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Myocardial Condition Right Ventricle in Patients with Bronchial Asthma

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ABSTRACT
The aim of the study was to assess the structural and functional state of the right ventricular myocardium in patients with moderate and severe bronchial asthma (BA) to identify early signs of impaired hemodynamics of the small circulatory circle.
Materials and methods. 51 patients with moderate and severe asthma were examined during the period of exacerbation and in dynamics 12 months after the exacerbation of the disease, 10 people made up the control group. All patients were treated spirometry, bodyplethysmography, echocardiography.
Results. The interrelations between the functional state of the respiratory tract, the structure of pulmonary volumes and the morphofunctional characteristics of the right ventricular myocardium in patients with asthma have been established.
Conclusion. In parallel with the severity of AD, disorders of the diastolic function of the right ventricle are progressing. Changes in morphometric parameters, violations of the diastolic function of the right ventricular myocardium are associated with damage to small pathways in patients with moderate and severe bronchial asthma.
Key words: bronchial asthma, right ventricle, diastolic dysfunction.

Introduction

Bronchial asthma (BA) is a global health problem, which is associated with a steady trend towards an increase in morbidity and social losses in this pathology. Currently, the problem of asthma is moving from pulmonological to cardiopulmonological, since hemodynamic disorders of the small circle of blood circulation often determine the prognosis of patients with this pathology. One of the main causes of disability and mortality in AD is the involvement of the heart and blood vessels in the process. Changes in the structure and function of the right ventricle (RV) they are more often caused by a primary disorder of the respiratory system. It is known that pulmonary hypertension, changes in the pulmonary vessels and the right ventricle of the heart develop earlier than the clinical, radiological, electrocardiographic signs of hypertrophy of the right heart are determined. Hypertrophy of the right ventricle is considered as a late and optional sign of AD, and the problem of right ventricular dysfunction is not considered as leading to the stage of its decompensation. Mutual aggravation and progression in combination of bronchopulmonary and cardiovascular diseases It is based on the commonality of some links in pathogenesis, which can lead to accelerated progression of coronary and heart failure, early development of life-threatening cardiorespiratory complications. In this regard, the continuation of studies on the relationship between the cardiovascular and respiratory systems in patients with asthma remains relevant.
The purpose of the study. To evaluate the structural and functional state of the right ventricular myocardium in patients with moderate and severe bronchial asthma in order to identify early signs of hemodynamic disorders of the small circulatory circle.

Materials And Methods

61 people were examined: 51 patients with moderate and severe bronchial asthma during the period of exacerbation and in dynamics after 12 months without exacerbation of the disease; 10 practically healthy individuals. Inclusion criteria: age over 18 and less than 70 years with a previously established diagnosis of asthma, bronchial obstruction confirmed by spirography data, which is reversible (an increase in forced exhalation volume in 1 second ≥ 12% and 200 ml from the initial level after a sample with 400 mcg of salbutamol), the possibility of proper use of basic drugs, adequately assess your condition (according to the researcher), adequate visualization of the structures and chambers of the heart during an echocardiographic (EchoCG) study, obtaining informed consent to participate in the study.

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Exclusion criteria: mild asthma, the presence of cerebrovascular diseases (stroke, transient ischemic attacks); heart disease (CHD: acute myocardial infarction, unstable angina pectoris, stable angina pectoris of functional classes III-IV, a history of myocardial infarction, coronary revascularization, chronic heart failure Stages II and III); malignant neoplasms; severe renal and hepatic insufficiency; pregnant and breast-feeding women; diabetes mellitus; chronic obstructive pulmonary disease. Depending on the severity of the disease, the patients were divided into 3 groups. Group 1 included 20 patients with moderate asthma, among them 6 men (31±5.17%) and 14 women (69±5.17%), the median age was 42[30;53] years, the median age of the disease – 3[1;9] years. In group 2, 15 patients with severe nonsteroid-dependent asthma (NSDBA) were observed, of whom 2 (16±4.67%) were men, 13 (84±4.67%) were women, the median age was 49[43;55] years, the median age of the disease was 13[6;17] years old. In group 3, 16 people with steroid-dependent BA (NWBA) were examined, among them men – 4 (22±5.24%), women – 12 (73±5.24), median age – 51[47;56] years, median age of the disease – 15[9;24] years. The control group consisted of 10 people, whose median age was 38[32;48] years, among them men – 5 and 5 women. anamnesis of the disease was collected from all patients, a physical examination was performed, the number of daytime and nighttime asthma symptoms per day, and the need for emergency medications per day were estimated. The functional state of the respiratory system was studied using spirometry and bodyplethysmography (BPG) methods. The study was performed on a MasterScreenE installation. Jaeger (Germany) in compliance with all the requirements of standardization of methodological techniques.

Echocardiographic examination was performed using the approaches recommended by the American Society of Echocardiography on the SEQUOIA-512 digital computer sonography device from Acuson (USA) using multi-frequency sector-type sensors with a scanning frequency of 2.5-3.5 MHz.

Statistical processing of the results was carried out using IBM SPSS Statistics v. 19 application programs. To assess the significance of statistical differences between the study groups in the absence of a normal distribution of variables, the nonparametric Kraskel-Wallace criterion was used. If there are statistically confirmed differences between the study groups, A pairwise comparison of the observation groups was performed using the Mann-Whitney method. The differences between the groups in terms of qualitative characteristics were determined using the criterion $\chi 2$. The differences were considered statistically significant at $p < 0.05$. To assess the relationship of the signs, a correlation analysis was used with the calculation of correlation using the Spearman method.

Research Results And Their Discussion

The structural and functional state of the right ventricular myocardium in patients with moderate and severe asthma has been studied. According to echocardiography in group 1, the basal diameter of the right ventricle (BDRV) did not statistically significantly differ from the control parameters in the dynamics of the disease ($p>0.05$). In the groups of patients with NSZBA and NWBA (groups 2 and 3), an increase in this indicator was observed in comparison with the group of practically healthy patients as at the moment of exacerbation of the disease ($p= 0.038$; $p=0.034$, respectively), and with dynamic follow-up after 12 months ($p=0.002$; $p= 0.05$). In addition, in the NSZBA and NWBA groups, an increase in the basal diameter of the right ventricle was found in comparison with the indicators of patients of the 1st group of BA ($p>0.05$). In all groups, during the period of exacerbation of BA, a statistically significant decrease in the longitudinal size of the right ventricle was noted relative to the indicators of practically healthy ($p=0.001$, $p=0.014$, $p=0.047$, respectively), whereas after 12 months of follow -up, there were no differences in this indicator compared with the control ($p>0.05$). The thickness of the anterior wall of the right ventricle (TAWRV) in the studied groups exceeded a similar indicator of healthy individuals both in the acute phase ($p<0.001$) and in dynamics after 12 months, outside the exacerbation of the disease ($p<0.001$). It was noted that the aggravation of the BA course is accompanied by an increase in the thickness of the ESRD: the differences are statistically significant between the 1st and 2nd, 1st and 3rd groups ($p<0.001$). Both during the period of exacerbation and in dynamics after 12 In all groups, an increase in the average pulmonary artery pressure (CpDLA) was observed in comparison with the control parameters ($p<0.001$, $p<0.001$ and $p=0.002$, respectively). Systolic pressure in the pulmonary artery (SDLA) in patients of group 1, it did not differ statistically significantly from the control indicators, regardless of the follow-up period ($p>0.05$). Whereas, in patients of the 2nd and 3rd groups, an increase in the SDL index was recorded during the period of

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exacerbation of the disease in comparison with the control (p<0.001). In addition, during the entire follow-up period, the values of SDL in groups 2 and 3 were statistically significantly higher than in patients of group 1 (p<0.001). We have detected an increase in end-diastolic pressure in the pulmonary artery (CDDLA) in all groups of patients during the period of exacerbation of AD in comparison with the control (p<0.001, p<0.001, p=0.006, respectively). After 12 months of follow-up, in the group of patients with moderate asthma, the CDLA level decreased (p=0.004) and was comparable with the control indicators (p>0.05). Whereas, in the groups of patients with severe asthma (NSDBA and NWBA) after the exacerbation of the disease, the level of CDDL remained elevated in comparison with the indicators of practically healthy (p=0.001) and patients with moderate asthma (p=0.012). At the same time, it was noted that in the group of moderate BA with SDLA figures that do not differ from the control, and in the groups of severe BA (NSDBA and NWBA) with minor pulmonary hypertension, hypertrophy of the right ventricular wall is determined. It can be assumed that the remodeling and development of right ventricular hypertrophy in patients with moderate and severe asthma occurs in the early stages of pressure changes in the small circle. The analysis of the transtricuspid blood flow in group 1 under dynamic observation showed that the value of the rate of early the filling of the right ventricle (LV) did not differ from the indicators of the control group (p=0.343 at exacerbation, p=0.467 after 12 months), whereas the value of late filling of the right ventricle (A pancreas) was statistically significantly higher than in the healthy group both during the period of exacerbation (p=0.012) and after 12 months of follow-up (p<0.001), the ratio (E/A pancreas) it decreased in comparison with the control group (p<0.001). The time of isovolumic relaxation of the right ventricle (RVIR) during the period of exacerbation was statistically significantly higher, than in the control group (p=0.047). Upon repeated examination after 12 months, the VIR index did not differ from the parameters of practically healthy patients (p= 0.936). In patients with severe NSAIDs and NWBA, the same type of changes were revealed, both with exacerbation of the disease and after 12 months of follow-up. In these groups, a violation of diastolic function was found, manifested in a decrease in RV E (p<0.05) and RV E/A ratio (p<0.001), an increase in RV A (p<0.001,), and RV VIR (p<0.001, p=0.002, respectively) in comparison with the control group. The dependence of the progression of changes in the diastolic function of the right ventricle on the severity of AD was recorded, the differences were statistically significant in patients Groups 1 and 2 (p=0.003), groups 1 and 3 (p=0.027).

In addition, we noted that pulmonary hypertension in patients with moderate to severe asthma is associated with diastolic dysfunction of the right ventricle (r=0.56; p<0.05) and changes in the morphometric state of the right ventricle (r=0.48; p<0.05). At the same time, the development of hypertrophy, dilation and insufficiency of the right ventricle can be observed with relatively low values of pressure in the pulmonary artery when SDLA does not exceed 35 mmHg, which indicates that the role of pulmonary hypertension in the formation of a chronic pulmonary heart is not the only one.

The results of the correlation analysis in the group of moderate asthma, both during and outside the period of exacerbation, showed that the degree of hypertrophy of the right ventricle (TPRV) is inversely dependent on the indicator

OFV1/FVC (r=-0.36; r=-0.41 p<0.05, respectively). Outside The exacerbation of the disease showed a negative relationship between TSPF and the FEV1 index (r=-0.37; <0.05). In the group of patients with severe asthma (NSDBA and NWBA), a moderate negative relationship between the FEV1 index was also recorded during the exacerbation of the disease /FVC and the diameter of the pulmonary artery (r=-0.47; p<0.05). Correlation analysis of echocardiography data with bodyplethysmography in the group of patients with moderate asthma at the time of exacerbation revealed a negative relationship between the maximum rate of late filling (LV) and residual lung volume (OOL) (r=-0.45; p<0.05). In the group of patients with severe asthma (NSZBA and NWBA), significant positive relationships were noted between the thickness of the anterior wall of the right ventricle and OOL, and the OOL/OEL ratio (r=0.55; r=0.47, respectively; p<0.05), between OOL and the end diastolic pressure on the pulmonary artery (CDDLA) (r=0.54; r=0.51 p<0.05). Outside the exacerbation of the disease, after 12 months, in the group of patients with moderate asthma, a positive relationship between bronchial expiratory resistance (SDPvyd.) and SDLA (r=0.31; p<0.05) was recorded. Thus, we have revealed that the shape change the cavity of the right ventricle (an increase in the ratio of transverse to longitudinal size) is combined with the development of diastolic dysfunction of the right ventricle. Such changes were noted in group 1 in 27.9±5.04% of cases, in 2nd – in

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64.5 ±6.08%, in the 3rd group – in 65.1±6.01% of patients. In addition, a combination of signs of right ventricular hypertrophy (increased TPH) with the development of diastolic dysfunction of the right ventricle was registered in group 1 in 15.2±4.04% of patients, in group 2 in 29±5.76% of patients and 20.6±5.10% of people from the 3rd group. These disorders reflect a single process of structural and functional remodeling of the right chambers of the heart in patients with moderate and severe bronchial asthma.

Remodeling of the myocardium of the right ventricle is interrelated with chronic persistent inflammation of the respiratory tract, bronchial obstruction and impaired pulmonary volumes, which is confirmed by the results of correlation analysis: TSPF and FEV1/FVC (r=-0.36; r=-0.41 p<0.05, respectively); TPSPJ and OFV1 (r=-0.37; <0.05), Am and OOL (r=-0.45; p<0.05), TPSPJ and OOL (r=0.55, p<0.05), OOL and CDLA (r=0.54; r=0.51 p<0.05), SDPvyd. and SDLA (r=0.31; p<0.05). In previous studies, it was found that in AD, the state of diastolic function of the right ventricle depends on the severity of the disease, the level of afterload, the magnitude of pulmonary hypertension and the severity of right ventricular hypertrophy. The results of our research have confirmed the already known literature data. In addition, we conducted a comprehensive study of the functional state of the respiratory system and the structural and functional state of the right ventricular myocardium, depending on the severity and phases of the disease in patients with moderate and severe bronchial asthma. We also identified the relationship between the functional state of the respiratory tract, the structure of pulmonary volumes and morphofunctional characteristics of the right ventricular myocardium in patients with asthma. It was found that in parallel with the severity of the course of bronchial asthma, violations of the diastolic function of the right ventricle are progressing.

Conclusion

In parallel with the severity of the disease, patients with moderate and severe bronchial asthma undergo structural and functional remodeling of the right heart, the earliest manifestation of which is the development of right ventricular hypertrophy, manifested by an increase in the thickness of the anterior wall and the diastolic size of the right ventricle. In parallel with the severity of the disease, the development of diastolic dysfunction is observed in patients with moderate and severe bronchial asthma, which manifests itself in a decrease in the maximum rate blood flow during the period of early filling of the right ventricle, an increase in the maximum blood flow rate during the period of late filling of the right ventricle, a decrease in their ratio, an extension of the time of isovolumic relaxation and contraction, an extension of the time of slowing down the flow.

The progression of changes in morphometric parameters, disorders of the diastolic function of the right ventricular myocardium is associated with damage to small pathways in patients with moderate and severe bronchial asthma.

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