according to indications more often, with An ECG is performed at every visit. Echocardiography was performed once a year. Sanitation of chronic foci of infection, observance of the regime of the day and rest, rational nutrition were carried out. The children were repeated metabolic therapy (Elkar), magnesium preparations, etc., taking into account the severity of the disease 2-3 months after discharge from the hospital, with repeated respiratory diseases, as well as the presence of concomitant signs of MAS (small developmental anomalies).

4. Conclusions

Myocarditis in children is a common pathology, observed at any age, but the severity of clinical manifestations and the course of the disease depend not only on the etiology, but also on the age of the child and the presence of factors that can contribute to a more severe course. Small anomalies of the heart are not a pathology, but indicate a violation of the metabolic processes of the connective tissue, their severity may decrease with age. The conducted observations revealed the frequency of occurrence of small anomalies in the development of the heart, depending on age, with the highest diagnosis in children of preschool age.

Small anomalies can contribute to the development of a more severe form of the disease and the subacute course of myocarditis, especially in young children and adolescents, predispose to the occurrence of hemodynamic disorders, the occurrence of cardiac arrhythmias.

Therapy should be carried out not only for the underlying disease, but also include drugs that correct collagen formation. When conducting dispensary observation, it is necessary to conduct an echogram and prescribe preventive metabolic therapy.

Identification of signs of dysplastic syndrome in children from the first years of life and timely conduction of an echogram will contribute to the early diagnosis of minor developmental anomalies and the appointment of preventive metabolic therapy that contributes to the normal formation of connective tissue and an adequate response of the body in pathological conditions.

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