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Relationship between the level of blood plasma amino acids with daily amount of group ventricular extrasystoles and the duration of pain or painless myocardial ischemia in patients with stable and unstable angina

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It is now known that the human body suffering from coronary heart disease is trying to adapt to new working conditions through biochemical rearrangements, one of which is to increase the involvement of amino acids in cardiomyocyte metabolism. Amino acids are metabolized in the myocardium under normal conditions, myocardial ischemia leads to a major restructuring of biochemical reactions, which increases the use of amino acids as metabolites. It is proved that myocardial ischemia, painless myocardial ischemia, and group ventricular extrasystoles are prognostic indicators of the adverse course of ischemic heart disease. According to the results of the study, in patients with stable (SA) or unstable angina (UA), the reliable correlations between the frequency of group ventricular extrasystoles and painless or painful myocardial ischemia with the levels of arginine, the amount of sulfur-containing amino acids and amino acids with branched lateral chain are formed. This indicates the pathogenetic role of the imbalance of the amino acid spectrum of blood plasma in the development of atherosclerosis, destabilization of coronary circulation, and the emergence of cardiac arrhythmia.

Ключові слова: *stable angina, unstable angina, amino acid, correlation.*

Introduction. Currently, cardioprotective properties of amino acids (AAs) in various cardiovascular pathologies are well known [1, 2]. However, the mechanisms of influence of AAs on the energy metabolism and other possible pathways of the influence that provide a better adaptation of heart to hypoxia remains unclear. It is revealed that the human body suffering from coronary heart disease (CHD) is trying to adapt to new working conditions through biochemical rearrangements, one of which is to increase the involvement of AAs in cardiomyocyte metabolism. AAs are metabolized in myocardium under normal conditions, but, in fact, myocardial ischemia (MI) leads to a significant restructuring of biochemical reactions, which increases the use of

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AAs as metabolites [3–5]. The prognostic significance of MI, painless myocardial ischemia (PMI), and group ventricular extrasystole (GVE) is known [6, 7].

Purpose of the study: the correlation analysis between MI, PMI, and GVE, and arginine content, sum of sulfur-containing AAs, and the sum of branched-chain AAs in patients with SA and UA, arginine content, sum of sulfur-containing AA and branched-chain AAs SA and UA will be performed.

Material and methods of research. 66 patients with stable angina (SA) aged 58-69 years (mean age 64.0 years ± 6.4 years) and 64 patients with unstable angina (UA) aged 62-71 years (mean age 65.0 years ± 6.7 years).

To record cardiac arrhythmia and myocardial ischemic changes, all subjects underwent the Holter monitoring of the electrocardiogram (HM ECG) within the first 1-2 days of the hospital stay and 3 weeks after a treatment. ECG registration was performed for 24 h on an SD / MMC flash card followed by a computer processing of the received information promptly. For this purpose, the system of Holter monitoring of CardioSensK made by the company "KhAI-MEDIKA" (Kharkiv, Ukraine) is used. Recording was performed using a 5-channel ECG recorder.

The determination of the amino acid spectrum of blood plasma of patients was performed by ion-exchange liquid-column chromatography on an automatic T-339 amino acid analyzer manufactured by "Microtech" (Czech Republic, Prague) at the O.V. Palladin Institute of Biochemistry, National Academy of Medical Sciences of Ukraine.

Table 1. **Relationship of group ventricular extrasystole, pain and painless myocardial ischemia with arginine level, sum of sulfur-containing amino acids and amino acids with branched lateral chain in patients with stable angina**

Indicators ECG	Level of amino acids		
	Arginine	Sum of sulfur-containing amino acids	Amount of amino acids with a branched lateral chain
GVE	+0.27*	+0.17	–0.09
MI	–0.06	+0.29*	+0.23*
PMI	+0.37*	–0.63*	+0.29*

* Reliable correlation links.

Table 2. **Relationship of group ventricular extrasystole, pain and painless myocardial ischemia with arginine level, sum of sulfur-containing amino acids and amino acids with branched lateral chain in patients with unstable angina**

Indicators ECG	Level of amino acids		
	Arginine	Sum of sulfur-containing amino acids	Amount of amino acids with a branched lateral chain
GVE	–0.43*	+0.18	+0.32*
MI	–0.38*	+0.29*	+0.19
PMI	+0.33*	–0.65*	+0.17

* Reliable correlation links.

Table 3. **Level of branched-chain amino acids in blood plasmain patients with SA related to the development of MI and PMI**

Indicator	$M \pm m$	Σ	Me
AAs with a branched lateral chain, μmol/100 ml	28.28 ± 1.6	3.56	28.89

Table 4. **The level of sulfur-containing amino acids, branched-chain amino acids in the blood plasma of patients with UA related to the development of MI, PMI and the development of ventricular extrasystolic arrhythmia**

Me	$M \pm m$	Σ	Me
AAs with a branched lateral chain, μmol/100 ml	34.92 ± 1.6	7.44	30.46
Sulfur-containing Aas, μmol/100 ml	13.63 ± 0.9	2.19	13.54

To establish a correlation relationship, the Pearson correlation coefficient (r) was determined, and the linear regression analysis was performed to determine the standardized coefficient β.

Results of the study and discussion. In patients with SA, the direct correlation relationships of the mean strength between the GVE frequency, PMI, and the level of arginine in blood plasma are determined, respectively: $r = +0.27$ ($P < 0.05$) and $r = +0.37$ ($P < 0, 05$). An increase in the duration of MI is accompanied by an increase in the amount of sulfur-containing AAs in blood plasma: $r = +0.29$ ($P < 0.05$), and an increase in the duration of PMI is associated with a decrease in the level of these AAs: $r = -0.63$ ($P < 0.05$)). An increase in the duration of PMI and MI in patients with SA is associated with an increase in the amount of AAs with a branched lateral chain in the blood plasma, respectively: $r = +0.23$ ($P < 0.05$) and $r = +0.29$ ($P < 0.05$) (Table 1).

In patients with UA, a negative correlation between the mean force between the GVE frequency and the level of arginine in blood plasma is formed: $r = -0.43$ ($P < 0.05$) and a direct correlation with the level of the sum of AAs with branched lateral chain: $r = +0.32$ ($P < 0.05$). An increase in the duration of MI is accompanied by a decrease in the level of arginine: $r = -0.38$ ($P < 0.05$) and an increase in the amount of sulfur-containing AAs in blood plasma: $r = +0.29$ ($P < 0.05$), and an increase in the duration of PMI is associated with an increase in arginine level: $r = +0.33$ ($P < 0.05$) and a decrease in the level of sulfur-containing AAs in the blood plasma: $r = -0.65$ ($P < 0.05$) (Table 2).

For a more detailed analysis of the investigated indices (AAs), which are significantly correlated with the indicators of myocardial ischemia and cardiac arrhythmia according to the results of the ECG, additional calculations of such statistics as the standard deviation and median were performed (Tables 3 and 4).

Therefore, the results of studies demonstrated the reliable correlation between the rate of GVE, MI, and PMU in patients with SA and UA, which indicates the involvement of amino acids of the blood plasma spectrum in the development of myocardial ischemia and heart rhythm disorders in patients with overbite.

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ЗВ'ЯЗОК МІЖ РІВНЕМ АМІНОКИСЛОТ ПЛАЗМИ КРОВІ З ДОБОВОЮ КІЛЬКІСТЮ ГРУПОВИХ ШЛУНОЧКОВИХ ЕКСТРАСИСТОЛ І ТРИВАЛІСТЮ БОЛЬОВОЇ АБО БЕЗБОЛЬОВОЇ ІШЕМІЇ МІОКАРДА У ХВОРИХ НА СТАБІЛЬНУ ТА НЕСТАБІЛЬНУ СТЕНОКАРДІЮ

Відомо, що організм людини, яка страждає на ішемічну хворобу серця, намагається пристосуватися до нових умов життєдіяльності шляхом біохімічних перебудов, одна з яких – залучення більшої кількості амінокислот до метаболізму кардіоміоцитів. Амінокислоти метаболізуються в міокарді і за нормальних умов, міокардіальна ішемія призводить до значної перебудови біохімічних реакцій, внаслідок якої посилюється використання амінокислот як метаболітів. Доведено, що больова ішемія міокарда, безбольова ішемія міокарда та групова шлуночкова екстрасистолія є прогностичними показниками несприятливого перебігу ішемічної хвороби серця. За результатами дослідження, у хворих на стабільну або нестабільну стенокардію формуються достовірні кореляційні зв'язки між частотою групових шлуночкових екстрасистол, безбольової і больової ішемії міокарда з рівнем аргініну, суми сірковмісних амінокислот та амінокислот з розгалуженим бічним ланцюгом у плазмі крові. Це свідчить про патогенетичну роль дисбалансу амінокислотного спектра плазми крові в розвитку атеросклерозу, дестабілізації коронарного кровообігу та виникненні порушень серцевого ритму.

***Ключові слова**: стабільна стенокардія, нестабільна стенокардія, амінокислота, кореляційний зв'язок.*