

---

## The Functional Significance of Acyl Hydroperoxides for the Heart

**Kotova TV\* and Grishan MA**

Russian State Social University, Moscow, Russia

\***Corresponding author:** Kotova Tatyana Vladimirovna, Russian State Social University, Moscow, Russia, Tel: +79102732263; E-mail: [ilmedv1@yandex.ru](mailto:ilmedv1@yandex.ru)

**Received:** November 23, 2019; **Accepted:** December 02, 2019; **Published:** December 10, 2019

### Abstract

It was found that an important risk factor for recurrent thrombosis, coronary heart disease and cerebrovascular pathology is the level of acyl hydroperoxides in the blood. An analysis was made of the level of acyl hydroperoxides in patients with coronary heart disease with episodes of painless myocardial ischemia, as well as its correction with B vitamins. 84 patients with coronary heart disease with functional angina I-III were examined. It was found that a combination of a high level of acyl hydroperoxides and frequent episodes of painless myocardial ischemia is recorded mainly in patients with a high functional class of angina pectoris. The intake of B vitamins can significantly reduce the concentration of acyl hydroperoxides in the blood plasma and the frequency of episodes of painless myocardial ischemia.

**Keywords:** Acyl hydroperoxides; Cardiology; Coronary heart disease; Angina pectoris; Painless ischemia

### Introduction

In recent years, the pathology of the cardiovascular system occupies a leading position in the morbidity and mortality of the population worldwide [1]. Coronary heart disease has the status of the leading cause of death in most developed countries and accounts for about 30% of total mortality, with no tendency to decrease this indicator [2]. Moreover, back in 2001, cardiovascular diseases claimed the lives of about 16 million people, that is, a third of global world mortality, by 2025 it is predicted that this figure will be 25 million, and in almost half of cases it will be caused by coronary heart disease [3,4].

In this regard, the search for new risk factors continues, the identification of which would allow to influence the mortality rate from cardiological causes. Today there is no doubt that inflammation factors and procoagulants circulating in the blood play an important role in the pathogenesis of vascular lesions and atherosclerosis [5,6]. It has been established that an increase in the level of acyl hydroperoxides is an important risk factor for recurrent thrombosis, coronary heart disease, and cerebrovascular pathology [7,8].

The high level of acyl hydroperoxides negatively affects endothelial and smooth muscle cells of blood vessels, platelets, blood lipids, nitric oxide and coagulation factors. In addition, they stimulate atherosclerosis, disrupt vasomotor function and anticoagulant properties of endothelium [8,9].

For patients with coronary heart disease, regardless of the clinical form, elevated plasma acyl hydroperoxides and episodes of painless myocardial ischemia are very characteristic [10,11]. According to modern concepts, the phenomenon of painless myocardial ischemia is found in 2-5% of the healthy population, in 30% of patients with post-infarction atherosclerosis, and 40-100% of patients with stable and unstable angina [12]. The proportion of episodes of painless myocardial ischemia reaches 75-89% of the total number of cases of myocardial ischemia in these patients. The detection of painless myocardial ischemia in combination with other high-risk criteria in a patient with coronary heart disease and confirmed angina pectoris is an indication for surgical treatment, since it significantly increases the likelihood of fatal cardiac complications in the near future [13].

Along with a high level of acyl hydroperoxides, the presence of painless myocardial ischemia is now regarded as one of the risk factors for the development of complications of coronary heart disease, including myocardial infarction and prognostically unfavorable heart rhythm disturbances [14]. It is believed that a combination of an excess of acyl hydroperoxides and episodes of painless myocardial ischemia worsens the course of coronary heart disease. A relationship was suggested between the level of homocysteine in blood plasma in patients with coronary heart disease and the frequency of occurrence of episodes of painless myocardial ischemia due to the presence of moments in their pathogenesis and the point of application that damages the effects of acyl hydroperoxides [15].

It is believed that metabolic elimination of excess acyl hydroperoxides is possible with the help of vitamins. When prescribing vitamins, the initially elevated level of lipid peroxidation products is weakened [16].

The aim of the study was to analyze the level of acyl hydroperoxides in patients with coronary heart disease with episodes of painless myocardial ischemia and its correction with a combination of vitamins B<sub>1</sub>, B<sub>6</sub> and B<sub>12</sub>.

## **Materials and Methods**

84 patients (62 people-the main group and 22-the control group) who had a diagnosis of coronary heart disease with angina pectoris I-III functional class were examined in the clinic of the Russian State Social University. The average age of the patients was  $53.8 \pm 1.45$  years, of which 58 were men and 26 women. The study did not include patients with acute myocardial infarction, valve defects, and chronic heart failure stage III (according to the classification of Strazhesko-Vasilenko), cardiomyopathy and endocrine pathology, with any kidney pathology and oncology.

To study the frequency and characteristics of painless myocardial ischemia, electrocardiography was used according to the standard method, two-dimensional echocardiography, bicycle ergometry, electrocardiography with dosed physical activity after the withdrawal of antianginal therapy, except nitroglycerin, which was used in case of an angina attack.

All patients with coronary heart disease were determined the concentration of homocysteine in plasma on the first and on the fourteenth day of observation. Blood sampling was carried out on an empty stomach after 12-hour fasting from a cubital vein in an amount of 10 ml. For quantitative determination of the level of acyl hydroperoxides in blood plasma, the standard method was used [17].

In addition to standard antianginal therapy, patients additionally received B vitamins: B<sub>1</sub> at a dose of 150 mg/day, B<sub>6</sub>-150 mg/day and B<sub>12</sub>-3 mg/day.

The effectiveness of treatment was evaluated by re-determining the concentration of acyl hydroperoxides in blood plasma on the 14th day, as well as the frequency and intensity of angina attacks and exercise tolerance.

Statistical processing of the data obtained in the studies was carried out using variation statistics based on the program Statistica 5.0 for Windows, including the determination of t-student criterion and correlation analysis. Differences starting from  $p < 0.05$  were considered statistically significant.

## Results

For the convenience of comparative characteristics of patients with coronary heart disease of the main group, they were divided into 3 groups, depending on the functional class of angina pectoris. The first group (n=20) included patients with the I functional class, the second group (n=21)-the patients with the II functional class and the 3rd group (n=21) were the patients with the III functional class. Patients of group 1 showed a milder course of coronary heart disease, fewer complications than in groups 2-3. The presence of postinfarction cardiosclerosis in the first group was noted in 11.5% of cases, and episodes of painless myocardial ischemia in 11.7% of cases; in patients of the 2nd group, postinfarction cardiosclerosis was in 32.6% of cases, episodes of painless myocardial ischemia in 38.4%, in patients of group 3 postinfarction cardiosclerosis was recorded in 69.6% of cases, and in 72.3% - episodes of painless myocardial ischemia. When analyzing the level of acyl hydroperoxides in patients with coronary heart disease, it was taken into account in combination with concomitant pathology, taking into account previous myocardial infarction. Thus, the highest concentration of acylhydroperoxides was observed in patients with coronary heart disease with post-infarction cardiosclerosis and averaged  $1.92 \pm 0.34$  D<sub>233</sub>/1 ml compared with patients with coronary heart disease without complications -  $1.80 \pm 0.46$  D<sub>233</sub>/1 ml ( $p < 0.05$ ). Patients with coronary heart disease and also having hypertension- $1.74 \pm 0.39$  D<sub>233</sub>/1 ml  $\mu\text{mol/l}$  compared with patients without arterial hypertension-were distinguished by a rather high level of acyl hydroperoxides. With a combination of coronary heart disease with post-infarction cardiosclerosis and hypertension, the level of acyl hydroperoxide remained elevated -  $1.89 \pm 0.44$  D<sub>233</sub>/1 ml.

Among patients included in group 2 and 3, the highest percentage of concomitant pathologies, such as hypertension, was noted - 31.9% and 55.6%, respectively.

Painless myocardial ischemia was diagnosed in 28 patients (33.3%) of the total number examined with coronary heart disease in the form of stable angina pectoris of functional class III, with a history of post-infarction cardiosclerosis in 30 (35.7%) cases (Table 1).

**Table 1:** The level of acyl hydroperoxides in the plasma of patients with coronary heart disease while taking vitamins of group B.

Patient groups	Homocysteine level, D <sub>233</sub> /1 мЛ, M ± m		p
	for 1 day	for 14 day	
1 group (n=20)	1.69 ± 0.35	9.1 ± 0.8	<0.05
2 group (n=21)	1.86 ± 0.37	13.1 ± 0.7	<0.05
3 group (n=21)	2.08 ± 0.42	15.0 ± 1.2	<0.05
Control group (n=22)	1.32 ± 0.24	17.2 ± 0.8	

The duration and frequency of episodes of painless myocardial ischemia directly depended on the severity of the course of coronary pathology and occurs in patients with coronary heart disease with a high functional class of stable angina pectoris, that is, in the 2-3 group, as well as in people who have suffered myocardial infarction. After myocardial infarction, 44% of patients

with coronary heart disease who had had angina attacks before, ceased to feel pain typical of angina pectoris, therefore, the study of the frequency of detection of painless myocardial ischemia in these patients is of no small importance. When conducting physical exercise tests in patients with coronary heart disease in the late post-infarction period, despite the absence of angina attacks in most patients, almost 45.2% of them revealed episodes of painless myocardial ischemia.

When analyzing the level of acyl hydroperoxides in patients with coronary heart disease, a tendency was revealed to significantly increase their level as the functional class of angina pectoris increased. So, in patients of the 1st group the average level of acylhydroperoxides was  $1.69 \pm 0.35$  D<sub>233</sub>/1 ml, in the 2nd group their concentration reached  $1.86 \pm 0.37$  D<sub>233</sub>/1ml, in the 3rd group  $2.08 \pm 0.42$  D<sub>233</sub>/1 ml ( $p < 0.05$ ). That is, in patients with tension angina of functional class III, the concentration of acyl hydroperoxides was higher than in functional class I by 63.8%. When re-determining the concentration of acyl hydroperoxides after taking B vitamins, a significant decrease in the level of acyl hydroperoxides was observed ( $p < 0.05$ ). So, its average level in group 1 after 14 days decreased to  $1.42 \pm 0.26$  D<sub>233</sub>/ml. In group 2, after 14 days, it decreased to  $1.49 \pm 0.41$  D<sub>233</sub>/1 ml, and in group 3 to  $1.70 \pm 0.38$  D<sub>233</sub>/1 ml ( $p < 0.05$ ). In the control group, the level of acyl hydroperoxides did not experience dynamics (Table 1).

## Discussion

The results obtained indicate that with the additional intake of vitamins B<sub>1</sub>, B<sub>6</sub> and B<sub>12</sub> in combination with antianginal therapy, the level of plasma acyl hydroperoxides in patients with coronary heart disease significantly decreases.

Against the background of a decrease in the level of acyl hydroperoxides, the quality of life improved in patients by reducing the number of angina attacks and thereby reducing the use of nitroglycerin per week, compared with the control group. So, in the 2nd group, the number of nitroglycerin tablets consumed by patients after 14 days decreased by 25.8%, in the 3rd group this amounted to 36.1%. In the control group, the dynamics of nitroglycerin consumption were not detected ( $p < 0.05$ ). Also, against the background of the treatment, all patients noted an improvement in overall health, a decrease in the frequency and intensity of angina attacks, as well as increased tolerance to physical activity. In this regard, it is necessary to recognize the need for early diagnosis of painless myocardial ischemia and correction in such patients of the level of acyl hydroperoxides. This will help slow the progression of angina pectoris and reduce the number and duration of episodes of painless myocardial ischemia.

## Conclusion

The level of plasma acyl hydroperoxides is directly proportional to the functional class of angina pectoris. The higher the level of acyl hydroperoxides, the harder the clinical manifestations of stable exertional angina. An additional intake of B vitamins statistically significantly reduces the level of acylhydroperoxides in blood plasma in most patients. This is accompanied by a decrease in the number and duration of episodes of painless myocardial ischemia. There is reason to hope that a decrease in acyl hydroperoxides will inhibit the progression of coronary heart disease and lower the functional class of angina pectoris.

## REFERENCES

1. Simonenko VB, Medvedev IN, Kumova TA. Losartan for correction of thrombocyte activity in patients suffering from arterial hypertension with metabolic syndrome. *Klinicheskaja Meditsina*. 2008; 86: 38-41.
2. Medvdev IN, Skoryatina IA, Zavalishina SYu. Aggregation ability of the main blood cells in arterial hypertension and dyslipidemia patients on rosuvastatin and non-drug treatments. *Cardiovas Therap Prevent*. 2016; 15: 4-10.

3. Lonn E. Homocysteine-lowering B vitamin therapy in cardiovascular prevention-Wrong again? JAMA. 2008; 299: 2086-2087.
4. Medvedev IN, Skoryatina IA. The aggregation capacity of neutrophils in patients with arterial hypertension and dyslipidemia treated with fluvastatin. Klinicheskaia Meditsina. 2015; 93: 66-70.
5. Medvedev IN, Skoryatina IA. Pravastatin in correction of vessel wall antiplatelet control over the blood cells in patients with arterial hypertension and dyslipidemia. Cardiovas Therap Prevent. 2014; 13: 18-22.
6. Medvedev IN, Skoryatina IA. Erythrocyte aggregation in patients with arterial hypertension and dyslipidemia treated with pravastatin. Klinicheskaia Meditsina. 2014; 92: 34-38.
7. Albert CM. Effect of folic acid and B vitamins on risk of cardiovascular events and total mortality among women at high risk for cardiovascular disease: a randomized trial. JAMA. 2008; 299: 2027-2036.
8. Skoryatina IA, Medvedev IN, Zavalishina SYu. Antiplatelet control of vessels over the main blood cells in hypertensives with dyslipidemia in complex therapy. Cardiovas Therap Prevent. 2017; 16: 8-14.
9. Medvedev IN, Skoryatina IA. Aggregation properties of blood cells and vascular control over them in patients with arterial hypertension and dyslipidemia. Russian J Cardiol. 2015; 4: 18-22.
10. Simonenko VB, Medvedev IN, Kumova TA. Effect of eprosartan on thrombocytes aggregative capacity in patients with arterial hypertension and metabolic syndrome. Klinicheskaia Meditsina. 2008; 86: 19-21.
11. Shmeleva SV, Yunusov FA, Morozov SY, et al. Modern approaches to prevention and correction of the attorney syndrome at sportsmen. Prensa Med Argent. 2018; 104: 2.
12. Morozova EV, Shmeleva SV, Rysakova OG, et al. Psychological rehabilitation of disabled people due to diseases of the musculoskeletal system and connective tissue. Prensa Med Argent. 2018; 104: 2.
13. Skoryatina IA, Zavalishina SYu. Impact of experimental development of arterial hypertension and dyslipidemia on intravascular activity of rat's platelets. Annual Res Rev Biol. 2017; 14: 1-9.
14. Medvedev IN, Gamolina OV. Lisinopril effects on platelet activity in patients with arterial hypertension and impaired glucose tolerance. Russian J Cardiol. 2008; 3: 45-48.
15. Bikbulatova AA. Indices' dynamics of microcirculatory processes in women with habitual miscarriage of pregnancy daily wearing prophylactic trousers in the course of the third pregnancy term. Prensa Med Argent. 2019; 105: 1.
16. Medvedev IN, Kumova TA, Gamolina OV. Renin-angiotensin system role in arterial hypertension development. Russian J Cardiol. 2009; 4: 82-84.
17. House AA. Effect of B-vitamin on progression of diabetic nephropathy: A controlled trial. JAMA. 2010; 303: 1603-1609.
18. Gavrillov VB, Mishkorudnaya MI. Spectrophotometric determination of the content of lipid hydroperoxides in blood plasma. Laboratory Work. 1983; 3: 33-36.