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Detection of Glycated Albumin on the Evaluation of Short Term Glycemic Control for Patients with Type 2 Diabetes*

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ABSTRACT Objective: To investigate the clinical value of glycated albumin reflective indicator of the general monitoring standard of blood glucose in the diabetics patients. **Methods:** 323 patients with Type 2 Diabetes Mullites (T2DM) who were treated in our hospital between June 2010 and July 2013 were enrolled in the study. The fasting plasma-glucose (FPG), two-hours' postprandial blood glucose (2hPG), MGB, GA and HbAlc of patients were detected and evaluated. The above parameters were measured again respectively on the 6th and the 12th day. **Results:** A positive relation of GA value, HbAlc, FPG, 2hPG and MBG was found with the coefficient index of 0.791, 0.541, 0.456 and 0.401, respectively (P<0.01); On the 6th day after the admission, the mean level of GA in the 92 patients was (27.1± 5.45)%, and the 12th day was(22.77± 4.34)% that were both significantly lower than (30.31± 6.75)% in the first day(P<0.01); After the admission for 6 and 12 days, the GA level of patients decreased in 3.12% and 7.54%, respectively(P<0.1), when compared with that of the first day; The HbAlc level was decreased in 0.31% and 0.78%, respectively(P<0.1). The decreasing degree of GA was greater than that of HbAlc (P<0.01). **Conclusion:** The level of GA can reflect the short-term changes of the mean level of blood glucose in an immediate and exact way. Meanwhile, it was well correlated with HbAlC which was the gold standard of long-term diabetic controlling, as well as a good indicator for monitoring blood glucose control of the diabetic patients.

Key words: Type 2 Diabetes Mullites; Glycated albumin; Measurement

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Introduction

With the continuous improvement of people's living standard, the incidence of diabetes is tend to increase year by year. However, type 2 diabetes(mullites) is accounted for 95% against the total diabetic patients without effective therapeutic approach at the present. Blood glucose monitoring is an important part of the daily diagnosis and treatment of diabetes. A good control of blood glucose can delay the onset and development of diabetes and chronic complications. HbAlc, as an international recognized gold standard of the evaluation on long-term blood glucose control can reflect the mean level of blood glucose of the diabetic patients in the past 2 to 3 months. However, as the red blood cell has a long-half-life, the changes of blood glucose will take a good while to have an influence on HbAlc. Therefore, it could not be able to reflect the short-term fluctuation of blood glucose immediately. Glycated albumin (GA) can reflect the mean level of blood glucose of the patients in the recent 2 to 3 weeks, and could be an index of judging the short-term blood control in clinic practice. However, the report about whether GA could reflect the more recent as one to two weeks' changes of blood glucose to meet the demands of hypoglycemic effective evaluation of the diabetic inpatients in a shot-term period in hospital is rarely seen. In this essay, the clinical records of Type 2 Diabetes Mellitus inpatients in Shenzhen Futian District TCM Hospital from June 2010 to July 2013 were analyzed retrospectively, which aims to evaluate the clinical value of Glycated Albumin on shortterm efficacy of diabetic patients.

1 Materials and Methods

1.1 Clinical data

The clinical records of Type 2 Diabetes Mullites inpatients were selected, including 191 males and 132 females with an average age of 61.3± 11.8. The diagnosis and treatments of diabetes mullites have applied to the standard of the World Health Organization (WHO): Fasting plasma-glucose (FPG) ≥ 7.0 mmol/L and two-hours' postprandial blood glucose was (2hPG)≥ 11.1 mmol/L. Lifestyle intervention, combined treatment with oral hypoglycemic drugs, treatment with insulin were the main methods of diabetes mullites according to the patients' blood glucose condition. The enrollment standard of patients: diagnosed as Type 2 Diabetes Mullites in clinical practice at 20 years, with no limits of male or female; BMI was 22 kg/m^2; high density lipoprotein cholesterol (HDL-C)<0.8 mmol/L, low density lipoprotein cholesterol (C-LDL)>3.1 mmol/L, Hypertriglyceridemia>1.7 mmol/L, hyperc-

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holesterolemia>5.7 mmol/L; 24 h urinary albumin excretion was 300 mg or urinary albumin/creatinine ratio>300. Exclusion criteria: the age of type 1 diabetes mullites patients was over 80 years; kidney failure with the renal replacement therapy phase; serum electrolyte abnormity, such as hyperpotassemia, Kalemia was 6.0 mmol/L; patient with serious hepatosis, cardiac functional insufficiency and malignancy. The patients were acquired and agreed the fact.

1.2 Research methods

The level of FPG, 2hPG, MPG (before three meals, 2h after three meals, at 9 pm and 3 am), GA and HbAlc of the first day were detected. 92 T2DM inpatients in the recent two weeks were chosen for the study, which including 54 males and 38 females with the average age of (60.9± 9.4) with the mean diabetic duration of 7.4 years. The GA, HbAlc, FPG, 2hPG and MPG were measured again respectively on the 6th and 12th day.

GA was measured by SIEMENS ADVIA2400 fully automatic biochemistry instrument in using liquid enzyme process (The reagents were provided by Japanese Asahi Chemical Medical Co. Ltd). HbAlc was measured by using Immuno-chromatographic Assay (NycoCard Ⅱ automatic hemoglobinometer, and the reagents were provided by Norway Axis-Shield pol AS Company). The blood glucose was measured by using glucose oxidase method (SIEMENS ADVIA 2400 fully automatic biochemistry instrument, and the reagents were provided by Shanghai KeHua Bio-engineering Cooperation). The MPG was measured by Optium blood glucose meter.

1.3 Statistical analysis

The statistics were input by the specially appointed person and SPSS 11.0 was the main statistical software used to analyze the data. The normal distributed measurement data was represented by ($\bar{x}$± s), the comparison of the variables before and after the treatments was examined with the paired f-test. The comparison of Percentages are conducted by X2 test. Measurement data with non-normal distribution is showed in the form of the median, while he difference among the groups is compared by using non-parametric statistical methods. In terms of univariate analysis linear correlation is adopted.

2 Results

2.1 The dependency of GA, glucose criteria and HbAlc

The positive correlation between GA and HbAlc (r=0.791)、FPG (r=0.541)、2hPG (r=0.456)、MPG (r=0.401) of patients was found, respectively(P<0.01).

2.2 The changes of each indicator before and after the treatment

Among the 92 inpatients in the near two weeks after the admission of 6th and 12th day, the level of GA, HbAlc, GA/HbAlc were obviously lower than those of the 1st day (P<0.01). Comparing first day with 6th day, the FPG was (1.03± 2.51) mmol/L, 2hPG was (3.25± 4.10) mmol/L, and the MPG was (1.06± 1.38) mmol/L with statistically significant differences(P<0.01), (Table 1).

Table 1 The changes of blood glucose indicator and GA level of patients before and after the treatment

Date	HbAlc(%)	GA(%)	GA/HbAlc	MPG(mmol/L)	FPG(mmol/L)	2hPG(mmol/L)
1st	11.01± 2.44	30.31± 6.75	2.74± 0.41	11.44± 2.26	9.22± 3.39	15.18± 4.75
6th	10.71± 1.97	27.1± 5.45	2.49± 0.38	9.71± 1.77	8.53± 2.55	13.20± 3.20
12th	10.23± 1.44	22.77± 4.34	2.22± 0.39	8.22± 1.36	7.34± 1.86	9.67± 2.38

2.3 The changes of GA and the correlation with glucose indicators

92 cases with T2DM hospitalized patient were significantly lower than that at admission (P<0.01) with 3.12% and 7.54% (P<0.01). Compared with that at admission, with the average declining rate of 10.2% and 23.6%, respectively. After hospitalization, HbAlc 6th and 12th day decreased 0.31% and 0.78% respectively, with the average declining rate 2.58% and 6.45% respectively. The average declining rate of GA was significantly greater than that of HbAlc (P<0.01). GA and HbAlc (r=0.791), FPG (r=0.541), 2hPG(r= 0.456), MPG(r=0.401) were positively correlated (P<0.01).

3 Discussion

T2MD has become the third worst pandemic, following cancer and cardiovascular disease. And once it happens, the event is irreversible. It will induce impaired glucose tolerance of patients, or produce insulin resistance in certain degree, or cause insufficient insulin [8-12]. And the most critical factor for the occurrence of the disease T2DN is that the decreased insulin sensitivity or secretion defects causes long-term hyperglycemia. At present, the detection methods that have been applied to clinical use in China include intravenous glucose, fingertips rapid blood glucose, HbAlc, glycosylated serum protein(GSP) or fructosamine(FM) and continuous glucose monitoring system (CGMS), etc.

Immediate glucose (including intravenous glucose and fingertips rapid blood glucose) is only the value of blood glucose at the instant show in the process of detection of vein, and it is easily influenced by diet, drugs, emotion and other factors. Therefore, it can not reflect the degree of glucose control over a period of time. CGMS conducts continuous 3d glucose detections, and its monitor is placed under the skin of the stomach. It measures the value of

interstitial fluid glucose every 5 minutes. The data can show the level fluctuation of glucose after it is processed by the CGMS software. This contributes to a comprehensive, objective evaluation of the patient's carbohydrate metabolism [13], but its operation is very complex, and the time for the test is so long that the patient is painful. Besides, real-time download of date cannot supported, and data on the fluctuation of glucose cannot be provided in time either. HbAlc is the gold standard to evaluate the long-term (2-3 mons)' glucose control, and can function as a reliable predictor to diabetes supervening with microvascular, macro-vascular diseases and so on, but the red blood cells, only when changes in glucose maintain for a long time, it is able to influence HbAlc, so the detection value can not reflect the passive changes of glucose in a short time.

The average level of blood glucose that GSP or FM reflect 2 to 3 weeks before the test is currently an indicator that is used clinically to determine short-term glucose control. However, because determination of GSP is to reflect total content of glycosylated plasma protein in plasma, therefore it is easily influenced by blood the concentration protein, bilirubin, chyle and low molecular substances and so on. Especially for the patients with hypoproteinemia and abnormal inversion of albumin, the fact is that the nonspecific reductive substances in serum can react with each other, and that the ratio of he Nonenzymatic glycosylation in protein components is different, GSP detection is not so specific, and is valueless, and it will be phased out. But GA detection determine GA quantitatively on the basis of GSP. The percentage of serum glycosylated albumin and albumin in serum is used to express the level of GA, so the influence of albumin in serum on the result of the detection is avoided. In this way, GA is more accurate than GSP or FM[14].

This experiment is designed to study whether GA can function as an indicator of the overall level of the recent glucose control(2 weeks) of targets. As the results of the experiment show, GA blood glucose levels can be obviously reflected, and it is still valuable during the first two weeks after the treatment [15]. This study proved that there was a correlation between GA and HbAlc, the current internationally used "gold standard" to judge the long-term glucose control of diabetes -HbAlc good correlation between ($r=0.8194$, $P<0.01$); There is a good correlation between GA and FPG, 2hPG, the commonly used clinically blood glucose detection indicators, indicating that GA is an effective indicator of average blood glucose during a time. Determining the blood glucose and determining GA at the same time will be helpful to make the evaluation of glucose control level in diabetic patients in recent time more objective, accurate and reliable. There is a good correlation between GA and FPG, 2hPG, the commonly used clinically blood glucose detection indicators, indicating that GA is an effective indicator of average blood glucose during a time. Determining the blood glucose and determining GA at the same time will be helpful to make the evaluation of glucose control level in diabetic patients in recent time more objective, accurate and reliable.

Domestic and international studies have shown that [16-20] GA can not only reflect the status of glucose metabolism, but also relates to the incidence of some chronic complications of diabetes such as diabetic nephropathy, retinopathy, cardiovascular disease and other closely related diseases. Therefore, it is also a valuable research direction whether early diabetic vascular disease intervention treatment can be provided by GA detection in order that complications of diabetes can be controlled as soon as possible.

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糖化血清白蛋白检测对 2 型糖尿病患者短期血糖控制的疗效评价 *

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摘要 目的:探讨糖化血清白蛋白(glycate dalbumin, GA)作为反映近期(2 周内)血糖控制总体水平的指标在糖尿病人群中的临床应用价值。**方法:**选取 2010 年 6 月 -2013 年 7 月间深圳市福田区中医院住院的 2 型糖尿病(T2DM)患者 323 例,测定空腹血糖(FPG)、餐后 2 小时血糖(2hPG)、1 日指尖血糖谱均值(MBG)、GA、糖化血红蛋白(HbAlc)等,并对其中 92 例住院近 2 周的患者分别在入院后 6 天及 12 天复查上述指标。**结果:**GA 与 HbAlc(r=0.791),FPG(r=0.541),2hPG(r=0.456),MBG(r=0.401),均呈正相关(P 均 <0.01);患者入院 6 天检测 GA 为(27.1± 5.45)%,入院 12 天为(22.77± 4.34)%,均显著低于入院第一天的(30.31± 6.75)%(P<0.01);入院 6 天和 12 天,患者的 GA 较入院时分别下降 3.12% 和 7.54%(P<0.01);HbAlC 分别下降 0.31% 和 0.78%,GA 下降降幅显著大于 HbAlc(P<0.01)。**结论:**GA 可及时、准确的反映短期(1～2 周)平均血糖的变化情况,并与长期血糖控制的金标准 HbAlC 有良好的相关性,是监测糖尿病患者血糖控制的良好指标。

关键词:2 型糖尿病;血清白蛋白;检测

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