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## **THE USE OF STATISTICAL ANALYSIS FOR THE ASSESSMENT OF MYOCARDIAL DAMAGE IN PATIENTS WITH TYPE 2 DIABETES**

According to the World Health Organization, diabetes mellitus (diabetes) is achieving the threatening scale of the global epidemic due to the rapid increase in the number of patients worldwide. For instance, in Ukraine the prevalence of diabetes mellitus has increased for about 6% over the last 5 years, and the number of newly diagnosed cases of diabetes is steadily growing, mainly due to type 2 diabetes [1].

Type 2 diabetes possesses an important social significance, because of the development of severe micro- and macrovascular complications. Ophthalmopathy is found in 35% of patients, polyneuropathy - in 12%, proteinuria - in 2%. Acute disorders of cerebral circulation occur 3.8 times more often in patients with diabetes than in the general population, chronic renal failure - 15-20 times, blindness - 10-20 times more often, respectively. According to the data provided by the Institute of Endocrinology and Metabolism named after V.P. Komisarenko of the National Academy of Medical Sciences of Ukraine, 1264500 patients were registered with diabetes in Ukraine in 2011, 1311335 patients – in 2012, and 1380470 - in 2013. The recent research data assume that there are more than 3 million patients with diabetes in Ukraine today [2; 3].

The pathology of the cardiovascular system, including myocardium, in diabetes is caused by the development of specific microangiopathy, macroangiopathy, autonomic neuropathy and a direct damage of cardiomyocytes with subsequent formation of diabetic cardiomyopathy (CMP) and diastolic heart failure. [4; 5].

In order to diagnose CMP in patients with diabetes the following tests are used: determination of indexes of carbohydrate metabolism, lipid profile, load tests, electrocardiographic and echocardiographic examination, computed tomography, coronary angiography. However, some of these methods are not widely available in clinical practice, so the purpose of the study was to try to find a novel way to evaluate myocardial damage in patients with type 2 diabetes, using statistical methods of cluster analysis.

**Methods.** A total of 102 patients with type 2 diabetes mellitus without severe diabetic complications were examined. The control group consisted of 20 healthy volunteers. The groups were comparable in age and gender. A physical, clinical, biochemical, instrumental survey methods were used for examination of patients. Statistical methods of information processing were used to analyze the obtained data.

**Results.** Correlation analysis was performed between all of the studied indicators according to their distribution law using the licensed Statistica 6.0 program. The linear correlation coefficient (R) and its reliability (p) were calculated. A multivariate statistical analysis was performed to identify the strongest correlations between the obtained data.

Initially, a natural classification of patients with type 2 diabetes was used, taking into account body mass index (BMI), age, waist circumference, hip circumference, waist circumference to hip circumference ratio (WC/HC ratio), systolic blood pressure (SBP), diastolic blood pressure, mean arterial pressure (MAP), fasting plasma glucose, glycosylated hemoglobin, immunoreactive insulin, insulin resistance index, the levels of total cholesterol, triglycerides, cholesterol, high-density lipoproteins, low-density lipoproteins, adipokines (leptin, resistin), pro-inflammatory mediators (interleukin-1 $\beta$ , interleukin-6), ECG and echocardiography (31 index in total). Natural classification was performed by the method of hierarchical grouping after

preliminary standardization of indicators. By doing so, we revealed two groups (clusters) into which all patients were divided. [6]. At this stage, such grouping was used to minimize the variability of indicators within clusters and to maximize the differences between clusters.

Having obtained significant differences between the indicators in the groups, we decided to evaluate the impact of each indicator on belonging to a particular cluster using the classification tree method. The method of discriminant one-dimensional branching was used. The method is based on the step-by-step construction of a tree, where each following step solves the question of which of the terminal vertices of the tree should be divided at this stage and which one to use. Upon creation of the classification tree, the reliability was 88.3%, while the results of cross-checking were 85.4%, which indicates a good adequacy of the model.

Thus, we obtained a natural distribution of patients into two groups, which were characterized by the different degree of severity of diabetic CMP (moderate and severe). The severity of CMP was evaluated according to the level of diastolic dysfunction due to obtained echocardiography data [7]. The most informative indicator for determining the severity of diabetic CMP in patients with type 2 diabetes was BMI, SBP, MAP, as well as WC/HC ratio. BMI 28.47 kg/m<sup>2</sup> and SBP <150 mm Hg indicates a moderate diabetic CMP, while BMI greater than 28.47 kg/m<sup>2</sup> and an MAP greater than 97.38 corresponds to severe CMP.

Conclusion. The obtained data suggest that the use of tree classification method can be applied in wide clinical practice for the determination of the degree of myocardial damage in patients with type 2 diabetes. The availability of the method is provided by the most significant indicators - BMI, SBT, MAP, WC / HC ratio, which are easy to determine when examining a patient and do not require the use of high-tech methods.

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