**EARLY ECHOCARDIOGRAPHIC`S MARKERS OF CHRONIC LUNG HEART OF CHILDREN WITH A NEW FORM OF BRONCHOPULMONARY DYSPLASIA**

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**Summary:** A total of 140 patients with a new form of bronchopulmonary dysplasia (study group) and 43 children born prematurely, had respiratory disorders, but is not formed bronchopulmonary dysplasia (comparison group). Age surveyed - 1- 36 months corrected age. The study was conducted on the basis of the Regional сentre of diagnosis and treatment of bronchopulmonary dysplasia in children, Regional children's hospital. The aim of the study was to improve the early diagnosis of chronic pulmonary heart disease in children with a new form of bronchopulmonary dysplasia by identifying marker role in end-diastolic diameter of the right ventricle, the thickness of the wall of the right ventricle and the mean pulmonary artery pressure. The study found that when comparing the end - diastolic diameter of the right ventricle in children of the main group was significantly higher than in the comparison group (p<0,01). In 67 (47,9±1,9%) patients of the main group identified indicators of end-diastolic diameter of the right ventricle in excess of 90 percentile. In the control group the diameter of the right ventricle does not exceed the 75 percentile (p<0,001). The thickness of the free wall of the right ventricle than 90 percentile in 27 (13,1±2,3%) children of the main group. The children of the comparison group thickness free wall of the right ventricle does not exceed the 90th percentile (p<0,001). A characteristic feature of children with a new form of bronchopulmonary dysplasia was dilatation of the right ventricle (KW (n = 183) = 17,3; rank- 4,1; p<0,0001), against the backdrop of a lack of compensatory hypertrophy of the right ventricular wall to increase the pressure in a small circulation (r=0,165; p>0.05). The correlation between end-diastolic diameter of the right ventricle and the mean pressure in the pulmonary artery (r=0,413; p<0.05). The higher the pressure in the pulmonary artery, the diameter of the right ventricle was no longer. However, reliable correlative relationship between indicators of end-diastolic diameter of the right ventricle and the thickness of the free wall of the right ventricle were found (r=0,165; p>0,05), indicating that the lack of compensatory hypertrophy of the right ventricular wall to increase the pressure in the pulmonary circulation.

In children with a new form of bronchopulmonary dysplasia occurred inadequate compensatory hypertrophy of the right ventricular wall to increase the pressure in the pulmonary circulation, which is confirmed by the lack of reliable correlative connection between the end-diastolic diameter of the right ventricle and the thickness of the free wall of the right ventricle (r=0,165; p>0,05). Early markers of chronic pulmonary heart formation in children with a new form of bronchopulmonary dysplasia consider preservation of right ventricular dilatation (90 percentile) (λ Wilkes=0,885; F SUP 6,14; p = 0,019), against the backdrop of persistent pulmonary hypertension (λ = 0,891 Wilkes; F SUP 5,9; p = 0,021).

**Keywords:** bronchopulmonary dysplasia, echocardiography, markers, chronic pulmonary heart.

**Introduction:** The adult patient start suffered from chronic pulmonary heart disease when reduced 5-10% of the pulmonary capillaries. Reduction of 15-20% pulmonary capillaries leaded to a significant right ventricular hypertrophy. When pulmonary capillary surface reduced by more than 30% results chronic heart failure decompensated [*Adam J. et al., 2013; Moore B.D. et al., 2014*].

Bronchopulmonary dysplasia (BPD) – chronic lung disease in children. Patients with bronchopulmonary dysplasia develop chronic pulmonary heart disease. It is a dynamic process that becomes clinically significant only in the later stages of the disease [*Volodin N.N.; 2010*]. One of the main causes of death in children with BPD was precisely pulmonary heart.

Chronic pulmonary heart usually develops to response to a progressive increase pulmonary vascular resistance and caused by hypoxia and inhibition of the formation of the alveolar capillary. Physiological reflex (reflex Euler-Liljestrand) of contractions of arterioles and stop blood perfusion turns into a pathological in patients with bronchopulmonary dysplasia. These reflex leads prolong spasm precapillaries. Eventually, pressure in the pulmonary circulation and minute volume of blood increased, biologically active substances are exposed. Prolonged spasm of the capillaries leads to anatomical reduction of the vessels, thrombosis and obliteration of arterioles. The right heart has hypertrophy, dilatation and myocardial degeneration and right ventricular failure is development [*Lemmer E. et al.; 2014*].

Clinical manifestation of chronic pulmonary heart disease in children with a new form of bronchopulmonary dysplasia is nonspecific. It difficult to distinguish when viewed from the genesis of dyspnea, tachypnea, cyanosis. Extension of the right heart percussion determined in the later stages of the disease. The most informative and safe method of determining the state of the right heart, according to the recommendations of the European Association of Cardiologists remains Doppler echocardiography [*Guiddelines for the diagnosis and treatment of pulmonary hypertension, 2009*].

Determining the status of the right heart is now widely studied in patients with bronchial asthma, pneumonia, tuberculosis [*Guiddelines for the diagnosis and treatment of pulmonary hypertension, 2009; Lemmer E. et al.; 2014*]. Research on the state of the right heart in children with bronchopulmonary dysplasia is too little [*Adam J. et al., 2013; Vandenheuvel M.A.et al., 2013*]. Study of status of the right heart of a patient with a new form of BPD is not found at all.

Objective: improvement of early diagnosis of chronic pulmonary heart disease in children with a new form of bronchopulmonary dysplasia by identifying marker as the end-diastolic diameter of the right ventricle, the size of the wall of the right ventricle and the mean pulmonary artery pressure.

Methods: The study was conducted on the basis of the Regional Centre of the diagnosis and treatment of bronchopulmonary dysplasia in infants Regional Children's Hospital. The study involved 140 patients with a new form of bronchopulmonary dysplasia in age from 1 to 36 months corrected age (main group). The comparison group involved 43 children aged 1 to 36 months corrected age, who were born prematurely, had a respiratory disorder, but not formed bronchopulmonary dysplasia.

Corrected age was calculated using the formula: A (k) = - 40 + (A (g) + A (n)) / 4 Where, A (k) - corrected age, A (g) - the gestational age of the week, and (n) - chronological age in weeks.

Estimating the size of the right heart and the measurement of pulmonary artery pressure was carried out with the echocardiography ("AU 3 Partner" company "Esaote Biomedica" (Іtalіya)). Dimensions of the right ventricle compared with the standard indicators, depending on the child's weight [*Beloserov A.V.,2004*] Statistical processing of data by parametric and nonparametric statistics. Early markers of diagnosis of chronic pulmonary heart disease in children with a new form of bronchopulmonary dysplasia were determined using the method of discrimination, the program Statistica-6.

Results and discussion: Diastolic diameter of the right ventricle in children of the main group was significantly higher than in the comparison group (p<0,01). Percentile distribution of final diastolic diameter of the right ventricle to the weight of the surveyed is presented in figure 1.

Fig.1. The percentiles distribute of the indicators in end-diastolic diameter of the right ventricle to the weight of the subjects.

The indexes of end-diastolic diameter of the right ventricle was 90 percentile in 67 (47,9±1,9%) patients of the main group. The diameter of the right ventricle does not exceed the 75 percentile (p<0,001) in the comparison group. Dilatation of the right ventricle is typical for children with a new form of bronchopulmonary dysplasia (KW(n=183)=17,3; rank – 4,1; p <0,0001).

More than half of patients with a new form of bronchopulmonary dysplasia had dilatation of the right atrium by the echocardiography. Percentile distribution of the thickness of the free wall of the right ventricle to the weight is shown in figure 2.

The thickness of the free wall of the right ventricle was more than 90 percentile in 27 (13,1±2,3%) children of the main group. The thickness free wall of the right ventricle did not exceed the 90th percentile (p<0,001) in the comparison group Hypertrophy of the free wall of the right ventricle is inherent in bronchopulmonary dysplasia. We supposed that children of main group had compensation of chronic pulmonary heart disease. At the same time, 40 (28,6±2,1%) patients of the main group had dilatation of the right ventricle and had not hypertrophy free wall of the right ventricle.

Fig.2. The percentile distribution of the thickness of the free wall of the right ventricle to the weight of the subjects.

It was performed the analysis of the mean pulmonary artery pressure correlation with the parameters of the right heart in the examined children. Mean pulmonary artery pressure in children of the main group was 32,37±1,7 mmHg. In the comparison group – 22,0±1,22 mmHg, which was significantly less (p = 0,033).

The correlation between the end-diastolic diameter of the right ventricle and the mean pressure in the pulmonary artery (r=0,413; p<0,05). If the pressure in the pulmonary artery increased, the diameter of the right ventricle increased too. However, reliable correlative relationship between indicators of end-diastolic diameter of the right ventricle and the thickness of the free wall of the right ventricle was not found (r=0,165; p>0,05). It showed lack of compensatory hypertrophy of the wall of the right ventricle to increase the pressure in the pulmonary circulation.

Discriminant analysis showed that early markers of chronic pulmonary heart were preserving the dilatation of the right ventricle (90 percentile) (λ Wilks = 0,885; F exclusion 6.14, p=0,019), and persistent of pulmonary hypertension (λ = 0.891 Wilkes; F exclusion 5.9, p = 0.021) during the first 2 years of life.

Conclusions:

1. Children with a new form of bronchopulmonary dysplasia usually had a dilatation of the right ventricle (KW (n = 183) = 17.3; Rank - 4.1, p <0.0001).
2. Children with a new form of bronchopulmonary dysplasia had insufficient compensatory hypertrophy of the right ventricular wall to increase the pressure in the pulmonary circulation, which is confirmed by the lack of reliable correlative connection between the end-diastolic diameter of the right ventricle and the thickness of the free wall of the right ventricle (r = 0,165; p > 0.05).
3. Early markers of formation of chronic pulmonary heart disease in children with a new form of bronchopulmonary dysplasia were persisting right ventricular dilatation (90 percentile) (λ Wilks = 0,885; F SUP 6.14, p = 0.019) and pulmonary hypertension (λ Wilks = 0,891; F SUP 5.9, p = 0.021) during the first 2 years of life.

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