CHANGES IN THE QUALITY OF LIFE OF CHILDREN AND ADOLESCENTS WITH COGNITIVE DEFICIENCY IN TYPE 1 DIABETES MELLITUS

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Abstract. *In this article the ways of determination of quality of life and neuropsychological condition of children, age range from 7 to 18 years. Early identification of quality of life facilitates the timely provision of medical and psychological care, which in turn leads to the reduction of possible disorders associated with the nervous system.*
Keywords: *quality of life, diabetes mellitus, cognitive deficiency, children, adolescents.*

Introduction: Diabetes mellitus (DM) is a chronic metabolic disease that is formed due to an absolute deficiency of insulin in type 1 diabetes or its relative deficiency and resistance in type 2 diabetes. Currently, throughout the world, diabetes is recognized as a so-called “non-infectious epidemic.” [3]. The reason for this is its high incidence, in all age categories, as well as the presence of an increased risk of complications with subsequent disability. This disease is a serious problem in which many organs and systems are affected, the central nervous system being no exception.

The number of children and adolescents seeking help for diabetes mellitus is only increasing from year to year. In this regard, childhood diabetes has been a pressing global health problem for many years. The expansion of the range of age limits, the formation of quite serious complications against the background of diabetes with possible subsequent disability, largely determine its leading position in both global and national programs for timely counteraction and assistance to victims [5,6,7].

As noted above, one of the “targets” of the negative effects of hyperglycemia, already at the initial stages of the disease, is the central nervous system (CNS). Various pathologies affecting the central nervous system, due to the peculiarities of innervation, among complications of diabetes in childhood have their own priority, since they have a heterogeneous nature of clinical signs, as well as the problematic nature of diagnostic and especially therapeutic measures. Moreover, cognitive impairment, which is the main brain abnormality in type 1 diabetes, negatively affects the achievement and maintenance of optimal glycemic control [4]. According to the literature, it is clear that the initial manifestations of cognitive dysfunction in this disease can occur already during the first 2-8 years from the onset of the disease. In this regard, early determination of quality of life and its subsequent study in the dynamics of the disease will contribute to the timely provision of medical and psychological assistance, which will naturally affect the reduction of complications of the nervous system in type 1 diabetes.

For the first time, the concept of “quality of life - QoL” was introduced into medical practice by the scientist J.R. Elkinton in 1966. This method began to be used as an additional method to traditional methods, allowing a cumulative assessment of the patient’s physical, psychological and social state. According to many authors, determining a child’s QoL before treatment, during it, and at follow-up allows one to improve methods of therapeutic and rehabilitation measures. Quality of life is considered to be an individual’s understanding of how

optimal his physical, emotional, psychological, social and other needs are, as well as how capable he is for self-expression and well-being.

At the present stage of development of medicine in clinical practice and in scientific research, the parameters of complex criteria have begun to be quite widely used, simultaneously and in totality making it possible to assess the physical, mental and social state of both a sick and a healthy person. One of the above evaluation criteria is the method for assessing the patient's quality of life. In pediatric practice, the most popular for assessing quality of life is the general pediatric questionnaire Pediatric Quality of Life Inventory - RedsQL 4.0, which is easy to use, reliable and has a high degree of sensitivity. The method can be used both in sick children of different ages and in absolutely healthy peers. In addition, specialists prefer this method due to the fact that the questionnaire has excellent psychometric properties and is easy to fill out and statically analyze. The age range of the questionnaire is from 7 to 18 years [1].

QoL in medical practice is associated with psychosomatic theories of relationships. This is a complex structure of the fusion of somatic and mental systems that play a significant role in the process of developing QoL. Pathologies that develop in patients in childhood will definitely influence personality development in the future. In modern studies, the authors especially emphasize the negative impact of chronic somatic pathologies on the optimal functioning of the cognitive, conceptual, communicative, and motivational spheres, and this contributes to personal and behavioral deviations [2].

Purpose of the study: Early determination of neurocognitive deficits and quality of life in children and adolescents with cerebral disorders in type 1 diabetes.

Materials and research methods

To achieve this goal, 102 ((there were 46 (45.09%) girls, 56 (54.9%) boys) children suffering from type 1 diabetes mellitus with pathology experience from 1 to 15 years were examined. The studies were carried out in the children's department of the Republican Specialized Scientific and Practical Medical Center of Endocrinology of the Republic of Uzbekistan in 2021-2023. The age of the children at the time of analysis of clinical data ranged from 7 to 18 years. Clinical studies included assessment of complaints, neurological status, provision of neurocognitive testing with the study of concentration and stability of attention according to the Bourdon scale, memory using the "Learning 10 words" method according to the A.R. Luria test, in addition, the emotional sphere was analyzed using the Spielberger-Khanin method and an assessment of the quality of life of patients was given using the Pediatric Quality of Life Inventory - RedsQL questionnaire 4.0.

Results and discussions: To determine the neurocognitive changes and quality of life of these children, we formed 3 groups depending on the length of the disease. Group I with a duration of the disease up to 3 years, Group II from 3 to 6 years and Group III with a duration of diabetes more than 6 years.

The results of assessing the state of cognitive functions taking into account the duration of the disease are presented in Table 1.

Table 1.

Analysis of Cognitive impairment depending on the indicator "Length of illness"

Indicators	Categories	Length of illness			p
		Me	$Q_1 – Q_3$	n	

mental performance AU (characters/sec.)	up to 3 years	2,50	1,54 – 3,14	33	0,001* Pmore than 6 years – up to 3 years < 0,001
	4-6 years	2,02	1,77 – 2,46	32	
	more than 6 years	1,60	1,42 – 2,16	37	
indicator of mental productivity E (cu)	up to 3 years	954,95	615,00 – 1108,64	33	0,001* Pmore than 6 years – up to 3 years < 0,001
	4-6 years	767,77	603,13 – 848,69	32	
	more than 6 years	579,84	476,47 – 789,26	37	
concentration of attention K (%) (%)	up to 3 years	71,0	64,0 – 77,0	33	< 0,001* P4-6 years – up to 3 years = 0,006 Pmore than 6 years – up to 3 years < 0,001
	4-6 years	63,0	54,0 – 66,2	32	
	more than 6 years	55,0	48,0 – 66,0	37	
indicator of stability and concentration of attention Ku (cu)	up to 3 years	64,1	51,0 – 96,1	33	0,020* Pmore than 6 years – up to 3 years = 0,016
	4-6 years	59,0	40,1 – 93,1	32	
	more than 6 years	52,4	35,1 – 65,0	37	
Luria's method of memory research (Point) (Point)	up to 3 years	4,0	3,0 – 4,0	33	0,003* P4-6 years – up to 3 years = 0,015 Pmore than 6 years – up to 3 years = 0,004
	4-6 years	3,0	3,0 – 4,0	32	
	more than 6 years	3,0	3,0 – 4,0	37	

* – the differences between the indicators are statistically significant ($p < 0,05$)

According to the data obtained when comparing the indicator “mental performance AU”, the indicator “mental productivity indicator E”, the indicator “concentration of attention K (%)”, the indicator “indicator of stability and concentration of attention Ku”, the indicator “Luria Methodology for studying memory (Ball)” depending on the indicator “Disease duration”, statistically significant differences were established ($p = 0.001$, $p = 0.001$, $p < 0.001$, $p = 0.020$, $p = 0.003$, respectively) (methods used: Kruskal–Wallis test, Kruskal–Wallis test, Kruskal–Wallis test, Kruskal–Wallis test, Kruskal–Wallis test).

When assessing the indicator “situational anxiety scale”, the indicator “personal anxiety scale” depending on the indicator “Duration of illness” in children and adolescents with type 1 diabetes, we found statistically significant differences ($p < 0.001$, $p < 0.001$, respectively). (Table 2.).

Table 2.

Analysis of psycho-emotional disorders depending on the indicator "Distance of illness"

Indicators	Categories	Length of illness			p
		Me	$Q_1 – Q_3$	n	
state anxiety scale (score)	up to 3 years	41,0	39,0 – 46,0	33	< 0,001* Pmore than 6 years – up to 3 years < 0,001 Pmore than 6 years – 4-6 years < 0,001
	4-6 years	44,0	42,0 – 46,0	32	
	more than 6 years	47,0	45,0 – 49,0	37	
personal anxiety scale (score)	up to 3 years	40,0	37,0 – 42,0	33	< 0,001* P4-6 years – up to 3 years = 0,008 Pmore than 6 years – up to 3 years < 0,001 Pmore than 6 years – 4-6 years = 0,032
	4-6 years	44,0	40,0 – 47,0	32	
	more than 6 years	46,0	43,0 – 48,0	37	

* – the differences between the indicators are statistically significant (p < 0,05)

The results of the analysis of the Quality of Life in patients with type 1 diabetes depending on the indicator "Duration of the disease" are shown in Table 3.

Table 3.

Analysis of Quality of life depending on the indicator "Length of illness"

Indicators	Categories	Length of illness			p
		Me	$Q_1 – Q_3$	n	
FF (point)	up to 3 years	62,5	56,0 – 72,0	33	< 0,001* Pmore than 6 years – up to 3 years = 0,020 PControl – up to 3 years < 0,001 PControl – 4-6 years <0.001 PControl – more than 6 years <0,001
	4-6 years	59,0	50,0 – 66,8	32	
	more than 6 years	53,1	40,6 – 62,0	37	
	Control	88,8	83,6 – 93,8	28	
EF (point)	up to 3 years	60,0	55,0 – 65,0	33	< 0,001* pmore than 6 years – up to 3 years = 0,017 pControl – up to 3 years <0.001 pControl – 4-6 years <0.001 pControl – more than 6 years <0.001
	4-6 years	52,5	45,0 – 61,2	32	
	more than 6 years	50,0	40,0 – 60,0	37	
	Control	87,5	80,0 – 95,0	28	
SF (point)	up to 3 years	70,0	65,0 – 75,0	33	
	4-6 years	65,0	60,0 – 70,0	32	

	more than 6 years	65,0	55,0 – 70,0	37	< 0,001* pControl – up to 3 years <0.001 pControl – 4-6 years <0.001 pControl – more than 6 years <0.001
	Control	95,0	90,0 – 100,0	28	
RF(point)	up to 3 years	60,0	55,0 – 65,0	33	<0.001* pmore than 6 years – up to 3 years = 0.005 pControl – up to 3 years <0.001 pControl – 4-6 years <0.001 pControl – more than 6 years <0.001
	4-6 years	52,5	45,0 – 60,0	32	
	more than 6 years	50,0	40,0 – 55,0	37	
	Control	85,0	75,0 – 90,0	28	

* – differences in indicators are statistically significant ($p < 0.05$)

In accordance with the presented table, when comparing the FF, the "EF" indicator, the "SF" indicator, the "RF" indicator depending on the "Duration of the disease" indicator, we identified statistically significant differences ($p < 0.001$, $p < 0.001$, $p < 0.001$, $p < 0.001$, respectively) (methods used: Kruskal–Wallis test, Kruskal–Wallis test, Kruskal–Wallis test, Kruskal–Wallis test).

Correlation analysis of the average QoL score and the “Duration of the disease” indicator established a noticeably close inverse relationship. The observed dependence of the average QoL score on the “Disease Duration” indicator is described by the paired linear regression equation:

YQOL Avg. score = -1.603 × XDuration of disease + 66.081

Thus, with an increase in the “Duration of disease” indicator by 1 year, one should expect a decrease in the average QoL score by 1.603. The resulting model explains 30.8% of the observed variance (Table 4).

Table 4.

Results of correlation analysis of the relationship between the indicator “Duration of disease” and the indicator “QoL Average score”

Indicator	Characteristics of correlation		
	ρ	Connection tightness on the Chaddock scale	p
Duration of disease – QoL Avg. point	-0,527	Noticeable	<0,001

Thus, in patients of childhood and adolescence with cognitive impairment in type 1 diabetes, a decrease in quality of life by 9% is observed in children with a disease duration of 3-6 years compared with children with less than 3 years of experience, in turn, in children with more long-term illness (more than 6 years), QoL decreases by 16.5% in relation to children with less than 3 years of experience.

Conclusions: According to the results of the study, it was clear that in the studied groups, disorders of cognitive activity were detected already in the early stages of type DM. The pace of information processing slows down, both short-term and long-term memory, productivity and

accuracy of task completion suffer. Moreover, one of the earliest cognitive impairments was a slowdown in the rate of information processing, which occurred in patients with diabetes mellitus before other disorders. The data obtained from the QoL questionnaire indicate that in children suffering from type 1 diabetes, there is a statistically significant decrease in the quality of life in all of these indicators, depending on the length of the disease. This is also demonstrated by the inverse correlation relationship established during the study of noticeable closeness.

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