

CONDITION OF THE CARDIOVASCULAR SYSTEM IN CHILDREN WITH BRONCHIAL OBSTRUCTION

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✓ **Resume,**

The morpho - functional changes in the cardiovascular system that accompany asthma and their pathogenetic therapy are not sufficiently reflected in the recommended guidelines for the prevention and treatment of bronchial asthma. A comprehensive examination of the circulatory system revealed the features of the state of the cardiovascular system of the examined children with varying degrees of severity of bronchial asthma. For the correction of the identified changes in the cardiovascular system, a complex of cardiometabolic therapy was proposed, depending on the severity of damage to the circulatory system.

Key words: children, bronchial asthma, cardiovascular system, electrocardiography, echocardiography, complications.

БОЛАЛАРДА БРОНХИАЛ ОБСТРУКЦИЯДА ЮРАК - ҚОН ТОМИР ТИЗИМИНИНГ ҲОЛАТИ

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✓ **Резюме,**

Болаларда бронхиал астма касаллигига юрак - қон томирнинг ҳолати ўзгаришининг қўшилиб келишини патогенетик даволаш усуллари манбааларда етарлича ёритилмаган. Болаларда бронхиал астманинг турли даражаларида юрак - қон томирнинг ҳолатини баҳолашда қон айланиш тизими органларини комплекс текшируви зарур саналади. Бронхиал астма, обструкцияда юрак - қон томир тизими томонидан аниқланган ўзгаришларни коррекциялаш мақсадига комплекс тарздаги кардиометаболик даволаш кенг жорий этилган.

Калит сўзлар: болалар, бронхиал астма, юрак - қон томир тизими, электрокардиография, эхокардиография, асоратлар.

СОСТОЯНИЕ СЕРДЕЧНО-СОСУДИСТОЙ СИСТЕМЫ ПРИ БРОНХИАЛЬНОЙ ОБСТРУКЦИИ У ДЕТЕЙ

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✓ **Резюме,**

Морфо - функциональные изменения сердечно - сосудистой системы, которые сопровождают бронхиальную астму и их патогенетическая терапия не достаточно отражены в рекомендуемых руководствах по профилактике и лечению бронхиальной астмы. Комплексное обследование органов кровообращения позволило выявить особенности состояния сердечно - сосудистой системы обследованных детей с различной степенью тяжести бронхиальной астмы. Для коррекции выявленных изменений со стороны сердечно - сосудистой системы был предложен комплекс кардиометаболической терапии в зависимости от тяжести поражения органов кровообращения.

Ключевые слова: дети, бронхиальная астма, сердечно - сосудистая система, электрокардиография, эхокардиография, осложнения.

The urgency of the problem

Acute broncho-obstructive syndrome (BOS) of viral or viral-bacterial etiology has the greatest frequency in childhood. According to V.Tatochenko (2000) in every fourth child with acute respiratory disease, the bronchi with a prolonged broncho-obstructive syndrome are involved in the inflammatory process [1, 3, 6]. Respiratory disorders in acute obstructive syndrome of infectious genesis have varying degrees of severity and are accompanied by hypotension and metabolic acidosis. In the works, both domestic and foreign researchers have shown that it is the combination of viral infection, vegetative disturbances and acute hypoxia arising from bronchial obstruction in young children that underlie multiorgan lesions, including the cardiovascular system. A number of studies have proven the cardiotoxicity of

influenza viruses and enteroviruses, contributing to the development of acute myocardial infection in children. Recently, a significant role in the development of acute infectious lesions of the cardiovascular system is assigned to chlamydial and mycoplasmal infections. At the same time, the nature and severity of changes in the cardiovascular system and their prognostic significance in acute respiratory diseases accompanied by bronchial obstruction in young children are not sufficiently studied [2,3,9].

It was proved that in the perinatal period, hypoxic damage in 40-70% of children is accompanied by the development of disadaptation syndrome (DM) of the cardiovascular system (CVS) in the newborn period [10]. The use of modern high-informative instrumental and biochemical methods of research allowed to determine markers of inflammatory cardiomyopathy in children. The

results of biopsy of the cardiac muscle, patients with myocarditis, confirm the presence of dystrophic and fibrotic changes in the myocardium [11]. According to clinical and morphological studies, the frequency of myocarditis, myocardiodystrophy, and cardiomyopathy among the adult population is 7-9% of all diseases of the cardiovascular system. At the same time, in the literature there are no clear data on the frequency and nature of myocardial infection in children [6,8,9].

Thus, the state of the cardiovascular system in young children, with acute respiratory diseases occurring with bronchial obstruction, has not been practically studied, risk factors for the formation of pathological changes and their prognostic significance have not been determined, no differentiated approaches to the treatment and prevention of chronic cardio - Vascular pathology, which defined the objectives of this study and formulated its purpose.

Purpose of the study: To establish risk factors and the main pathogenetic mechanisms of the lesion of the cardiovascular system in acute bronchial obstruction of infectious genesis in young children in order to optimize differentiated therapy and improve the prediction of cardiovascular disorders.

Materials and methods

In accordance with the tasks, we analyzed the results of the examination, treatment and long-term (for 5 years) follow-up observation of 500 children aged from 6 months to 7 years (whose average age was from 8.0 months $\pm$ 0.9 to 5.0 years $\pm$ 1.1) with respiratory pathology, among them 260 girls, 240 boys. With a clinical picture of acute respiratory disease, 400 children were observed, while in 200 patients the disease proceeded with the development of bronchial obstruction (BOS) in 200 with acute respiratory viral infection without developing bronchial obstruction.

The results of the study

Studies have shown that in the case of mycoplasma infection in half of the patients, acute broncho-obstructive syndrome is accompanied by impaired CVS activity, less often these changes were found in adenoviral (5%) and rhinosyncytial viral (3%) etiology.

Correlation analysis showed the presence of a reliable direct correlation between the development of impaired CVS activity and the myoplasma BFB etiology ($g = 0.65$, $p < 0.005$); < 0.005) and $g = 0.40$, ($p < 0.005$), respectively.

Thus, acute respiratory diseases occurring with the development of bronchial obstruction in young children more often develop in the presence of adenoviral, MS, viral and mycoplasmal infections.

1. Clinical manifestations of acute bronchial obstruction of infectious genesis in children of the first year of life.

Acute bronchial airway obstruction in children of the first year of life developed 3.03 ± 0.22 days from the onset of ARVI. The main complaint on admission to the hospital was difficulty breathing. 52% had expiratory dyspnea, and 48% had a mixed nature. All patients had pale skin and pronounced cyanosis of the nasolabial triangle.

The disease began with a dry cough in 57% of cases, a wet cough was observed in 43%. Auscultatory dry rales

prevailed over wet in 57% of children. The frequency of wet wheezing at the beginning of observation in children of the first year of life was 43%. In 1% of BFB was accompanied by the formation of atelectasis of the upper right lobe of the lung. The respiratory rate (RR) when the child was admitted to the hospital ranged from 48 to 60 (54.6 ± 2.5) breaths per minute. In 55% of children, BH values were distributed between 75 and 95 percentiles and averaged (50 ± 2.0 breaths per minute). In 10% of patients, BH was determined at a level from 50 to 75 percentiles / in 45% - above 95 percentiles.

In 67% of the first year of life, the course of acute respiratory disease with bronchial obstruction was regarded by us as a disease of moderate severity with grade II.

In 33% there was a severe course of the disease, accompanied by a DN of III degree. Assessment of the severity of hypoxia based on the determination of oxygen saturation (xOg) in serum during the acute period of bronchial obstruction showed that their 802 level ranged from 88 to 90%, which also corresponded to the moderate severity of biofeedback. In 60% of them there was a decrease in oxygen saturation to 87-85%, which also gave reason to regard the condition of these children as severe in 40% of these patients α 02 was maximally reduced (from 80 to 84%), which corresponded to an extremely severe course of bronchial obstruction these patients needed assisted breathing

The acute period of bronchial obstruction in all cases was accompanied by the formation of an adaptive response from the CVS. Dyspnea detected with low subfebrile fever ($37.3-37.5$) was characterized by an increase in heart rate (HR) from 145 to 170 (180 ± 3.4) beats per minute. In 10% of the HR values were distributed between 50 and 75 percentiles (145 ± 2.0), in 45% between 75 and 95 percentiles (150 ± 2.0) and in 45% of patients exceeded 95 percentiles (195 ± 4.0).

The coordinated activity of the cardiorespiratory system in the absence of symptoms of circulatory failure (1G) was detected in 55% of children. They were characterized by BH and HR values above 50 percentile with BH values from 46 to 54 (average 48 ± 3.0) per minute and heart rate from 140 to 150 (average 130 ± 5.0 , per minute and the ratio of heart rate to BH, as 3: 1. The level of oxygen saturation in these patients ranged from 88 to 90%, which corresponded to the moderate severity of bronchial obstruction.

It was noted that the acute period of biofeedback, along with changes in heart rate, was characterized by changes in the level of systolic pressure. In 90% of children with no signs of MK, systolic pressure indicators (MAP) were between 30 and 45 percentiles, in 5% of children between 45 and 60 percentiles and in 5% between 60 and 90 percentiles. Thus, the SAD level was within normal variability and did not exceed 90 percentile of the age distribution. Electrophysiological changes in patients in this group were characterized by isolated sinus tachycardia.

In 45% of children, values above 95 percentile were observed: BH from 54 to 62 per minute (average 54 ± 2.0) and heart rate from 180 to 220 (average 195 ± 7.0 per minute). The ratio of heart rate to BH was greater than 3: 1 above ($3.5: 1$ on average) / In 87% of these patients, systolic blood pressure was characterized by an increase (above 95 percentile), and in 13% by a decrease (below 20 percentile). It should be noted, the reduction of the GARDEN to 60 mm Hg. in all cases it was associated

with severe hypoxia with oxygen saturation in the blood below 85%. In 13% of children with elevated SBP above the age norm, the level of bO_2 was also reduced and ranged from 85 to 87%. In 4% of these patients, on day 3 of the onset of acute respiratory disease, which proceeds with bronchial obstruction, on the background of subfebrile fever (37.7) and severe intoxication, signs of circulatory insufficiency (HK1-P) were observed. Clinical signs of acute bronchial obstruction in patients with NK were similar to other patients with bronchial obstruction, however tachycardia was recorded at a significantly higher level with a heart rate of 220 to 230 beats per minute), while the BH increased from 56 to 60 per minute and the GARDEN decreased. 40 mm Hg up to 50 mm Hg Hepatolienal syndrome was noted that the liver protruded from the edge of the costal arch by 4.5-5.0 cm, spleen by 1.0-1.5 cm. More significant involvement of CVS in the pathological process was considered as a pronounced impairment of adaptation of the CVS in the acute period of biofeedback. Along with severe isolated sinus tachycardia, electrophysiological changes in this group were characterized by other rhythm, conduction disturbances and repolarization disorders.

Thus, the acute period of bronchial obstruction of infectious genesis in young children is generally characterized by a lesion not only of the respiratory system, but also of the cardiovascular system. The existing clinical signs were identified in the complex of changes in the cardiorespiratory system during the acute period of biofeedback, which made it possible to determine the criteria for adaptive capacity of the cardiovascular system and to divide all patients into subgroups: with normal and impaired adaptive capacity of the cardiovascular system. A clinical and instrumental study of cardiovascular disease in 200 patients in the acute period of bronchial obstruction, made it possible to identify in 45% of patients a disorder of adaptation of cardiovascular system. The normal adaptation response of the cardiovascular system in acute broncho-obstructive syndrome was determined in 55% of children.

2. The state of the cardiovascular system in the acute period of bronchial obstruction of infectious genesis in young children.

2.1 Structural changes of the cardiovascular system in the acute period of bronchial obstruction.

In all 200 patients in the acute period of bronchial obstruction, various ECG changes were detected, while in children with impaired.

Adaptation of the cardiovascular system occurred not only sinus tachycardia (ST), other rhythm disturbances or their combination of extrasystole (6%) and ectopic supraventricular tachycardia (2%) were noted. Conduction abnormalities (NBPNG and T-wave inversion) were detected in 12% of patients, the violation of repolarization processes in the myocardium was determined in 47%. Only in patients with impaired adaptation of the cardiovascular system during the acute period of biofeedback, ECG changes such as inversion of the T wave, extrasystole, ectopic supraventricular paroxysmal tachycardia were detected.

The cardiac examination performed by ECM revealed the presence of small cardiac abnormalities (MARS) in 22% of children, which did not exceed the population frequency of this phenomenon. At the same time, they were found 2.5 times more often in children with impaired adaptation, so PMK with regurgitation of 1 degree was

detected only in children with impaired adaptation. An open oval window with a drop of blood from left to right at the level of the atria was 2 times more common in children with an adaptation disorder of the cardiovascular system ($p < 0.05$). The frequency of detected MARS had a significant positive correlation with the development of an adaptation disorder of the cardiovascular system ($g = 0.58$, $p < 0.05$). The association of MARS with impaired adaptation of the CAS in children with bronchial obstruction probably reflects the greater vulnerability of the CAS to the development of arrhythmia and requires further study.

During echocardiography, all patients with bronchial obstruction were observed to varying degrees of severity of changes in left ventricular (LV) diastolic function parameters, which, in patients with CAS adaptation disorder, were characterized by an increase in peak rates in the early diastolic filling phase (E). The presence of LV diastolic dysfunction in patients with adaptation disorder in the acute period of bronchial obstruction correlated with the level of heart rate ($g = 0.65$, $p < 0.05$).

Thus, the acute period of bronchial obstruction of infectious genesis is accompanied by electrophysiological changes (rhythm and conduction disturbances, disorders of repolarization processes) that are significantly more frequently detected during bronchial obstruction occurring with an impairment of cardiovascular insufficiency. The association of MARS with impaired adaptation of the CAS in children with bronchial obstruction probably reflects the greater vulnerability of the CAS to the development of arrhythmia and requires further study. 2.2 Troponin T and cardiospacial enzymes as factors of myocardial damage in the acute period of bronchial obstruction.

In the acute period of bronchial obstruction, we estimated serum troponin T concentration and its dependence on the degree of SO_2 reduction. With oxygen saturation of 88-90%, the concentration of troponin T in all patients was less than 0.01 ng / ml, which indicates the absence of cardiac muscle necrosis in these patients. An increase in the concentration of troponin T in the blood above the threshold value was found in 1/3 of patients with BOS with impaired adaptation of the CAS. In 60% of them, with an oxygen saturation of 85-87%, the range of troponin T values ranged from 0.02 to 0.065 ng / ml, which corresponds to a low risk of myocardial damage.

In 40% of patients, with VO_2 , 82-84% fluctuations in the level of troponin T in the blood ranged from 0.07 to 0.22 ng / ml ($p < 0.05$), which corresponds to a high risk of myocardial damage. These changes were characteristic of children with severe bronchial obstruction, who were in the acute period in auxiliary breathing. According to our data, the level of troponin T in the blood serum had a high degree of inverse correlation depending on the oxygen saturation indicators ($g = -0.60$, $p < 0.02$).

To determine the effect of hypoxia in the acute period of biofeedback, the level of cardiospecific enzymes (CK MV and LDG1) was analyzed depending on the oxygen saturation level. It was found that a significant increase in the CK MV enzymes (up to 25 U / l) and LDG1 (up to 500 U / l) It was observed only in 7% of patients with oxygen saturation $> 87\%$. Among patients with impaired adaptation, an increase in CFC MV (up to 22

U / l) and LDG1 (up to 400 U / l) in serum was observed in 27% of cases and correlated with oxygen saturation ($g = -0.70$, $p < 0.005$). Increased level of

myocardial damage markers (CK MB and LDH 1), along with troponin T in the blood, in the acute period of bronchial obstruction, indicates a violation of the stability of cardiomyocyte cytomembranes, which reflects the pathophysiological process of the formation of an adaptation disorder of the cardiovascular system in the acute period of BOS. Comparing the results of CPK MV, LDG 1 with serum troponin T values in the acute period, a significant correlation relationship between troponin T level and serum levels of traditional markers of myocardial damage - CPC MV and LDH 1 ($g=0.58$, $p < 0.005$ and $g=0.50$, $p < 0.005$, respectively).

Thus, the absence of cardiomyocyte necrosis, revealed in severe bronchial obstructions, does not exclude the presence of an impaired level of stability of cytomembranes of cardiomyocytes, as evidenced by an increase in serum CK and LGD1 levels in the acute period of bronchial obstruction.

2.3. Immunological mechanisms of myocardial damage in children with acute bronchial obstruction.

In the acute period of bronchial obstruction, we performed the determination of anti-cardiac antibodies (to the vascular endothelium, cardiomyocytes, the conduction system, and smooth muscles) (Fig. 2). Analysis of the results of the study of anti-cardiac antibodies showed that in patients with acute respiratory infection occurring with bronchial obstruction, antibodies to the vascular endothelium in titer 1: 40 were determined in 25% of patients (which is the norm). At the same time, 75% of children showed an increase to 1:80 titer. An increase in antibodies to cardiomyocytes in a titer of 1:80 was detected in 63% of patients. The degree of increase in the antibody titer to cardiomyocytes varied depending on the nature of adaptive disorders of the cardiovascular system.

In patients with impaired adaptation of the cardiovascular system, the titer of antibodies to cardiomyocytes was significantly higher (75%) than with normal adaptation of cardiovascular system. It was noted that in 50% of children the level of antibodies to cardiomyocytes was above 1: 160. An increase in the antibody titer to the smooth muscles of the heart muscle was determined in half of the children (up to 1:80) and was observed equally often in patients with impaired adaptation of the cardiovascular system and during normal activity of the cardiovascular system. It should be avenged that the most frequent (85%) increase in the level of antibodies to the fibers of the conducting system was determined in a titer from 1:80 to 1: 160. In case of impaired adaptation of cardiovascular diseases, they were elevated in all observed patients, and in 50% of them values above 1: 160 were determined. In patients with the normal adaptation ability of cardiovascular system, an increase in the antibody titer to the fibers of the conducting system was determined in 70% of children, while its values did not exceed 1:80.

Thus, in the acute period of bronchial obstruction, antibodies to various structures of the myocardium were detected, but the degree of interest of various structures of the myocardium was different. In general, the presence of high titers of antibodies to the endothelium of cardiac vessels, cardiomyocytes, smooth muscles and the myocardial conduction system indicates the course of the immunopathological process in more than 85% of patients in the acute period of bronchial obstruction.

2.4. Metabolic and nonspecific immunological changes during bronchial obstruction.

To determine the role of lipid peroxidation processes in the development of adaptation disorder in BOS in infants of early age, we studied the levels of malondialdehyde (MDA), superoxide dismutase (SOD), and serum ascorbic acid, which showed that there is an acute period of bronchial obstruction accompanied by an increase in the concentration of MDA 1.5 times compared with the norm. At the same time, in patients with acute bronchial obstruction, which occurs with impaired adaptation of the cardiovascular system, the level of MDA was 3.5 times higher than the norm and 1.5 times higher than in children with the normal adaptive capacity of cardiovascular system.

The activity of antioxidant protection was also reduced in all patients with BOS, as evidenced by a significant decrease in the level of SOD in the blood serum ($p < 0.005$). At the same time, the maximum decrease in SOD level was observed in patients with impaired adaptation to cardiovascular disease. The lack of SOD can be supported by the deficiency of one of the low molecular weight antioxidants, ascorbic acid. Our determination of the level of ascorbic acid in the blood serum showed that in case of acute respiratory infections more than 70% of young children have a low content of ascorbic acid in the blood serum. ($p < 0.05$). In all patients, in the acute period of bronchial obstruction, a decrease in serum ascorbic acid levels was noted. If the adaptation of the CVS is impaired in the acute period of bronchial obstruction, its concentration was significantly lower ($p < 0.005$) than in children with bronchial obstruction without an adaptation disorder of the CVS. factors contributing to the enhancement of lipid peroxidation processes and impaired adaptation of the cardiovascular system during the acute period of bronchial obstruction.

Along with the characteristic of metabolic disorders, we conducted a study of the level of total interferon and the induced ability of interferon (INF) in the blood serum of young children with acute respiratory disease that occurs with bronchial obstruction. It has been shown that in the majority of patients in the acute period of the disease, the low ability of lymphocytes to produce a and in INF is determined. The low induced ability of leukocytes to produce INFA (<4) was 1.5 times more frequent, and in INF (<4) 3 times more often in children with acute bronchial obstruction, which occurred with impaired adaptation to CVS, compared with patients with normal adaptive capacity of the cardiovascular system ($p < 0.05$).

We also found changes in the functional markers of lymphocytes CD25, CD71, CD95 in children with acute respiratory diseases. The acute period of bronchial obstruction is accompanied by an increase in more than 2 times the subpopulations of lymphocytes with receptors CD 25 and CD 71 in all patients, compared with the norm. Analysis of the results of the study of the expression of CD95 receptors revealed an increase in patients with impaired adaptation of the CVS in bronchial obstruction by almost 14 times, compared with the norm, and 6 times, compared with patients who did not have changes in the CVS.

Thus, the acute period of bronchial obstruction of infectious genesis is accompanied by an increase in lipid peroxidation processes, a decrease in superoxide dismutase activity and ascorbic acid levels in serum, a low concentration of total interferon, a reduced leukocyte-

induced ability to produce induced α , interferon, and an increase in SB25, SP71, S095 in the blood. The revealed violations are significantly more often observed in the acute period of biofeedback and remain more long in patients with cardiovascular adaptation ($p < 0.05$).

3.0 The state of the cardiovascular system in the period of reconvalence bronchial obstruction.

Control instrumental studies conducted in the period of clinical recovery (7-10 days of biofeedback), revealed ECG changes in 98% of children. At the same time, it should be noted that among patients who had an impaired adaptation of the CVS in the acute phase of biofeedback, 94% had electrophysiological changes. In the period of recovery, in 23% of patients, rhythm and conduction disturbances persisted, the number of children with impaired repolarization in the myocardium increased 1.5 times (in 73%). In case of bronchial obstruction of infectious genesis that occurred without disruption of CVS activity in 94% of cases, ECG changes were transient in nature and only 6% of ECG changes remained in the recovery period (disruption of repolarization processes in the myocardium and NBPRG).

It should be noted that in all children with NK in the acute period of bronchial obstruction, clinical recovery was not accompanied by normalization of the ECG. Against the background of sinus rhythm, in 1 child, the premature beats remained, in 1 child, a decrease in the processes of repolarization was combined with an AU blockade of 1 tbsp. and 2 remained a decrease in repolarization. HELL corresponded to the age norm in 3 children, one had hypotension, 65 mm Hg was determined.

In 18% of children with changes in systolic blood pressure in the acute period of bronchial obstruction, protruding with impaired adaptation, the recovery period in convalescence was accompanied by persistent changes in blood pressure (5% had hypotension, 13% hypertension). With acute bronchial obstruction, occurring without disrupting the activity of the cardiovascular system, in the recovery period, the values of systolic blood pressure corresponded to the age norm.

Studies of the systolic and diastolic functions of the LV, carried out in the period of recovery of biofeedback showed that all the analyzed parameters in 95% of the examined children corresponded to the age norm. In 2 children with bronchial obstruction occurring with impaired adaptation of the cardiovascular system, a decrease in PI to 55-60% was noted, while the peak speed of diastolic filling (E) corresponded to the lower limit of the norm and was 0.78 m / s in one child and 0.95 m / s in the second, and the blood flow velocity (A) in the systole phase was reduced to 0.55 m / s in the first child and 0.6 m / s in the second, which may be a manifestation of moderate left ventricular dysfunction.

The study of anti-cardiac antibodies in the period of clinical remission of acute bronchial obstruction showed that changes detected in the acute period of the disease in most cases are transient, even in cases when high antibody titers were detected initially (1: 320 and 1: 160). In the dynamics (in 14 days) there was a tendency to decrease. However, in 20% of patients, high titers (1: 160) remained to the conduction system, which indicates the course of the immunopathological process in the myocardium during the period of clinical recovery, which requires the exclusion of inflammatory cardiomyopathy. We obtained a high degree of correlation dependence ($r = 0.85$, $p < 0.005$) between rhythm and conduction

disturbances according to ECG data and an increase in antibody titers to the myocardial conduction system.

The recovery period was accompanied by the normalization of CD25 and CD 71 values, which indicates a short-term increase in these indicators in the acute period of bronchial obstruction. At the same time, the continuing increase in the level of CD95 involved in the process of apoptosis suggests that there is an imbalance and inadequacy of the intercellular interaction during acute bronchial obstruction, which may determine the further development of impaired CVS activity in young children.

Thus, in clinical recovery, 98% of children remained electrophysiological changes, which manifested as impaired repolarization processes in the myocardium, arrhythmias and conduction disturbances that were significantly more frequent ($p < 0.005$) in the period of convalescence of bronchial obstruction with impaired CVS adaptation. The revealed electrophysiological disorders in the acute period of bronchial obstruction and persisting in the period of convalescence suggest a causal relationship with hypoxia during bronchial obstruction. In the group of patients with impaired adaptation to cardiovascular disease, immunological disorders persisted for a long time - high titers of anti-cardiac antibodies and elevated levels of CD 95., which required their further observation.

4.0 Follow-up observation of children with bronchial obstruction of infectious genesis in history.

Considering the originally established role of hypoxia, as one of the factors of the development of the immunopathological process in the CAS, we performed in the catamnesis the assessment of spirometry in 180 children in the catamnesis at the age from 4 years to 7. The resistance indicators of the peripheral sections of the respiratory tract were higher in all observed children of the control group and ranged from 0.97 to 0.92 V / 1, which indicated that certain violations of bronchial reactivity remained. It was noted that in children who had a biofeedback with an impaired adaptation of the CVS, the resistance of the peripheral sections of the respiratory tract in the distant follow-up was significantly higher ($p < 0.005$) than in children without disruption of the CVS in the acute period of the biofeedback 0.72 ± 0.13 . Correspondingly. Thus, the increase in resistance of the central and peripheral parts of the respiratory tract can be associated with ventilation failure in acute hypoxia and constantly ongoing inflammatory process, which is supported by frequent acute respiratory viral infections and biofeedback.

A follow-up ECG study in children, conducted one year after acute bronchial obstruction, which occurred with an adaptation disorder of the cardiovascular system, showed that 59% of the children had no changes on the ECG, while rhythm disturbances persisted in 12% of children (CT-3%, SB-3%, ES-6%), conduction disturbances in 11% (AU bl.1st, - 2%, migration of pacemaker -2%, NBPN-7%), impaired repolarization in the myocardium were detected in 18% of children. In children examined after 3 years, electrocardiographic examination data did not differ from previous ones. The ECG data performed 5 years after the postponed biofeedback with impaired adaptation showed that the number of children with an ECG age limit decreased to 47% and the number of children with rhythm and conduction disturbances increased to 35%, of which 24% of children showed the following rhythm disturbances : ST - 6%, SB-10%, PR-2%, ES-6%. and in 11% of

conduction disturbances: AU blockade 1 st-4%, prolongation of the interval P-C> -7%. Disruption of the processes of repolarization persisted in 18%.

The revealed ECG changes in all cases were not accompanied by complaints from the observed children. Changes in electrophysiological parameters (increase in children with rhythm and conduction disturbances) when observed in follow-up, after acute broncho-obstructive syndrome with adaptation disorder, can be associated with a damaging effect on myocardial hypoxia in the acute period of BOS, age-related risk periods, repeated respiratory diseases in 63 % and existing chronic foci of infection in 40% of children.

In the follow-up study, we conducted a study of anti-cardiac antibodies (antibodies to cardiomyocytes, the conduction system, smooth muscle and vascular endothelium) in 40 children who had previously undergone bronchial obstruction.

According to our data in the follow-up period, an increase in the antibody titer to cardiomyocytes and the myocardial conduction system was observed in 10%, which was observed significantly more often in children who had a history of bronchial obstruction with impaired adaptation to cardiovascular system ($p < 0.05$), and half had a maximal increase in antibody titer from 1: 160 to 1: 320. The presence of antibodies to the conducting system was accompanied by the presence of rhythm and conduction disturbances (extrasystole - in 2, in 1 - AU blockade of 1 degree and in 2 - shortening of P - C?).

Along with the electrophysiological examination of the heart, 5 years after acute obstructive bronchitis, we carried out the determination of cardiospecific enzymes (CK MB and LDH-1) and functional markers of the lymphocytes CB25, CB71, SB95 in the serum of 80 children who had a history of acute bronchial obstruction of the infectious of genesis with impaired adaptation of the cardiovascular system, the observations revealed an increase in the blood level of cardiospecific proteins in 13%, ..

When determining the concentration of functional markers of lymphocytes CB25, CB71, SB95, the normal concentration in serum was established

CB25, C07, and a significant increase was only observed for C095 (440 ± 19) ($p < 0.005$). Thus, it can be assumed that hypoxia due to acute bronchial obstruction of infectious genesis at an early age can increase the susceptibility of cardiomyocytes to any inflammatory process occurring in the body, accompanied by damage to cardiomyocytes with an intensification of apoptosis. These children require further observation and examination to clarify the nature of myocardial damage.

Thus, the observation of patients in the catamnesis made it possible to identify persistent arrhythmias, conduction disturbances and repolarization processes, which were significantly more pronounced in patients with bronchial obstruction proceeding with CVS adaptation disorder. In addition, on the basis of an immunological study, the course of immunopathological processes was revealed, which may be due to inflammatory cardiomyopathy.

5.0 Prediction of the development of a violation of the adaptation of the cardiovascular system during bronchial obstruction of infectious origin.

Mathematical analysis (anamnesic data of anamnesis of a patient's life, child's development, presence of concomitant pathology, clinical course, laboratory and

ECG examination data, treatment of biofeedback, etc.) revealed 21 signs (Table 8) that are associated with the formation of adaptation disorders of the cardiovascular system in acute bronchial obstruction of infectious genesis in young children. We have constructed an equation to predict the development of the disorder of the cardiovascular system in acute bronchial obstruction of infectious genesis, or the BFB will proceed unchanged from the cardiovascular system.

$C(x) = X1 \times B$ where B is the sum of the signs (max $p = 21$), Hyprinmark, the weight coefficient of the trait, ?the trait number.

If $0 > 33$, then such a patient has a high probability of developing an adaptation disorder of the cardiovascular system. If, as a result of multiplying and adding 21 values of all the used signs, the resulting amount is less than 33, then in such a patient, BOS with a high probability (93%) will proceed without disrupting the CAS activity. This recommended equation has been tested in practice in 300 patients with acute bronchial obstruction. In 95% of cases, a prediction match was obtained.

Thus, the mathematical model developed by us, using available clinical signs, makes it possible to isolate a group of patients with a high risk of developing adaptation disorders in the acute period of bronchial obstruction of infectious genesis. In these patients, it is necessary to expand the scope of research, make an adequate correction of the therapy and carry out their follow-up.

According to the data of the conducted study, adaptation disorder of the cardiovascular system in the acute period of bronchial obstruction should be expected in patients with 1 year of life with a burdened perinatal history of diseases of the respiratory section, with tachycardia above 95 percentile, with heart rate above 95 percentile, with oxygen saturation below 90%, with conduction disturbance according to an electrocardiogram, etc.

6.0 The main directions of prevention of the development of disorders of the cardiovascular system in acute bronchial obstruction, measures for timely diagnosis and emergency care.

A modern feature of the treatment of infectious diseases of BOS is pathogenetically substantiated inhalation bronchodilator and corticosteroid therapy, which eliminates the inflammatory process, contributes to the elimination of bronchospasm and the rapid elimination of hypoxia. Our correlation analysis showed that the use of 0-2 short-acting agonists and X-rays (pulmicort) in the treatment of biofeedback can quickly stabilize the child's condition and reduce the time of hypoxia (respectively, $r = 0.9$, $r^2 = 0.75$) ($p < 0.005$).

Disturbances of the processes of lipid peroxidation and reduction of blood protection antioxidant against low levels of ascorbic acid in blood serum revealed by us in the acute period of BOS have been the basis for the inclusion of ascorbic acid in a dose of 200 mg per day into complex therapy, the need for which is determined by a high degree of inverse correlation ($r = -0.75$) ($p < 0.05$) between the level of ascorbic acid and the degree of reduction of MDA in the blood.

In order to improve the cellular energy and functional state of the myocardium in the complex therapy, in 22 patients who had, according to ECG data, violations of the YT-T segment, L-carnitium (elcar) was used at a dose of 50 mg / kg per day in 3 doses. In a dynamic study of ECG after 4 weeks of treatment, half of the children remained changes on the ECG. With continued therapy

for up to 8 weeks, depression of the ST-T segment persisted in only 9% of children.

Thus, our studies allowed us to establish the value of hypoxia for the development of immunological and metabolic disorders in acute bronchial obstruction of infectious genesis, which in turn can cause the formation of morphological changes in the myocardium, accompanied by ECG changes (rhythm and conduction disturbance, disruption of repolarization processes in the myocardium), which persist for a long time after the children recover. Changes in the myocardium, occurring in the acute period of bronchial obstruction, and disappearing with recovery, allow us to consider them as a transient disorder of the CVS in conditions of acute hypoxia. In the period of clinical recovery, with continuing changes on the ECG, apparently, the diagnosis of infectious cardiomyopathy is valid. For a long time, within 6-12 months, the remaining changes on the ECG detected during the acute period of bronchial obstruction require the elimination of inflammatory cardiomyopathy, myocardiodystrophy, the choice of the identified functional, metabolic, immunological and cardiovascular disorders in children with acute broncho-obstructive syndrome determine the choice of differentiated therapy and duration observation of children in follow-up (see Algorithm).

Algorithm for observing young children with bronchial obstruction, accompanied by impaired adaptation by the cardiovascular system.

Conclusions

1. Adenovirus, rhinosyncytial virus, or their combination (66%) plays a leading role in the etiology of obstructive bronchitis in acute respiratory disease. In 18% of young children obstructive bronchitis is caused by mycoplasma and chlamydial infection (8%).

2. The acute period of bronchial obstruction of infectious genesis in all young children is characterized by involvement in the pathological process of the cardiovascular system and in 45% of children proceeds with the formation of persistent violations of cardiovascular activity.

3. Broncho-obstructive syndrome in all young children is accompanied by tachysystole and electrophysiological changes in the myocardium in the form of cardiac arrhythmias (4%), conduction disorders (7%) and disorders of the repolarization process in the ventricular myocardium (35%), the degree and severity of which reflects the degree disorders of the adaptation of the cardiovascular system.

4. The increase in the level of specific (troponin T) and non-specific (CK-MV and LDG-1) markers of myocardial damage reflect the pathophysiological process of the formation of a disorder of adaptation of the cardiovascular system in the acute period of bronchial obstruction.

5. It has been established that in the majority (80%) of young children, acute respiratory diseases with acute obstructive syndrome are accompanied by a transient increase in the level of anti-cardiac antibodies to the conducting system, cardiomyocytes, and smooth muscle of the myocardium. The increased titers of antibodies to the cardiac conduction system ($> 1:160$) that persist in the period of convalescence indicate a prolonged course of the immunopathological process and require the exclusion of inflammatory cardiomyopathy.

6. In children of the first year of life, acute respiratory diseases with bronchial obstruction are accompanied by a

decrease in the concentration of total interferon in serum 2.5 times as well as a reduced ability of leukocytes to produce induced α , and in interferons by an increase in pro-inflammatory cytokine (C [25, CE] 71) and activation of apoptosis (SB95). The revealed violations are more typical for children with impaired adaptation of the cardiovascular system.

7. Acute obstructive syndrome in infectious respiratory diseases is accompanied by activation of lipid peroxidation processes in the form of a decrease in superoxide dismutase activity and serum ascorbic acid levels, the severity of which correlates with the severity of the underlying disease.

8. Comprehensive assessment of the severity of clinical symptoms (assessment of respiratory rate, severity of hypoxia according to oxygen saturation, heart rate), electrophysiological changes and markers of autoimmune myocardial lesions allow, with a probability of up to 93%, to predict the development of adaptation disorders of the cardiovascular system during acute bronchial obstruction infectious genesis in young children.

9. In differentiated therapy of metabolic and immune disorders in the acute period of bronchial obstruction in young children, along with the generally accepted treatment of acute respiratory diseases, it is recommended to include the correction of hypoxic disorders using antioxidants, membrane stabilizers. The persistent increase in the level of anti-cardiac antibodies without the exacerbation of acute respiratory diseases dictates the need to correct autoimmune disorders.

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