VARIABILITY OF ANTHROPOMETRIC, ECHOCARDIOGRAPHIC AND BIOCHEMICAL INDICES WITH COMORBIDITY PATHOLOGY – ESSENTIAL HYPERTENSION AND TYPE 2 DIABETES

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The mechanisms of development and progression of essential hypertension (EH) and concomitant type 2 diabetes (DM2) still remain not completely studied, so the comprehensive evaluation of the contribution of various indicators to the formation of this comorbidity have scientific interest.

The aim of this study was comprehensive assessment of the variability of anthropometric, echocardiographic and biochemical parameters in patients with EH and concomitant DM2.

Material and methods. We examined 243 patients aged 45-60 years. The main group consisted of 153 patients with EH stage II, grade 2 and DM2 moderate, subcompensated; comparison group - 70 patients with EH stage II, grade 2 without DM2. The control group consisted of 20 healthy individuals.

Methods: biochemical blood analysis, echocardiography evaluation of mitral diastolic blood flow and tissue Doppler spectral modes, reactive hyperemia, color Doppler mapping, enzyme immunoassay. Integrated data processing was carried out with the help of factor analysis using principal component.

Results and their discussion.

In the analysis there were 73 variables, based on the relationships among which there were 4 factors that together explain 52.61% of the total variability of the empirical data. In this case the first and the most powerful factor explained 33.07% of the total variability of indices (Table 1). Among the variables there were some constellations - 41.17% of the fluctuations and changes observed in the empirical data, which were caused by two latent reasons of the highest level, that is the influence of two factors (and four factors explained more than half of the variation).

Table 1

Loads of the factors

Indices	Percents of variability indices			
	33,07	8,10	6,68	4,75
	Factor 1	Factor 2	Factor 3	Factor 4
DC	0,947			
MDA	0,944			
TNF-α	0,935			
IL-6	0,933			
Blood glucose	0,892			
HbA1c	0,853			
HOMA	0,851			
Leptin	0,816			
Insulin	0,815			
IMT	0,751			
SOD	-0,909			
EDVD	-0,873			
Catalase	-0,872			
Adiponectin	-0,795			
HDL cholesterol	-0,752			
GFR	-0,623			
LV ESV		0,95		
LV ESD		0,947		
LV EDV		0,931		
LV EDD		0,923		
LV MM		0,83		
LV MMI		0,781		
LV EF		-0,698		
IL-10			0,825	
MAP			0,624	
SBP			0,619	
E/A			-0,480	
Weight				0,536
BMI				0,499
S				0,494
E/e				-0,586
E				-0,476
PAP				-0,469

Note: DC – diene conjugates, MDA – malondialdehyde, TNF-α – tumor necrosis factor-α, IL-6 – interleukin-6, HbA1c – glycosylated hemoglobin, IMT – intima-media thickness of the common carotid artery, SOD – superoxide dismutase, EDVD – endothelium-dependent vasodilatation, HDL cholesterol – high-density lipoprotein cholesterol, GFR – glomerular filtration rate, LV ESV – left ventricle end-systolic volume, LV ESD – left ventricle end-systolic diameter, LV EDV – left ventricle end-diastolic volume, LV EDD – left ventricle end-diastolic diameter, LV MM – left ventricle myocardial mass, LV MMI – left ventricle myocardial mass index, LV EF – left ventricle ejection fraction, IL-10 – interleukin-10, MAP – mean arterial pressure, SBP – systolic blood pressure, E/A – ratio of the maximum velocity of early and late left ventricle filling, BMI – body mass index, E/e – ratio of peak e and E on the mitral valve in the spectral and tissue Doppler, E – early filling of the left ventricle in spectral Doppler mode, PAP – average pulmonary artery pressure on Kitabatake.

The highest load of factor 1 were at indicators DC, MDA, TNF-α, IL-6, blood glucose and insulin, HbA1c, HOMA, leptin, IMT, while at the negative pole of this factor were SOD, catalase, EDVD, adiponectin, HDL cholesterol, GFR.

At the next stage we investigated intensity of factors in groups of patients and reliability of differences in group factor estimates (Table 2). Including the variables for Factor 1, it was found that the patients with EH and contaminant DM2 had metabolic disorders with severe endothelial dysfunction, which significantly differed the main group from the group of control and comparison ($p<0,001$).

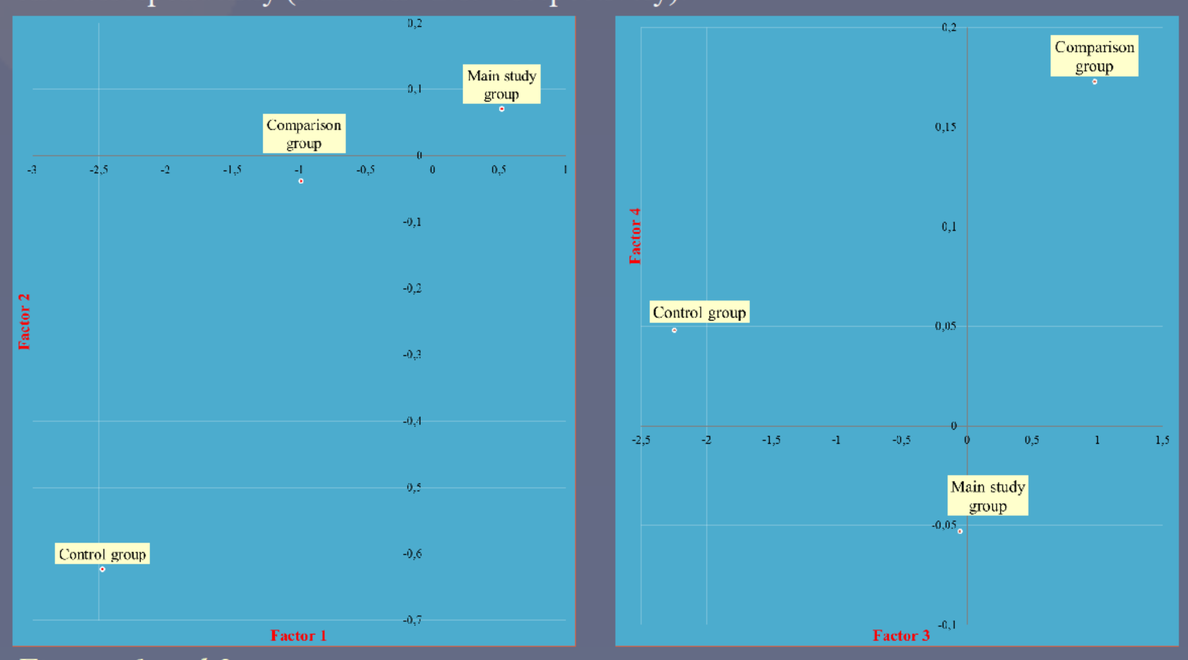
Analysis of the second important Factor 2 showed that the patients with EH with and without DM2 had changes in LV geometry that reliably differed the main group and the comparison group from the control one.

Table 2

Averaged factor estimates and differences between the study groups on factors

Groups	Factors	Averaged factor estimates	Couples comparison groups	Significant differences between group factor estimates	Distances between groups
Main study group	Factor 1	0,517 ± 0,025	Main study group – Comparison group	Factor 1, p<0,001	1,507
	Factor 2	0,071 ± 0,062		Factor 2, p>0,05	
	Factor 3	-0,057 ± 0,040		Factor 3, p<0,001	1,059
	Factor 4	-0,053 ± 0,062		Factor 4, p<0,05	
Comparison group	Factor 1	-0,986 ± 0,039	Comparison group – Control group	Factor 1, p<0,001	1,601
	Factor 2	-0,038 ± 0,061		Factor 2, p<0,001	
	Factor 3	0,978 ± 0,059		Factor 3, p<0,001	3,229
	Factor 4	0,173 ± 0,071		Factor 4, p>0,05	
Control group	Factor 1	-2,476 ± 0,037	Main study group – Control group	Factor 1, p<0,001	3,072
	Factor 2	-0,623 ± 0,083		Factor 2, p<0,001	
	Factor 3	-2,249 ± 0,070		Factor 3, p<0,001	2,194
	Factor 4	0,048 ± 0,077		Factor 4, p>0,05	

Figures 1 and 2 show the groups in coordinates «Factor 1 - Factor 2» and «Factor 3 - Factor 4» respectively. Distances between the groups showed which groups and which factors differed the most from each other according to all the investigated parameters (the more the distances between the groups, the more pronounced differences the have). The main group differed the most from the control and comparison groups in the coordinate system «Factor 1 - Factor 2», the differences related to Factor 1 were more considerable. The impact of Factor 3 with the patients with EH is shown by the more considerable distance from the comparison group to the control group in the coordinate system «Factor 3 - Factor 4» compared with the distance of the main group the control one correspondently (3.229 and 2.194 respectively).



Figures 1 and 2

The group accommodation in the coordinate system «Factor 1 – Factor 2» and «Factor 3 – Factor 4» respectively

Conclusions

1. We discovered 4 main factors, the general action of which explained 52.61% of variability indices in comorbid pathology - EH and DM2.
2. Factor assessment of the most powerful Factor 1 with high significance made the studied groups of patients differ from each other.

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