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PLASMA LEVEL OF HIGH-SENSITIVE C-REACTIVE PROTEIN IN PATIENTS WITH ACUTE MYOCARDIAL INFARCTION AND ARTERIAL HYPERTENSION

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Abstract. Arterial hypertension is an independent predictor of acute myocardial infarction. Nowadays, plasma level of high-sensitive C-reactive protein is a marker of cardiovascular risk.

The objective of the research was to evaluate plasma level of high-sensitive C-reactive protein in patients with acute myocardial infarction and arterial hypertension depending on myocardial remodeling type.

Materials and methods. 130 patients with myocardial infarction (63 individuals with concomitant arterial hypertension and 67 individuals without it) were observed. Transthoracic echocardiogram was used. To evaluate plasma level of high-sensitive C-reactive protein the ELISA method was applied.

Results. Plasma level of high-sensitive C-reactive protein in patients with acute myocardial infarction increased by 5.11 times compared to the control group: (10.67 [5.43; 12.89]) mg/l and (2.09 [1.40; 4.60]) mg/l, respectively ($p<0.001$). In myocardial infarction and arterial hypertension, this parameter increased by 6.57 times (to (13.73 [7.05; 15.17]) mg/l) ($p<0.001$), and by 1.27 times ($p<0.05$) as compared to patients without arterial hypertension. No differences in plasma level of high-sensitive C-reactive protein were detected in patients with different types of left ventricular remodeling.

Conclusions. Acute myocardial infarction caused by high plasma level of high-sensitive C-reactive protein is severer in co-existent arterial hypertension. There are no differences in blood levels of high-sensitive C-reactive protein depending on the type of left ventricular remodeling.

Keywords: myocardial infarction; arterial hypertension; high-sensitive C-reactive protein; left ventricular remodeling.

Problem statement and analysis of the recent research

Coronary heart disease (CHD) is known to be a major cause of death and disability in developed countries [1]. Although CHD mortality has gradually declined over the last decades in western countries, it still causes about one-third of all deaths in people older than 35 years [2].

The 2016 Heart Disease and Stroke Statistics update of the American Heart Association has recently reported that in the USA, 15.5 million persons older than 20 years of age suffer from CHD [3], whilst the reported prevalence increases with age for both women and men and it has been estimated that approximately every 42 seconds, an American suffers from myocardial infarction (MI) [4].

High blood pressure is a major risk factor for MI and stroke. The American Heart Association has identified it as 1 of the 7 components of ideal cardiovascular health. Based on 2011 to 2012 data, 82.3% of children and 42.2% of adults met these criteria [3].

Nowadays, arterial hypertension (AH) affects 1 billion people worldwide and causes 7.5 million death every year [5]. The National Health and Nutrition Examination Survey (NHANES) 2009 to 2012 estimated the prevalence of hypertension (age adjusted) among US adults ≥20 years of age to be 32.6%. This equates to an estimated 80.0 million adults ≥20 years of age who have high blood pressure (38.3 million men and 41.7 million women), extrapolated to 2012 data [3].

The age-related correlation between AH and the incidence of MI and stroke was determined: 54% of cases of acute disturbances of cerebral circulation and 47% of cases of acute coronary syndrome caused by high blood pressure [6].

C-reactive protein (CRP) is a liver-derived pattern recognition molecule that increases in inflammatory states. It rapidly increases within hours after tissue injury, and it suggests that it is a part of the innate immune system and contributes to host defense. Since cardiovascular disease is at least in part an inflammatory process, CRP has been investigated in the context of arteriosclerosis and subsequent vascular disorders. Based on multiple epidemiological and intervention studies, minor

CRP elevation (high-sensitivity CRP (hs-CRP)) has been shown to be associated with future major cardiovascular risk (hs-CRP:<1 mg/L=low risk; 1-3 mg/L=intermediate risk; 3-10 mg/L=high risk; >10 mg/L=unspecific elevation) [7]. Despite the publication of guidelines on the use of hs-CRP in cardiovascular diseases risk *prediction*, there is a lack of clear consensus regarding the optimal clinical use of hs-CRP and its plasma levels in patients with MI and AH depending on cardiac muscle remodeling.

The objective of the research was to evaluate plasma level of hs-CRP in patients with acute MI and AH depending on myocardial remodeling type.

Materials and methods

130 patients with ST-elevation MI were involved in the study. There were 82 (63.07%) males and 48 (36.93%) females. The average age was (64.68±12.59) years. All the patients were divided into 2 groups: 63 persons with AH and 67 persons without AH. The control group included 30 apparently healthy individuals similar in age and sex.

Transthoracal echocardiography was performed and the types of myocardial remodeling were calculated according to the recommendations of the American Society of Echocardiography (ASE) and the European Association of Echocardiography [8].

Plasma level of hs-CRP was assayed using the hs-CRP ELISA kit (Cusabio, China).

The study was performed in accordance with the Helsinki Declaration and Good Clinical Practice Guidelines. The study was approved by the local ethics committee and written informed consent was obtained from all the patients.

Categorical variables are presented as percentages, whereas normally distributed continuous variables are presented as the mean (M) and the standard error of the mean (m) and non-normally distributed ones are presented as the median and the interquartile range (Me (IQR)). Categorical variables were compared by the χ^2 test and continuous variables were compared using the t-test or the Mann-Whitney U test. A p value of <0.05 was considered statistically significant. All tests were 2-sided. The analyses were performed using Statistica software (version 12.0).

Results and discussion

According to the results of echocardiography, in patients with MI and AH, the most prevalent remodeling type was left ventricular concentric remodeling – 24 (38.1%) persons (Table 1). Concentric hypertrophy was verified in 17 (26.9%) cases, and eccentric hypertrophy was found in 11 (17.5%) patients.

In contrast, in patients with acute MI without AH, the most prevalent type of left ventricular remodeling was eccentric hypertrophy - 37 (55.2%) patients (χ^2=19.88; p<0.01).

Left ventricular mass is known to predict risk of cardiovascular events regardless of blood pressure, other risk factors or CHD presence [9]. Some studies showed that the classification of left ventricular geometry enhanced the prediction of prognosis in patients with uncomplicated essential hypertension. The 10-year mortality rate was 1%, 6%, 10% and 24% for patients with normal, concentric remodeling, eccentric and concentric left ventricular hypertrophy, respectively [9].

Plasma level of hs-CRP in patients with acute MI increased by 5.11 times as compared to the control group: (10.67 [5.43; 12.89]) mg/l and (2.09 [1.40; 4.60]) mg/l, respectively (p<0.001). In MI and AH, this parameter increased by 6.57 times (to (13.73 [7.05; 15.17]) mg/l) (p<0.001), and by 1.27 times (p<0.05) as compared to patients without AH. No differences in plasma levels of hs-CRP were detected in patients with different types of left ventricular remodeling (Table 2).

One of small cross-sectional studies determined a strong positive correlation between serum hs-CRP and Troponin I levels (beta = 0.509, p<0.001) in patients with acute MI. The multiple linear regression showed that hs-CRP level could strongly predict serum level of Troponin I within the first 24 hours after MI (beta = 0.308, the standard error = 0.080, p<0.001). However, there was no significant correlation between the mean serum level of hs-CRP and the location of myocardial infarction, the number of segments being involved, left ventricular ejection fraction, and ST-segment elevation score [10].

The other trial which included patients with MI found that hs-CRP levels reflect the vulnerability of culprit coronary lesions and predict adverse coronary events after primary percutaneous transluminal coronary angioplasty or stenting [11]. Some investigators studied serum hs-CRP levels in 205 old women with MI; they found that hs-CRP levels increased in many patients and were independently stratified in patients with in-hospital mortality risk [11].

Conclusions

Acute MI caused by high plasma level of hs-CRP is more serious in co-existent AH. There are no differences in blood levels of hs-CRP depending on the type of left ventricular remodeling.

Prospects for further research include the study of different effects of drugs on the regression of left ventricular remodeling after MI.

Conflicts of interests: none

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Table 1. Types of left ventricular remodeling in patients with myocardial infarction

Type of remodeling	Patients without AH, n=67	Patients with AH, n=63
Normal geometry	19 (28.4%)	11 (17.5%)
Eccentric hypertrophy	37 (55.2%)	11 (17.5%)**
Concentric hypertrophy	7 (10.5%)	17 (26.9%)*
Concentric remodeling	4 (5.9%)	24 (38.1%)**

Note: the difference between values * p<0.05, ** p<0.01

Table 2. Plasma levels of high-sensitive C-reactive protein in patients with myocardial infarction and different types of left ventricular remodeling

Type of remodeling	hs-CRP, mg/l	
	Patients without AH, n=67	Patients with AH, n=63
Type of remodeling	10.13 [5.2; 11.5]	11.69 [5.63;13.51]
Eccentric hypertrophy	10.70 [5.0; 12.5]	12.65 [6.15;13.75]
Concentric hypertrophy	11.10 [5,35; 13.0]	12.73 [5.95;14.45]
Concentric remodeling	10.97 [5.3; 12.95]	12.41 [6.74;14.05]

Note: the difference between values p>0.05

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DYNAMICS OF HEART FAILURE MARKERS IN PATIENTS AFTER PAST MYOCARDIAL INFARCTION WITH THE USE OF POTASSIUM AND MAGNESIUM SALTS OF GLUCONIC ACID, EPLERENONE AND RIVAROXABAN

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Abstract. **The objective of the research** was to increase the efficiency of treatment of patients with chronic heart failure (CHF) and post-infarction cardiosclerosis by adding potassium and magnesium salts of gluconic acid, eplerenone and rivaroxaban to the background therapy taking into account the indices of growth differentiation factor 15 (GDF-15), aldosterone and galectin-3.

Materials and methods of the research. Emmunoenzymometric determination of the galectin-3, GDF-15 and aldosterone levels concentration in blood serum was conducted to achieve the stated objective. 42 patients with CHF and post-infarction cardiosclerosis after coronary artery stenting in the acute period of myocardial infarction (MI) were examined. The patients were randomized into four groups according to the peculiarities of treatment. Group I included patients with CHF and post-infarction cardiosclerosis treated with the background therapy (BT). Group II consisted of patients with CHF who were treated with BT and addition of potassium and magnesium salts of gluconic acid. Group III included patients with CHF who were prescribed eplerenone secondary to BT. Group IV consisted of patients who were treated with BT and rivaroxaban.

Results. The proposed treatment regimens were proved to be effective in reduction of GDF-15, aldosterone and galectin-3 indices in 12 months of treatment. Conducted therapy with the use of rivaroxaban secondary to BT led to more intensive decrease in GDF-15 concentration in comparison with the use of potassium and magnesium salts of gluconic acid or eplerenone on the background of BT. This index constituted (2110.21±107.4) pg/ml before the treatment in these patients and significantly decreased to (1286.75±109.6) pg/ml being significantly before the therapy. The performed treatment with the use of eplerenone secondary to BT was proved to be more effective for normalization of aldosterone and galectin-3 levels in blood serum compared to other studied treatment regimens. The average value of aldosterone changed in the treatment process by 67.24%. Thus, the average level of this index constituted (139.8±7.63) pg/ml before the treatment and was equal to (45.8±5.52) pg/ml at the end of the treatment course. The average value of galectin-3 in patients with CHF and post-infarction cardiosclerosis was noted to be (34.69±1.67) ng/ml before the treatment. It constituted (22.53±0.98) ng/ml after the end of treatment being significantly lower compared to the value before the treatment. The average value of this index changed in the course of twelve-month treatment by 35.05%. Lower risk of sudden cardiac arrest (SCA), acute coronary syndrome (ACS) and stroke was observed in the patients with CHF and post-infarction cardiosclerosis with the use of rivaroxaban secondary to BT.

Conclusions. Thus, the use of rivaroxaban combination therapy secondary to BT led to more intensive decrease in GDF-15 concentration in comparison with the use of potassium and magnesium salts of gluconic acid or eplerenone. Conducted therapy with the use of eplerenone on the background of BT was more effective for the normalization of galectin-3 and aldosterone levels in the blood compared to other studied treatment regimens.

Keywords: heart failure; growth differentiation factor 15; galectin-3; eplerenone; rivaroxaban.