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The State of the Sympatho-Adrenal System in Patients with Ischemic Heart Disease in Combination with Chronic Obstructive Pulmonary Disease

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Abstract The article presents a comparative analysis of the indicators of catecholamines (CA) - adrenaline, norepinephrine and dopamine, the metabolite – vanillylmindal acid (IUD) in daily urine, as well as malonic dealdehyde (MDA) and the enzyme oxidative deamination of KA - monoamine oxidase (MAO) in serum in patients with coronary heart disease and coronary heart disease in combination with chronic obstructive pulmonary disease. The results showed significant violations of the sympathoadrenal system function, namely: a decrease in the level of adrenaline, an increase in the level of norepinephrine and dopamine, which indicates a violation of the activity of the sympathoadrenal system in this category of patients. In IHD, as well as in combination with IHD and COPD, there is a significant decrease in the activity of monoamine oxidase relative to the control group, which indicates a change in its catalytic properties.

Keywords Sympatho-adrenal system, Catecholamines, Ischemic heart disease, Chronic obstructive pulmonary disease

1. Introduction

Cardiovascular pathology continues to be one of the most important problems of humanity, occupying a leading position in countries with high and average living standards, not only in terms of morbidity, but also in terms of mortality [1]. The widespread prevalence of cardiovascular diseases (CVD) is a problem not only for medicine, but also for society as a whole, with the frequent development of severe complications leading to disability of people of working age, as well as premature death [4]. Ischemic heart disease (IHD) occupies a predominant share in the structure of CVD, according to various authors, IHD, as a cause of death, accounts for 42 to 61% of the total number of deaths in economically developed countries. This problem is also relevant in Uzbekistan. According to the results of WHO research, the Republic of Uzbekistan, like many other countries of the world, belongs to countries with a high risk of developing CVD. Uzbekistan has entered the top five leading countries in terms of mortality from cardiovascular diseases. According to the latest data published by World of Statistics on Twitter, in 2023, 61% of deaths in Uzbekistan are associated with diseases of the circulatory system [5].

Over the last decade, there has been a tendency to increase the number of patients with comorbidity of ischemic heart disease and COPD. This is due to the common risk factors of these diseases. Persistent inflammation is one of the leading mechanisms of atherogenesis and CVD in COPD. The combination of coronary heart disease and COPD, according to various studies, ranges from 10% to 62.8%, in the elderly up to 78% [2].

Ischemic heart disease and COPD are often combined in one patient. Chen J. et al. After conducting a large-scale epidemiological study involving 201,752 patients with coronary heart disease, we obtained data indicating that COPD occurs in such patients in 21% [3].

Recent studies have shown that in order to understand the pathogenesis of coronary heart disease, further study of circulatory regulation systems is necessary, in particular the sympathetic adrenal system (SAS), the function of which is assessed by the excretion of catecholamines, metabolic products of biogenic amines and enzymes involved in their metabolism [6].

Purpose of the study:

To study the state of the sympathoadrenal system in patients with ischemic heart disease in combination with chronic obstructive pulmonary disease.

2. Material and Methods

The object of the study was 58 patients, of whom 29 were diagnosed with coronary heart disease and 29 patients with a

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combination of ischemic heart disease and COPD, 20 healthy volunteers were taken as a control group. All participants had written consent to participate in the study. The content of catecholamines - adrenaline, norepinephrine and dopamine, the metabolite – vanillylmindal acid (VMA) in daily urine, as well as malonic dealdehyde (MDA) and the enzyme oxidative deamination of KA - monoamine oxidase (MAO) in blood serum were determined in all patients. The indicators were determined by the ELISA method using standard kits manufactured by Demeditec Diagnostics GmbH (Germany) on the Mindray MR-96 ELISA analyzer (China).

Statistical data processing was performed using the Microsoft Excel – 10 software package with the calculation of the average values (M) of their arithmetic mean errors (m), as well as the confidence coefficient of the difference between the Student's compared values (t).

3. The Results and Discussion

A comparative analysis of the results obtained by the studied groups showed that in patients with coronary heart disease, relative to patients with a combination of coronary heart disease and COPD, the content of vanillylmandelic acid (VMA) in daily urine was significantly ($p<0.05$) lower by 43.3% (Table 1). Relative to the control group, the indicators of both studied groups of patients were statistically significantly lower ($p<0.05$) by 196.7% and 107.0%, respectively, groups 1 and 2.

Table 1. The content of catecholamines in daily urine, MAO A and MDA in the blood serum of the examined groups of patients with coronary heart disease and In combination with IHD and COPD

Groups of surveyed	URINE				BLOOD	
	VMA ng/ml	DA ng/ml	Adrenaline ng/ml	Noradrenaline ng/ml	MDA ng/ml	MAO ng/ml
IHD group 1 (n=29)	3,0±0,4	30,1±3,3	8,3±1,5	20,2±0,6	338,3±75,96	2,9±0,24
Group 2 CHD+COPD (n= 29)	4,3±0,3	37,5±3,13	7,9±0,5	21,3±0,4	292,3±75,2	2,4±0,12
Group 3 healthy (n=20)	8,9±1,8	15,2±0,73	20,1±2,9	18,7±0,5	358,3±104,1	3,7±0,15
P	1-2 <0,05 1-3 <0,01 2-3 <0,05	1-2 >0,05 1-3< 0,001 2-3 <0,001	1-2 >0,05 1-3< 0,001 2-3 <0,001	1-2 >0,05 1-3 >0,05 2-3 <0,001	1-2 >0,05 1-3 >0,05 2-3 >0,05	1-2 >0,05 1-3< 0,05 2-3 <0,001

Dophamine levels in urine were statistically unreliably lower in patients with IHD compared with patients with IHD in combination with COPD ($p>0.05$), and significantly higher in comparison with healthy patients ($p<0,001$). Also, the level of dopamine in patients with IHD in combination with COPD was statistically significantly higher than in healthy subjects.

Urine epinephrine levels in patients with IHD and IHD in combination with COPD were statistically significantly lower than in healthy individuals ($p<0.001$), but their difference between each other was unreliable ($p>0.05$).

However, norepinephrine levels, on the contrary, in patient groups were slightly higher than in the control group (healthy individuals), but the differences were significant only between patients with IHD in combination with COPD and healthy people ($p<0.001$).

The average monoamine oxidase (MAO) index in the group of patients with coronary heart disease was unreliably higher than the average in the group of patients with a combination of IHD and COPD, but both indicators were significantly less than the indicator of the control group (Table).

According to the MDA indicators, the same pattern is noted, i.e. in patients with only IHD, the indicator is unreliably higher than in patients with IHD in combination with COPD. Both indicators were below the level of healthy individuals, and the differences were unreliable.

4. Conclusions

A comprehensive examination of patients with IHD in combination with COPD showed significant dysfunction of the sympatho-adrenal system, namely: a decrease in adrenaline levels, an increase in norepinephrine and dopamine levels, which indicates a violation of the activity of the sympatho -adrenal system in this category of patients. In IHD, as well as in combination with IHD and COPD, there is a significant decrease in the activity of monoamine oxidase relative to the control group, which indicates a change in its catalytic properties.

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