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The Disorders of Verbal Communication in Patients with Diabetes Mellitus Type 2: Causes and Treatment

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Abstract: The study describes the decline of verbal and communicative functions in patients with diabetes mellitus type 2. The researchers reveal the causes of verbal communication impairment and describe some methods of its estimation (baseline neurocognitive tests, Mini-Mental State Examination and Montreal Cognitive Assessment) as well as the research outcomes. We discuss certain problems of verbal contact in these patients from neurological, neurolinguistic and neuropsychological points of view. Verbal communication disorders evidently declare themselves through short and long-term verbal memory impairments and language attention decline. They negatively affect cognitive functions, significantly reducing the patient's capability for adequate communication. The researchers suggest some ways of medical and linguistic assistance to patients with diabetes mellitus type 2 in clinical practice. They accentuate the need for timely diagnostics and help for these patients. The research was conducted at Department of Neurology No. 1, Republic Clinical Hospital No. 2 (Kazan, Russia), the clinical base of Kazan Federal University.

Key words: Diabetes mellitus type 2, verbal decline, communicative decline, cognitive decline, cognitive disorders

INTRODUCTION

All medical specialties can be divided into two groups. The first group is guided in the diagnosis mainly by the data obtained through laboratory and instrumental investigations and the second receives diagnostic information mainly from verbal contact with patients. The second group includes the branches of medical science connected with various diseases of central nervous system and in particular with the so-called functional disorders that do not have explicit morphological substrate (such as stroke, tumors or multiple sclerosis) at the current level of neuroimaging methods. The importance of a timely diagnosis of functional disorders is due to the fact that, they may be the first symptom of an impending serious pathology. At the stage of functional disorders, it is easier to prevent the further decline and to cure the patient.

It is necessary to mention that the term "functional" is rather relative: of course, it has a material substrate (at the level of cellular receptors or/and neurotransmitters), but routine diagnostic methods, Electroencephalography (EEG), Electromyography (EMG), Magnetic Resonance Imaging (MRI) can not reveal it.

In diagnosing functional disorders, a neurologist may rely only on the patient's report about the symptoms. It is possible solely in the situation of successful verbal contact which depends on the following factors:

- The patient's ability to describe his/her problems correctly
- The patient's ability to clearly reproduce the history of his/her disease in chronological order with all details
- The patient's ability to understand the doctor's questions
- The patient's ability to understand medical instructions and to follow them

Defective verbal communicative interaction between doctor and patient may lead to diagnostic errors and thus, to ignoring functional disorders of the nervous system which will decrease the possibility of early diagnosis.

In addition, the patient may incorrectly follow the doctor's prescriptions due to inadequate understanding. In some cases, it can lead to undesirable and even negative consequences.

In general, verbal problems make a common patient's life environment very complicated: a person with speech problems wants to minimize contacts because communication begins to depress him/her. This minimization pushes verbal deterioration still further because in the absence of constant practice language functions do not improve.

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METERIALS AND METHODS

The causes of verbal and communicative disorders in patients with diabetes mellitus type 2: The problems with verbal contact in patients with diabetes mellitus type 2 are the result of general cognitive decline which manifests itself in various fields of a person's everyday, intellectual and spiritual life.

Diabetes Mellitus type 2 (DM) is a disease that at an early stage declares itself only through functional disorders of the central nervous system. One of the first manifestations of brain dysfunction in DM is Diabetic Encephalopathy (DE) (Elias *et al*., 1997). We define DE as brain damage in diabetic patients caused by a combination of vascular and non-vascular factors which manifest themselves by cognitive decline, determined by hyperglycemia and episodes of hypoglycemic events in combination with insulin resistance in the brain tissue (Khayrullin *et al*., 2014). The importance of timely DE diagnosis is described in detail in Russian (Strokov *et al*., 2012) and in Foreign Medical Literature (Ott *et al*., 1996; Brunton, 2009).

Encephalopathy declares itself through cognitive disorders and focal or diffuse changes of the brain, according to MRI data. However, despite the fact that MRI data provide guidance on changes in the brain of diabetics, an accurate diagnosis of DE is impossible only by neuroimaging and neurophysiological methods, since a key manifestation of DE is a cognitive decline which to a large extent is expressed at the verbal-communicative sphere, so behavioral assessment is quite necessary. The outcome of behavioral studies depends on the contact between doctor and patient and verbal-communicative disorders influence the accuracy of diagnosis.

Cognitive functions are complex functions of the brain which are responsible for rational knowledge and provide stability to the interaction between the person and his/her environment. Speech is one of these functions alongside with gnosis, praxis, control functions, thinking and memory. It is well-known that gnosis and thinking and memory as well as a number of control functions are associated with speech abilities. A man thinks verbally; to live a full social life he needs verbal memory; intellectual processes are also associated with speech, etc.

Thus, speech is one of the most important cognitive functions, and speech impairments automatically cause problems in various spheres of human activity. A patient with established cognitive decline needs language assistance.

At the Department of Neurology No. 1 in Republic Clinical Hospital No. 2 (Kazan, Russia) the neurolinguistic group of Kazan Federal University works with patients suffering from verbal and communication disorders caused by neurological diseases of various origins, including diabetes mellitus type 2. Joint work of specialists (neurologists, neurolinguists, neuro psychologists) aims to improve the quality of life of patients with speech disorders.

Unfortunately, at the moment speech therapy in Russia is relatively seldom given to patients with diabetes mellitus and if it is it happens at the stage of the disease when cognitive decline has already led to dementia. It is more difficult to help the patient at the stage of dementia or severe cognitive decline than at the initial stages when the problems have just been identified and the impairment has not yet touched all of the basic social and communicative functions. To prevent this, it is obviously necessary to develop and maintain language assistance to patients with diabetes mellitus.

The estimation of verbal communication skills in patients with diabetes mellitus type 2: We examined 120 patients (70 women and 50 men) with moderate DM type 2, average age 54.87±6.35 years, disease duration 7.20±5.6 years. The average Body Mass Index (BMI) is 32.62±5,49. The blood glucose level: from 7-10 mm^{-1} on an empty stomack and 10-15 mm^{-1} 2 h after a meal. Glycosylated hemoglobin is in the range of 7-9%.

The assessment of cognitive functions (including verbal communication) was conducted with the help of Mini-Mental State Examination scale and Montreal Cognitive Assessment test.

Mini-Mental State Examination (MMSE) gives the opportunity to estimate the orientation in time and place, oral-aural memory, praxis, gnosis, the level of understanding teams, reading, writing and drawing. This is a fairly simple test that allows a specialist to quickly identify the spheres of cognitive decline. It is not suitable for detailed diagnosis but it can be used as a marker of the presence/absence of problems. The test includes 11 items categorized into 5 groups (Folstein, 1975).

Orientation: This group gives an estimate of the spatial and temporal gnosis.

Registration: This test checks the oral-aural memory and the patient's ability to remember and immediately reproduce the lexical units. The patient is told the names of three unrelated objects and is asked to repeat them. The first immediate repetition determines his/her score. This test assesses the patient's ability to assimilate new information and be able to reproduce it.

Attention and calculation: The patient is asked to begin with 100 and count backwards by 7s. After the 5th subtraction the test finishes. If the patient fails, he is asked to spell the word (e.g., world) backwards.

This test helps to determine the patient's ability to switch to another type of activity, attention, speed of response to a new task, the ability to make the simplest calculations in his/her head.

Recall: The patient is asked to repeat the words from the Registration task. It is an assessment of short-time memory.

Language: This block contains 6 subtests:

- Naming: the patient is asked to name a common object. This subtest evaluates the capability for recognizing simple things and naming them
- Repetition: the patient is asked to repeat a sentence after the doctor. This subtest evaluates the ability to reproduce different syntactic constructions
- The 3-stage command: the patient is offered to follow a three-step instruction. This subtest shows the level of speech understanding and the capacity to switch from one operation to another
- Reading: a very simple test aimed at estimating if a patient has retained reading skills
- Writing: the patient is asked to write any sentence he/she wants
- Copying: The patient is asked to copy the intersecting pentagons

Montreal Cognitive Assessment (MoCA test) (Chan, 2014) gives an opportunity to evaluate the abstract and spatial thinking, vocabulary and memory. The test takes into account the initial level of education that allows a doctor to compare the results of patients with a higher baseline cognitive reserve with the results of patients with lower results. This test is more detailed and takes more time than MMSE.

MoCA includes the following blocks: alternating trail making, visuocon structional skills, naming, memory, attention, sentence repetition, verbal fluency, abstraction, delayed recall, orientation. The MoCA contains rather complex speech tasks:

- A 5-word test aimed at testing the patient's ability to remember and immediately reproduce the lexical units
- A task revising the ability to repeat difficult syntactic constructions and assessing the speed and adequacy of repeated speech
- Naming pictures aimed at identifying optico-mental disorders
- Checking the so-called verbal fluency. It is necessary to consider the specificity of this test. In fact, it demonstrates the speed of lexicon actualization (Gorobets *et al*., 2015)

In the dynamics (when the patient is tested several times after a certain period of time) these scales show the cognitive reserve of the patient. Cognitive reserve can be defined as the ability of the brain to functional compensation of disturbed functions and minimizing of cognitive inability (Slobodin and Goreva, 2012).

RESULTS AND DISCUSSION

MMSE showed the results <27 points in 85% of patients: 82.5% of patients had a result 25-27 points (mild and moderate cognitive impairment) and 2.5% of patients 20-24 points (severe cognitive impairment), 15% of the indicators were within normal limits (28-30 points).

The most evident cognitive decline was observed when performing the 3-word test and counting backwards from 100 by 7s. These results indicate a lack of short-term oral-aural memory and concentration. In patients with 28-29 points, the result was reduced due to low short-term memory.

MoCA test: About 15% of patients had scored fewer than 21 points (severe cognitive impairment); 70% of patients had 21-26 points (mild and moderate cognitive impairment) and 15% of patients showed normal results (28-30 points). The greatest decrease was observed in tasks of verbal fluency, 5-word test, abstraction and spatial reasoning.

The test revealed speech disorders in 85% of patients; the most difficult were the repeated speech test and verbal fluency test; 83% of patients had problems with delayed recall of 5 words which indicates a lack of short-term verbal memory.

The normal range was in 15% of patients when performing MMSE and 15% upon implementation of the MoCA-test. With the result within 28-30 points on the MMSE, 60% of patients showed <26 points on MoCA test. Only 25% of patients had results within normal limits. This group includes patients with 2-5 year duration of diabetes and level of glycemia no >8-9 mmol L^{-1} during the whole period of the disease.

The tests aimed to reveal cognitive impairments are necessary even if, the patient with diagnosed diabetes has no complaints. At early stages of encephalopathy, the patient and his relatives seldom think that they need treatment. It is widely believed that problems with speech functions are the manifestations of sclerosis (which is quite misleading as there are various meanings of "sclerosis" in mass conscience) and for the retirement or pre-retirement age problems with speech are considered somewhat normal.

In addition, patients and their relatives practically never complaints about speech issues. It is more typical

to be worried about memory impairment. During the conversation, a doctor needs to find out in detail what the patient means by saying "I have a bad memory". If it is said about events, objects, persons, a patient indeed has memory problems. But, the most frequent complaints are "I forget words/confuse words/can't find the right words" or "I forget the names of the people I know/I forget the names for most common things". This complaint touches not only upon memory in general but a verbal memory in particular and as a rule, these memory impairments are associated with other speech disorders.

If the complaints are connected mostly with verbal memory, it is advisable to suggest the patient takes specific linguistic tests in order to determine the most evidently damaged speech function. In addition, in some cases, it is recommended to check if the patient has alexithymic features (Esin *et al*., 2014).

CONCLUSION

Diabetes mellitus type 2 is accompanied by the development of verbal-communicative dysfunction in 85% of patients even when the degree of the disease is moderate.

Verbal communication disorders evidently declare themselves through both short-term and long-term verbal memory impairment and language attention decline. They negatively affect the cognitive processes, significantly reduce the patient's ability to adequate communication. If the patient has such problems, he/she cannot accurately follow the doctor's advice and medical recommendations, which minimizes the effectiveness of the treatment of diabetes and its complications.

In addition, problems with speech and speech communication have a significant impact on the quality of the patient's life: if a person has communicative problems, he/she begins to avoid communicative situations.

Patients with revealed speech problems need adequate medical treatment and linguistic assistance. The lack of linguistic assistance not only leads to deterioration of speech but also to reduction of all other cognitive and communicative functions associated with speech and conducted with the help of speech.

RECOMMENDATIONS

Verbal-communicative dysfunction may be the earliest manifestation of encephalopathy, independently of its etiology. It is advisable to offer cognitive tests to all patients with diabetes, regardless of duration and severity of their disease. Neurocognitive tests must be carried out in dynamics in order to track changes in results.

In spontaneous dialogue with the patient, it is necessary to assess the degree of patient's ability to understand oral speech addressed to him/her. It is recommended to ask him/her to retell the content of doctor's prescriptions, to summarize the results of the conversation with the doctor. If any problems of inadequate understanding are revealed, it is recommended to involve the close relatives of the patient to the process of treatment in order to help the patient to carry out the assignments.

The presence of verbal and communication problems is an indication for permanent treatment (nootropics) and obligatory systematic verbal training for speeding-up the cognitive compensation.

Currently, there is a large number of studies showing the efficiency of a standardized Extract of Ginkgo biloba (EGb 761) in the treatment of diabetes complications (Khayrullin *et al*., 2014; Taliyan and Sharma, 2012; Kudolo *et al*., 2006).

As for linguistic assistance, as a rule, all patients need training verbal memory. It is recommended to begin with 3-word tasks for recall, gradually increasing the number of elements. As for complicated syntactic structures, it is necessary not only to offer the patient to repeat them (as it is in the MoCA test) but also to find out if the patient is able to explain what is repeated. The analysis revealed that in some cases successful repetition of syntactic structures (e.g., I only know that John is the one to help today and The cat always hid under the couch when dogs were in the room from the MoCA test) doesn't mean that the content is fully understood. Detailed analysis reveals that that the patient can repeat these sentences automatically without understanding or with low degree of understanding.

Further recommendations are very individual and depend on the degree of verbal-communicative impairment. Recommendations for recovery of cognitive functions should be composed by a multidisciplinary team (neurologists prescribe medication, linguists provide verbal assistance, psychologists help the patient and his relatives to adapt to this situation).

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