



## COGNITIVE IMPAIRMENT IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

**Kholbaeva Dilfuza Maratovna**

Assistant of the Department of Medicine,  
branch of KFU in Jizzakh, Uzbekistan

dilfuza.holbaeva@mail.ru

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### ABSTRACT

*Diabetes mellitus is a disease characterized by a violation of all types of metabolism and, first of all, carbohydrate metabolism, pathological changes in various organs caused by an absolute or relative lack of insulin. It is one of the most common chronic diseases in the world. Purpose of the article is improving physical rehabilitation and cognitive impairment in patients with type 2 diabetes mellitus.*

To date, macrovascular lesions of the central nervous system in T2DM have been predominantly studied, which is probably due to greater accessibility for research. However, the number of studies confirming the presence of other pathogenetic effects of T2DM on the central nervous system, including the cognitive functions of patients, is increasing [1].

Cognitive refers to the most complex functions of the brain, through which the process of rational cognition of the world and interaction with it is carried out. There are different classifications of CI based on severity, the number of cognitive functions involved, and etiopathogenesis. According to the criteria of the National Institute of Aging (USA), CI is classified as mild, moderate and severe [2]. A number of both neurological and somatic diseases, including T2DM, can disrupt homeostatic control in the brain and suppress the implementation of cognitive functions.

Induced T2DM or independently occurring CIs can play a significant role in the course of T2DM, changing the behavior of patients [3]. Thus, it has been shown that patients with T2DM and CI have worse control over their well-being, including self-monitoring of glycemia less frequently, forgetting to take antidiabetic medications, may skip meals, are less likely to seek medical help, experience more difficulties in learning new instructions, tend to change their usual drug therapy regimen, etc. [6]. All of the above problems lead to deterioration of glycemic control and, as a consequence, to the development and progression of micro- and macrovascular complications of T2DM.

According to clinical studies of the Scientific Center Neurology (Moscow), CI in elderly patients with T2DM is associated with previous strokes and subclinical signs of macrovascular pathology. The review discusses literature data and the results of our own research on the effect of diabetes mellitus on cognitive functions and cerebrovascular pathology, and also considers possible pathogenetic mechanisms for the implementation of



this influence [4]. The results of studies on the effect of antidiabetic drugs on cognitive functions are presented.

AD – Alzheimer's disease

DPP-4 – dipeptidyl peptidase-4

CI – cognitive impairment

MRI – magnetic resonance imaging

HbA1c – glycosylated hemoglobin

T1DM – type 1 diabetes mellitus

T2DM – type 2 diabetes mellitus

MCI – mild cognitive impairment

CNS - central nervous system [5]

Diabetes mellitus and cognitive impairment atherosclerosis [7]. However, it cannot be argued that only vascular factors can influence cognitive status patients with T2DM. When studying cognitive functions in 90 patients with T2DM, of which 68% had complaints for memory impairment for current events, while neither none of the examined patients had dementia, and CIs were diagnosed with approximately the same frequency as in patients with diabetes without significant cardiovascular risk factors, and in the group with severe cardiovascular clinical symptoms. With a detailed neuropsychological examination (brief assessment scale mental status, battery of tests to assess frontal dysfunctions, clock drawing test, verbal association test, etc.) CIs were found in 71.1% of patients, of which in 51.1% they met the criteria for moderate cognitive impairment (MCI), and in 20.0% they met the criteria for mild CI [8].

Today, atherosclerosis and its complications are recognized - atherostenosis, atherothrombosis, atherothromboembolism, which determine the development of up to 80% of all vascular pathology brain [9]. In patients with T2DM, atherosclerosis may be considered as one of the manifestations of macrovascular complications of T2DM [10]. A significantly higher frequency of detection of occlusion and pronounced atherostenosis of the extracranial parts of the internal carotid and vertebral arteries in patients with T2DM [11]. According to research results, among all patients with diabetes, including young people, cerebrovascular pathology is detected in 14.6% cases [12]. In patients with T2DM, in comparison with patients with other risk factors, neuroimaging reveals significantly more pronounced leukoaraiosis and higher incidence of lacunar infarctions.

This fact indicates a negative effect of diabetes on the state of the brain substance, which is realized through vascular damage, but direct damage is not excluded brain substances. Both diabetes and metabolic syndrome are associated with an increased risk of acute brain damage.

According to epidemiological studies, in patients with diabetes the manifestation of vascular brain damage is more often manifested as ischemic stroke, rather than transient ischemic attacks.

The combination of diabetes and arterial hypertension increases the risk of stroke is 4.5 times, and if it develops, these patients have a more than 9-fold probability of death compared to patients without this pathology [12]. In the structure of the risk of developing acute cerebrovascular complications in patients with type 1 diabetes (T1DM), the progression of



microvascular complications is significant. Thus, the presence of proliferative retinopathy associated with increased risk of stroke 3 times (ischemic - 2.7 times and hemorrhagic - 3.7 times). The progression of diabetic nephropathy had an even more pronounced effect: for example, the presence macroalbuminuria increased the risks by 4.9 times (5.2 and 3.6 times for ischemic and hemorrhagic variants respectively), while against the background of end-stage renal failure these risks increased to 7.5 times (5.5 and 14.9). If a patient had both complications, the risk of stroke increased by 6.1 times (5.7 and 7.4, respectively) compared with patients who had these complications.

It is well known that carbohydrate metabolism disorders, in particular the level of glycated hemoglobin (HbA1c), are closely associated with the likelihood of developing a stroke: for example, an increase in HbA1c by 1% was accompanied by an increase in the incidence of stroke by 17% [11]. It was found that the relative risk of stroke increases with increasing levels of HbA1c not only in patients with diabetes, but even in healthy people. It has been shown that the effective glycemic control can reduce the risk of stroke, development of CI or reducing their severity, while increased glycated hemoglobin levels are associated with an increased risk of dementia. In the study of A. Ramirez et al. (2015) took part in people aged 75 years and older without dementia according to the results preliminary testing. Over the course of 6 years, patients were re-examined every 18 months. Level glycated hemoglobin of 6.5% was associated with an increased risk of dementia, and its increase was only 1% increased this risk by 40%. It should also be noted that the fact of primary diagnosis of diabetes did not affect the risks the development of dementia if the level of glycated hemoglobin was below 7%. Despite higher risks of macrovascular lesions in patients with diabetes, this factor did not play a key role. In addition, it is shown that the initial level of cognitive function did not affect risk of developing dementia during the follow-up period.

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