

## Fundamentals of Insulin Therapy in Patients with Type I Diabetes Mellitus

*Zhurakulova Zebuniso Ahtamovna*

*Abu Ali Ibn Sino Bukharan State Medical Institute Sino Department of Internal Medicine and Endocrinology*

### ABSTRACT

*Diabetes mellitus: is a chronic endocrine disorder accompanied by elevated blood glucose levels due to an absolute or relative deficiency of the pancreatic hormone insulin, and/or due to a decrease in the sensitivity of target cells of the body to it. Glucose is the main source of energy in the human body. Basic bolus therapy is focused on pathophysiological changes and, with professional training and high-quality self-control, gives good results with sufficient flexibility in everyday life. All insulin analogues have advantages over human insulins in terms of treatment outcomes and patient safety. All types of insulin therapy in clinical practice can be carried out using simple schemes.*

**KEYWORDS:** *type 1 diabetes mellitus; insulin therapy; insulin analogues.*

### Introduction

Numerous prospective studies indicate a steady increase in the prevalence of diabetes mellitus (DM) among the population of people regardless of age, gender, and nationality [1, 2].

It is obvious that the socio-economic damage caused to society by this disease is very significant. This creates a powerful medicosocial and financial incentive for the development of new methods of treating diabetes, such as beta-cell transplantation, immunomodulation, cell therapy to preserve the residual function of beta-cells, the creation of non-injectable forms of insulin, etc. However, despite the rapid development of high technologies in the treatment of diabetes, adequate insulin therapy is still the only effective way to control glycemia in children and adults.

**Type 1 diabetes mellitus (DM1)** — this is a polygenic multifactorial disease, which is based on immune-mediated or idiopathic destruction  $\beta$ -of pancreatic beta-cells, leading to absolute insulin deficiency.

To compensate for violations of carbohydrate metabolism in the body, insulin therapy is indicated.

**Insulin** therapy is a complex of measures aimed at achieving compensation for carbohydrate metabolism disorders by injecting drugs into the patient's body of insulin. In clinical practice, it is mainly used for the treatment of diabetes mellitus of various etiologies.

### Indications

The use of medications to compensate for disorders of carbohydrate metabolism in the body has certain indications for carrying out, let's consider them:

- Insulin-dependent type 1 diabetes.
- Decompensation of type 2 diabetes.
- Diabetic ketoacidosis.

- Diabetic coma.
- Comprehensive treatment of schizophrenia.
- Weight loss in endocrine pathologies.
- Diabetic nephropathy.
- Hyperosmolar coma.
- Pregnancy and childbirth in diabetes.

Type 2 diabetes mellitus is non-insulin-dependent, although it is classified as a metabolic disease. The pathology occurs with chronic hyperglycemia due to a violation of the interaction of insulin with pancreatic cells. Insulin therapy for the second type of diabetes has the following indications::

- Individual intolerance or ineffectiveness of drugs that reduce blood sugar levels.
- Newly diagnosed disease with high glucose levels within 24 hours.
- Exacerbation of chronic diseases.
- Infectious diseases.
- Signs of insulin deficiency in the body.
- Serious kidney and liver disorders.
- Dehydration of the body.
- Precoma and coma.
- Diseases of the hematopoietic system.
- Detection of ketone bodies in urine.
- Planned surgical intervention.

Based on the above indications, the endocrinologist draws up a treatment regimen, selects the optimal dosage and recommendations for therapy with the use of insulin medications.

#### **Schemes and modes of insulin therapy :**

Current insulin therapy regimens are based on imitation of physiological insulin secretion, which includes::

- basal secretion;
- stimulated (food) secretion.

Basal secretion provides an optimal level of glycemia between meals and during sleep, promotes the utilization of glucose entering the body outside of meals (due to gluconeogenesis, glycogenolysis). The rate of basal secretion is 0.5-1 u/ h, or 0,16–0,2– 0,45 units per 1 kg of actual body weight, i.e. 12-24 units. per day. With physical exertion and fasting, basal secretion decreases to 0.5 u/h.

The secretion of insulin stimulated by food intake corresponds to the level of postprandial glycemia. In this case, the blood glucose level depends on the amount of carbohydrates eaten. On average, approximately 1-1. 5 units of insulin are produced per 1 bread unit (XE). It should be remembered that insulin secretion is subject to daily fluctuations. In the early morning hours (4-5 hours) it is the highest. Depending on the time of day, on average, 1 XE requires:

- for breakfast-1.5-2.5 units of insulin;

- for lunch, 1,0-1,2 units of insulin;
- for dinner 1.1-1.3 units of insulin.

One unit of insulin reduces blood sugar by an average of 2.0 mmol/l, and 1 XE increases it by 2.2 mmol/l. Of the average daily dose of insulin, the amount of "food" insulin is approximately 50-60 % (20-30 units), and the share of basal insulin is 40-50 %.

Among the existing insulin therapy regimens, the following can be distinguished:

- 1) traditional (short-acting insulin before breakfast and dinner; medium-acting insulin before breakfast and dinner). Currently, this therapy scheme is rarely used;
- 2) intensive insulin therapy, or a multiple injection regimen:
  - short-acting insulin (Insuman® Rapid — - before breakfast, lunch, dinner, and before going to bed — a drug of medium duration of action (Insuman® Basal).
  - short-acting insulin (Insuman® Rapid — - before breakfast, lunch, or dinner.
  - medium-duration insulin (Insuman® Bazal) - before breakfast and dinner.

### ***Principles of insulin therapy***

Like many therapeutic methods, insulin therapy has certain principles, let's consider them:

1. The daily dose of the drug should correspond as much as possible to the physiological one. During the day, you should enter up to 70% of the dosage, the remaining 30% - before bedtime. This principle allows you to simulate the real picture of hormone production by the pancreas.
2. The choice of optimal dosage is influenced by the daily requirements for the drug. They depend on the physiological characteristics of the body. So, one person needs ½ unit of insulin for assimilation of one bread unit, and another 4 units.
3. To determine the dose, it is necessary to measure the blood glucose level after a meal, taking into account the number of calories consumed. If glucose is higher than normal, then the dose of the drug is raised by several units until this indicator returns to normal.
4. You can adjust the dose of the drug according to glycemic indicators. According to this method, for every 0.28 mmol/l of glucose in excess of 8.25 mmol/l, 1 unit of medication should be added. That is, each additional unit of sugar requires 2-3 units of the drug.

Studies and patient feedback indicate that the most relevant and appropriate way to maintain normal blood sugar levels is through self – monitoring of glucose. For this purpose, individual glucose meters and stationary devices are used.

### ***Preparation***

Before the introduction of insulin, the patient must undergo special training. First of all, choose the method of administration – using a pen syringe or an insulin syringe with a small needle. The area of the body in which you plan to make an injection must be treated with an antiseptic and well kneaded.

No later than half an hour after the injection, you need to take food. In this case, it is contraindicated to enter more than 30 units of insulin per day. The optimal treatment regimen and exact dosage is selected by the attending physician, individually for each patient. If the patient's condition worsens, the dosage is adjusted.

***Recommendations for insulin therapy***

According to the conducted studies, the time of action of insulin preparations on the body is individual for each patient. Based on this, there are different duration of action of the drug. When choosing the optimal medication, doctors recommend focusing on the level of glycemia, while observing the prescribed diet and adhering to physical activity.

Physical activity and hunger reduce basal secretion by 1.5-2 times.

Maximum compensation of carbohydrate metabolism with the help of a properly designed insulin therapy scheme can significantly reduce the risk of developing complications of the disease. The smaller the fluctuations in blood sugar during the day, the better the patient's condition. Many doctors advise you to keep a special diary, indicating the dose of the drug administered, the number of bread units eaten, and the level of physical activity. This allows you to keep your diabetes under control.

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