

FEATURES OF DIAGNOSIS AND THERAPY FOR MYOCARDIAL DAMAGE IN CHILDREN WITH ACUTE RESPIRATORY DISEASES

Khakimova Umida Rikhsibaevna

Muratkhodjaeva Akida Valievna

Tashkent Pediatric Medical Institute

<https://doi.org/10.5281/zenodo.7227840>

Abstract. *About 1-5% of patients with acute viral infection may have myocardial damage. The pathogens of many common infections are able to have a direct or indirect damaging effect on the heart muscle. An examination of 178 children with a diagnosis of acute respiratory infection was carried out. Most children (78%) observed changes from the cardiovascular system in the form of functional disorders (60%) and the development of myocarditis (18%), which was confirmed by ECG, Echo-KG and determining the activity of cardiospecific enzymes. All children were carried out therapy using antiviral and antibacterial drugs, and when detecting disorders from the heart, drugs were used that improve metabolic processes in the myocardium, if necessary, anti-inflammatory drugs.*

Key words: *acute respiratory diseases, functional disorders of the cardiovascular system, myocarditis, and therapy.*

ОСОБЕННОСТИ ДИАГНОСТИКИ И ТЕРАПИИ ПОРАЖЕНИЯ МИОКАРДА У ДЕТЕЙ С ОСТРЫМИ РЕСПИРАТОРНЫМИ ЗАБОЛЕВАНИЯМИ.

Аннотация. *Около 1-5% больных острой вирусной инфекцией могут иметь поражение миокарда. Возбудители многих распространенных инфекций способны оказывать прямое или косвенное повреждающее действие на сердечную мышцу. Проведено обследование 178 детей с диагнозом острая респираторная инфекция. У большинства детей (78%) наблюдались изменения со стороны сердечно-сосудистой системы в виде функциональных нарушений (60%) и развития миокардита (18%), что подтверждалось данными ЭКГ, Эхо-КГ и определением активности кардиоспецифических ферментов. Всем детям проводилась терапия с применением противовирусных и антибактериальных препаратов, а при выявлении нарушений со стороны сердца применялись препараты, улучшающие метаболические процессы в миокарде, при необходимости противовоспалительные препараты.*

Ключевые слова: *острые респираторные заболевания, функциональные нарушения сердечно-сосудистой системы, миокардит, терапия.*

INTRODUCTION

Worldwide, infectious diseases are the most common childhood pathology. Each child has an acute respiratory infection 6–10 times a year and up to 4 times an acute intestinal infection (AII). Many common pathogens can have a direct or indirect damaging effect on the heart muscle. The cardiovascular system (CVS) is involved in the pathological process in 80% of patients [8]. In a significant proportion of patients, CCC reactions can be considered functional, naturally developing in response to an infectious-inflammatory process. [3,4] Regardless of the nature of the damaging factor, nonspecific inflammation is observed on the mucous membrane of the respiratory tract, which develops with the participation of humoral and cellular inflammatory mediators. In the process of inflammation, metabolites are formed (prostaglandins and leukotrienes, cytokines, tumor necrosis factor). The release of pro-

inflammatory mediators attracts new cells to the site of inflammation, the destruction of which again releases inflammatory mediators and increases the inflammatory response. The components of the infectious-inflammatory process have a toxic effect, contribute to damage to cardiomyocytes), when there is a decrease in myocardial contractility, deterioration of microcirculation in the heart muscle [5].

Purpose of the study. Detection of myocardial damage and determination of the nature of the lesion in children with acute respiratory diseases, therapy depending on functional disorders or the development of the inflammatory process.

MATERIALS AND RESEARCH METHODS

A total of 178 children aged 3–16 years with a diagnosis of acute respiratory infection, who were admitted for treatment at the 4th Children's Clinical Hospital in Tashkent, were observed. In order to determine the pathogen, all patients underwent analysis of swabs from the nose and throat, using bacteriological and serological methods. To identify the signs and nature of myocardial damage, electrocardiographic (ECG) and ultrasound (ECHO-KG) studies were performed. For the timely diagnosis of cardiovascular complications to exclude myocarditis, a comprehensive examination of children was performed with the determination of cardiospecific enzymes and proteins.

RESULTS

When conducting bacteriological and serological studies in 98 (55%) children, acute respiratory infections were of a mixed viral-bacterial nature, in other cases, in 80 (45%) children, acute respiratory infections had a viral etiology. In the group with viral and bacterial lesions, children of preschool and early school age predominated. In the children's population, the so-called group deserves special attention. "frequently ill children" who carry 4-6 or more acute respiratory infections during the year. As a rule, their infections are of a mixed viral-bacterial nature [1, 2].

One of the most frequent causes of acute respiratory infections were rhinoviruses, adenoviruses, parainfluenza viruses, respiratory syncytial virus (RS-virus), enteroviruses were also detected. In children with viral and bacterial etiology of acute respiratory infections, bacterial pathogens were detected in most cases: Haemophilus influenza, Streptococcus pneumoniae and Moraxella catarrhalis, Staphylococcus aureus and Streptococcus hemolyticus were detected in some children, more often in the presence of chronic foci of infection.

Associations of bacteria with viruses can be observed during primary infection with viruses that, when introduced into the body, cause inflammation of the mucous membrane and contribute to the secondary colonization of bacteria. In frequently ill children, persistent viral agents play a significant role, which can contribute to the development of chronic tonsillitis. Epstein-Barr virus (EBV) and cytomegalovirus (CMV) are highly prevalent and have a tropism for lymphoid formations of the pharynx [6,7]. Long-term persistence of viral infections such as Epstein-Barr virus (EBV), cytomegalovirus (CMV), in frequently ill children leads to the addition of secondary bacterial flora. [eight].

In the group of children with viral-bacterial etiology of acute respiratory infections in 28 (36%) cases, foci of chronic infection (chronic tonsillitis, caries) were detected; PCR diagnostics revealed cytomegalovirus in 2 children, herpes virus in 4 children. Herpesvirus infections play a special role as triggers for the development of cardiac lesions in children due to their high

prevalence, lifelong persistence of viruses, and affinity for cells of the immune and nervous systems.

Acute respiratory diseases due to the possibility of developing complications at any time from the onset of the disease are a serious problem, especially in childhood. Viral infections in children often lead to the development of pathology of the cardiovascular system.

The clinic of respiratory diseases was manifested by general (fever, chills, malaise, loss of appetite, etc.) and local symptoms (difficulty in nasal breathing, rhinorrhea, congestion of the pharynx, sore throat, swelling of the tonsils, hoarseness, cough, signs of laryngotracheitis, bronchitis, etc.). The nature of the clinical picture of acute respiratory infections depends on the pathogenic properties of the pathogen, but also due to the age of the child, the state of his immunity. In the acute period of the disease, all children had functional changes in the cardiovascular system, which persisted in children after the elimination of symptoms of intoxication, but with a lesser degree of severity.

The majority (139 children - 78%) showed changes in the cardiovascular system. Clinical symptoms of infectious lesions of the myocardium are nonspecific and diverse, depending on the age of the child, the nature of the changes, as well as the presence of other factors affecting the functional ability of the myocardium. To improve the diagnosis, all children used functional diagnostic techniques, primarily electrocardiography (ECG) and echocardiography (ultrasound of the heart) with monitoring over time. Cardiological examination plays an important role in the practice of managing a number of diseases belonging to the category of cardiovascular diseases, as well as in cases of damage to the central nervous system of an organic and functional nature [9].

In 30 children (15%), after the elimination of intoxication and signs of the disease, no changes in the cardiovascular system were observed, which was confirmed by ECG, ECHO-KG and determining the activity of cardiospecific enzymes. Children with signs of changes in the cardiovascular system, depending on the nature of the changes detected during the examination, were divided into two groups: with functional disorders (107 children - 60%) and the development of myocarditis (32 children - 18%).

ECHO-CG revealed minor heart anomalies (MHA) in 40 (22%) children: foramen ovale - in 5 (3%) children, left ventricular trabeculae - in 20 (11%), mitral valve prolapse - in 15 (8%). In children with minor heart anomalies, changes in the cardiovascular system were observed, of which 28 were of a functional nature, and 12 were diagnosed with myocarditis. Structural changes in small heart anomalies are unstable and may disappear with age. The identified structural features must also be correlated with the child's age, considering many MHA as a dynamic process that requires observation for adequate clinical interpretation and a differentiated approach [10–13]. Small anomalies of the heart under certain conditions can cause or contribute to the development of disorders of the cardiovascular system.

With functional disorders of the heart, in most cases, pain in the region of the heart, tachycardia, a change in the sonority of heart tones, the presence of systolic murmur, were observed, combined with symptoms of autonomic disorders: headaches, dizziness, sweating, shortness of breath when walking, chest compression, unmotivated fatigue; neurological disorders (tearfulness, poor sleep) [14]. It should be noted that individual clinical symptoms were noted in these children before the disease in a less pronounced form. The children had a history of frequent illnesses, allergic reactions, and school-age children also had physical inactivity,

physical and mental overload. The presence of concomitant chronic foci of infection in 47 (34%) and anemia in 24 (17%) children contributed to metabolic disorders and the development of more prolonged functional disorders.

ECG changes in functional disorders were characterized by sinus tachycardia in 92 (66%) children, bradycardia in 12 (9%), extrasystole in 11 (8%), incomplete blockade of the right bundle branch block in 16 (12%), atrioventricular blockade of the 1st degree - in 8 (5%). It should be noted that bradycardia and signs of atrioventricular blockade were determined in children with minor heart anomalies.

Blood tests indicated the presence of signs of inflammation (leukocytosis, accelerated ESR, a slight increase in CRP), which were more often determined in children with chronic foci of infection. In the dynamics of observation against the background of the treatment, there was a rapid normalization of blood counts.

In the dynamics of observation and examination, 10 children were diagnosed with myocarditis, chronic foci of infection were detected in all children, and herpes virus was detected in 3 children during PCR diagnostics. In children with myocarditis, the clinical symptoms were identical with the identified functional disorders at the first stage of the examination, but in dynamics such symptoms as discomfort in the chest, shortness of breath with little physical exertion joined. Physical examination revealed percussion displacement of the boundaries of relative cardiac dullness, cardiomegaly; tachycardia, weakening of the 1st tone were determined more often on auscultation. Clinical manifestations of myocarditis are nonspecific, depending on the forms and course of the disease.

An important role for ascertaining myocarditis is the confirmation of signs of inflammation in a biochemical blood test. In all patients, clinical and biochemical blood tests revealed an increase in ESR and CP-protein, an increase in the activity of lactate dehydrogenase (LDH) and creatine phosphokinase (CPhK).

Evidence of myocardial damage are signs of a violation of its functions: first of all, contractility, and then automatism, excitability and conduction, which is determined during instrumental research methods. When conducting an ECG in children, in all cases, sinus tachycardia, signs of repolarization disorders (pathological changes in the T wave and ST segment), a decrease in the voltage of the teeth, in 2 children - a violation of the conduction of the bundle of His bundle were detected. Echocardiography revealed minor heart anomalies in 2 children, all children showed signs of disturbance in the form of myocardial hypokinesia, an increase in the end diastolic and systolic sizes of the left ventricle, and a decrease in the systolic function of the left ventricle. Therapy for acute respiratory diseases in children was determined by the most likely etiology of the disease, age and premorbid characteristics of the child [15]. Etiotropic antiviral therapy is, in principle, indicated for any respiratory viral disease. WHO recommends immediate antiviral therapy for patients at high risk for complicated course - children under the age of 5 and especially up to 2 years, the elderly; pregnant women, people with chronic diseases and those with immunosuppressive conditions. It is impossible to predict the variant of the course of the disease by the first signs and its outcome in children, and therefore its effectiveness depends on the earliest possible start of etiotropic therapy [16–18]. In all cases of observation, antiviral and anti-inflammatory therapy was prescribed from the first days of the disease. The basis of etiotropic therapy was antiviral drugs: Anaferon, Arbidol, Ergoferon. For the treatment of recurrent respiratory diseases, drugs with combined antiviral and

immunomodulatory effects were used: inosine pranobex (Isoprinosine, Grosprinosin), umifenovir (Arbidol), as well as interferons (Viferon, Grippferon) and their inducers - methylglucamine acridone acetate (Cycloferon), Kagocel. Interferon preparations for children with acute respiratory viral infections are often used topically in the form of ointments, drops, gel, inhalations or rectally. The most effective and safe for children are preparations of recombinant interferon (Viferon, Genferon Light, Grippferon) [19].

The basis of etiotropic therapy was antiviral and antibacterial agents, the appointment of these groups of drugs requires a strictly differentiated approach. If foci of chronic infection with signs of exacerbation were detected in children, as well as the presence of symptoms indicating the addition of a bacterial component of the infectious process (febrile fever for more than 3 days, severe intoxication), antibiotics were prescribed from the first days of the disease. In some cases, with a protracted nature of the course of the disease (more than 2 weeks) and the absence of severe intoxication, with a periodic rise in temperature to subfebrile figures, children were also prescribed antibacterial drugs. Amoxicillin, cephalosporins, macrolides were mainly used. Amoxicillin / clavulanate has the highest activity against typical pathogens of bacterial respiratory infections (*S. pneumoniae*, *M. Catarrhalis*, *H. Influenza*). Along with β -lactam antibiotics, macrolide drugs (clarithromycin, roxithromycin, azithromycin, josamycin), which are active against most types of streptococci, some strains of staphylococci and atypical pathogens, occupy an important place in the treatment of respiratory infections.

When functional disorders of the cardiovascular system were detected in children, complex therapy was carried out with the elimination of factors contributing to the development of metabolic cardiomyopathy (sanation of chronic foci of infection, antiallergic diet, treatment of anemia) [20–22]. The children were prescribed cardiotropic drugs (riboxin, panangin, thiotriazoline, levocarnitine, cocarboxylase, vitamins B, C, A, Magne B6, potassium orotate, etc.), as well as herbal remedies that regulate the activity of the autonomic nervous system (valerian, persen, hawthorn, motherwort, novopassitis, etc.) [23, 24]. In some cases, to improve metabolic processes at the brain level, metabolic nootropic drugs (pantogam, nootropil), as well as agents that improve microcirculation (cavinton, stugeron, trental) were used. Tranquilizers, antidepressants and neuroleptics were not used in children, as they are prescribed in minimal doses and only in the absence of the effect of other methods of treatment. All children were recommended to normalize the daily routine with the exclusion of physical and psychological overload (watching TV, working on a computer, tablet).

DISCUSSION

Against the background of the treatment, after 3-4 weeks, in most cases, the symptoms of functional disorders of the heart and signs of autonomic disorders decreased. Children with an established diagnosis of myocarditis were recommended to limit motor activity, adhere to bed rest for 2–4 weeks, followed by restriction of physical activity until the complete elimination of clinical symptoms and normalization of heart function parameters according to ECG and EchoCG [25, 26, 27].

In the acute period of the disease, therapy aimed at the impact of the etiological factor was used, with the use of antiviral and antibacterial drugs. Glucocorticoids were not used in the treatment, since the clinical symptoms and indicators of laboratory and instrumental studies indicated a moderate course of the disease. The administration of glucocorticoids in the early stages of the disease, with an insufficient amount of neutralizing antibodies, exacerbates the

course of myocarditis [25, 26]. With proven persistence of the virus, immunosuppression is not indicated, since a negative effect of glucocorticoids on the elimination of the pathogen and reparative processes in the myocardium has been established [28].

In order to reduce the inflammatory process in the myocardium, nonsteroidal anti-inflammatory drugs (pyrazolone drugs, indomethacin, brufen, voltaren, etc.) were used, which were prescribed more often to children with chronic foci of infection for 2–3 weeks. Long-term use of non-steroidal anti-inflammatory drugs is not recommended due to the cardiotoxic effect, and there is also evidence of a slowdown in reparative processes in the myocardium in the treatment of acute carditis with these drugs [25]. It is necessary to carry out treatment with cardiotropic drugs that improve myocardial metabolism [25,26,28]. The course of cardiotropic therapy depends on the clinical indicators of the severity and course of the disease; it is carried out for at least 4-6 weeks, with repeated conduct in the dynamics of observation.

After discharge, children should be advised to refrain from excessive exercise for several months. The timing of physical activity restriction depends on the severity of the disease and the severity of LV systolic dysfunction, ECG and ECH parameters, which are carried out in the course of observation.

After suffering myocarditis, the child is under observation, when it is recommended to observe the regimen of the day and rest, rational nutrition and adherence to the drinking regimen, sanitation of chronic foci of infection, and, if necessary, cardiotropic therapy. 6 months after the onset of the disease, it is advisable to consider the gradual expansion of the motor regimen.

In the dynamics of observation, as the clinical symptoms of the underlying disease decreased and the treatment of acute respiratory infection and concomitant pathological conditions in most children, signs of cardiac dysfunction decreased in both groups, but remained in children with concomitant minor heart anomalies, both with functional disorders and in children with diagnosed myocarditis.

CONCLUSION

Acute respiratory diseases are a common pathology in children, especially in the autumn-winter period. Viruses are the most common etiological factor, but in childhood, a viral-bacterial association is more often observed. In most cases (78%), against the background of acute respiratory diseases, signs of functional disorders of the cardiovascular system (60%) and myocardial inflammation (18%) develop, which manifested themselves after the elimination of symptoms of intoxication 10-15 days after the onset of the disease. In a significant part of children, functional disorders can be considered as naturally developing in response to an infectious-inflammatory process. In children diagnosed with minor heart anomalies, functional disorders and clinical symptoms of myocarditis were more pronounced. Therapy with the use of antiviral and antibacterial drugs was carried out from the first days of the disease, subsequently, the features of therapy depended on the nature of the changes detected, with the obligatory use of drugs that improve metabolic processes in the myocardium, if necessary, anti-inflammatory drugs. Children with identified cardiac disorders require longer follow-up and treatment, depending on the nature of the identified changes.

REFERENCES

1. Samsygina G.A. On recurrent respiratory tract infection in children. *Pediatrics. Journal. them. G.N. Speransky.* 2012; 91(2):6–8.
2. Burianac J, Buserb P, Erikssona U. Myocarditis: the immunologist's view on pathogenesis and treatment. *Swiss Med Wkly* 2005; 15:359–64.
3. Ruzhentsova T.A., Gorelov A.V., Smirnova T.V., Schastnykh L.A. Diagnosis and treatment of infectious lesions of the myocardium in children. *Pharmateka.* 2011. - No. 11-s1-11. S. - 44 - 48.
4. Srinivasan A., Gu Z., Smith T., Morgenstern M., Sunkara A., Kang G. et al. Prospective detection of respiratory pathogens in symptomatic children with cancer. *Pediatr Infect Dis J.* 2013;32(3):e99–e104. doi: 10.1097/INF.0b013e31827bd619.
5. Ekusheva E.V., Filatova E.G. *Russian Medical Journal.* 2017; 25(4): 1790-1795 (in Russian).
6. Mutafyan OA. Heart defects and minor anomalies in children and adolescents. Part 2. Minor anomalies of the heart. SPb. 2005; 67–128
7. Korovina N.A., Tarasova A.A., Tvorogova T.M. Clinical significance of small anomalies in the development of the heart in children. *Attending doctor.* 2005; 4:57–59.
8. Kadurina T.I. Connective tissue dysplasia. Guide for doctors / T.I. Kadurina, V.N. Gorbunova - St. Petersburg: "ELBI". - 2009.- 714 p.
9. Dombialova E.S., Barkun G.K., Lysenko I.M., Zhuravleva L.N., Ivanova L.G., Nishchaeva N.F. Clinical significance of small heart anomalies in the structure of cardiovascular pathology in children and adolescents. *Protection of motherhood and childhood.* 2015. - No. 2 (26). - P.79 - 83.
10. Khakimova U.R., Dauksh I.A. Functional disorders of the cardiovascular system in young children against the background of acute respiratory diseases. *Scientific collection "Interconf" / Washington, USA.* 2020. - No. 3 (36): November: 1179-1183.
11. Samsygina G.A. Modern treatment of acute respiratory diseases in children. *Pediatrics. Journal. them. G.N. Speransky.* - 2013. - T. 92. - No. 3 - S. 38–42.
12. *Influenza: epidemiology, diagnosis, treatment, prevention.* Ed. O.I. Kiseleva, L.M. Tsymbalova, V.I. Pokrovsky. M., 2012. 496 p.
13. *Influenza: epidemiology, diagnosis, treatment, prevention.* Ed. O.I. Kiseleva, L.M. Tsymbalova, V.I. Pokrovsky. M., 2012. 496 p. 16.
14. Wong K.K., Jain S., Blanton L., et al. Influenza-Associated Pediatric Deaths in the United States, 2004–2012. *Pediatrics.* Published on-line October 28, 2013. doi: 10.1542/peds. 2013–1493.
15. Gorelov A.V., Feklisova L.V., Gracheva N.M., Alpenidze D.N. Exogenous interferonization as an aspect of etiopathogenetic therapy of acute respiratory viral infections. *Pharmateka.* 2011;15:73–81.
16. Murathodzhaeva A.V., Dauksh I.A., Aliev A.L., Khakimova U.R., Mirkhalikova D.I. The use of immunomodulatory therapy in the complex treatment of frequently ill children. *Pediatrics. Tashkent.* No.1-2. 2014. - P.109-111.
17. Dauksh I.A., Murathodzhaeva A.V., Pirnazarova G.Z. Rehabilitation therapy for children with recurrent respiratory diseases. *International scientific and practical conference*

- "Natural and medical sciences: scientific discussion" Kyiv, Ukraine. 2014. No. 4. - S. 53-57.
18. Dauksh I.A., Murathodzhaeva A.V., Khakimova U.R. Features of pathogenetic therapy in acute respiratory diseases in children. Actual problems of medicine. Grodno. GrGMU. 2016, pp. -158-161.
 19. Shkolnikova M.A., Alekseeva E.I. Clinical guidelines for pediatric cardiology and rheumatology. M.-2011. C - 512.
 20. Current state of knowledge on aetiology, diagnosis, management, and therapy of myocarditis: a position statement of the European Society of Cardiology Working Group on Myocardial and Pericardial Diseases. European Heart Journal .2013; 34:2636–2648.
 21. Canter CE, Simpson KE. Diagnosis and treatment of myocarditis in children in the current era. *circulation*. 2014 Jan 7; 129(1):115-128.
 22. Shostak N.A., Klimenko A.A., Shemenkova V.S., Loginova T.K. non-rheumatic myocarditis. *Clinician* 2015. V. 9. No. 3. S. 46 - 51.
 23. Maisch B., Pankuweit S. Standard and etiology-directed evidence-based therapies in myocarditis: state of the art and future perspectives. *Heart Fail Rev* 2012; 18(6):761–95.
 24. Gilyarevsky S.R. Myocarditis: modern approaches to diagnosis and treatment. Moscow: Media Sphere, 2008.
 25. 25 JCS Joint Working Group. Guidelines for diagnosis and treatment of myocarditis (JCS 2009): digest version. *Circ J* 2011; 75(3):734–43.
 26. Dauksh I.A., Muratkhodzhaeva A.V. The use of thiotriazoline in the treatment of non-rheumatic carditis in children. Actual problems of diagnostics, treatment and medical rehabilitation of diseases of internal organs. Tashkent 2007. - S.21-23.
 27. Ruzhentsova T.A., Gorelov A.V., Smirnova T.V. Metabolic therapy for myocarditis and cardiomyopathy developed in children with common acute infectious diseases // *Infectious Diseases*. 2010. Vol. 8(3). pp. 39–45.
 28. Sadykova D. I. Principles of drug therapy of myocarditis in children. *Journal Bulletin of modern clinical medicine*. Kazan 2013, V.6. No. 3 P.54 -60.