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USE OF ULTRA-SHORT INSULIN PREPARATION IN CHILDREN WITH TYPE 1 DIABETES MELLITUS

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Modern insulin preparations are divided into groups according to origin – animal and human. The therapy with insulin of animal origin causes the formation of high levels of antibodies as well as some lipodystrophic changes in the subcutaneous fat. The use of animal insulin in children with type 1 diabetes mellitus is not able to achieve compensation for the disease. In this regard, use of ultra-short and short insulin preparations is a matter of great importance in the achievement and maintenance of this compensation for sick children with type 1 diabetes.

Purpose of the study. *The purpose of the study is to assess postprandial hyperglycemia during the treatment for diabetes mellitus with ultra-short insulin preparations.*

Material and methods. *The study was conducted using the children's department of Shymkent oblast endocrinology clinic. The study involved 60 children aged 5 to 12 years, who had type 1 diabetes mellitus. The children undertook insulin therapy with the bolus ultra-short preparation (Humalog) in accordance with an intensified scheme. Taking into account the level of disease compensation the children taking Humalog were divided into two groups: compensated (30) and decompensated (30).*

Results and discussion. *According to the data obtained from compensated children with diabetes in the group "Humalog", the maximum rise of glycemia level after nutritional loading occurs earlier – in a half an hour after having a meal. In addition, these children have higher figures of the maximum level of glycemia. In 2 hours after nutritional loading the levels of hyperglycemia in the compensated patients met the criteria for compensation. After 2 hours after the meal glycemia in both groups exceeded a tolerant dose and reached particularly high figures in patients in the decompensated group. The study showed that postprandial glycemia figures are not a strict constant of range. The range of postprandial glycemia is influenced by many factors, primarily the state of endogenous insulin secretion. The absolute insulin deficiency inherent to type 1 diabetes mellitus contributes to an increase in the postprandial hyperglycemia level after a meal. A significant increase in glycemia levels is observed in the period of decompensation of the disease. According to our data, having a course with a fixed content of carbohydrates, as in the compensated patients described above, especially receiving ultra-short insulin preparations helps to keep the figures of postalementary glycemia within tolerable limits.*

Conclusions. *The ranges of postprandial glycemia depend on supplying the body with insulin. The highest level of postprandial glycemia was obtained from the decompensated patients with diabetes mellitus. The absolute insulin deficiency contributes to an increase in glycemia.*

Key words*: diabetes mellitus, ultra-short insulin preparations, postprandial hyperglycemia, postalimentary glycemia.*

Modern insulin preparations are divided into groups according to origin – animal and human. For 60 years porcine insulin has been used for the treatment of diabetes mellitus, which differed from human insulin with 3 and 1 amino acids respectively in composition. The therapy with insulin of animal origin is the long-term immunization of a child's body which causes the formation of high levels of antibodies (IgG). The resulting antigen-antibody complex is a potent pathogenic factor in the development of vascular complications such as micro- and macroangiopathy, as well as insulin resistance. In addition, animal insulin preparations often cause some lipodystrophic changes in the subcutaneous fat. Moreover, use of animal insulin in children with type 1 diabetes mellitus is not able to achieve compensation for the disease. In this regard, use of ultra-short and short insulin preparations is a matter of great importance in the achievement and maintenance of this compensation for sick children with type 1 diabetes [1].

Biosynthetic insulin has the highest purity and biocompatibility, as well as safety. In the manufacture of this type of insulin the recombinant DNA containing a gene of human insulin is inserted into a cell of baker's yeast or E. Coli by a genetic engineering technique. As a consequence, yeasts or bacteria start to synthesize human insulin. Genetically engineered human insulin preparations are the best type and a priority has to be given to these preparations while choosing a medication of treatment for 1 type diabetes mellitus. The prescription of genetically engineered human insulin is not only the optimal treatment for diabetes mellitus, but is also a key factor in preventing later cardiovascular complications.

In the references there is relatively scarce information about postalimentary glycemia after the use of genetically

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engineered human insulin [2]. The data relating to the level of postalimentary glycemia after meals is uncommon**.** Moreover, this work has been carried out by foreign scientists, where the nutrition of the population differs significantly from that in Kazakhstan [3, 4, 5]. In addition, in the 70-80s, when the studies were conducted, the possibility of insulin therapy was limited. Firstly**,** at that period physicians and patients had only animal insulin with a lower biological activity than human insulin. Secondly**,** the physicians did not have the ultra-short insulin preparations that are highly effective remedies for the elimination of postprandial hyperglycemia.

Purpose of the study

The purpose of the study is to assess postprandial hyperglycemia during the treatment for diabetes mellitus with ultra- short insulin preparations.

Material and methods

The study was conducted using the children's department of Shymkent oblast endocrinology clinic. The study involved 60 children aged 5 to 12 years, who had type 1 diabetes mellitus. The children undertook insulin therapy with the bolus ultra-short preparation (Humalog) in accordance with an intensified scheme.

Taking into account the level of disease compensation the children taking Humalog were divided into two groups: compensated (30) and decompensated (30).

The data on the state of carbohydrate metabolism in the examined children, who agreed to be included into the study, is shown in table 1. The recommendations of the Saint Vincent Declaration were used as criteria for compensation of diabetes [6]; according the these recommendations the evidence of compensation for children with type 1 diabetes mellitus, blood glucose levels has to be not more than 7.0 in the morning on the empty stomach, and 10.0 mmol in 2 hours after having a meal.

Postalimentary glucose was estimated in the patients having conventional food [7]. The study was conducted in a dinner hour. The necessary amount of glycemia was calculated immediately before a meal and every other 30 minutes for 2 hours after the meal.

Results and discussion

According to the data obtained from compensated children with diabetes in the group "Humalog", the maximum rise of glycemia level after nutritional loading occurs earlier – in a half an hour after having a meal. In addition, these children have higher figures of the maximum level of glycemia (table 2).

In 2 hours after nutritional loading the levels of hyperglycemia in the compensated patients met the criteria for compensation.

In the decompensated patients with diabetes as well as in the compensated group a maximum of postprandial glycemia occurred in a half an hour after meal and achieved much higher figures (table 3).

After 2 hours after the meal glycemia in both groups exceeded a tolerant dose and reached particularly high figures in patients in the decompensated group.

The study showed that postprandial glycemia figures are not a strict constant of range. The range of postprandial glycemia is influenced by many factors, primarily the state of endogenous insulin secretion. The absolute insulin deficiency inherent to type 1 diabetes mellitus contributes to an increase in the postprandial hyperglycemia level after a meal. A significant increase in glycemia levels is observed in the period of decompensation of the disease.

Another factor affecting the findings of glycemia is the type of applied bolus insulin. Ultra-short insulin preparations have a greater effect on postprandial glycemia figures, which is reflected in the range of postalementary glycemia.

This conducted study has proved once again that the possibilities of modern insulin therapy, despite the emergence of ultra-short insulin preparation, are limited. It is obvious that this limitation has been connected with the peculiarities of pharmacokinetics of available insulin preparations, which do not fulfill the basic requirement of insulin therapy in the need for complete matching of the level of glycemia with the level of insulinemia in every time interval.

According to our data, having a course with a fixed content of carbohydrates, as in the compensated patients described above, especially receiving ultra-short insulin preparations helps to keep the figures of postalementary glycemia within tolerable limits.

Conclusions

1. The ranges of postprandial glycemia depend on supplying the body with insulin.

2. The highest level of postprandial glycemia was obtained

Table 1 – **The state of carbohydrate metabolism in children with type 1 diabetes mellitus when they were selected for the study, mmol/l**

Group	n[1]	Glycemia	
		before a meal	after 2 hours after a meal
The first (compensated)	30	5.4±1.2	9.6±3.8
The second (decompensated)	30	8.8±3.2	14.3±4.2
[1]n is the number of children			

Table 2 – **Kinetics of postprandial glycemia (M±m) in the compensated group "Humalog"**

n	Before a meal	After a meal				
		after 30 minutes	after an hour	after an hour and a half	after 2 hours	after 2 hours and a half
30	5.4±2.3	10.2±5.2	9.8±5.7	8.5±5.5	8.0±5.6	7.5±4.7

Table 3 – **Kinetics of postprandial hyperglycemia (M±m) in the decompensated group "Humalog"**

n	Before meal	After meal				
		after 30 minutes	after an hour	after an hour and a half	after 2 hours	after 2 hours and a half
30	10.6±4.8	16.4±8.5	14.5±5.8	13.7±5.0	12.4±5.9	11.8±6.2

from the decompensated patients with diabetes mellitus. The absolute insulin deficiency contributes to an increase in glycemia.

REFERENCES

1. Kasatkina E.P. Diabetes mellitus in children and adolescents. – Moscow, 2002. – P. 92-122
2. Kurbanov S.K. Effect of dietary loading on postalimenary glycemia in patients with lipoid hepatosis in combination with obesity // Nutrition. – 2003. – N 1. – P. 17-20
3. Odud E.A. The glycemia indexes in optimizing dietotherapy for insulindependent diabetes in children and adolescents // Dissertation. – Moscow, 1993. – P. 21-22
4. Ekpebegh C.O. A comparison of the glycemic response indices to maize pap and sorghum pap meals // Diabetes Metabolism. – 2003. – N 29. – P.197
5. Azemati B., Taleban F.A. The effects of low and high glycemic index foods eaten at dinner on incremental blood glucose response areas after standard in patients // Diabetes Metabolism. – 2003. – N 29. – P. 200
6. St Vincent Declaration and its meaning in the general medical practice // Diabetography. – 1998. – N 7. – P. 10

Р Е З Ю М Е

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ОПТИМИЗАЦИЯ ИНСУЛИНОТЕРАПИИ ДЕТЕЙ, СТРАДАЮЩИХ САХАРНЫМ ДИАБЕТОМ 1 ТИПА

Современные препараты инсулина разделяют на группы в зависимости от происхождения – животные и человеческие. На протяжении 60 лет для лечения сахарного диабета применяли свиной инсулин, который по составу отличался от человеческого на 3 и 1 аминокислоты. Терапия инсулином животного происхождения – это длительная иммунизация организма ребенка, которая вызывает образование высоких титров антител (IgG). Образующийся комплекс антиген-антитело является мощным патогенетическим фактором в развитии сосудистых осложнений – микро- и макроангиопатий, а также инсулинорезистентности. В этой связи большое значение в достижении и поддержании компенсации у больных детей сахарным диабетом 1 типа имеет значение применения ультракоротких препаратов инсулина.

Цель исследования. Оценка постпрандиальной гликемии на фоне применения ультракоротких препаратов инсулина.

Материал и методы. Исследование было проведено на базе детского отделения Шымкентского областного эндокринологического диспансера. Обследовано 60 детей в возрасте от 5 до 12 лет, больных сахарным диабетом 1 типа. Дети получали инсулинотерапию по интенсифицированной схеме с использованием в качестве болюсных препарат ультракороткого действия (Хумалог). С учетом уровня компенсации заболевания дети были разделены на две группы: компенсированные (30) и декомпенсированные (30). Среди них выделяли пациентов, получавших Хумалог (подгруппа «Хумалог» – компенсированные 30 детей и декомпенсированные 30).

Результаты и обсуждение. Согласно полученным данным у компенсированных детей с диабетом в подгруппе «Хумалог», максимальный подъем гликемии после пищевых нагрузок происходит раньше – через полчаса после еды. Кроме того, для этих детей характерны более высокие, цифры максимальной гликемии. Через 2 ч после пищевых нагрузок уровни гликемии у компенсированных больных соответствовали критериям компенсации. У декомпенсированных больных диабетом максимум постпрандиальной гликемии, как и в группе компенсированных, наступал через полчаса после еды, достигая при этом значительно более высоких цифр. Гликемия через 2 ч после еды в обеих подгруппах превышала допустимую, достигая особенно высоких цифр у пациентов, в декомпенсированной подгруппе. Проведенное исследование показало, что цифры постпрандиальной гликемии не являются строго постоянными величинами. На величину постпрандиальной гликемии влияет множество факторов, в первую очередь, состояние эндогенной секреции инсулина. Абсолютная инсулиновая недостаточность, присущая диабету 1 типа, способствует повышению постпрандиальной гликемии после приема блюд. Особенно значительное повышение гликемии наблюдается в период декомпенсации заболевания.

Выводы. Величины постпрандиальной гликемии зависят от обеспеченности организма инсулином. Наиболее высокая постпрандиальная гликемия получена у декомпенсированных больных сахарным диабетом. Абсолютная инсулиновая недостаточность способствует повышению постпрандиальной гликемии.

Ключевые слова: *сахарный диабет, ультракороткий инсулин, постпрандиальная гипергликемия, посталиментарная гликемия.*

Т Ұ Ж Ы Р Ы М

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ИНСУЛИНГЕ ТӘУЕЛДІЛЕРДІҢ ІШІНДЕГІ КӨПШІЛІГІН ҚАНТ ДИАБЕТІНІҢ І ТҮРІМЕН ЗАРДАП ШЕГЕТІН БАЛАЛАР ҚҰРАЙДЫ

Қазіргі заманғы инсулин препараттарын пайда болуына қарай жануарлық және адамдық деген екі топқа бөледі. 60 жыл бойы қант диабетін емдеуде шошқа инсулинін қолданды,ол адам инсулинінен 3 және 1 аминоқышқылға ерекшеленеді. Жануар инсулинімен терапия – ол бала ағзасын ұзақ уақыт иммундау,ол антидененің (IgG) жоғары титрінің түзілуін тудырады. Антиген–антидененің түзілген комплексі тамырлық асқынулар – микро- және макроангиопатия дамуында, сонымен қатар инсулинтөзімділікте де мықты патогенетикалық фактор болып табылады. І типті қант диабеті бар науқас балаларда компенсацияны қолдау және жеткізуде ультрақысқа инсулин препараттарын қолдану үлкен маңызға ие.

Зерттеу мақсаты. Поспрандиалді гликемияны ультрақысқа инсулин препараттарын қолданған соң бағалау.

Материал және әдістері. Зерттеу Шымкент облыстық балалар эндокринологиялық диспансерінің базасында өткізілді. Қант диабетінің І типімен науқас 5 пен 12 жас аралығындағы 60 бала тексерілді. Балалар интенсифицерленген тізбекте ультрақысқа әсердегі (Хумалог) болюсті препараттарды қолдану арқылы инсулинді терапия қабылдады. Компенсация деңгейіне байланысты балалар 2 топқа бөлінді: компенсирленген (30) және декомпенсирленген (30). Олардың ішінде Хумалог («Хумалог» тобы – компенсирленген 30 бала және декомпенсирленген 30) қабылдаған науқастарды ерекшелеп қойды.

Нәтижелері және талқылауы. Алынған нәтижелерге сүйенсек «Хумалог» тобында қант диабетімен ауыратын компенсирленген балаларда гликемияның ең жоғарғы деңгейі тағамдық жүктемеден кейін ерте дамиды – тамақтан соң жарты сағаттан кейін. Тағамдық жүктемеден кейін 2 сағаттан соң компенсирленген балаларда гликемия деңгейі компенсация белгілеріне сәйкес келді. Декомпенсирленген қант диабетімен науқастарда жоғары постпрандиальді гликемия компенсир-

ленген топтағыдай тамақтан соң жарты сағаттан кейін дамыды, ол маңызды жоғары сандарға жетті. Гликемия тамақтан соң 2 сағаттан кейін екі топтада жоғарылады, әсіресе декомпенсирленген топтағы науқастарда жоғары сандарға көтерілді. Жүргізілген зерттеу постпрандиальді гликемия санының үнемі жоғарламайтынын көрсетті. Постпрандиальді гликемияның жоғарылауына көптеген факторлар әсер етеді, бірінші кезекте инсулиннің ішкі секрециялық жағдайы. I типтегі абсолютті инсулинді жеткіліксіздік постпрандиальді гликемияның тамақ қабылдағаннан кейін жоғарылауына әсер етеді. Әсіресе гликемияның маңызды жоғарылауы аурудың декомпенсация кезеңінде байқалады.

Қорытынды. Постпрандиальді гликемияның жоғарылауы ағзаның инсулинмен қамтамасыз етілуіне тәуелді. Постпрандиальді гликемияның ең жоғары деңгейі декомпенсирленген қант диабетімен науқастардан алынған.

Негізгі сөздер: *қант диабеті, ультрақысқа инсулин, постпрандиальді гликемия, посталиментарлық гликемия.*

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