Research Article ISSN 2639-9512

Stem Cell & Regenerative Medicine

Application of Autologous Adipose Stem Cells in the Treatment of Type 2 Diabetes

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Received: 03 Mar 2024; **Accepted:** 08 May 2024; **Published:** 16 May 2024

Citation: Xiaohui Cui, Rongrong Li, Xinyi Shi, et al. Application of Autologous Adipose Stem Cells in the Treatment of Type 2 Diabetes. Stem Cells Regen Med. 2024; 8(1): 1-3.

ABSTRACT

Objective: *To explore the application effect of autologous adipose stem cells in the treatment of human type 2 diabetes.*

Methods: *A total of 104 patients with type 2 diabetes were enrolled. The study period was from February 2018 to October 2020. They were divided into a reference group of 52 cases (conventional treatment) and a study group of 52 cases (autologous adipose stem cell treatment). The therapeutic effects were compared.*

Results: *After treatment, the fasting insulin and fasting blood glucose of the study group were better than those of the reference group, $P<0.05$, the difference was statistically significant. The incidence of adverse reactions in the study group was lower than that in the reference group, $P<0.05$, and the difference was statistically significant.*

Conclusion: *Autologous adipose-derived stem cells in the treatment of human type 2 diabetes can effectively control blood sugar level, reduce adverse reactions, and improve drug safety, which has significant application value.*

Keywords

Autologous adipose stem cells, Metformin, Insulin, Type 2 diabetes.

Introduction

Diabetes is a chronic metabolic disorder syndrome characterized by elevated blood sugar levels [1]. In recent years, the incidence of the disease has been increasing due to the aging of the population structure, changes in people's lifestyles, and the acceleration of urbanization. It is estimated that the number of diabetic patients will reach 629 million by 2045, and the overall disability rate is as high as 30%-40%. Therefore, the treatment of diabetes has attracted widespread attention in the medical community. Diabetes is usually accompanied by a variety of complications, such as diabetic nephropathy, diabetic foot, etc. when the disease was diagnosed, effective treatment should be given in time to reduce the disability rate caused by it. Type 2 diabetes patients are mostly treated with drugs, mainly for the purpose of controlling blood sugar and delaying the progression of the disease. In recent years, stem cells have shown encouraging effects in the study of diabetes treatment. The stem cells derived from fetus umbilical cord is widely used for the treatment of diabetes all over the world, but there is not much data on the treatment of type 2 diabetes with adipose-derived mesenchyme. In this paper, 104 patients in recent years were used as the object to explore the clinical effects of autologous adipose-derived mesenchymal stem cells on type 2 diabetes. The details are described as follows.

Materials and Methods

General Information

A total of 104 patients with type 2 diabetes were selected from February 2018 to October 2020, and they were divided into a research group of 52 cases (autologous adipose stem cell therapy), and a reference group of 52 cases (conventional therapy). In the

study group, there were 30 male patients, 22 female patients, the ages ranged from 43 to 71 years, with an average age of (62.63±4.36) years, the disease duration was 2 to 11 years, with an average of (6.45±1.76) years. In the reference group, there were 21 male patients and 31 female patients, the ages ranged from 47 to 72 years, and the mean age was (62.63±4.36) years, and the mean disease duration was (6.12±1.83) years. There were no significant differences in age, gender, and course of disease between the two groups (P>0.05). Inclusion criteria: normal thinking, complete data, clear consciousness, based on the diagnostic criteria of diabetes, diagnosed with type 2 diabetes by laboratory diagnosis, familiar with the study and volunteered to participate. Exclusion criteria: incomplete data, mental disorders, major organ diseases, poor compliance.

Methods

The patients in the research group were treated with autologous adipose-derived mesenchymal stem cells:

Culture of Adipose-Derived Mesenchymal Stem Cells

5ml fat was extracted from the abdomen of the patients, digested with type IV collagenase, centrifuged, and nucleated cells were collected and cultured using standard tissue culture protocols. The solution was transfered into a six-well plate and placed in a CO_2 incubator (5% at 37°C) for cultivation. After 48 hours, the medium was changed every 3 days. When the cell confluency reached 80%-90%, the cells were passaged with the ratio of 1 to 3.

Identification of Adipose-Derived Mesenchymal Stem Cells

The cells are spindle-shaped, the pathogenic examination is negative (including bacteria and fungi, etc.), it has the typical immunophenotype of mesenchymal stem cells, and the endotoxin test is negative [2].

Transplantation of Adipose Stem Cells

After harvesting, the adipose-derived mesenchymal stem cells were resuspended with normal saline solution, intravenously reinfused at 1 X 10^7 cells per kilogram of body weight, and kept in hospital for observation for 4 hours.

The patients in the reference group were given routine treatment: metformin (manufacturer: Beijing Shengyong Pharmaceutical Co., Ltd., approved by Chinese medicine name: H20058567) was used orally, once a day, 500 mg each time. Oral Bayer (manufacturer: Bayer Healthcare Co., Ltd.; H19990205;) 3 times/day, 50mg/time. The dose of the drug should be adjusted according to the actual situation of the patient, and the daily dose should be 100 mg. The medications were continued for 3 months.

Observation Indicators

The blood glucose changes, including fasting blood glucose and insulin levels, were compared between the two groups before and after treatment, and the incidence of adverse reactions during the treatment was counted in details.

Statistical Processing

SPSS 20.0 software was used for analysis. The counted data was analyzed by X2 test, expressed as %. The measurement data was analyzed by T test, expressed as ±, P<0.05, with statistical significance.

Results

Comparison of Blood Glucose Indicators between the Two Groups of Patients

After treatment, fasting insulin (15.76 ± 2.45) μU/ml and fasting blood glucose (6.23 ± 0.48) mmol/L in the study group were better than those in the reference group, P<0.05. As shown in Table 1.

Table 1: Comparison of blood glucose indicators (X ± S).

Group	n	Fast glucose (μU/ml)		Fast blood sugar (mmol/L)	
		Before	After	Before	After
research	52	26.95±3.87	15.76±2.45	10.43±0.98	6.23±0.48
control	52	26.57±3.26	21.57±3.84	10.52±0.87	7.86±0.74
T value	/	0.8734	6.0945	0.3973	4.5784
P value	/	0.3423	0.0000	0.8734	0.0000

Comparison of Adverse Reactions between the Two Groups of Patients

For the incidence of adverse reactions, the research group was lower, P<0.05. As shown in table 2.

Table 2: Comparison of adverse reactions between the two groups of patients (%).

Group	n	Nausea	Lack of appetite	Mild rash	Occurrence rate
research	52	2 (3.85%)	1 (1.92%)	1 (1.92%)	4 (7.69%)
control	52	5 (9.62%)	4 (7.69%)	3 (5.77%)	12 (23.77%)
X^2 value	/	/	/	/	5.0667
P value	/	/	/	/	0.0244

Discussion

At present, clinical treatment of patients with type 2 diabetes often uses drug therapy, including metformin, glutathione and so on. Metformin reduces hepatic glucose output and promotes increased insulin sensitivity, which in turn lowers blood sugar and avoids cardiovascular complications [3]. Baitangping is a commonly used hypoglycemic drug in clinic. It can effectively inhibit the competition between oligosaccharides in small intestinal mucosal cells. Combined with the body's glucosidase, the enzyme activity is reduced, the degradation of carbohydrates is delayed, and the intestinal glucose absorption is reduced to ensure normal blood sugar level [4]. In addition, insulin injection is also a routine method for daily control of blood sugar in diabetic patients. This method can effectively control the level of glucose metabolism and significantly improve the survival time and quality of life of patients, but it does not improve the development of diabetes and the occurrence of complications. [5]. Mesenchymal stem cells (MSCs) have the characteristics of multi-directional differentiation potential, low immunogenicity, immune regulation,

anti-inflammatory and anti-apoptotic effects, and are considered as ideal cells for the treatment of diabetes among all types of stem cells. Stem cells derived from human tissue have become the focus of research in recent years. Among them, adipose-derived mesenchymal stem cells (ADSCs) are considered to be the best choice for the treatment of diabetes due to their wide source of tissue and easy access in large quantities. The results of this study showed that after 3 months of ADSCs treatment, the related indicators of type 2 diabetes patients showed significant improvement, and this effect showed a trend of further improvement after 9 months. At the same time, the incidence of adverse reactions in the study group treated with ADSCs was also reduced, and no complications occurred during the clinical treatments.

In conclusion, autologous adipose-derived mesenchymal stem cells can significantly improve the related indicators of type 2 diabetes, and also have a positive effect on complications and adverse reactions, with high safety and significant clinical application values.

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