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Comparative assessment of quality of life of the children and adolescents with diabetes mellitus type 1 on pump insulin therapy

Azimova OT,[1] Ismailov SI,[1] Alimova NU[2]

[1]Department of Endocrinology, Tashkent Pediatric Medical Institute, Republic of Uzbekistan

[2]Republican Specialized Scientific-Practical Medical Center of Endocrinology, Ministry of Health, Republic of Uzbekistan

Correspondence: Azimova Ozoda, Department of Endocrinology, Tashkent Pediatric Medical Institute, Republic of Uzbekistan, Tel +998903226704, Email azimova.ozoda26@gmail.com

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Abstract

Background: Diabetes mellitus type 1 in children and adolescents is a complex problem throughout the world. The onset of the disease at an early age and the threat of development of acute and chronic complications already at a young age encourage to search the most optimal methods of treating this serious disease. The article presents the results of the use of pump insulin therapy in the practice of pediatric endocrinologists in Uzbekistan.

Purpose: The purpose of this study was to assess the quality of life in children and adolescents with type 1 diabetes mellitus on pump insulin therapy, with considering of carbohydrate value in Uzbek national foods.

Materials and methods: In the study in order to assess the quality of life in patients with type 1 diabetes it was used Russian version of the Diabetes Quality of Life for Youth Pediatric Quality of Life (DQOLY-SF) questionnaire.

Results of the study: the results of the conducted study demonstrate reliably that the use of modern technologies is accompanied by the improvement of not only glycemic control, but also the quality of life of children and adolescents with type 1 diabetes.

Conclusion: 1. The use of pump insulin therapy has a positive impact on all aspects of the quality of life detected by the questionnaire DQOLY-SF. The greatest improvements were noted in such aspects of quality of life as the impact of diabetes symptoms, the impact of treatment, the impact on daily activities, relationships with parents. Moreover, worries associated with diabetes, decreased by almost 2 times.

Keywords: quality of life, pump insulin therapy, diabetes mellitus in children and adolescents

Introduction

Quality of life is an integral index including physical, social prosperity of patient and reflecting his physical, social, cognitive capabilities. The special actuality the problem of improvement of QOL acquires at chronic diseases physiological indemnification of that the modern methods of secondary prophylaxis allow to provide, that, however, does not diminish, and, rather, only increases meaningfulness of psychical adaptation to life with the burden of illness. In the structure of similar diseases an important place occupies a diabetes mellitus, height of morbidity that on the estimations of specialists.

According to IDF, 542,000 children (0-14 years) with type 1 diabetes mellitus were registered in the world in 2015, of which 86,000 were newly diagnosed.[1] The prevalence of type 1 diabetes varies considerably in different countries, within one countries and in various ethnic populations. Most often it occurs in Finland,[2] the Nordic countries[3,4] and Canada.[5] Among European Europeans living in Europe, the frequency of occurrence is 20-fold scatter[6] and correlates with the incidence of HLA genes in the population as a whole.[7] Of the approximately 500,000 children with diabetes, 1 which constituted about 26% from Europe and 22% from North America and the Caribbean. In Asia, the incidence of DM 1 is very low: South-East Asia recorded 149,300 children and adolescents with type 1 diabetes. In 2017, according to the International Diabetes Federation, there were approximately 19,500 newly identified children and adolescents. India is on the second place in the world with type 1 diabetes after the United States, the number of incidents is 128,500.[8–10] In the Republic of Uzbekistan at the period 01.01.2017, with pediatric endocrinologists on a dispensary record of 2532 patients with type 1 diabetes mellitus are registered with pediatric. Children with type 1 diabetes mellitus are constituted 1791 and adolescents 741. On the period of 10 years, the prevalence of type 1 diabetes among children in the Republic increased from 10.6 to 19.8 per 100,000 children for the period 2006-2016. As for, as to adolescents, this indicator has doubled since 2006-2016 from 22.2 to 41.2 per 100,000 adolescents. The incidence in 2016 was 2.3 per 100 000 children, at the same time it should be noted that the incidence among adolescents for 10 years increased by 3 times. In 2006, the 100 000 adolescent population had a morbidity rate of 2.6, in 2016 this figure was 6.9.[11]

In accordance with the "St. Vincent Declaration", the main directions of the medical and social policy regarding diabetes should be aimed at minimizing its growth, development of complications and improving the quality of life (QOL) in patients of all age groups.[12] From the moment of manifestation of Diabetes mellitus type 1 patients should be introduced with insulin therapy in the basal-bolus regimen (ISPAD 2017).

A fundamentally new and progressive step in the treatment of diabetes has become apparatus for continuous subcutaneous insulin injection - insulin pumps, and pump insulin therapy (PIT) is classified as a new high-tech medical device.[13] Insulin pumps provide better glycemic control compared to the regime of multiple injections of insulin (MII) and significantly reduce the incidence of hypoglycemia, which is one of an important aspect in the compensation of diabetes. In the world, pump insulin therapy is used quite widely not only in type 1 diabetes: up to 34% of adult patients with DM 2 in the US and up to 25% in Europe patients are used pumps to administer insulin therapy. In Russia, the number of pump users is progressively increasing and by 2014 it has been about 10,000 people.[14] Researchers of European countries have shown that QOL depends on many factors - age, gender, duration of the disease, family relationships, treatment methods and others. It is quite obvious that long-term maintenance of glycemic targets with low QOL or at the cost of its reduction, for example, the need to increase the frequency of self-monitoring and the number of daily injections often sharply reduces QOL. For a patient, it may be more important to evaluate a happy family life, an opportunity to enjoy a hobby, personal finances than wellbeing. Patient-oriented questionnaires for assessment of quality of life, where a person with diabetes determines and evaluates what important for himself and it gives a higher QOL score when using PIT compared to MII.[15] Only one large multicenter prospective study was published that evaluated satisfaction with treatment and QOL in patients using the integrated continuous blood glucose monitoring system and continuous insulin subcutaneous insulin (RT-CGM / CSII) systems.[16] Along with the improvement of QOL, PIT is an effective and safe method of treatment of diabetes in children and adolescents, of which only a small part of patients refuses themselves (continue insulin therapy in MII regime after 6-12 months of using PIT).[17] It is also important to emphasize that PIT provides better glycemic control compared with the regime of multiple insulin injections (MII) and also, a significant reduction in the incidence of hypoglycemia is compared to those patients who use multiple insulin therapy.[18]

But in order to make extensive use of intensive care methods through the use of MII and insulin pumps in Uzbekistan, there are have been developed tables for assessing the carbohydrate value of Uzbek and Eastern cuisine in Bread Units (BU) and prepared an electronic base for integration into specialized computer programs of pumps (bolus calculators) and for optimizing the settings of insulin pumps in structured training programs for programming the calculation of bolus doses of insulin.

Using of carbohydrate value of dishes in grams in recipes of national Uzbek dishes and a known ratio of 1 BU corresponding to 10-12 grams of carbohydrates, which also depends on the composition of food, according to this there are first tables of the BU and bolus types for pump insulin therapy have been developed, consisting of 32 dishes and products of the Uzbek national kitchen.[11]

Thus, at present, the study of assessment of QOL is very important, when transferring patients with type 1 diabetes to pump insulin therapy.

Purpose: The purpose of this study was to assess the quality of life in children and adolescents with type 1 diabetes mellitus on pump insulin therapy, with consideration of the carbohydrate value in Uzbek national foods.

Methods and materials of the research

Twenty children with type 1 diabetes who were on pump insulin therapy participated in the study (Table 1). A group of patients with type 1 diabetes was formed from the number of patients at the city Endocrinology dispensary in Tashkent and the Region Endocrinology dispensary of the Tashkent.

Table 1 Clinical characteristic of the patients

The indicators of the groups		
The number of the patients		N=20
Average age		12,3±0,7
Sex	Boys	12
	Girls	8
Duration of the disease		4,5±0,7
The complications		Have not
Duration of the control		12 month
General clinical observation of the patients included follow:		Weight, SDS of height, blood glucose and glycated hemoglobin

All patients have been investigated by standardized complex clinical-laboratory observation, which included collection of anamnesis, the physical observation of the patients, laboratory and instrumental investigation, also the assessment of the quality of the life by the questionnaire/

The general clinical methods of observations consisted from:

a) questionnaire survey by the constructed protocol of research;

b) anthropometric methods of assessment of physical development, which is the measurement of the weight, SDS of the height by

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percentile binds (WHO 2007);

c) functional methods of investigation (EKG);

d) Biochemical investigations (creatinine);

e) Consultation of the oculist whit the direct ophthalmoscopy of the eye ground.

Clinical methods of the investigation

Indicators of the compensation of the carbohydrate metabolism have been assessed by the recommendations of ISPAD (International Society for Pediatric and Adolescent Diabetes) 2014 published.

For the assessment of QOL of the patients with the type 1 diabetes mellitus have been used Russian version of the questionnaire of Diabetes Quality of Life for Youth Pediatric Quality of Life (DQOLY-SF). This questionnaire is distinguished by high reliability, validity and sensitivity and allows to objectively assess the quality of life of children and adolescents with type 1 diabetes.

In the present study, were used blocks for the age groups 8-12 and 13-18 years. The DQOLY-SF questionnaire includes 22 questions relating to scales assessing quality of life factors: the impact of diabetes symptoms, the impact of treatment, the impact on daily activities, relationships with parents, experiences related to diabetes, health perception. In addition, during the survey, it is possible to count the total scores on the various scales of the questionnaire.

Each question has five possible options for assessing the degree of one or another anxiety from 0 to 4, with 0 - never, and 4 - constantly. A higher score indicates a more negative impact of diabetes and a worse quality of life, lower scores are associated with good QOL. The evaluation of each sub-section is made separately by summing up the scores for each sub-item question. The emphasis on the sum of points in each subsection, in contrast to the total score, makes it possible to assess the problem in more detail in a separate area.

The total number of points after recoding (transfer of raw data to life quality scores) was calculated on a 100-point scale; The lower the value, the higher the quality of life of the child. The following formulas were used in the explanation to the questionnaire: This questionnaire was provided to patients for completion before group training on a structured program and after the completion of the annual follow-up period. All patients signed informed consent to participate in the study. (application questionnaire).

Results

The use of pump insulin therapy has a positive impact on all aspects of the quality of life detected by the questionnaire DQOLY-SF. The greatest improvements were noted in such aspects of quality of life as the impact of diabetes symptoms, the impact of treatment, the impact on daily activities, relationships with parents. Moreover, worries associated with diabetes, decreased by almost 2 times. Against a background of investigation and modified therapy according improvement of carbohydrate metabolism there were registered positive dynamic of the main aspects of the QOL. For the children under 12 year and for the parents of the children younger 12 have been suggested to fill up the questionnaire of QOL before and after using 1 year of pump insulin therapy. By evaluating of quality of life we got following results (Table 2).

Table 2 Comparative assessment of quality of life of patients with type 1 diabetes mellitus before and after using one-year PIT

Quality of life parameters	Scores before PIT (%)	Scores after 1 year of using PIT (%)	Scores %	P
Influence of symptoms of diabetes mellitus	23	18	↓5	<0.05
Effect of treatment	27,8	19,6	↓8,2	<0.05
Impact on daily activities	13,6	5,9	↓7,7	<0.05
Relations with parents	62	47,7	↓14,3	<0.05
Anxiety associated with diabetes	40	22,4	↓17,6	<0.05
Perception of health	50	47,7	↓2,3	<0.05
Overall assessment of QOL	29,5	22,3	↓7,2	<0.05

As can be seen from Table 2, statistically significant differences in the quality of life indicators were obtained when the questionnaire was filled by children and parents before the initiation of PIT and after 1 year. After transferring to pump insulin therapy, parents and children assessed all the indicators higher:

-the impact of diabetes symptoms decreased by 5%;

-the impact of treatment by 8.2%;

-the impact on daily activities improved by 7.7%;

-the relationship with parents became better by 14.3%;

-worries associated with diabetes decreased almost on twice;

-perceptions of health changed for the better by 2.3%, while after transferring to PIT more patients and parents began to assess the health of children good and excellent;

-overall quality of life assessment showed an improvement in QOL by 7%.

When comparing questionnaires filled with parents and children, parents were more concerned about the development of complications of diabetes than children.

Thus, the results of the conducted study reliably demonstrate that the use of modern technologies is accompanied by the improvement of not only glycemic control, but also QOL.

Discussion

The latest published meta-analysis of studies comparing CSII and MDI (multiple daily injection)[19,20] demonstrated improvement in glycemic control using pump therapy in patients with DM 1. At the current time, there are only a few reviews on the use of CSII in adults, adolescents and small children with DM 1.

In this study, an assessment of the quality of life in children and adolescents with type 1 diabetes mellitus was conducted on pump insulin therapy, taking into account the carbohydrate value in dishes of Uzbek national cuisine. It was shown that the method of insulin administration plays a huge role in achieving compensation of type 1 diabetes, thereby improving the glycemic control and QOL parameters of the subjects. Attention is drawn to the more pronounced dynamics of a statistically significant improvement in QOL for a larger number of patient outcomes after transferring to the PIT regime after a year. Thus, the results of the conducted study demonstrate reliably that the use of modern technologies, such as PIT, is accompanied by an improvement not only in glycemic control, but also in QOL. Taking into account the data of earlier studies and the accumulated clinical experience, it can be assumed that pump insulin therapy has an ambiguous effect on patients: the repeatedly increasing amount of information on glycemia, its dynamic changes depending on various events and the possibility of flexible control of food intake by patients provides a great opportunity for them to look at diabetes with other eyes. QOL is an important result both in itself and because it can affect the patient's activity with regard to self-management of the disease. If the requirements for adherence to the treatment scheme do not coincide with how patients want to live, they can choose less strict glycemic control in order to maintain their QOL. Thus, patients on pump therapy in conventional clinical practice admitted improving thinking, mood and well-being after a transfer from MDI, and these and other psychosocial factors are increasingly being evaluated in scientific studies on PIT. Knight et al. showed that the improvement in HbA1c in children with type 1 DM after transition to PIT was accompanied by an improvement in a number of cognitive indicators, such as sensory perception, selective attention and short-term memory, relationship with parents, etc.

Conclusion

The advantage of usage of pump insulin therapy is that it impacts on all aspects of QOLs on the DQOLY-SF questionnaire. It should be highlighted, that the greatest improvements were noted in relation to such aspects of QOL as the impact of the symptoms of diabetes mellitus, the impact of treatment, the impact on daily activities, relationships with parents. Worries associated with diabetes decreased almost 2 times.

To sum up and understand specific aspects of insulin pump therapy that are related to quality of life it is important to use insulin pumps for improving health outcomes among youngsters with type 1 diabetes. Firstly, it should be pointed out that on pump insulin therapy patients are feeling flexible because it allows to arrange their eating habits and following specific diet. Moreover, it affects the state and a mood of the parents of the patients for they feel more relaxed and psychologically stable due to the understanding of the state of their children that are not any different from the state of other children that are not affected by diabetes. Last but not least, there is a psychological aspect that needs to be taken into account. This has mostly to do with social environment which creates a feeling of freedom among children and invokes in them an impetus for doing sports, setting up a family, perform in education and so on.

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