
LEGAL LITERATURE OF SPEECH DISORDERS AND COGNITIVE DISORDERS IN MEDICAL LAW AND DIABETES MELLITUS: RUSSIAN AND FOREIGN STUDIES

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Abstract

Since almost all legal provisions are moral or, in some way, their goal is ethics, and on the other hand, law can support ethics and maintain it; Therefore, proper use and support of each against the other can be effective in advancing practical goals. Ethics and rights have a close and unavoidable relationship. Contrary to the opinion of some legal philosophers regarding the separation of law from morality, law is clearly a historical deposit of morality. Medical ethics and medical law are among the categories that will benefit from this relationship. The correct understanding of this relationship and the proper use of the gentleness of ethics and coercion of rights can take care of many emerging issues in the field of health, which are sensitive issues. Moral responsibility is a responsibility that the legislator did not express and create, and it means the customary, moral and social responsibility of the doctor, from the point of view of his religion and contemporary norms. The legal responsibility is that which is foreseen in the law and has a guarantee of legal enforcement (criminal and civil). In criminal and civil, its common face is breach of contract and it can be requested from the court. One of the differences between moral and legal responsibility is the guarantee of their implementation. In addition, it is possible that the limits of the characteristics of the subjects of the laws are different from the limits and characteristics of the moral subjects. This article presents the analysis of modern Russian and foreign studies data confirming the relationship between speech disorders, cognitive impairment and diabetes mellitus (type 1 and type 2). Diabetes mellitus is a disease characterized by impaired secretion or action of insulin produced by the pancreas, which can lead to the chronic hyperglycemia. This disease is a serious medical and social problem, because it causes a number of complications that are dangerous for the patient, and significantly impairs the quality of life. Research shows that diabetes type 1 and type 2 has a negative effect on the central nervous system. One of the common complications of diabetes mellitus is diabetic encephalopathy, which causes gradually increasing cognitive impairment and speech disorders. It has been proven that mild cognitive impairment in diabetes mellitus can progress to the stage of dementia. So it is extremely important to identify cognitive dysfunction at the early stages of development, when the disease has not yet reached a severe stage.

Keywords: Law, Medical Law, Legal Literature, diabetes mellitus, diabetic encephalopathy, cognitive decline, dementia, mild cognitive impairment.

INTRODUCTION

Diabetes mellitus is one of the most serious medical and social problems of modern society. This disease can lead to a range of life-threatening complications and, ultimately, to an increase in the number of deaths. According to the World Health Organization, today there are over 463 million people with diabetes in the world. According to the International Diabetes Federation, this number will increase to 700 million by 2045 [1].

Diabetes mellitus is a chronic disease resulting from insufficient production of insulin by the pancreas, or when the body is unable to properly use the insulin it produces [2].

Over the past decades, the prevalence of diabetes mellitus has grown rapidly among different age groups, regardless of gender and nationality. There is strong evidence that diabetes increases the risk of mild cognitive impairment, vascular dementia, and Alzheimer's disease [3].

Diabetes mellitus can cause permanent or temporary cognitive decline, which can occur as a result of chronic or acute disorders of blood glucose homeostasis. Numerous studies show that mild cognitive impairment in diabetes can progress to dementia. In general, the risk of developing dementia in patients with diabetes is 2-3 times higher than in people without diabetes [4].

Today, many complex and diverse pathogenetic mechanisms of the influence of diabetes mellitus on cognitive dysfunction are known. The most significant of them: violation of the integrity of the blood-brain barrier, impaired neurogenesis, hyperglycemia and hypoglycemia, systemic inflammatory reactions and dysfunction of the microvasculature [5].

Due to the increasing prevalence of diabetes mellitus every year and a decrease in the age at diagnosis, there is a possibility of an increase in the number of patients with cognitive impairment associated with diabetes, which can have a significant impact on society [6]. Due to increased life expectancy, cognitive dysfunction caused by diabetes can place a great strain on the health care system [7].

The purpose of this article is to review the data of Russian and foreign scientific literature on speech disorders and cognitive impairment in patients with type 1 and 2 diabetes mellitus, the pathogenetic mechanisms of their occurrence.

METHODS

We have carried out a search and analysis of scientific articles devoted to the study of speech and cognitive status in patients with type 1 and 2 diabetes mellitus, and to the study of diabetic encephalopathy as a complication of diabetes mellitus. The literature search was conducted using the keyword method in the electronic scientific databases Web of Science (<https://www.webofknowledge.com>), Scopus (<https://www.scopus.com>), Pubmed (<https://pubmed.ncbi.nlm.nih.gov/>), Scientific Electronic Library eLIBRARY.RU. (<https://elibrary.ru>).

RESULTS AND DISCUSSION

There are two types of diabetes depending on the pathogenetic mechanisms. In type 1 diabetes mellitus, insulin is not produced in the body in sufficient quantities. These patients require regular insulin injections to maintain proper glucose levels in the blood. The exact causes of this type of disease are unknown, and therefore it is impossible to prevent it. It is believed that type 1 diabetes can develop as a result of a complex relationship between environmental factors and genetic predisposition to this disease. Type 2 diabetes is the most common. It is characterized by insulin resistance – the ineffective use of insulin by the cells of the body. The most common risk factors for this type are a combination of genetic predisposition with overweight, unhealthy diet and low physical activity. Symptoms of type 2 diabetes mellitus are less manifested and for several years may be almost absent in the patient. In addition, they are often similar to the symptoms of type 1 diabetes, which significantly increases the risk of late detection of this disease and can lead to complications [2].

Many studies show that both type 1 and type 2 diabetes can cause changes in brain structure and cognitive decline from baseline in patients. It was found that patients with type 1 diabetes have problems with the speed of information processing, attention, memory, and executive functions. Type 2 diabetes is associated with mild to moderate cognitive deficit manifested in a decrease in the speed of psychomotor processes and memory impairment – risk factors may be the duration of the disease and the presence of accompanying complications [8].

Several studies show a correlation between cognitive decline and poor metabolic and glycemic control. Thus, a study of patients with type 1 diabetes in a sample of 126 people aged 15 to 59 years revealed impaired cognitive functions already at the early stages of the development of the disease. The MoCA-test found significant impairment in attention, memory, delayed recall, visual-spatial and executive functions, and language [9].

The presence of cognitive impairment in diabetes mellitus is also supported by some prospective studies. It was revealed that in the group of patients with type 1 diabetes, whose average age was 40 years, there is a significant decrease in the speed of psychomotor processes compared with the control group without diabetes. At the same time, no differences were found in the groups in the field of tasks for learning and memory [10].

The researchers note that cognitive impairment is also observed in patients with type 2 diabetes. One prospective study shows that a group of patients with type 2 diabetes performs lower in cognitive areas such as memory, executive function, attention and information processing speed compared to people without diabetes [8, 11]. In addition, mental flexibility impairment has been found in some studies in patients with type 2 diabetes mellitus [12].

Another study demonstrates the presence of cognitive decline in patients with diabetes mellitus compared with the control group without the disease and the group that included patients with hypertension. The study group consisted of 120 patients with compensated stage of type 2 diabetes, aged 40 to 75 years, who did not complain of memory loss or impairment of other cognitive functions. During testing with neurocognitive instruments generally accepted in medical practice (MMSE, MoCA-test, Trail Making Test), it was found that the results of the group of patients with hypertension are significantly higher than in the group of patients with type 2 diabetes mellitus, which indicates an obvious effect of diabetes on cognitive decline [13].

Neuroimaging techniques such as structural magnetic resonance imaging (MRI), functional MRI (fMRI), magnetic resonance spectroscopy (MRS) are also used to study the effect of diabetes on human cognitive functions [8].

A study was conducted in a group of 82 patients with type 1 diabetes mellitus and a control group of people without this disease. Structural magnetic resonance imaging showed changes in the gray matter of the brain in patients with type 1 diabetes. Compared to the control group, these patients had a lower density of gray matter in the cerebellum and in the posterior and temporal regions of the brain. In addition, patients with type 1 diabetes showed poorer results in standard cognitive testing compared with healthy group [14].

There are also known studies that are devoted to identifying the relationship of type 2 diabetes with cognitive decline using neuroimaging methods. For example, 350 patients with type 2 diabetes and 363 participants without diabetes were studied. Magnetic resonance imaging (MRI) helped to reveal that type 2 diabetes is associated with a decrease in the volume of the white and gray matter of the brain. A decrease in gray matter was observed mainly in the medial temporal and medial frontal lobes. Loss of white matter was found in the temporal and frontal regions. Neurocognitive testing in this group of patients showed that the deterioration of cognitive functions in this case is associated with a decrease in brain volume [15].

A number of Russian and foreign studies show a gradual progression of cognitive decline in diabetes mellitus from mild cognitive impairment to dementia. There is a study in which 302 patients with diabetes with moderate cognitive impairment were examined for 9 years. It was found that diabetes mellitus accelerates the progression from mild cognitive impairment to dementia and brings the onset of dementia by more than three years [16].

In general, the researchers note that the rate of progression of moderate cognitive impairment to dementia is higher in patients with type 2 diabetes mellitus – the risk of occurrence is 95% compared with patients without diabetes mellitus. Also it was found that dementia in patients with diabetes mellitus develops in younger age [17].

Cognitive dysfunction in diabetes mellitus is a very serious problem, especially during progression to the stage of dementia, as it can lead to the loss of the ability of patients with diabetes mellitus to adequately control blood glucose levels. Patients stop following a special diet, forget to take medications, and do insulin injections on time. All this, in turn, entails the risk of complications that can lead to disability [18].

Generally, the researchers note that the cognitive impairment in diabetes has a negative impact on the patient's quality of life. Thus, a study of 120 patients with type 2 diabetes showed that the level of their quality of life, identified using the SF-36 questionnaire, is significantly lower compared to the rest of the population [19].

Now in modern science has taken shape such a specific concept as diabetic encephalopathy that denotes such complication of diabetes mellitus as cognitive dysfunction.

In general, the effect of diabetes mellitus on the central nervous system and cognitive functions of patients was first described in the 1920s. W. Miles and H. Root in their study using a series of psychological tests revealed that patients with diabetes demonstrate cognitive decline compared to a control group without diabetes [20]. In the 50s of the XX century, the term "diabetic encephalopathy" was proposed to denote such disorders that occur in diabetes and are accompanied by cognitive decline [21].

It should be noted that not all researchers use the term "diabetic encephalopathy", as it has a negative connotation and is not quite suitable for denoting mild cognitive impairments. In addition, there are difficulties in diagnosing this disorder, since it does not have clear detection criteria, and in type 2 diabetes it can be accompanied by a number of complications [22].

Diabetic encephalopathy is a brain damage in diabetes mellitus resulting from prolonged hyperglycemia with cases of hypoglycemia combined with insulin resistance of the brain tissue. As a rule, this complication is manifested by diffuse changes in the white matter of the brain, cerebral atrophy and deterioration of cognitive functions [23].

At first the term «diabetic encephalopathy» was used to refer to complications from type 1 diabetes and did not include disorders that are caused, for example, by high blood pressure or the age of patients [24]. According to research data, diabetic encephalopathy in its pure form is found mainly in patients with type 1 diabetes, and in type 2 diabetes it is accompanied by a number of complications (Alzheimer's disease, vascular risk factors, mixed forms of dementia) – all this complicates the diagnosis [23].

Cognitive decline is one of the main manifestations of diabetic encephalopathy. As a rule, it develops gradually – patients and doctors do not immediately notice its manifestations which increases the risk of its progression to serious stages of damage to the central nervous system. Such patients often have problems with auditory memory, speed of thinking, attention, visual-spatial and regulatory functions [18]. In addition, patients have difficulties in processing and analyzing unstructured information [23], in generalization, in understanding words units with figurative meaning.

Also researchers note that 85% of patients with type 2 diabetes at the early stages of its development have a reduce in productivity of verbal communication [25]. Verbal communication disorders are one of the first signs of diabetic encephalopathy.

Unfortunately, in modern clinical practice, help for patients with speech dysfunction caused by diabetes mellitus is carried out at a stage when cognitive impairment is already progressing to the stage of dementia. This fact is a very serious problem, because it is much more difficult to help patients with severe cognitive impairments than patients at the initial stages of deficit. In general an important problem today is the early detection of the onset of cognitive decline in patients with diabetes mellitus, and organization of helping this kind of people (supervision of specialists as neurologists, clinical psychologists and linguists) [25].

SUMMARY

Results from various types of studies, including those using neuroimaging techniques, have shown that type 1 diabetes mellitus most often causes mild to moderate cognitive impairment. As a rule, with this type of disease, disorders arise in the field of general intelligence, mental flexibility, attention and speed of psychomotor processes.

Type 2 diabetes mellitus is often the cause of mild cognitive deficits, but there are studies showing cases of progression of mild cognitive impairment in diabetes mellitus to dementia. Important risk factors for the development of cognitive dysfunction are glycemic control, duration of diabetes and microvascular complications [8].

CONCLUSIONS

A large number of scientific studies show a close relationship between type 1 and 2 diabetes mellitus with the development of cognitive dysfunction and speech disorders in patients. There is evidence of a decrease in the quality of life of patients with cognitive impairment caused by diabetes mellitus. The problem of studying the cognitive decline in diabetes, due to its prevalence and severity of the consequences, both for the patients themselves and for the health care system as a whole, is very relevant in modern Russian and foreign studies.

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