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Myocarditis in Children: Clinical Picture, Diagnosis and Treatment

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Abstract: This article is dedicated to the clinical manifestations, diagnosis, and treatment methods of myocarditis in children. Myocarditis is an inflammatory disease of the myocardium caused by various etiologies, potentially leading to cardiac dysfunction. The study highlights the primary causes of myocarditis in children, including viral, bacterial, immunological, toxic, and drug-induced factors. The article provides an in-depth analysis of the pathogenesis, clinical classification, symptoms, and diagnostic approaches to the disease. Treatment strategies, including etiological, pathogenetic, and symptomatic therapies, are discussed. The importance of early detection and adequate treatment of myocarditis is emphasized to prevent its adverse outcomes.

Keywords: myocarditis, children, heart diseases, diagnosis, clinical classification, inflammation, treatment methods, heart failure.

Introduction: According to experts of the European Society of Cardiology (ESC, 2013), "myocarditis is an inflammatory lesion of the myocardium characterized by histological signs of inflammatory infiltration, degeneration and necrosis of cardiomyocytes of non-ischemic origin, often associated with cardiac dysfunction" [1]. The term "myocarditis" was first introduced into medical practice by G. Sobernheim in 1837, and over the long history of studying this disease, approaches to its definition and diagnosis have changed significantly.

Myocarditis in children is an inflammatory disease of the myocardium of various etiologies that occurs primarily or is a complication of other diseases. The causes of pathology are infectious, allergic, toxic and medicinal factors. Symptoms of myocarditis include heart pain, shortness of breath, weakness, and fever. Laboratory examination (myocardial markers, serological reactions) is used for diagnosis, instrumental methods — radiography of OGK, EchoCG, ECG. Treatment is carried out taking into account the etiology: children are prescribed antibiotics and antiviral drugs, glucocorticoids, cardiotropic drugs.

Reasons: In children, myocarditis occurs more often against the background of viral damage to the heart. Among the etiological factors, parvoviruses, herpes virus type 6, enteroviruses (Coxsackie and ECHO) predominate. A combination of several infectious agents is possible, which is a prognostically unfavorable sign. Among other causes of inflammatory heart damage, pediatric cardiologists call:

Bacterial ones. Diphtheria is considered the most dangerous (infectious and toxic) myocarditis, as well as heart damage are found in scarlet fever, typhoid fever, salmonellosis. Less often, children develop myocardial inflammation caused by pathogenic strains of staphylococci and streptococci.

Immunological. Myocarditis occurs as a special type of allergic reaction to the administration of tetanus toxoid, serums or vaccines. Another option is an autoimmune mechanism associated with systemic connective tissue diseases, sarcoidosis, and Wegener's granulomatosis.

Toxic. Damage to the heart muscle occurs in response to the action of metals — copper, iron, lead. Myocarditis is observed when bitten by poisonous insects and snakes, poisoning with arsenic or carbon monoxide. At the same time, they are combined with multiple organ pathology. Among the physical factors of the disease are radiation and electrical exposure.

Medicinal. The cardiac muscle is affected by prolonged or uncontrolled use of antibiotics, anticonvulsants, antipsychotics. Symptoms of myocarditis also appear after taking lithium, doxorubicin, and other cytostatics. In adolescents, the disease can be provoked by drug use (amphetamine, cocaine).

Pathogenesis: Despite the variety of causes, similar immunopathological processes play a role in the mechanism of disease development. The results of experimental studies show that myocarditis is the result of a combination of direct cytotoxic effects on cardiomyocytes and indirect negative effects on cells, which are realized through cytokines and other biomolecules.

Developing immunological deficiency causes dysregulation of the immune response and the production of antibodies to cardiomyocytes. Myocardial dysfunction provokes hyperproduction of neurohormones and proinflammatory cytokines, and subsequently - total structural damage to cells. Physiological features of the cardiovascular system in children cause rapid maladaptation and decompensation of the condition.

Classification: In domestic pediatrics, the disease is divided into congenital (antenatal) and acquired (postnatal). According to the duration, myocarditis can be acute (up to 3 months), subacute (up to 1.5 years) and chronic. To summarize the nature of the course of the disease and the prognosis, doctors use the foreign clinical and pathological classification according to E. Liberman, which includes 3 forms:

Lightning variant. It is manifested by a rapid increase in signs of circulatory failure and decompensation, including cardiogenic shock. In children, left ventricular dysfunction is expressed, and the symptoms of myocardial inflammation are clearly visible during ultrasound diagnostics.

Subacute form. It proceeds asymptomatically or with an erased clinical picture, children do not complain of malaise or take it for ordinary fatigue. In this case, arrhythmia and structural changes in the heart muscle often develop.

Chronic course. With an active variant of myocarditis, relapses of the disease are observed with a positive response to therapy. The chronic persistent form is characterized by constant symptoms and inflammatory foci in the myocardium, which give an unfavorable long-term prognosis.

Symptoms of myocarditis in children: In most children, the disease proceeds without pronounced cardiac manifestations, so it is rarely diagnosed in time. Since the leading symptoms of myocarditis are shortness of breath, vomiting, loss of appetite, in 80% of cases, during the initial examination by a pediatrician, another diagnosis is made, and heart inflammation is discovered after instrumental and laboratory diagnostics.

The clinical picture of myocarditis depends on the age of the patient. Newborns and infants of the 1st year of life are characterized by a severe or fulminant course. The baby has respiratory arrest attacks, followed by noisy shortness of breath, he sweats a lot, becomes sluggish and inhibited. The child refuses to breastfeed or bottle. The skin around the mouth and on the fingertips takes on a bluish hue.

At an early age, the symptoms of left ventricular failure are typical — frequent and noisy breathing, shortness of breath during exercise, periodic coughing with wheezing. The state of

health worsens when lying down, during a night's sleep. In an acute process, body temperature rises to subfebrile or febrile numbers. In schoolchildren, the above-described signs of myocarditis are complemented by abdominal pain, nausea and vomiting.

Myocarditis is a potentially life—threatening disease for a child, as it can cause sudden cardiac death. The timeliness of diagnosis is of great prognostic importance, since without treatment, mortality reaches 20% in adolescents and up to 75% in newborns. Cardiogenic shock and thromboembolic syndrome are also distinguished among the complications of the acute period.

In 46% of cases, untreated myocarditis develops into dilated cardiomyopathy, which is accompanied by chronic heart failure. With a chronic course, hypertrophy develops, followed by myocardial fibrosis, and persistent cardiovascular dysfunction is observed. Usually, such children have rhythm and conduction disturbances.

Diagnostics. During a physical examination, the doctor evaluates tachycardia, muffled heart tones and the appearance of pathological rhythms, the presence of various types of pulmonary wheezing. The diagnostic plan for myocarditis in children includes the following methods:

Ultrasound of the heart. During echocardiography, the cardiologist sees the expansion of the heart chambers, thickening of their walls, and interstitial tissue edema. The study is complemented by Dopplerography to assess blood flow in the vessels. To clarify the diagnosis, it is recommended to perform an MRI of the heart with contrast.

Radiography of OGK. The doctor detects an expansion of the cardiac shadow in all directions and an increase in the cardiothoracic index of more than 0.5, which characterizes cardiomegaly. There is a smoothing of the contours of the organ and spherical deformation, which indicates active inflammation and swelling of the tissues.

The ECG. The cardiogram shows a decrease in the voltage of the teeth and symptoms of left ventricular myocardial hypertrophy. Unstable changes in repolarization are less often noticeable. Early symptoms of myocarditis are represented by various conduction disorders, in 60% of cases they are accompanied by extrasystole.

Studies of myocardial markers. An increase in troponin and its isoenzymes is informative for the doctor, which indicates an acute course. Valuable diagnostic information is provided by tests for CFRP and LDH, which reflect the activity of the inflammatory process. NT-proBNP is determined to confirm heart failure.

Serological tests. Blood tests and other biological materials are required to determine the cause of myocarditis, if its viral or bacterial nature is assumed. In practice, these methods are not always effective. Therefore, microbiological analysis of nasopharyngeal flushes is additionally performed.

Endomyocardial biopsy is considered the "gold standard" for diagnosing myocarditis. The method is necessary for histological verification of the diagnosis in questionable cases, as well as for detecting etiologic factors of inflammation. Due to the complexity of the procedure and its invasiveness, cardiac wall biopsy has not been introduced into the routine diagnostic complex, but is performed according to indications in specialized cardiology centers. Treatment of myocarditis in children. A child with myocarditis requires hospitalization and a therapeutic and protective regimen during the first 1-2 months or until the acute phase of the disease subsides. Physical activity is completely limited, since it intensifies the inflammatory process. A complete balanced diet is selected, schoolchildren are advised to limit salt intake. The drinking regime is carefully monitored to prevent edema. Drug treatment of myocarditis has several components: etiotropic therapy, provided that the infectious agent is isolated, correction of signs of heart failure, the use of pathogenetic drugs to influence the mechanisms of disease development. The following groups of drugs are used for therapeutic purposes:

Antibiotics. Children are prescribed protected penicillins in combination with aminoglycosides or cephalosporins (at school age). The course lasts 2-4 weeks to completely eliminate myocarditis caused by a viral-bacterial association, to prevent the onset of infective endocarditis.

Antiviral agents. The drugs are effective only in the first days after the infectious agent enters the body, so they are not indicated for all patients. In case of infection with herpes viruses, drugs of the acyclovir group and anti-cytomegalovirus immunoglobulin are used.

ACE inhibitors. Medicines occupy the first place in the therapy of heart failure in children. To increase their effectiveness, they are supplemented with beta-blockers, low-dose cardiac glycosides and metabolic drugs.

Glucocorticoids. Anti-inflammatory hormones are effective in severe inflammation, development of infectious-toxic shock, damage to the cardiac conduction pathways. Immunosuppression is recommended only in the acute period of myocarditis.

Conclusion. Detection of signs of damage to the cardiovascular system in children at any age requires mandatory careful monitoring. In order to clarify the nature of the damage to the heart muscle, as well as to resolve the issue of further treatment and the amount of medical care required at this stage, a wide diagnostic search is required. Timely detection of signs of myocarditis in a child can determine the outcome of his disease. The prognosis for acute myocarditis without signs of heart failure or with symptoms of heart failure in young children, provided early detection and adequate therapy, is usually favorable. Fulminant myocarditis may have an unfavorable prognosis, as well as subacute and chronic myocarditis, with the outcome of dilated cardiomyopathy due to progressive heart failure.

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