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Heart Rhythm in Patients with Type 2 Diabetes Mellitus Depending on the Degree of Glycemia

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Abstarct: Classic publications on arrhythmias and diabetes mellitus (DM) describe predominantly vagal mechanisms for the development of cardiac arrhythmias (CHD) in obesity and diabetes against the background of diastolic myocardial dysfunction.[1,2]. In recent decades, new data have emerged on cardiac damage in diabetes. It has become known that the mechanical activity of the myocardium in type 2 diabetes is associated with a high rate of oxygen consumption due to an impaired biological response of peripheral tissues to the effects of insulin or insulin resistance (IR), which occurs in 84% of patients with type 2 diabetes, and induced hyperinsulinism (HI). Under HI conditions, the sympathetic nervous system (SAS) is activated and the activity of the parasympathetic nervous system decreases, which leads to an increase in heart rate, a decrease in heart rate variability, and ultimately to impaired relaxation and a marked decrease in myocardial contractility[3, 4, 5]. Introduction. Consequently, the cardiovascular system of patients with type 2 diabetes is in a state of significant biochemical changes and activation of the SAS, and the cardiomyocyte is in a state of pronounced energy imbalance with a significant decrease in coronary blood flow due to microvascular disorders, which leads to significant structural and morphofunctional changes in the heart[3]. Considering that diabetes is a risk factor for cardiovascular diseases, much attention is paid to the problem of coronary artery disease and diabetes, while not many works are devoted to NRS in conditions of pronounced changes in carbohydrate metabolism. Diabetes and cardiovascular diseases. Along with the effectiveness of glucose-lowering therapy, the safety of diabetes treatment remains an important aspect, especially in elderly patients. Therefore, when choosing antidiabetic drugs, many different factors should be taken into account for each individual patient. These include the risk of hypoglycemic conditions, concomitant diseases, duration of diabetes, gender and age of the patient, level of treatment adherence, and many others. There is a clear link between diabetes and cardiovascular disease (CVD). It has long been known that CVDs are 2–5 times more common in patients with diabetes than in people without diabetes. CVD, and specifically cardiovascular outcomes, are the main cause of mortality in these patients in both men and women. In addition, in diabetes there is a high risk of coronary heart disease (CHD), myocardial infarction (MI), arterial hypertension and acute cerebrovascular accident, and patients with diabetes may experience silent acute MI associated with the presence of autonomic cardiac neuropathy. Various rhythm disturbances are much more common in diabetes, including paroxysmal forms of atrial fibrillation, which increase the risk of death by 1.8–2 times [1]. Recently, chronic heart failure (CHF), along with peripheral arterial diseases, is one of the first manifestations of diabetes-associated CVD. At the same time, CHF, which occurs several times more often in diabetes, is the main cause of mortality in diabetes mellitus 2. According to the State Register of Diabetes Mellitus of the Russian Federation according to the status of 2015, the leading cause of mortality in diabetes mellitus 2 is cardiovascular pathology (46, 24% of patients): chronic cardiovascular failure – in 28.7% of patients,

cerebrovascular accident – in 12.4%, MI – in 5.14% [2]. High blood glucose levels lead to the development of micro- and macrovascular complications. The relationship between the development of vascular complications and hyperglycemia is not well understood. While the relationship between increased levels of glycosylated hemoglobin (HbA1c) and increased microvascular complications is well established, studies on reducing cardiovascular risk through intensive glycemic control show conflicting results.

Keywords: diabetes mellitus, hyperglycemia, hypoglycemia, heart rate variability, blood pressure variability.

Target– to evaluate the characteristics of heart rate variability (as a predictor of increased sudden cardiovascular mortality from arrhythmias) against the background of episodes of mild and moderate hypoglycemia.

Material and methods. Combined glycemic monitoring (CGMS) and Holter monitoring were performed in 60 patients diagnosed with type 2 diabetes mellitus (T2DM) (average age of patients – 63±7 years, disease duration – from 1 to 15 years).

Results. In patients with T2DM, a decrease in heart rate variability was detected (LF 321.8±346.7 versus 602.3±528.2 ms2(p=0.05), HF 108±105.1 versus 370±450; p=0 ,01). Against the background of hyperglycemia, there was a significantly significant decrease in the low-frequency component of HRV (250.2±154.2 versus 426.2±154.2 ms2; p=0.03). Against the background of hypoglycemia, there was a decrease in the high-frequency component of HRV in patients with a history of hypoglycemia: 120.7 ± 71.9 ms2 against the background of hypoglycemia versus 254.48 ± 170.4 ms2 against the background of normoglycemia (p = 0.09). In patients without hypoglycemia, a more pronounced decrease in HRV HF was noted (89±94 vs. 329±263 ms2; p=0.03). In patients with T2DM, a decrease in the level of daily blood pressure index was detected: CI SBP (3.43±0.7 versus 15.5±0.8 in healthy people), CI DBP (4.3±0.9 versus 13.14± 1.3 in healthy people). Blood pressure variability was significantly increased in patients with diabetes: ST SBP (day) 17.1±0.5 versus 8.2±0.5 (p<0.05); ST DBP (day) 13.4±1.3 vs. 9.3±0.4 (p<0.05); ST SBP (night) 15.0±0.5 vs. 7.2±0.8(p=0.05); ST DBP (night) 13.1±0.4 versus 8.6±0.7 (p<0.01). 79.5% of the studied patients had a distorted circadian rhythm of blood pressure.

Conclusions. Patients with T2DM in combination with coronary heart disease and arterial hypertension are characterized by decreased heart rate variability and disruption of the daily blood pressure profile, which together increases the risk of acute cardiovascular complications. Hyperglycemia further increases these risks, as indicated by decreased HRV values. In patients with T2DM without a history of previous hypoglycemia, a sharp decrease in heart rate variability is recorded in response to the onset of hypoglycemia with severe symptoms, which is dangerous due to the development of life-threatening arrhythmias, but is preventable with medication. In patients with T2DM and a history of frequent hypoglycemia, no changes in heart rate variability were recorded in response to the onset of hypoglycemia due to a decrease in the sympathoadrenal response, which is extremely dangerous in terms of prognosis due to asymptomatic conditions and a high risk of severe hypoglycemia.

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