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Original Research

Effect of glycosylated hemoglobin protein molecule in treating diabetes

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Abstract: The object of this study was to observe and analyze the effect of glycosylated hemoglobin in treating diabetes and provide valuable guidance for clinical treatment. For this purpose, 160 patients treated in our hospital who were definitely diagnosed with diabetes after relevant examinations were classified into the study group. 160 cases with healthy physical examinations for the same period were enrolled as a reference group. Fasting blood glucose and glycosylated hemoglobin levels were measured in both groups, and inter-group comparisons were made. The detection results showed that the study group had significantly higher fasting blood glucose and glycosylated hemoglobin levels than the healthy reference group. The difference was statistically significant ($p<0.05$). Diabetic patients in the study group were also observed. The results showed that patients with complications had significantly higher fasting blood glucose and glycosylated hemoglobin levels than those without complications. Statistical significance existed, $p<0.05$. For diabetic patients, glycosylated hemoglobin detection is of great significance in profoundly affecting diabetes diagnosis and treatment and providing positive guidance, which means great value for evaluating disease control effects.

Key words: Glycosylated hemoglobin; Diabetes; Application effect.

Introduction

Diabetes is a metabolic disease characterized by high blood sugar, which has two main causes. One is that the pancreas cannot produce enough insulin, and the other is that the cells are insensitive to insulin. It is characterized by patients' blood sugar beyond the standard value for a long time. High blood sugar causes common symptoms of "three mores and one less": polyphagia, polydipsia, pollakiuria and weight loss (1-3). Type 2 diabetes is more often the case, which is common in middle-aged and elderly people and has a high incidence in obese people. It is often complicated by high blood pressure, dyslipidemia, arteriosclerosis, etc. With the insidious onset, it has no symptoms in the early stage, or only with mild fatigue, thirst. Those with unobvious blood sugar elevation need a sugar tolerance test to confirm the diagnosis. Serum insulin levels are normal or elevated in the early stage, but low in the late stage.

Glycosylated hemoglobin is a product of the combination of sugar and hemoglobin, which mainly reflects blood glucose change in the recent two months as a good indicator of blood sugar control over a longer period. The normal value of glycosylated hemoglobin is 4%-6%. A value lower than 6% suggests insufficient control, and hypoglycemia is easy to occur; a value of 6%-7% suggests ideal control; that of 7%-8% means acceptable control; that of 8%-9% suggests poor control; that above 9% means bad control, which is a risk factor for the occurrence and development of chronic complications, and may cause acute comorbidities such as ketoacidosis. Therefore, when glycosylated hemoglobin is above 8%, blood sugar control should be strengthened (4-5). This study was to observe and analyze the effects of glycosylated hemoglobin application during the treatment of diabetes so that valuable guidance can be provided for clinical treatment. The report contents are as follows.

Materials and Methods

General data

160 patients definitely diagnosed with diabetes (Figure 1) were selected as subjects (January 2018 to June

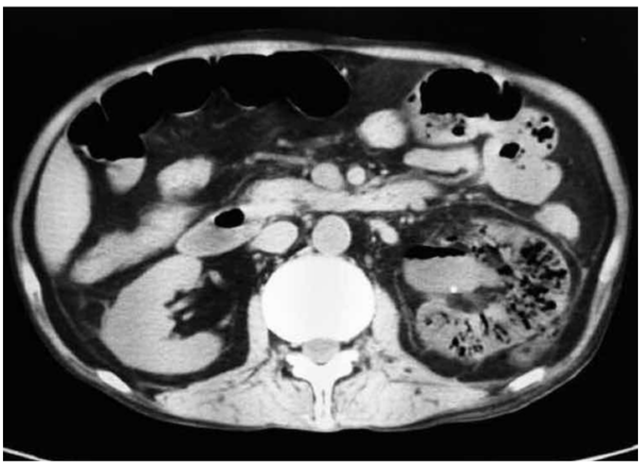

Figure 1. Diabetes examination (with fatigue, poor appetite and abdominal pain).

2019) and classified as a study group. The study group had an average age of (56.8 ± 3.2) years old and there were 84 males and 76 females. All cases met the WHO diagnosis and classification criteria for diabetes. The study excluded patients with special cases such as mental illness, non-coordination, severe heart, lung, kidney and other organ dysfunction. Patients and their families had the right to know and signed informed consent. The study was approved by the hospital ethics association. At the same time, healthy subjects examined in the hospital during the same period (from January 2018 to June 2019) were selected as the reference group. The reference group had an average age of (57.3 ± 3.6) years old, with 86 males and 74 females. Related data of the two groups are comparable (P>0.05).

Method

2mL fasting venous blood was taken from both groups in the morning, and the value was detected by glycosylated hemoglobin analyzer. The fasting blood glucose level was measured by an automatic biochemical detection analyzer, and the value was determined by the glucose oxidase method. The glycosylated hemoglobin and fasting blood glucose were observed in the two groups, and those with and without complications in the study group were compared for the two indicators, followed by rigorous statistical comparative analysis.

Glycosylated hemoglobin (GHb) is a product of a combination of hemoglobin in red blood cells and sugars in serum. Formed by slow, sustained and irreversible saccharification reaction, it has an amount depending on the blood glucose concentration and the contact duration of blood glucose and hemoglobin, while blood drawing time, whether the patient is fasting, whether insulin is used are irrelevant factors. Therefore, GHb can effectively reflect the blood sugar control of diabetic patients in the past 1~ 2 months. GHb is composed of HbA1a, HbA1b, and HbA1c, of which HbA1c accounts for about 70% and is structurally stable, therefore acting as a monitoring indicator for diabetes control (6). Glycosylated hemoglobin represents a golden standard for measuring blood sugar as an important means for diabetes diagnosis and management. In the treatment of diabetes, glycosylated hemoglobin levels have important clinical significance in evaluating overall glycemic control, identifying problems in treatment and guiding treatment protocol. First, glycosylated hemoglobin is an indicator of overall glycemic control in diabetic patients. Second, glycosylated hemoglobin >9% indicates persistent high blood sugar. There will be complications such as diabetic nephropathy, arteriosclerosis and cataract in this case, and it is also a high-risk factor for myocardial infarction and stroke death (7-8). Next, the detection of glycosylated hemoglobin can serve as guidance for protocol adjustment. Finally, glycosylated hemoglobin plays a role in judging different stages of diabetes, as shown in Figure 2 below.

Statistical methods

Using SPSS21.0 statistical software, the measurement data were expressed by mean ± average ($\bar{x}$ ±s), and the count data were expressed by (n, %). t and X^2 were used for comparison between groups. $p < 0.05$ indicates statistical value.

Results

Comparison of glycosylated hemoglobin level and fasting blood glucose level between the study group and the reference group

According to the statistics in Table 1 below, comparison of related indicators between the two groups shows that diabetic patients in the study group have higher glycosylated hemoglobin and fasting blood glucose levels than the healthy reference group. The differences are obvious, p>0.05, suggesting statistical significance.

Comparison of glycosylated hemoglobin level and fasting blood glucose level in the study group

According to the statistics in Table 2 below, the comparison of glycosylated hemoglobin level and fasting

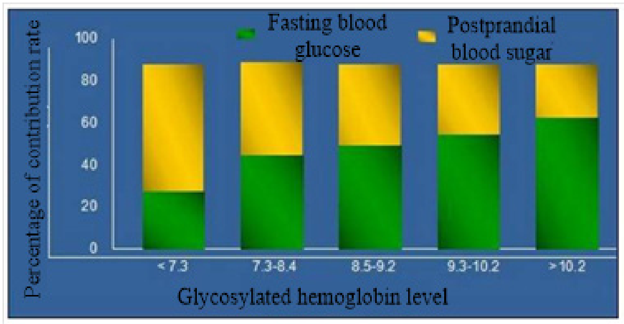

Figure 2. Glycosylated hemoglobin level.

Table 1. Comparison of glycosylated hemoglobin level and fasting blood glucose level between the study group and the reference group ($\bar{x}$ ±s).

Group	Case number	Glycosylated hemoglobin level (%)	Fasting blood glucose level (mmol/L)
Study group	160	8.60±1.25	8.28±1.05
Reference group	160	5.69±1.50	5.62±1.90
t		16.15	18.93
p		<0.05	<0.05

Table 2. Comparison of glycosylated hemoglobin level and fasting blood glucose level between those with and without complications ($\bar{x}$ ±s).

Group	Case number	Glycosylated hemoglobin level(%)	Fasting blood glucose level (mmol/L)
Complication group	90	9.85±1.31	9.93±1.06
Non-complication group	70	7.12±1.18	7.88±1.56
t		13.29	15.42
p		<0.05	<0.05

blood glucose level between patients in the study group shows that those with complications (90 cases) have a significantly higher level than those without complications (70 cases). The differences are significant in intergroup comparison, $p > 0.05$, with statistical significance.

Discussion

The current number of diabetic patients keeps rising. Many factors are leading to diabetes, mainly involving dietary changes, surrounding environment changes and increased mental stress, etc. (9). As an important protein of red blood cells, hemoglobin can effectively bind oxygen and transport it to systemic tissues. Meanwhile, after entry into red blood cells, glucose can combine hemoglobin to produce glycosylated hemoglobin in the case of high blood sugar. The level of glycosylated hemoglobin in the blood can be maintained for a long time by high dependence on the survival of red blood cells.

Glycosylated hemoglobin in diabetic patients can be elevated if blood glucose level is elevated, and red blood cells containing glycosylated hemoglobin survive longer in the blood. Two months after the restoration of blood sugar, red blood cells in the blood can be replaced by normal red blood cells without glycosylated hemoglobin, so that glycosylated hemoglobin level is lowered or restored to normal levels (10-11). Elevation of glycosylated hemoglobin will affect physical health, for example, triggering complications such as heart failure, the transition to complications of diabetic nephropathy, and high blood lipids. Glycosylated hemoglobin is a critical monitoring indicator for the diagnosis and treatment of diabetes, which can be used to assess the disease control effect.

In the clinical treatment of diabetes, to assess blood sugar control effects, it is necessary to monitor not only glycosylated hemoglobin levels but also fasting blood glucose. Better results can be obtained through the combination of the two, so that better guidance can be provided for the development of diabetes diagnosis & treatment protocol. Moreover, it can achieve targeted control of blood sugar in diabetic patients, prevent the evolution of diabetes, and reduce the risk of complications. Glycosylated hemoglobin is generally not affected by daily fluctuations in disease, life stress and environment, which just shows blood glucose levels (12-13). For diabetes, there are also recommendations for the use of medicinal herbs (14). New technologies such as genome editing are also very promising in this regard (15).

During the detection, if the blood glucose is well-controlled but with a high glycosylated hemoglobin level in the case of diabetic patients with better conditions, it is necessary to strengthen the guidance and education on daily blood glucose monitoring methods to helpfully and standardized implementation of postprandial and fasting blood glucose monitoring, avoid the reduction in accuracy of blood glucose monitoring results and medication scientificity owing to factors such as aging of blood glucose meters, expiration or dampness of test paper. If the glycosylated hemoglobin detection indicates a normal standard interval, but better blood sugar control is failed in recent treatment protocol, it suggests lower suitability of the treatment protocol for blood sugar control, and the protocol requires scientific adjustment. If glycosylated hemoglobin reflects a mean blood sugar level, while patients often have problems such as hyperglycemia and hypoglycemia, it suggests that glycosylated hemoglobin may be normal, and the glycosylated hemoglobin index has a decreased value in reflecting blood glucose change.

In summary, glycosylated hemoglobin is the main clinical indicator for the detection of diabetes. It is irreversible in the blood with high stability. It has a high accuracy as a detection index for diabetes, which helps guide clinical treatment and evaluate the therapeutic effect. The detection of glycosylated hemoglobin can positively assist in the accurate diagnosis and treatment guidance on diabetes, and its application results demonstrate that the method is worthy of wide applications in the clinic. In addition, the sample data of this study is limited, and larger sample data statistics are needed in the future to more fully support this result.

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