FORECASTING OF RECURRENT CARDIOVASCULAR

EVENTS IN 6 MONTHS OF MONITORING OF PATIENTS

AFTER ACUTE MYOCARDIAL INFARCTION WITH

CONCOMITANT OBESITY

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Abstract. The article analyzes the dependence of blood serum vitronectin and galectin-3 levels

in patients with acute myocardial infarction (AMI) and concomitant obesity associated with the

emergence of recurrent cardiovascular events for 6 months of follow-up. Vitronectin showed the best

results for predicting repeated cardiovascular events in the form of unstable angina and/or AMI with

high specificity (96 %) and sensitivity (86.7 %) at a level >283.27 ng/ml. Also it was found that the

definition of galectin-3 level in obese patients gave an opportunity to predict a high risk of recurrent

coronary events during a 6-month follow-up period with a sensitivity of 94.4 % and a specificity of

78.9 % at a level of galectin-3 > 12.83 ng/ml.

Conclusions It was found that hyperactivity of these markers significantly impairs the

prognosis of recurrent cardiovascular events within six months after acute myocardial infarction.

Keywords: vitronectin, galectin-3, acute myocardial infarction, obesity, marker.

Introduction. For today mortality from cardiovascular disease (CVD) does not leave leading

positions in the structure of overall mortality from noninfectious diseases. According to data for the

beginning of 2017, the number of deaths from the CVD reached about 450 thousand people, among

which the majority - the working-age population [1].

Nowadays acute myocardial infarction (AMI) is the most threatening form of coronary heart

disease (CHD) [2, 3]. According to statistics, every year in the world more than 15 million of new

cases of AMI are detected, and its long-term consequences are determined in months and years. Thus,

according to the American Heart Association, during 6 years after AMI 18 % of men and 35 % of

women undergo repeated MI, 22 % of men and 46 % of women become disabled due to the

development of severe heart failure (CH), and in 30-40 % of patients there is a left ventricular

dysfunction [4].

The results of large multicentral international studies, in particular the INTERHEART study,

have shown that throughout the world, regardless of the region of residence, nine factors affect the risk

of developing AMI. These are six factors that increase the risk of developing AMI: dyslipidaemia,

smoking, arterial hypertension, abdominal obesity, psychosocial factors (stress, social isolation,

depression), diabetes mellitus and three factors of anti-rick: the use of sufficient amounts of vegetables

and fruits, the regular use of very small doses of alcohol and regular physical activity [5, 6].

It is proved that the presence of abdominal obesity accelerates the development and

progression of CVD, in particular, AMI. Synergism of the pathogenetic mechanisms underlying

obesity and cardiovascular pathology potentiates the high prevalence and severity of coronary vascular

lesions, as well as unfavorable prognosis in individuals with comorbid conditions [7, 8]. Among the

mechanisms that determine the increased risk of coronary atherothrombosis, today the processes of

hypercoagulation and reduction of fibrinolytic activity of blood are highlighted. On the other hand, the

development of acute coronary syndrome is also associated with systemic inflammation, the activity of

which is also increased in patients with concomitant obesity [9, 10].

A fundamentally important step in the examination of patients with AMI is to determine the

probable risk of cardiovascular complications in the first days of the disease. This provides an

opportunity to intensify the therapeutic strategy aimed at preventing adverse events [11]. Currently,

there is a great scientific interest in the study of new biological markers of myocardial damage, which

can be a useful tool for monitoring the efficiency of pharmacotherapy (personalized medicine), early

diagnosis of the disease, prediction of its clinical outcome and play an important role in stratification

of the risk of patients [12]. Such markers for today are vitronectin and galectin-3, the importance of

which is still insufficiently studied to predict the risk of potential adverse cardiovascular effects in

patients with a history of AMI.  
The aim of the study. To investigate the relationships between the level of serum vitronectin,

galectin-3 and the occurrence of recurrent cardiovascular events during 6 months follow-up period for patients

with Q-positive myocardial infarction, depending on the presence or absence of concomitant obesity.

The object and methods of research. During the study, 105 patients with AMI aged

64.22 ± 1.42 years who were on treatment at the intensive care unit and heart-attack department of the

Kharkiv City Clinical Hospital №27 were examined. The first group consisted of 75 patients with

concomitant obesity, the second - 30 patients with normal body weight. Patients of both groups were

comparable in age (mean age - 62.28 ± 1.23 years and 66.16 ± 1.61 years respectively, p <0.05).

Obesity I st. was detected in 39 people, obesity II st. - in 31 persons, obesity of the III st. - 5 people.

Body mass index (BMI) in the group of patients with AMI with concomitant obesity was

35.43 ± 0.52 kg / m2, whereas in the group of comparison BMI was 24.04 ± 0.56 kg / m2.

Diagnosis of AMI was verified according to criteria of the Ministry of Health of Ukraine

("Protocol on medical care for patients with ST elevation coronary syndrome (myocardial infarction

with Q). The presence of obesity was established according to the WHO classification, 1997 [13] with

BMI> 30 kg / m2, which was determined by the formula:

BMI (kg/m2) = body weight / (growth)2

(1)

Criteria for exception were acute and chronic inflammatory processes, Q-negative AMI,

diffuse connective tissue disease, oncological diseases, concomitant diseases of the thyroid gland, and

the presence of symptomatic hypertension.

The diagnosis of AMI and its complications was carried out according to clinical and laboratory-

instrumental research data based on the recommendations of the European Society of Cardiology (2016).

The level of troponin I was determined no earlier than 6 hours after the start of the pain syndrome.

Vitronectin was determined by the enzyme-linked immunosorbent assay using commercial test

systems Human Vitronectin ELISA Kit (China) on the second day of AMI. The galectin-3 was

determined using the Human Galectin-3 ELISA Kit (China) reagent kit using the immunoassay on the

second day of AMI.

The data were processed statistically with Microsoft Office Excel software: the mean

arithmetial value (М) and standard error of the mean (m) were calculated, for estimated probability

and validity of the obtained data, Student’s t-test (р) was done, the statistical significance of different

averages was determined by the F-Fisher criterion. For risk stratification modeling, stepwise logistic

regression SPSS method was used.

The research is conducted in compliance with the standards of medical ethics and the

protection of patients' rights.

Results of the research and their discussion. During the study it was found that in patients

with AMI and obesity the levels of vitronectin exceeded those in patients without obesity by 25,9 % (p

<0,05). The concentration of galectin-3 was higher by 32.4 % in patients with AMI in the presence of

concomitant obesity than in patients with isolated AMI. Anthropometric parameters analysis revealed

differences in the groups of patients being studied. Thus, BMI growth was found to be 35.7 %

(p<0.05) in patients with AMI and obesity in comparison with patients with normal body weight. The

data is presented in Table 1.

Table 1. Levels of parameters being studied in patients with AMI in the presence or absence of

concomitant obesity

Parameter

Patients with AMI

p

Obesity+

Obesity –

Vitronectin, ng/ml

460,29±40,07

340,99±20,33

<0,05

Galectin-3, ng/ml

29,30±2,02

19,8±0,67

<0,05

BMI, kg/m2

35,47±0,62

22,78±1,41

<0,05

Such way, in patients with AMI in the presence of obesity there is a hyperactivity of the

thrombosis marker of vitronectin and new diagnostic and prognostic marker galectin-3, which

demonstrated a close relationship with the development of adverse effects in patients with acute

coronary syndrome [3]. In addition, galectinemia correlates with markers of necrosis and severity of

acute heart failure, consistent with the results obtained in our study.

The next stage in the design of our study was an analysis of the 6-month follow-up period for

patients with ST elevation in the presence of concomitant obesity. It was found that 37.56 % of

patients had a history of recurrent cardiovascular (CV) events in the form of unstable angina (UA)

and/or recurrent AMI. In this sample, UA was detected at 43.18 %, and a second-time AMI - in

56.82 % of patients. In addition, the BMI level exceeded 30 kg/m2 in all patients.

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Table 2. Levels of galectin-3, vitronectin and BMI in the presence of a recurrent CV events in

patients after AMI with concomitant obesity

Parameter

Recurrent CV event (UA

and/or AMI), n=24

Without recurrent CV

event, n=51

р

1

2

Vitronectin, ng/ml

386,89 ±32,78

212,93 ± 21,13

p1 и 2 < 0,05

Galectin-3, ng/ml

24,56 ± 1,75

16,19 ±1,51

p1 и 2 < 0,05

BMI, kg/m2

34,36 ±1,09

32,11 ±1,31

p1 и 2 = 0,09

In the group of patients with recurrent CV events, the levels of galectin-3 and vitronectin were

significantly higher than that in the group without those ones within six months after the AMI with

obesity, and BMI showed a tendency to increase that did not reach the level of probability (p = 0.09).

The data is represented in table 2.

Also, the design of the study included a stage devoted to the analysis of predictive properties of

these parameters. Using ROC-analysis, predictive value of vitronectin, galectin-3 and BMI for recurrent

CV events in patients after AMI in the presence of concomitant obesity in six months has been established.

According to the ROC curve, BMI had a high predictive value due to a sensitivity of 66.7 % and a

specificity of 79.2 %, an AUC of 0.704. The data from the ROC analysis showed that with BMI > 34.13kg

/ m2, it is possible to predict CV events within 6 months after AMI in patients with concomitant obesity.

Fig. 1. Prognostic value of the body mass index in patients with acute myocardial infarction in the

context of concomitant obesity in prediction of the development of recurrent CV events during the 6-

month follow-up period.

The study found that the addition of galectin-3 on the second day of AMI in obese patients gave an

opportunity to predict a high risk of recurrent coronary events during a 6-month follow-up period with a

sensitivity of 94.4 % and a specificity of 78.9 % at a level of galectin-3> 12.83 ng / ml, the AUC was 0.83.

Fig. 2. Prognostic value of galectin – 3 in

patients with acute myocardial infarction in the

context of concomitant obesity in prediction of

the development of recurrent CV events during

the 6-month follow-up period

Fig.3. The prognostic value of vitronectin in

patients with acute myocardial infarction in the

context of concomitant obesity in prediction of

the development of recurrent CV events during

the 6-month follow-up period

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The best results for the prediction of recurrent CV events such as UA and / or AMI was

vitronectin, which had a high specificity (96 %) and sensitivity (86.7 %) at the level > 283.27 ng / ml,

AUC was 0,96

The data is represented in table 3.

Table 3. Characteristics of variables with prognostic properties regarding the occurrence of

repeated cardiovascular events in patients with AMI with concomitant obesity

Variable

Classification of variable

Area under the ROC-

curve (AUC)

Authenticity

р(≤0,05)

Sensitivity, %

Specificity, %

BMI, kg/m2

0,704

0,02

66,7

79,2

Vitronectin, ng/ml

0,96

<0,0001

86,7

96,0

Galectin-3, ng/ml

0,83

0,04

94,4

78,9

Conclusions. 1. It was established direct relation between hypervitronectinemia and

hypergalectinemia and occurrence of recurrent cardiovascular events during the 6-month follow-up

period for patients with Q-positive myocardial infarction with obesity.

2. ROC analysis demonstrated that serum levels of vitronectin > 283.27 ng / ml, galectin-3 >

12.83 ng/ml and body mass index> 34.13kg / m2 give an opportunity to predict cardiovascular events

within six months after acute myocardial infarction in patients with concomitant obesity.

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