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The Correlation Study of Hyperglycemia on the Expression of White Blood cells and Inflammatory Genes in Patients with Type 2 Diabetes

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Abstract: ***Purpose:*** *With the continuous progress and development of social economy, the process of urbanization has been significantly improved. As people's physical fatigue and work intensity are significantly weaker than before, the way of sitting and working is significantly reduced, life and dietary habits have also undergone significant changes, high-calorie diets have further increased, and many regions and countries in the world are currently aging. At the stage of transformation, the average prevalence of diabetes is also on the rise in most parts of the world. Diabetes has become an important global public health and hygiene event in the 21st century. This article aims to study whether controlling hyperglycemia will reduce the white blood cell count and the expression of inflammatory genes.* ***Methods:*** *85 diabetic patients with poor blood glucose control in a hospital were selected for three months of hypoglycemic treatment, and the difference between the groups was compared by t test.* ***Results:*** *After three months of hypoglycemic treatment, the improvement group showed statistically significant differences in the measured quantity counts of leukocytes, neutrophils, monocytes, and lymphocytes and in the measured quantity counts of S100A8 gene and S100A9 gene mRNAs, none of the differences in the non improvement group.* ***Conclusion:*** *Controlling the blood sugar of diabetic patients can reduce their white blood cell count and also have an effect on the decrease of the expression of inflammatory genes in their granulocytes and monocytes.*

Keywords: *hyperglycemia, diabetes, white blood cells, inflammatory genes*

1. Introduction

With the growth of the world economy, the arrival of an aging society and the changes in human daily habits, the spread of chronic non-communicable diseases has become a global crisis. In almost every country, all income groups face a higher risk of illness, whether they are men, women, or the elderly and children [1-2]. According to the World Health Organization, chronic diseases such as diabetes pose a threat to personal health. Its prevalence, disability, mortality and overall health risk are second only to cardiovascular and cerebrovascular diseases. Some people have lost the ability to take care of themselves in work and life. This has brought a huge burden to their parents and society. The annual average mortality of diabetes is about 60% of all people in the world, 80% of which are mainly concentrated in low- and middle-income countries. Therefore, early prevention, early diagnosis, and early treatment are very important for the management of chronic diseases such as diabetes [3-4].

In recent years, many scholars have conducted research on diabetes and achieved good results. Some scholars believe that the risk of microvascular complications in type 2 diabetic patients receiving intensive glucose therapy is lower than that of patients receiving conventional diet therapy, and post-test monitoring is conducted to determine whether this improved blood glucose control persists and this treatment whether it has a long-term effect on the outcome of great vessels [5]. In addition, some scholars in our country have shown that there is a correlation between the level of glycosylated hemoglobin and serious cardiovascular events in patients with type 2 diabetes. Severe cardiovascular events in type 2 diabetic patients with vascular disease or other serious cardiovascular risk factors [6]. At present, there are many studies on the etiology, treatment and influencing factors of diabetes. These predecessors' theories and experimental results provide a theoretical basis for the research of this article.

Based on the analysis of factors contributing to diabetes, medications for diabetes, and the relationship between inflammation and diabetes, we divided 85 diabetic patients after hypoglycemic

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treatment into improved and unimproved groups and analyzed the differences in white blood cell count and inflammatory gene expression.

2. The correlation study of hyperglycemia on the expression of white blood cells and inflammatory genes in patients with type 2 diabetes

2.1 Factors that cause diabetes

(1) Overweight and obesity

A large number of epidemiological studies have shown that obesity is closely related to a variety of diseases, including hypertension, diabetes, coronary heart disease, and low cholesterol and blood lipids. More research results show that the severity of obesity is also closely related to its mortality. The severity of obesity is considered to be one of the most important causes of various chronic diseases in the world, and obesity-related complications are considered to be the current world. As one of the main causes of death for patients in the Asia-Pacific region, obesity is considered to be a major public health problem widely recognized globally, which will directly lead to disability and premature death, affect the normal living standards and health of cancer patients, and increase the entire society financial and economic burden. Obesity is also considered to be the main cause of diabetes in Asians. Because Asians are small, fat is more likely to accumulate in the abdomen for a long time. Obesity is relatively harmful to Asians' health [7-8].

(2) Smoking and drinking

Bad daily habits will greatly increase our chances of developing diabetes. Although smoking and drinking are not independent and risk factors that affect the onset of diabetes, the role of smoking and drinking in the development of diabetes cannot be ignored. With the increase in smoking and smoking years, the incidence and risk of diabetes in smokers will gradually increase, and indirect smoking will also increase the risk of disease [9-10].

(3) Insufficient physical activity

Lack of physical labor is the main factor that increases the risk of patients with type 2 diabetes. The reduction in physical labor will increase the risk of people suffering from diabetes. Among people, the prevalence of elderly people with less physical activity is often two to four times higher than that of other diabetic patients. Exercise can effectively reduce the blood lipids, high cholesterol levels and the body weight of patients with diabetes and hyperemia, thereby helping to control the further treatment of diabetes.

2.2 Drug treatment of diabetes

(1) Glucosidase inhibitor

It reduces postprandial blood sugar by competitively inhibiting glucosidase and promoting the adsorption of carbohydrates in the small intestine. It has a great effect on reducing FBG, PBG and HbAle, and they all help prevent diabetes from the diet. If the effect of a single application of hypoglycemic treatment is different, it can be combined with sulfonylureas, biguanide or other insulins [11-12].

(2) Insulin secretion enhancer

It is the first to stimulate insulin secretion through pancreatic beta, increase insulin levels in the body and lower blood sugar levels. It is used for non-obese type 2 (T2DM) diabetic patients with high fasting blood sugar levels. It is an optional drug. For renal insufficiency, the second-generation drugs mainly include glusione, which has stronger pharmacological effects and fewer side effects, which can ensure long-term blood pressure lowering effect. The third generation is a glimepiride chart, which has obvious effects on improving insulin resistance and lowering blood sugar. It is convenient to take, and it can be taken once a day, which can greatly improve the confidence and compliance of diabetic patients.

2.3 The relationship between inflammation and diabetes

(1) Interleukin

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Interleukin-β (IL-1β) has a strong inflammatory effect. Depending on the extracellular kinase (ERK) mechanism or the regulation of ERK activation that is not based on the post-transcriptional level, it may reduce the expression of IRS-1 at the transcriptional level, thereby reducing the production of IRS-1. By acting on IRS-1, IL-1β weakens insulin signal and function, participates in and synergizes with other cytokines, and induces the development of insulin resistance. IL-6 is usually produced by immunocompetent cells, B lymphocytes, monocytes/macrophages. It not only directly participates in various inflammatory reactions and physiological development processes of the body, but also is considered to be a balanced regulation of energy and metabolism. It is also believed that it can adjust the total metabolism of fat cells and other muscle tissues in the human body by adjusting the ways and methods of apoptosis.

(2) Monocyte trend factor

MCP-1, MCP-3, and others all play important roles in inducing insulin resistance in adipocytes and skeletal muscle cells in animals. Among them, MCP-1, some studies have shown to decrease the expression of adipose derived genes such as lipoprotein lipase in mature adipose tissue, inhibit the massive intake of exogenous lipids by mature adipocytes, and the lipolytic response generated within human cells, and it can promote FFA levels.

(3) Trend factor

Chemokine-like receptor is a kind of chemokine that has been discovered recently. The receptor is a member of a chemokine-like receptor, and the chemokine-like receptor is a kind of antigen-presenting cell that has been confirmed chemokines. Chemokines and other receptors mainly exist in adipose tissue, antigen-expressing cells, liver cells, etc., and can effectively regulate the differentiation of fat cells in the human body. The level of chemokines in serum is related to obesity and its disorders, and lipid metabolism. Mouse embryonic adipocytes cultured in vitro can produce an autocrine or paracrine form of chemokine. On the one hand, they can activate the cathodic signaling pathway in human cells and effectively regulate the expression of glut-4 and leptin, and affect the metabolism of glucolipid. Chemotactic dendritic cells or macrophages promote local inflammation. The lack of chemical inducers or receptor genes in mice inhibits the growth and differentiation of mouse embryonic progenitor cells, changes the metabolic function of mature fat cells in the body, and reduces fat storage in the body.

3. Experiment

3.1 Research methods

This article selects 85 diabetic patients with poor blood glucose control in a hospital from January 2018 to December 2019 as the research object. Among them, 56 were males and 29 were females. The average age of males was 42±5.67 years old, and the average age of females was 41.56±3.22 years old. After hypoglycemic treatment, all patients were tested for inflammatory gene mRNA in peripheral blood granulocytes and monocytes. A decrease in glycosylated hemoglobin of more than 15% was defined as the improvement group, and no more than 1.5% was defined as the unimproved group. The changes of white blood cells in the group of diabetic patients were compared with the expression of inflammatory index genes.

3.2 Inclusion criteria

(1) Age ≥ 18 years old

(2) Confirmed type 1 and type 2 diabetes patients

3.3 Exclusion criteria

(1) Exclude patients with malignant tumors

(2) Exclude patients with inflammatory diseases

(3) Exclude patients with gestational diabetes

(4) Exclude patients with thyroid disease

(5) Exclude patients who have undergone major surgery before admission

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(6) Exclude patients with diabetic ketoacidosis

3.4 Statistical methods

Data processing analysis method This article uses spss 10.0 statistical analysis software to comprehensively analyze the reliability of the data. The measured data information is expressed in expression $\overline{x} \pm s$, and the comparison between groups is performed by t test. P<0.05 means that the difference is statistically significant. The method of comparison is to use the chi-square test or Fisher's exact probability determination method; multiple independent, normal, and homogeneous variances of multiple data groups are compared by analysis of variance; if it is statistically significant in univariate analysis, it can be multi-factor analysis is included, and logistic regression model is adopted for multi-factor analysis. A test formula for t can be defined as:

$$t = \frac{\overline{X} - \mu}{\frac{\sigma_X}{\sqrt{n-1}}} \quad (1)$$

If the sample is a large sample, it can also be written as:

$$t = \frac{\overline{X} - \mu}{\frac{\sigma_X}{\sqrt{n}}} \quad (2)$$

Here, $\overline{X}$ is the sample average, μ is the overall average, σ_X is the sample standard deviation, and n is the sample size.

4. Discussion

4.1 Changes in white blood cells in diabetic patients

Table 1. Changes of white blood cells in diabetic patients with different control levels

leukocyte	Improvement group		Unimproved group	
	Baseline	Three months later	Baseline	Three months later
leukocyte	8.39±1.6	7.60±1.31	7.93±1.29	7.89±1.14
Neutrophils	5.74±1.3	5.11±1.0	5.45±1.09	5.51±0.99
Monocyte	0.68±0.20	0.53±0.12	0.61±0.16	0.60±0.15
Lymphocytes	1.73±0.29	1.75±0.42	1.62±0.39	1.57±0.35

It can be seen from Table 1 and Figure 1 that the white blood cell count of diabetic patients in the improvement group after 3 months of hypoglycemic treatment was (7.60±1.31)×109/L, and the neutrophil count was (5.11±1.0)× 109/L, and the count of monocytes was (0.53±0.12)×109/L, which was 9.41%, 10.97% and 22.05% respectively compared with the baseline, the difference was statistically significant; while the lymphocyte count was (1.75± 0.42)×109/L, the difference was not statistically significant. After 3 months of hypoglycemic treatment, the counts of white blood cells, neutrophils, monocytes and lymphocytes of diabetic patients in the unimproved group were (7.89±1.14)×109/L, (5.51±0.99)×109/L, (0.60±0.15)×109/L, (1.57±0.35)×109/L, the difference was not statistically different from the baseline.

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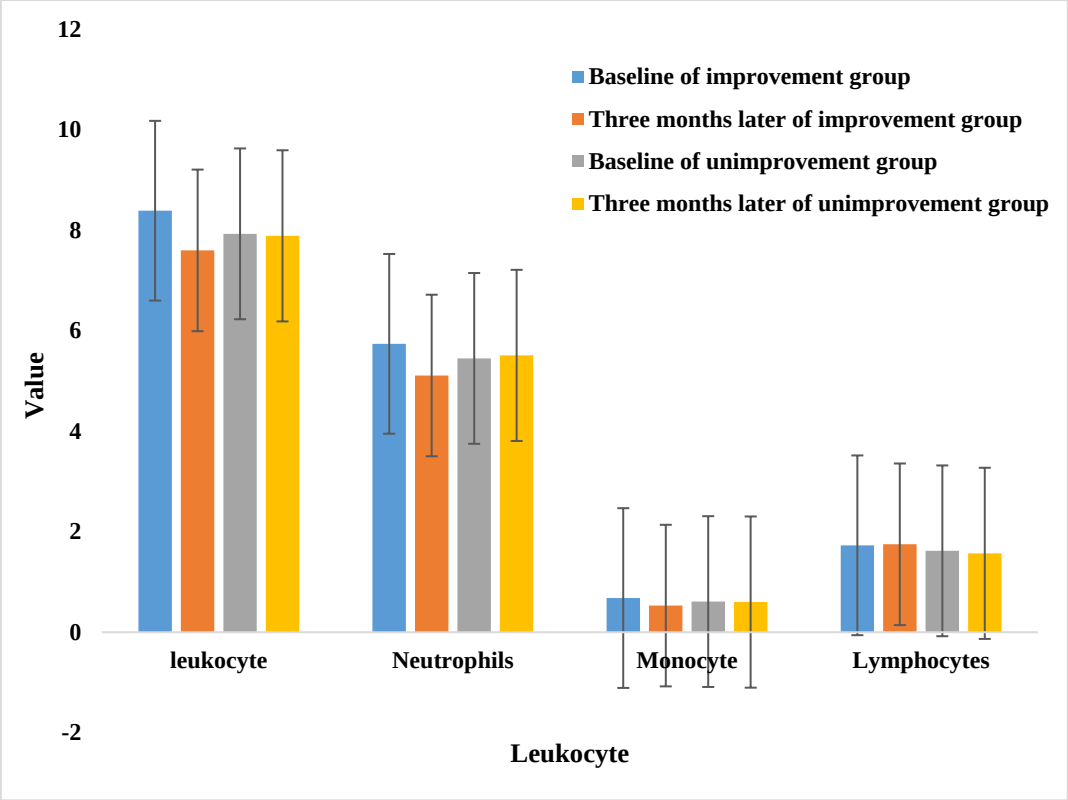
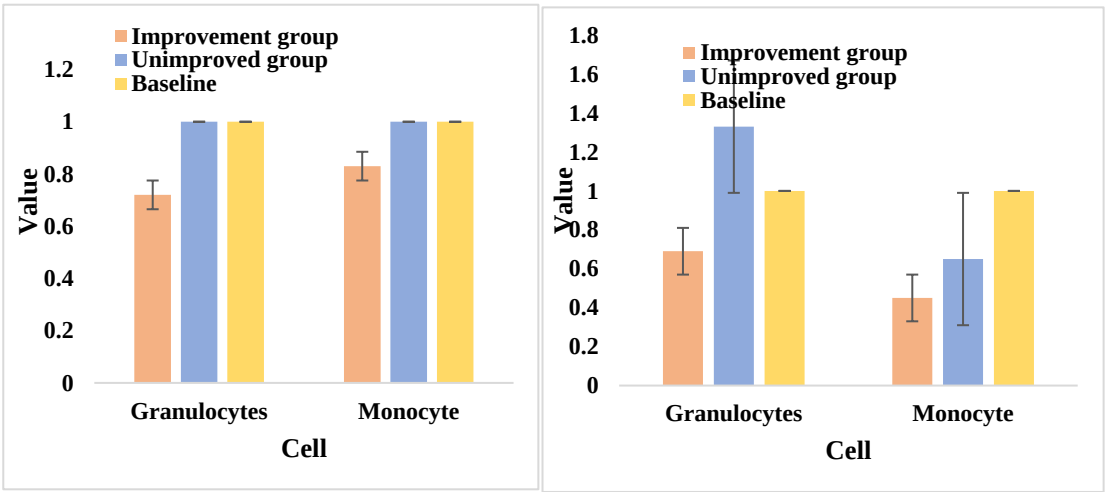


Figure 1. Changes of white blood cells in diabetic patients with different control levels

4.2 Gene expression of inflammatory indicators in diabetic patients



a)S100A8 b)S100A9

Figure 2. Changes of mRNA expression of blood granulocytes and monocyte genes in diabetic patients

Figure 2 shows the expression of inflammatory index genes in diabetic patients, where Figure a is the S100A8 gene and Figure b is the S100A9A gene. It can be seen from the figure that after 3 months of hypoglycemic treatment, the expressions of S100A8 gene and S100A9 gene mRNA in peripheral blood granulocytes of diabetic patients in the improvement group were significantly lower than the baseline, and the differences are statistically significant; the diabetic patients in the unimproved group. The expressions of S100A8 gene and S100A9 gene mRNA in peripheral blood granulocytes were not statistically significant compared with baseline. The expressions of S100A8 gene and S100A9 gene mRNA in peripheral blood mononuclear cells of diabetic patients in the improvement group were significantly lower than the baseline, and the differences were statistically significant. The expression of S100A8 gene and S100A9 gene mRNA in peripheral blood monocytes of diabetic patients in the

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unimproved group was lower than that of baseline None were statistically significant.

5. Conclusions

Chronic inflammation participates in the occurrence and development of diabetes through insulin resistance, and plays an important role in diabetic macrovascular and microvascular complications by regulating signal pathways related to inflammatory factors. Controlling hyperglycemia in diabetic patients and controlling the occurrence and development of chronic inflammatory processes in diabetic patients are also new trends in the prevention and treatment of diabetes and its complications.

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