www.revistageintec.net
ISSN: 2237-0722
revista GEINTEC Gestão, Inovação e Tecnologias

Some Peculiarities of Non-Specific Interstitial Pneumonia, Lung Sarcoidosis and Hypersensitive Pneumonitis Associated with the Ischemic Heart Disease

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Abstract

Introduction. *Modern aspects of the diagnostics and treatment of interstitial lung diseases are closely connected with the comorbidity, which is based on the study of the associations between cardiovascular diseases and interstitial lung diseases.*

Material and Methods. *The study included 65 patients with non-specific interstitial pneumonia, 78 patients with hypersensitive pneumonitis, and 68 patients with lung sarcoidosis.*

Results. *An association between the character of morphological alterations in the lung tissue and clinical-functional disorders was established. More expressed fibrous and interstitial alterations corresponded to more intense respiratory symptoms and more severe disturbances of ventilation and diffuse parameters of the lungs. There was a tendency in the dilation of right and left compartments of the heart in the group of patients with interstitial lung diseases associated with cardiovascular diseases.*

Key-words: Non-specific Interstitial Pneumonia, Hypersensitive Pneumonitis, Lung Sarcoidosis, Ischemic Heart Disease.

1. Introduction

Modern aspects of diagnostics and treatment of interstitial lung disease (ILD) are closely associated with the comorbidity[1–2]. It involves the study of the associations between cardiovascular and interstitial lung diseases and the presence of common pathogenetic mechanisms[3]. The linking elements between these diseases are hypoxia and hypercapnia, and possibly the development of chronic inflammation as a general mechanism of fibrosis and atherogenesis[4].In patients with ILD, the process of fibrosis is not limited by the lungs and is taken as the result of systemic inflammation[5].

Patients with ILD and IHD, have elevated levels of anti-inflammatory cytokines (interleukins 6 and 8) and tumor necrosis factor (TNF-α)[6]. Patients with ILD have an increased risk of the development of cardiovascular complications, including acute coronary syndrome (ACS), lung hypertension, deep vein thrombosis (DVT), supraventricular, and ventricular rhythm disturbances[7-8]. The study of the causes of the development of life-threatening conditions in patients with IHD will allow specialists to create therapeutic programs and improve their quality of life.

2. Material and Methods

Study Entry Criteria

The study included 213 patients with ILD: non-specific interstitial pneumonia (NsIP), hypersensitive pneumonitis (HSP), sarcoidosis of lungs,and intrathoraciclymphatic nodes (SLILN) aged 45.6 to 68.9. 97 of them were also diagnosed with IHD based on a) clinical syndrome characterized with discomfort in the chest that develops at physical loads or emotional stress, which is resolved by nitroglycerin;b) coronary angiography results that revealed at least one stenosis not less than 50% in one coronary artery.

The Study Exclusion Criteria

1. Pulmonary tuberculosis.2.Oncologic diseases. 3. Disseminated processes of unknown genesis. 4.Congenital and acquired heart valvular diseases. 5. Patients with III-IV FC of chronic heart failure by NYHA classification. IHD was verified according to the recommendations on the diagnostics of IHD, acute and chronic heart insufficiency of European Society of Cardiology 2013[9]. The diagnostics of interstitial diseases of lungs was performed by the criteria of the American Thoracic Society/European Respiratory Society 2015[10].

The study was approved by the local ethical committee and written informed consent was obtained from each of the participants. The patients were divided into two groups. The main group included 97 patients with IHD (associated group), 28 patients with NsIP, 36 patients with a chronic form of hypersensitive pneumonitis (HSP), and 33 patients with sarcoidosis of lungs and intrathoracic lymphatic nodes (SLILN). The group of comparison included 114 patients without IHD: 37 patients with NsIP, 42 patients with HSP, and 35 patients with SLILN. The characteristics of the participants are presented in Table 1.

Table 1 - Characteristics of the Patients with Interstitial Lung Diseases (ILD)

Parameters	**NsIP without IHD, n =37**	**NsIP with IHD, n = 28**	**HSP without IHD, n = 42**	**HSP with IHD, n = 36**	**SLILN without IHD,n = 35**	**SLILN with IHD, n = 33**
Age, years	59.42 [48.85; 64.23]	62.25 [56.71; 68.90]	61.13 [56.3; 63.8]	59.93 [52.3; 62.7]	58.7 [55.6; 60.16]	60.9 [57.7; 62.18]
Sex (male/female)	19/18	17/11	22/20	19/17	16/19	15/17
DurationofILD, years	5.17 [4.90; 6.42]	4.86 [3.74; 5.30]	6.37 [6.82; 7.28]	5.43 [5.10; 5.89]	3.04 [3.02; 3.51]	2.85 [2.57; 3.11]
DurationofIHD, years	-	2.06 [1.83; 2.85]	-	1.49 [0.99; 1.79]	-	2.08 [0.84; 2.47]
Dyspnoea, points	1.69 [1.52; 1.72]*	2.27 [1.89; 2.36]	1.54 [1.36; 1.67]	1.77 [1.48; 1.82]	1.23 [1.04; 1.46]	1.55 [1.42; 1.89]
Cough, points	0.92 [0.66; 1.17]	1.06 [0.78; 1.23]	1.42 [1.26; 1.64]	1.74 [1.53; 2.01]	1.38 [1.22; 1.62]	1.45 [1.38; 1.96]
Expectoration, points	0.78 [0.70; 0.99]	0.89 [0.64; 1.06]	0.66 [0.33; 0.82]	0.74 [0.28; 0.91]	0.43 [0.22; 0.73]	0.61 [0.29; 0.88]

Note:

1. Here and further in tables: IHD – ischemic heart disease, NsIP – non-specific interstitial pneumonia, HSP – hypersensitive pneumonitis, SLILN – sarcoidosis of lungs, and interstitial lymphatic nodes.

2. Here and further in tables 2-4: the data is presented as a median of 1st and 3rd quartiles Me [k25%; k75%], for the calculation of statistical significance between the subgroups of patients with and without IHD, two-sided Mann-Whitney U-test was used. The column "Sex" contains absolute values. For the calculation of statistical difference by gender, a two-sided Fisher's test was used.

** The difference from the subgroup of patients with NsIP and IHD was statistically significant ($p < 0.001$).*

All the patients had clinical and biochemical blood assays (leukocyte count, HDL and LDL levels, cholesterol, creatinine, uric acid, C-reactive protein), tests for platelet count, activated partial thromboplastin time (APTT), clotting time. All the patients had X-ray imaging and multidetector computed tomography (MDCT) of the chest organs, electrocardiography, respirometry, a test for diffuse lung capacity, pulse oximetry.Dyspnoea was evaluated by the modified Medical Research Council (scale 0 to 4 points).

Clinical symptoms (cough, expectoration) were evaluated by a 4 – xscale. Cough: 0 points – no symptoms, 1 –only in the morning, 2 – rare episodes (2-3) during a day, 3 – often episodes (more than 3) during a day. Expectoration: 0 points – no expectoration, 1 – periodic in minor amounts (up to 50 ml), 3 –expectoration more than 50 ml during a day. The calculations were performed by a statistical software package SPSS 21.0. Statistical comparison of the mean values of quantitative variables between two parallel groupswas performed with paired Student's t-test. In small samplings, a comparison of quantitative features in parallel groups was performed with a non-parametric analogWilcoxon-Mann-Whitney test. In small samplings, for paired comparisons, Wilcoxon's test was used. A two-tailed level of significance was established at 5%.

3. Results and Discussion

As it can be seen from Table 1, the groups of patients did not significantly differ by gender and age, except for the prevalence of men in groups with NsIP and HSP and women in the group with sarcoidosis. The patients with ischemic heart disease in all the subgroups were slightly older than the patients without it.

In both groups, other diseases were also registered that were defined as co-existing but not influencing the interpretation of the examination results in terms of interstitial lung diseases. These diseases were more often observed in patients without IHD: Chronic Obstructive Pulmonary Disease (COPD) in 13.7% of patients with non-specific interstitial pneumonia, in 4.76% of patients with hypersensitive pneumonitis, and in 5.71% of patients with lung sarcoidosis. Bronchial asthma (BA) was observed in 2.7%, 2.38%, and 2.85% of patients, respectively. In patients with IHD, COPD was observed 3.8 times rarer than in patients without IHD. The incidence rate of this disease in the subgroup of patients with NsIP was 3.57% and in the subgroup of HSP and lung sarcoidosis, it was diagnosed in 2.77% and 2.85% of patients. Bronchial asthma was diagnosed in one patient with hypersensitive pneumonitis. In patients from the other subgroups, it was not registered.

Single cases of these diseases, the stability of their development, and lack of acute periods during the study indicate that these diseases do not influence the interpretation of clinical symptoms. In patients with NsIP and HSP associated with IHD, respiratory symptoms are more intensive than in patients without this association. By one of the symptoms (dyspnoea), in these groups with NsIP, a statistically significant difference was observed ($p<0.001$), by the other two symptoms (cough, expectoration), there was no significant difference, but there was a tendency to a higher intensity of these symptoms in patients with IHD.

Patients with interstitial lung diseases without IHD had a longer duration of lung diseases. The time from the diagnostics of interstitial lung diseases (from the appearance of first symptoms to diagnosis) exceeded 3 years. Apparently, this was associated with the fact that morphological manifestations of the disease appeared before the development of respiratory symptoms and functional disorders. Probably, we analyzed subclinical forms of the disease.

An alternative explanation of late diagnostics of interstitial lung disease could be in its slow progression and the fact that clinical manifestations of the disease (dyspnea, cough) were taken by the patients as the symptoms of other diseases (COPD and BA). In such cases, the patients adapted to dyspnea by the reduction of their activity.

The development of a new event (coronary syndrome, arrhythmia) made the patients apply for medical assistance to identify the causes of the intensification of respiratory symptoms and to get the specification of functional disorders.

In patients with IHD, earlier diagnostics of ILD was performed at earlier stages in patients who had HSP for 1.5 years and in patients who had NsIP and lung sarcoidosis for 2 years. In the group of patients with lung sarcoidosis, the diagnostics of ILD nearly coincided with the duration of IHD.

It can be suggested that IHD contributes to earlier diagnostics of ILD. X-ray imaging of the chest (Table 2) showed that all the patients had reticular alterations with higher intensity in patients with NsIP and HSP both with IHD and without coronary pathology. The character of these alterations was different. In patients with NsIP and HSP, reticular alterations had diffuse character, in patients with lung sarcoidosis, they were localized primarily in the upper segments. The incidence rate of pleural changes was different: it ranged from 11.42% in patients with sarcoidosis to 27.02% in patients with NsIP.

Table 2 - Comparative Analysis of X-ray Imaging in Patients with Interstitial Lung Diseases (in %).

Parameters	**NsIP without IHD, n =37**	**NsIP with IHD, n = 28**	**HSP without IHD, n = 42**	**HSP with IHD, n = 36**	**SLILN without IHD,n = 35**	**SLILN with IHD, n = 33**
Reticularalterations	12 (32.43) [31.8; 36.1]	11 (39.28) [38.8; 40.1]	6 (14.28) [12.9; 15.06]	7 (19.44) [18.76; 20.01]	5 (14.3) [14.03; 14.41]	6 (18.18) [17.08; 18.6]
Alterations by all the fields	18 (48.64) [47.9; 50.2]	14 (50.0) [48.7; 52.4]	27 (64.28) [62.77; 65.72]	26 (72.22) [71.75; 72.64]	10 (28.57) [28.13; 28.93]	11 (33.33) [32.9; 33.5]
Alterations in basal sections	14 (37.83) [33.4; 39.0]	12 (42.85) [42.1; 45.6]	7 (16.7) [15.97; 16.98]	8 (22.2) [21.66; 22.97]	4 (11.42) [10.95; 12.07]	6 (18.18) [17.64; 18.9]
Unstructured roots of lungs	19 (51.35) [50.5; 56.7]	15 (53.37) [51.6; 57.8]	24 (57.14) [56.76; 57.46]	21 (58.33) [57.45; 60.88]	11 (31.42) [30.54; 34.15]	12 (90.91) [84.7; 92.5]
Pleural alterations	10 (27.02) [25.8; 29.3]	9 (32.14) [30.6; 33.6]	5 (11.90) [10.72; 12.53]	9 (25.0)*** [24.62; 26.03]	4 (11.42) [10.7; 12.09]	4 (12.12) [11.9; 12.7]
Intrathoraciclymphadenopathy	6 (16.22) [14.4; 18.4]	5 (17.57) [15.6; 20.3]	2 (4.76) [4.22; 4.98]	3 (8.33)*** [7.91; 8.28]	10 (28.67) [27.08; 30.21]	11 (33.33) [32.5; 34.1]
Hydrothorax	– *	3 (10.7) [9.96; 11.8]	-	3 (8.33)*** [8.24; 8.47]	– #	2 (6.06) [5.98; 6.34]
Symptomsoflunghypertension	2 (5.7) [5.12; 7.19]	2 (7.1) [6.92; 7.68]	1 (2.38) [2.11; 2.75]	2 (5.55)*** [5.06; 5.93]	2 (5.71)## [5.14; 5.93]	4 (12.12) [11.78; 12.5]
Dilationofleftventricle	– *	2 (7.1) [7.04; 7.32]	-	3 (8.33)** [8.07; 8.71]	– #	3 (9.09) [8.91; 9.67]
Dilation of right ventricle	2 (5.7) [5.56; 5.93]	2 (7.1) [6.57; 7.23]	2 (4.76) [4.23; 5.04]	6 (16.7)** [16.10; 16.92]	2 (5.71)## [5.14; 6.15]	4 (12.12) [11.6; 12.78]
Alterations in vascular pattern	– *	3 (10.7) [10.22; 11.03]	2 (4.76) [4.18; 4.92]	7 (19.44)** [19.02; 20.21]	– #	3 (9.09) [8.66; 9.47]
Multidetector computed tomography of the chest organs						
Ground-glassopacity	29 (78.9) [76.54; 82.27]	25 (89.28) [82.67; 91.05]	26 (61.90) [60.04; 63.18]	23 (63.88) [62.22; 64.56]	11 (31.42) [30.94; 32.06]	12 (36.4) [35.72; 36.8]
"Honeycomb"lung	10 (27.02) [26.11; 28.23]	9 (32.14) [31.62; 33.12]	11 (26.19) [25.84; 27.53]	13 (36.11) [34.11; 37.42]	4 (11.42) [11.23; 11.91]	5 (15.15) [14.6; 15.32]
Subpleuralshadows	12 (32.43) [30.24; 32.97]	10 (35.71) [33.82; 36.07]	6 (14.28)*** [10.03; 15.62]	10 (27.77) [21.52; 29.38]	3 (8.57) [8.27; 8.74]	4 (12.12) [11.9; 12.25]
Foci of consolidation	3 (8.1) [7.84; 8.29]	3 (10.71) [9.33; 11.90]	1 (2.38) [2.12; 2.84]	1 (2.77) [2.63; 3.04]	1 (2.86) [2.44; 3.13]	2 (6.06) [5.84; 6.24]
Tractionbronchiectasis	1 (2.702) [2.11; 2.96]	1 (3.57) [3.01; 3.89]	5 (11.90) [10.46; 12.54]	5 (13.88) [12.04; 14.62]	2 (5.51) [4.92; 5.85]	3 (9.09) [8.67; 9.38]
Intrathoraciclymphadenopathy	8 (21.60) [20.13; 22.52]	8 (28.56) [23.83; 30.07]	5 (11.90)** [10.73; 12.62]	8 (22.22) [19.54; 23.81]	29 (82.85) [80.94; 84.15]	(90.91) [84.7; 92.5]

Note:

1. The calculation of the statistical significance between the subgroups with and without IHD was performed with a two-sided Mann-Whitney U-test.

2. The difference from the subgroup with NsIP and IHD was statistically *significant: (*), p< 0.001;*

3. The difference from the subgroup with HSD and IHD was statistically *significant: (**), p< 0.001, (***), p< 0.05.*

4. The difference from the subgroup with SLILN and IHD was statistically *significant: (#), p< 0.001; (##), p< 0.05.*

More often, pleural alterations were observed in patients with cardiac pathology. In patients with HSP and IHD, the difference was statistically significant ($p< 0.05$). Pleural effusion was revealed in 6.06% of patients with sarcoidosis, in 8.33% of patients with HSP, in10.7% of patients with NsIP, and only in several patients with IHD and rhythm disturbances (permanent and paroxysmal atrial fibrillation). Hydrothorax and symptoms of hypervolemia were not observed in the group of patients with IHD and were observed quite rare ($p < 0.001$) in patients with IHD and arrhythmia. Radiographic evidence of congestive events in the pulmonary circulation (intensification of vascular pattern with enlargement of arterioles and dilation of veins) was observed in patients with HSP with and without IHD. In patients with sarcoidosis and NsIP they were observed only in those who had IHD. This tendency was registered during the analysis of the contours and cavities of the heart. The signs of dilation of right atrium and ventricle as a manifestation of chronic cor pulmonale were observed in patients with and without IHD, but more often, in patients with cardiac pathology.

Along with these features, an enlargement of the caliber of main pulmonary vessels with a general degradation of the vascular pattern was registered, which indicated lung hypertension. Dilation of the left ventricle and an increase in the stiffness of the aorta walls was observed only in patients with IHD. The evaluation of interstitial alternations and microcirculation disorders was performed with a CT scanning of the chest organs. This method had advantages when clinical symptoms were spare and the disease did not have any manifestations and was not associated with the changes in functional parameters (14). MDCT revealed the signs of hypervolemia and hypertrophy of the left and right compartments of the heart. Honeycomb lung and traction bronchiectasis were more often observed in patients with HSP. The phenomenon of “ground-glass opacity” was more often registered in patients with HSP and NsIP. The evaluation of interstitial alterations and interpretation of pathological changes at the level of alveoli (a symptom of ground-glass opacity) was possible only with the method of MDCT. This symptom not only indicated the development of alveolitis but also congestive events in the microvasculature due to the increase in the volume of capillary circulation. The symptom of ground-glass opacity included the thickening of the interalveolar septum and vascular events of peribronchovascular zone. Consolidation of lung tissue in patients with IHD was more often observed in patients with NsIP. In patients with sarcoidosis and HSP, it is registered only in single cases. MDCT revealed intrathoracic lymphadenopathy in 22.2% of patients with HSP and IHD, while plan radiography of the chest organs revealed it only in 8.3% of cases. In patients with NsIP and IHD, the same tendency was observed: in 17.57% of patients, enlargedmediastinal lymph nodes were revealed by plan radiography, and in 28.56% - by MDCT. This method increases the

diagnostics rate of intrathoracic lymphadenopathy in patients with sarcoidosis: in 33.3% of patients by plan radiography and in 90.91% of patients by CT. MDCT allowed specialists to identify the character of the revealed lymphadenopathy. X-ray images showed morphological alterations in the lung tissue and differed in patients with different forms of interstitial lung diseases, as well as in patients with or without cardiac pathology.In patients with IHD, signs of hydrothorax, intensification of vascular pattern, and enlargement of the left ventricle were registered more often. Despite the differences in the X-ray patterns of different forms of interstitial lung diseases, the results of spectrometry and the study of diffuse lung capacity registered the uniform character of functional disorders. The results of the functional examination are presented in Table 3.

Table 3 - Parameters of Functional Study in Patients with Interstitial Lung Diseases (ILD)

Parameters	**NsIP without IHD, n =37**	**NsIP with IHD, n = 28**	**HSP without IHD, n = 42**	**HSP with IHD, n = 36**	**SLILN without IHD,n = 35**	**SLILN with IHD, n = 33**
Lung vital capacity, %	65.62 [61.23; 67.5]	64.8 [57.3; 68.6]	74.11 [66.93; 76.92]	73.03 [68.72; 76.13]	75.18 [69.64; 77.29]	74.31 [70.5; 76.9]
Forcedlungvitalcapacity, %	72.52 [69.4; 75.2]	71.73 [68.8; 73.4]	75.09 [71.32; 78.21]	74.30 [68.1; 77.9]	77.22 [69.8; 78.17]	73.07 [71.0; 74.93]
Forced expiratory volume in the first second, %	67.23 [65.8; 67.7]	68.67 [65.1; 72.3]	68.84 [65.5; 72.7]	71.11 [68.1; 72.4]	69.47 [66.3; 74.0]	67.15 [64.5; 72.7]
Pulmonaryresidualvolume, %	71.11 [69.2; 74.8]	70.63 [68.5; 74.1]	72.12 [69.1; 78.0]	70.15 [62.9; 73.43]	72.48 [68.5; 74.9]	73.56 [69.9; 78.4]
Totallungcapacity, %	65.54 [61.62; 63.93]	67.95 [64.91; 75.0]	71.07 [68.44; 74.1]	70.03 [66.7; 72.3]	73.49 [67.37; 75.35]	72.07 [66.2; 75.28]
Diffusing lung capacity (DLCO) by CO, %	53.31 [47.9; 55.8]*	32.52 [30.9; 34.6]	54.33 [50.94; 58.87]**	35.75 [33.4; 42.4]	59.97 [52.01; 62.48]***	36.9 [32.67; 39.56]
Partial arterial pressure, mmHg	71.32 [69.6; 73.21]	69.64 [67.6; 70.88]	69.13 [66.87; 72.54]	68.14 [66.2;71.9]	72.16 [68.21; 73.48]	71.38 [69.4; 72.96]
Partial CO pressure, mmHg	39.14 [35.9; 43.45]	38.62 [36.3; 40.49]	37.65 [37.12; 40.92]	37.39 [36.76;37.88]	39.06 [38.4; 40.76]	38.57 [37.4; 42.4]

** Difference from the subgroup with NsIP and IHD was statistically significant ($p < 0.001$).*

*** Difference from the subgroup with HSP and IHD was statistically significant ($p < 0.001$).*

**** Difference from the subgroup with SLILN and IHD was statistically significant ($p < 0.05$).*

The evaluation of respiratory function (RF) showed a more significant reduction of statistical volumes anda decrease in lung compliance in patients with interstitial lung diseases and IHD. Statistically significant differences between the groups were not observed. Restrictive (decrease in

vital capacity and forced vital capacity) and obstructive (reduction of forced expiration volume during the 1st second (FEV 1)) disorders and a decrease in the elasticity of lungs were registered in all the groups. The alterations were specially expressed in the subgroup of patients with NsIP, least expressed in patients with sarcoidosis of lungs and intrathoracic lymphatic nodes, and intermediate – in patients with HSP. Reduction of gas exchange function of lungs was registered in all the patients. The assay of arterial blood showed insignificant hypoxia at a constant partial pressure of CO_2. There were no statistically significant differences in the parameters in patients with and without IHD. In patients with IHD,DLCO (Diffusing capacity of the lung for carbon monoxide) was significantly decreased. Statistically significant reduction of the diffuse capacity of lungs was registered in all the subgroups. It can be suggested that the disturbances in the microcirculation of the alveolar-capillary membrane and reduction of diffusion in patients with IHD were more expressed. Patients with IHD had a short-term cardiac anamnesis (1.49 to 2.08 years). Probably, the decrease in this parameter is a functional method of early diagnostics of hemodynamic disorders in the interstitial tissue. The study of lung diffuse capacity can be recommended for the facilitation of the choice of the treatment plan for patients with associated pathologies. The control of the dynamics is necessary for the evaluation of the effectiveness of the indicated therapy.

The results of the echocardiographic examination are presented in Table 4.

Table 4 - Results of Echocardiographic Examination of Patients with Interstitial Lung Diseases

Parameters	**NsIP without IHD, n =37**	**NsIP with IHD, n = 28**	**HSP without IHD, n = 42**	**HSP with IHD, n = 36**	**SLILN without IHD,n = 35**	**SLILN with IHD, n = 33**
Systolic pressure in pulmonary artery, mmHg	27.54 [27.84; 28.62]	35.58 [29.42; 36.37]	25.37 [25.1; 26.43]	37.08 [28.5; 39.74]	26.03 [25.8; 26.92]	28.19 [26.3; 30.61]
Ejectionfraction, %	58.53 [57.27; 60.41]	56.76 [55.35; 59.71]	56.7 [56.09; 57.42]	57.2 [56.43; 57.98]	55.9 [54.82; 56.01]	56.1 [55.11; 56.87]
Area of right atrium, cm^2	19.16 [18.9; 19.8]	22.02 [19.50; 22.40]	17.84 [17.21; 18.38]	18.72 [17.69; 19.35]	15.92 [15.10; 16.60]	16.03 [15.8; 16.40]
Right atrium free wall thickness, mm	4.47 [4.16; 4.84]	4.56 [4.02; 4.71]	3.63 [3.18; 4.17]	3.93 [3.32; 4.26]	3.98 [3.46; 4.53]	4.12 [3.90; 4.29]
Diastolic size of right ventricle, cm	1.75 [1.58; 1.92]	2.02 [1.73; 2.18]	1.25 [1.14 1.39]	1.27 [1.16; 1.33]	1.32 [1.19; 1.52]	1.40 [1.27; 1.46]
Final diastolic size of left ventricle, cm	4.39 [4.06; 5.03]	4.48 [4.26; 4.63]	3.88 [3.62; 3.96]	3.95 [3.47; 4.30]	3.90 [3.51; 4.24]	4.01 [3.94; 4.29]
Final systolic size of left ventricle, cm	3.84 [3.12; 4.06]	4.05 [3.73; 4.28]	3.42 [3.06; 3.59]	3.96 [3.64; 4.04]	3.43 [3.15; 3.78]	3.98 [3.72; 4.09]
left ventricular mass index, g/m^2	112.49 [110.3; 126.09]	116.5 [128.39; 140.09]	99.4 [96.03; 108.71]	119.6 [111.42; 138.04]	88.70 [84.32; 138.04]	107.68 [102.51; 115.74]

The results of echocardiogram in patients with NsIP and HSP showed moderate lung hypertension, dilation of right atrium, and hypertrophy of right ventricle. The alterations were more expressed in patients with IHD. There were no significant differences between the subgroups. Global contractility of the left ventricle was preserved. All the patients had ejection fraction within normal values. The signs of remodeling of left compartments of the heart with the increase in the myocardial mass index of the left ventricle were observed more often in patients with IHD, in particular, with heart rhythm disorders.Thus, the echocardiogram results showed that IHD in patients with ILD led to more expressed functional disorders not only of the left but also of the right compartment of the heart.

In the majority of patients with ILD, there was an association between the character of morphological alterations in the lung issue and clinical-functional disorders. Thus, more expressed reticular alterations and more intensive fibrosis of centrolobular nodules in patients with HSP were associated with higher intensity of respiratory symptoms. Patients with NsIP and sarcoidosis with an expressed ILD and inflammation, that were identified by the area of ground-glass opacity, had reduced gas-exchange function of lungs and a significant decrease in its diffuse capacity.

4. Conclusion

The data was obtained that indicated a higher intensity of respiratory symptoms, more expressed ventilation disorders, diffuse parameters of lungs, and dilation of the compartments of the heart in patients with ILD and comorbid cardiovascular pathology.

Conflict of interests: the authors declare no conflict of interests.

Financial support: the authors declare no external financial support

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