Prognostic Morbidity of Water and Salt Metabolism Disorders in Patients with Heart Failure

Shakhobidinov X.Sh.	Master of Cardiology, stage 3
Usmanova D.N.	Associate professor, candidate of Medical Sciences
Kholdorov B.X.	Cardiology specialty stage 3
Bektasheva G.M.	Student of the 5th stage of the Faculty of treatment Andijan State Medical Institute Andijan, Uzbekistan

ABSTRACT

Assessment of the impact of renal dysfunction and imbalance of body aquatic environments distribution on the risk of developing cardiovascular complications in the late period after acute coronary syndrome (ACS) and myocardial revascularization. We examined 120 patients with ACS undergoing myocardial revascularization. We estimated traditonal and renal risk factors (albuminuria 30-300 mg/l, the value of GFR, acute kidney injury development), and body aquatic environments factors. Upon completion of the primary material processing, to determine the effect of the studied risk factors, we selected combined endpoint of the study – development of arrhythmias or death of patients, which were registered 6 months after restoration of coronary blood flow. By results of the carried out research we established effect on the probability of cardiovascular complications (CVC) by such risk factors as the presence of albuminuria, and acute kidney injury (AKI).

Keywords: Acute coronary syndrome, myocardial revascularization, imbalance of body aquatic environments, hyperhydration, renal risk factors, acute kidney injury.

Introduction. Acute coronary syndrome (ACS) is an important problem for healthcare and is the reason for a significant increase in the number of hospitalizations. From a social, epidemiological and economic point of view, ACS makes the most significant contribution to the structure of cardiovascular morbidity and mortality [1]. Despite the successes achieved in the treatment of patients with ACS, due to the active use of reperfusion therapy, including percutaneous coronary intervention (PCI) with myocardial revascularization, the issues of assessing the long-term prognosis, the progression of early and late cardiovascular complications remain relevant. The search for new opportunities for early diagnosis of long-term complications of ACS currently remains one of the most important tasks. The identification of predictors of an unfavorable prognosis, the identification of high-risk criteria are aimed at timely and active primary and secondary prevention of cardiovascular diseases.

An important link in improving the prognosis and quality of life of patients with ACS is the most accurate assessment of the risk of adverse outcomes. Therefore, attention is currently being paid to assessing not only traditional risk factors for a long-term cardiovascular prognosis, but also the presence of kidney dysfunction, as well as violations of the distribution of water the state of the body in the acute period of coronary pathology. The importance of understanding the mechanisms

and forming ideas about the development of renal dysfunction in ACS is obvious. Both acute and chronic renal dysfunction are important risk factors for the development of cardiovascular complications (CVD) [2]. In turn, the progression or acute development of cardiovascular insufficiency, accompanied by a decrease in the contractile function of the myocardium, can serve as an important cause of violations of intrarenal hemodynamics [3].
The formation of uniform pathogenetic mechanisms leading to remodeling and disruption of cardiorenal relationships [4] contributes, in particular, to inadequate regulation of the water balance with the formation of hyperhydration syndrome, which in some cases may occur subclinically [5]. One of the most promising noninvasive methods of assessing the water balance in violation of the water-releasing function of the kidneys is bioimpedance, which, in particular, has been convincingly shown in patients receiving renal replacement therapy [6].

The purpose of the study. The aim of our study was to assess the effect of renal dysfunction and impaired distribution of body water on the risk of developing CVD in the long-term period after ACS and myocardial revascularization.

Patients and methods. The study included 120 patients with ACS. During further examination, 68 patients (56.7%) were diagnosed with unstable angina (NS), 52 (43.3%) – acute myocardial infarction (AMI) was confirmed. Among our patients there were 101 (84%) men and 19 (16%) women, the average age was 57.8± 0.82 years. The main criterion for inclusion in the study was the fulfillment of all patients in the first day of admission of coronary angiography with subsequent stenting of the coronary arteries. The exclusion criteria were the presence of CKD and AKI. To achieve this goal, all subjects were assessed for clinical status and risk factors were taken into account.
According to the study protocol, the presence and severity of renal dysfunction and disturbances in the distribution of body water media were assessed. The following were selected as renal risk factors: the presence of albuminuria (Al) greater than 30 mg/ml, the glomerular filtration rate (GFR) and the development of acute kidney injury (AKI). Availability of Al they were installed in a semi-quantitative way using test strips in the morning portion of urine. The GFR value was calculated using the formula CKD-EPI, based on known serum creatinine parameters. AKI was diagnosed on the basis of an increase in creatinine by 26.5 mmol/l over a period of 48 hours or more than 1.5 times the known for 7 days and a decrease in urine volume (less than 0.5 ml/kg for 6 hours). The method of bioimpedance spectrometry was used to diagnose violations of the distribution of aquatic environments of the body. To conduct the study, an analyzer of the water sectors of the body was used, according to the standard methodology of the manufacturer. The results were processed using the computer program "Analysis of body composition and water balance". Such indicators as the volume of total water (OW), the volume of total fluid (OW), the volume of intracellular fluid, the volume of extracellular fluid were evaluated. OO consists of extracellular and intracellular fluid, and OO consists of extracellular, intracellular fluid and fluids in the body in a bound state. 6 months after myocardial revascularization, an analysis of long-term cardiovascular complications was performed, as which the first cardiac arrhythmia and death were selected. During the follow-up period, de novo arrhythmias were detected in 4 patients (3.3%): in 2 patients, frequent ventricular extrasystole, rhythmic by the type of bi– and trigeminy, in 1 - paroxysmal form of atrial fibrillation, and in 1 case, an episode of ventricular tachycardia was established. Fatal cardiovascular event was registered in 1 patient (0.8%). Statistical data analysis was carried out using the package of applied statistical programs "Statistica 8.0" ("(StatSoft Inc.", USA). The data is given in the form arithmetic mean ± error of the mean. The Student's t-test was used for pairwise comparison of dependent groups. The degree of influence of the initial factors on the development of the MTR was assessed during logistic regression analysis. The null statistical

hypothesis about the absence of differences and connections was rejected at p<0.05.

Results. According to the results of the study, the prevalence of Al in patients with ACS was 62.5% of cases (75 patients), with an average Al level of 230.0±3.2 mg/l. Based on the results of logistic regression analysis, it was shown that the presence of Al before performing PCI and after the restoration of coronary blood flow significantly affects the risk of developing long-term cardiovascular complications (first-time rhythm disturbance and death) (χ2–criterion - 3.81, p<0.04). The probability of reaching the end point (rhythm disturbances and death) in the presence of Al is 31%. When analyzing the effect of the degree of GFR reduction on the risk of developing MTR, it was not possible to obtain a statistically significant mathematical model (χ2-criterion – 0.73, p=0.3). The patients we examined did not have absolute indications for bladder catheterization, therefore, an accurate measurement of hourly diuresis was not performed. In this regard, dynamic monitoring of serum creatinine levels was carried out to detect AKI. The concentration of creatinine in the blood serum at the time of admission of patients was 95.61 ± 1.53 mmol / l, and at discharge from the hospital – 101.39 ± 1.89 mmol / l, p = 0.1. Of 120 patients, the development of AKI was registered in 14 patients (11.7%). In patients with AKI, long–term CVD was observed in 21%, in patients without renal dysfunction - in 2% of cases (χ2-criterion – 7.17, p=0.007).

In order to exclude the influence of other factors on the probability of reaching the combined endpoint in the group of patients with ACS and AKI, a comparative analysis of the main predictors characterizing the severity of ACS and having independent significance in the formation of an unfavorable prognosis was carried out. The first group included 14 patients (11.7%) with AKI, the second group included 106 patients (88.3%) without AKI. There was no statistically significant difference between the selected groups in the number of cases of acute heart failure of class III and IV severity according to Killip, as well as systolic myocardial dysfunction.

According to the study protocol, all patients were assessed for violations of the distribution of body water volumes. When analyzing the data obtained, it was revealed that the increase in OO in comparison with should these values were recorded in 75.5% of cases (91 patients) (p<0.001), an increase in OJ in 68.3% of cases (82 patients) (p<0.01), an increase in OVnutricl.g. was found in 67.5% (81 patients) (p<0.01) and a decrease in OVnecell.g. in 58.3% (70 patients) (p<0.05). When conducting a logistic regression analysis, the effect of a decrease in OV, OJ, OVnutrikl.zh. and OVnecl.zh. in combination with AKI, an increase in the risk of cardiovascular complications was found (χ-criterion - 7.86, p=0.01 and χ–criterion - 7.22, p=0.02).

In order to determine the factors that can affect the imbalance of the body's aquatic environments, an analysis of diuretic therapy was carried out. Diuretic therapy, represented by loop diuretics, was received by 12 patients, at an average dosage (in terms of furosemide) of 48.3 ± 2.54 mg. There was no statistically significant effect of diuretic therapy on the distribution of body water volumes (p>0.05).

Discussion. In recent years, more and more data has been actively accumulating on the prognostic effect of cardiorenal relationships on the development of cardiovascular events [7, 8]. A large number of studies have been devoted to the study of cardiorenal relationships in acute coronary pathology, the role of decreased renal function in the formation of prognosis in patients with AMI [9]. According to the MONICA Ausburg Surveys study, in patients with chronic kidney disease (CKD) with GFR of 15-59 ml/min/1,73m2, the risk of AMI increased by 1.5 times [10]. And according to the analysis of the registers of patients with AMI, it was revealed that the presence of acute renal dysfunction leads to an increase in cardiovascular mortality by 52% [7, 11]. It is an established fact that ACS is a risk factor for the development of AKI [8, 12]. The development of AKI is inextricably linked with an increase in mortality, an increase in the cost and duration of treatment of patients after ACS [9, 13]. During

the search for the prognostic effect of AKI according to our data

the influence of the presence of AKI on the risk of rhythm disturbances and death was revealed. According to A. Tessone et al., renal dysfunction is associated with a 3.3-fold increase in the risk of CVD, atrial fibrillation and ventricular fibrillation [14]. The long-term prognosis of treatment of patients after an acute cardiovascular catastrophe, according to numerous studies, also depends on the severity of kidney damage in the acute period [15]. AKI on the background of acute coronary pathology can develop for many reasons, the main contribution among which is a decrease in the volume of circulating blood, the presence of renal hypoperfusion on the background of a decrease in systolic myocardial function, as well as the use of diuretic therapy [16]. At the same time, the presence of AKI in patients with ACS demonstrates the unity of pathogenetic mechanisms of pathology formation and may indicate the severity of pathological reactions in this cohort of patients, which forms a high risk of cardiovascular complications. The results of the work presented by us indicate a statistically significant difference in the severity of the clinical condition of patients with ACS who have AKI. It should be noted that the analysis of TIMI studies showed that in acute coronary

syndrome, a decrease in GFR was associated with an increase in 30-day and 6-month mortality, as well as the frequency of recurrence of myocardial ischemia, cerebral strokes and "large" bleeding [17].

The study revealed a high prevalence of urinary albumin excretion (in 62.5% of cases) as one of the markers of adverse course of cardiovascular diseases. In the course of our analysis, a statistically reliable relationship was revealed between the influence of the presence of Al on the risk of rhythm disturbances and death. According to numerous studies, the relationship between an increase in urinary albumin excretion and a sharp increase in cardiovascular morbidity and mortality has been revealed [18, 19].

The influence of the imbalance of the body's fluid media on the cardiovascular prognosis remains unquestionable. According to the results of our study, the redistribution of water sectors was revealed due to an increase in OOV, OVnutrikl.zh. and a decrease in OVnekl.zh. When analyzed, a statistically significant prognostic effect on the risk of rhythm disturbances and death has an imbalance of water the environment of the body in combination with acute kidney injury. Kidneys play an important role in the pathogenesis of the formation of an imbalance of aqueous media in acute coronary pathology. With ACS in combination with AKI, the renin-angiotensinaldosterone system (RAAS) is activated as compensatory mechanisms. With prolonged activation of RAAS, hypoperfusion of organs and tissues occurs, the action of angiotensin II leads to the retention of sodium and water ions mainly due to the expansion of intracellular volume [20]. Another prerequisite for the development of fluid redistribution from the vascular bed to the cells is the transfer of sodium ions into the cell sector in acute cell ischemia. The transition of sodium ions into the cell occurs as a result of reperfusion of damaged membrane structures of ion channels and energy deficiency, in turn, an increase in intracellular sodium concentration leads to an increase in osmoconcentration, and the movement of water from the extracellular compartment into cells. A set of mechanisms that potentiate the reactions of a single pathogenic cascade lead to the formation of an imbalance of the body's aqueous media in patients with ACS.

A number of clinical studies demonstrate the effect of hyperhydration on the development and progression of acute heart failure [21]. The potentiating effect of the violation of the body's aquatic environments and renal function, as an organ regulating both water-salt metabolism and the activity of neurohumoral factors, directly forms the prognosis of CVD. According to the PICARD study, which included patients in need of intensive care with concomitant cardiovascular pathology, hospital mortality in the group of patients with AKI and fluid overload was 37% [22, 23].

A group of patients with AKI and impaired distribution of the body's aqueous media in the early stages may undergo adequate drug

correction in order to reduce the risk of cardiovascular complications and death.

Conclusion. Our study revealed the prognostic significance of the detection of acute kidney injury, imbalance of the body's aqueous media and the presence of albumin excretion in urine in patients with acute coronary pathology. Thus, Al, the presence of AKI and the imbalance of the body's water sectors, as well as their complex analysis, can act as independent predictors of the development of cardiovascular complications in the long-term period after ACS. This will allow stratifying the risk of mortality and cardiovascular events in the long-term prognosis and thereby adequately adjust the recommendations for the management of patients with acute coronary syndrome.

Bibliographic list

1. Statistics of heart diseases and strokes – update for 2015. Review for 2015;
2. Agranov-ich N.V., Anopchenko A.S., Pustova K.B., Pilipovich L.A. Early diagnosis of kidney diseases in arterial hypertension in elderly patients. International Journal of Applied and Fundamental Research 2014;11(5):817-819]
3. Smirnov A.V., Kayukov I.G., Dobronravov V.A., Rumyantsev A.S. Acute kidney injury: conceptual problems. Nephrology 2014; 18 (2):8-24
4. Smirnov AB, Petrishchev NN, Panina IU, etc. The glomerular filtration rate is an indicator of the functional state of the endothelium in the early stages of the development of chronic kidney disease. Ter Arch 2007 (6): 25-29
5. Wable P., Chamney P., Moisl U., Yirka T. The importance of bioimpedance spectroscopy of the whole body for the control of fluid balance in the blood. Purif 2009;27(1): 75-80
6. Bovkun IV, Rumyantsev ASH. The state of the body's fluid spaces in patients with chronic kidney disease receiving treatment with programmed hemodialysis. Nephrology 2012; 16(3-1): 98-105
7. Smirnov AB, Dobronravov VA, Rumyantsev ASH, etc. National recommendations. Acute kidney injury: basic principles of diagnosis, prevention and therapy. Part I. Politics 2016; 20(1): 79-104
8. Smirnov AB, Dobronravov VA, Rumyantsev ASH, etc. National recommendations. Acute kidney injury: basic principles of diagnosis, prevention and therapy. Part II. Nephrology 2016; 20(2): 86-100
9. Statsenko ME, Bolotov DV. Features of the functional state of the heart, kidneys and cardiorenal relationships in patients after surgical myocardial revascularization. Ross Card Journal 2012; 6(98): 39-44
10. Bolotov D.V.. Functional state of the heart, kidneys and cardiorenal relationships in patients after surgical myocardial revascularization. Ross Cardiol J 2012; 6(98): 39-44]
11. Dzgoeva FU, Sopoev MU, Galaganova TM. 23 fibroblast growth factor and a new highly sensitive troponin I: a marker of early and alternative ways of developing cardiovascular diseases in chronic kidney disease. Ter Arch 2015;87(6): 68-73]
12. Meisinger S, Doring A, Lowell H. Chronic kidney disease and the risk of myocardial infarction and mortality from all causes and cardiovascular diseases in middle-aged men and women from the general population. Eur Heart J 2006; 27(10): 1245-1250
13. InTIME-II researchers. Intravenous administration of NSAIDs for the treatment of myocardial infarction at an early stage: InTIME II, double-blind comparison of single bolus administration of lanoteplase and accelerated alteplase for the treatment of patients with acute myocardial infarction. Eur Heart J 2000; 21(24): 2005-2013
14. Smirnov A.V., Kayukov I.G., Dobronravov V.A. et al. Acute kidney injury is a new

concept in nephrology. Clin nefr 2009;1:11-15]

15. Shutov A.M., Kurzina E.B., Serov V.A., Ivashkina T.N. Mitral regurgitation in patients with chronic heart failure associated with decreased renal function. Nephr 2008; 1(12): 19-23]