

MAIN ECHOCARDIOGRAPHIC PARAMETERS IN PATIENTS WITH CHRONIC CEREBRAL ISCHEMIA DEPENDING ON THE PRESENCE OF CONCOMITANT CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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Abstract

This study examines the main echocardiographic parameters in patients with chronic cerebral ischemia (CCI) and analyzes how these parameters are influenced by the presence of concomitant chronic obstructive pulmonary disease (COPD). CCI, associated with reduced cerebral blood flow, can be exacerbated by COPD, which negatively affects cardiovascular and respiratory functions. The study evaluates key echocardiographic markers such as left ventricular ejection fraction, right ventricular function, and pulmonary artery pressure. The findings indicate that patients with both CCI and COPD exhibit more significant cardiac dysfunction, suggesting that COPD may worsen cardiovascular complications in CCI patients.

Keywords Chronic cerebral ischemia, chronic obstructive pulmonary disease, echocardiography, left ventricular function, right ventricular function, pulmonary artery pressure, cardiovascular complications.

INTRODUCTION

According to the World Health Organization, chronic obstructive pulmonary disease (COPD) caused the death of 2.32 million people in 2019 [1]. Chronic inflammation, progressive emphysema, and pulmonary hyperinflation lead to an increase in the afterload on the right ventricle (RV) in patients with COPD due to an increase in pulmonary vascular resistance and a moderate increase in systolic pressure in the pulmonary

artery (PA), which over time causes structural changes in the right chambers of the heart and right ventricular failure [1,2].

The first key provision of chronic obstructive pulmonary disease (COPD) is a disease characterized by significant extrapulmonary manifestations that can further aggravate the course of the disease in individual patients [4,5]. According to the results of a large study in patients

hospitalized for exacerbation of COPD, the prevalence of comorbidity with arterial hypertension (AH) is 65.6% [4,5].

Aim: To study the main echocardiographic parameters in patients with chronic cerebral ischemia depending on the presence of concomitant chronic obstructive pulmonary disease.

METHODS

Over a period of 3 years, patients were selected: 1) patients with CCI stage II with concomitant COPD (main group - MG); 2) patients with CCI stage II without COPD (comparison group - CG). The control group (CG) included 20 patients, 10 men and 10 women, average age 63.1±6.4 years (Table 1).

The MG comprised 57 patients (47.5%) and the CG comprised 63 patients (52.5%). As can be seen from Table 1, the MG had a predominance of males - 34 (59.6%) versus females - 23 (40.4%) (p < 0.05). In the CG, there was a predominance of women - 36 (57.1%), the proportion of men was

42.9% (p < 0.05). The groups were dominated by elderly people according to WHO, 2022.

The diagnosis and stages of CIM were established according to the generally accepted criteria for the Republic after conducting thorough clinical, neurological, neuropsychological and instrumental (duplex scanning, MRI of the brain) studies (3).

The diagnosis of COPD was made on the basis of complaints (shortness of breath, cough with sputum), clinical picture of the disease, anamnestic data (presence of risk factors), results of physical and laboratory examination methods, instrumental data (measurements of airflow limitation (spirometry) - the ratio of FEV1 / FVC < 70%; post-bronchodilator value of FEV1 less than 80% of the expected) in accordance with the “Global strategy for the diagnosis, treatment and prevention of chronic obstructive pulmonary disease” (National Heart, Lung, and Blood Institute; revision 2008) and the “Respiratory Medicine Guidelines” (6).

Table.1.

Distribution of patients by groups, gender and age

Groups	gender		Age, WHO, 2022		total
			60 - 74 years old	75 - 90 years old	
MG n=57	M	abs	13	21	34
		%	38,2%	61,8%	59,6%
	F	abs	9	14	23
		%	39,1%	60,9%	40,4%
	total	abs	22	35	57
		%	38,6%	61,4%	47,5%
	M	abs	9	18	27

CG n=63		%	33,3%	66,7%	42,9%
	F	abs	12	24	36
		%	33,3%	66,7%	57,1%
	total	abs	21	42	63
%		33,3%	66,7%	52,5%	
Total n=120	M	ābc	22	39	61
		%	36,1%	63,9%	50,8%
	F	abs	21	38	59
		%	35,6%	64,4%	49,2%
	total	abs	43	77	120
		%	35,8%	64,2%	100,0%

Note: OG - main group; CG - comparison group; m - men; f - women; abs - absolute values; WHO - World Health Organization.

All patients underwent a standard clinical and neurological examination (analysis of patient complaints, life history and medical history, objective examination, including study of neurological status) and somatic examination.

Electrocardiography was performed in 3 standard and 6 chest leads with the assessment of the following parameters: signs of right heart hypertrophy, signs of left heart hypertrophy, signs of combined lesions. All patients underwent echocardiography (ECHO CG) (Vivid 9, GE Healthcare, USA). The following parameters were assessed using the apical four- and two-chamber position: sizes of the right and left atria (RA and LA), right and left ventricles (RV and LV), mean PAP, end-diastolic volume (EDV) and end-systolic volume (ESV) of the LV, ejection fraction (EF) according to Simpson, LV diastolic dysfunction parameters (LVD).

Statistical processing of the research results was

carried out using variation statistics methods using Microsoft Office Excel-2019 programs.

RESULTS

In order to identify signs of overload and/or hypertrophy of the right heart, all patients underwent such studies as ECG and ECHO-CG. On ECG, signs of hypertrophy of the left heart were detected in 54 (94.7%) patients of the MG, 48 (76.2%) patients of the CG. Signs of hypertrophy of the right heart: MG - 32 (56.1%) patients, CG - 5 (7.9%) patients, data for hypertrophy of the right and left heart - in 7 (13.2%) patients of the MG, 0 (0.0%) patients of the CG. Reliable differences were revealed among patients of the MG and CG ($p > 0.05$).

The systolic pressure in the pulmonary artery (SPPA), measured by echocardiography, averaged 42.4 ± 33.7 mm Hg. Increased systolic pressure in the pulmonary artery and hypertrophy of the right

heart were significantly more common in the MG.

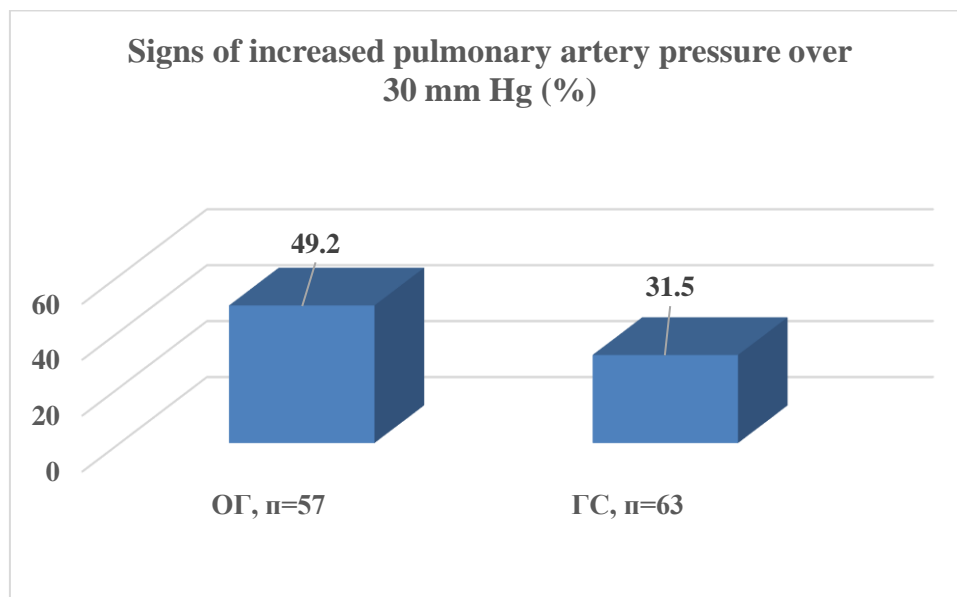


Figure 1. Percentage of identified patients with elevated pressure (more than 30 mm Hg) in the pulmonary vein

A mean pulmonary artery pressure (MPAP) of more than 20 mm Hg was considered characteristic of pulmonary hypertension. An increase in MPAP in the MG was detected in 38 people (66.7%). The MPAP level varied from 21.7 to 34. In the CG, MPAP was initially within the normal range – 17.3+1.4 mm Hg.

Echocardiography to assess primarily the right

heart and pulmonary artery pressure. The echocardiography results in the groups are presented in Table 2. As can be seen from Tables 2 and 3, statistically significant differences between the parameters were recorded when assessing the left ventricular end-systolic size, interventricular septum thickness, LV myocardial mass index, atrial areas, and some right ventricular dimensions ($p < 0.05$).

Table 2

Main echocardiographic parameters of the left heart chambers in patients with chronic myocardial infarction depending on the presence of concomitant COPD

Indicators	OG, n=57	GC, n=63	p<
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LV EDS, cm	5,1±0,49	5,2±0,78	
LV ESR, cm	3,2±0,41	3,4±0,67	0,05
T MZhp, cm	1,18±0,13	1,24±0,22	0,05
T ZS, cm	1,13±0,10	1,15±0,16	
OTM, units	0,46±0,04	0,46±0,07	
LV IMM, g/m2	109,0±17,2	117,9±20,2	0,05
LVEF according to Simpson, %	60,2±4,5	55,7±14,9	
S LP, cm2	15,5±3,1	19,5±5,05	0,05

As mentioned earlier, one of the objectives of the study was to identify predictors of myocardial damage in patients with a high risk of apnea syndrome. For this purpose, the method of stepwise regression analysis was used. According to the regression equations, the degree of risk of apnea syndrome participated as an independent predictor both in the development of pathological

remodeling of the heart and in the processes of diastolic dysfunction of the right ventricle.

The contribution of dynamic obstruction of the upper respiratory tract during sleep to the process of pathological remodeling was also indirect, through the development of nocturnal systolic hypertension and changes in the morning dynamics of blood pressure.

Table 3

Main echocardiographic parameters of the right heart chambers in patients with chronic myocardial infarction depending on the presence of concomitant COPD

Indicators	MG , n=57	CG, n=63	p<
PJ-lax, cm	2,9±0,27	3,1±0,32	0,05
PJ-sax, cm	2,5±0,28	2,5±0,43	
PJ-diam.base, cm	3,8±0,37	4,1±0,71	0,05
S PP, cm2	16,5±4,6	18,9±5,7	0,05
FI-S PJ,%	47,4±12,8	51,3±9,5	
TAPSE, cm	2,3±0,54	2,1±0,5	
LA, cm	2,1±0,19	2,1±0,18	
Average pressure in the pulmonary artery, mm Hg.	28,4±4,74	29,5±5,98	0,05

CONCLUSION

In patients with OH, a slight relative dilatation of the RV and RA, diastolic dysfunction of the LV, a decrease in Sm of the fibrous ring of the mitral and tricuspid valves is detected; diastolic dysfunction of the RV, RV hypertrophy is formed. According to the regression equations, the degree of risk of apnea syndrome appeared as an independent predictor in the development of pathological remodeling of the heart, and in the processes of diastolic dysfunction of the RV.

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