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Analysis of Therapeutic Effects of Huanglian Polysaccharide Adjuvant Therapy on T2DM patients with insulin resistance

Liangfeng Jiang[1]*, Shengjun Chen[1] & Zhiqun Huang[2]

[1]Pharmacy Department of the First People's Hospital of Fuyang District, Hangzhou

[2]Department of Integrated Traditional Chinese Medicine and Western Medicine, Fuyang District First People's Hospital, Hangzhou

Keywords

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***Correspondence**

Liangfeng Jiang, Pharmacy Department of the First People's Hospital of Fuyang District, Hangzhou.E-mail: jlf604@vip.qq.com

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Abstract

Background The study explored the therapeutic effect of Huanglian polysaccharide adjuvant therapy on type 2 diabetes mellitus (T2DM) patients complicated with insulin resistance. **Methods:** A total of 100 T2DM patients with insulin resistance in our hospital were selected from April 2019 to September 2020 and randomly divided into control group (n=50) and observation group (n=50). The control group was given metformin combined with insulin glargine while the observation group was given Huanglian polysaccharide combined with insulin glargine. The clinical efficacy, and insulin-related and blood rheological indexes of the two groups before and after treatment were compared. **Results**: After treatment, the total effective rate of observation group was significantly higher than that of control group (P<0.05). After treatment, the insulin sensitivity index (IAI) of the two groups was significantly higher than that before treatment (P<0.05), the insulin resistance index (IRI) and fasting insulin (FINS) of the two groups were significantly lower than those before treatment (P<0.05), but the IAI level of observation group was significantly higher than that of control group (P<0.05), while the IRI and FINS levels of observation group were significantly lower than those of control group (P<0.05). After treatment, the levels of whole blood high-cut reduction viscosity, whole blood low-cut reduction viscosity, plasma viscosity and fiber protein (FIB) in the two groups were significantly lower than those before treatment (P<0.05), and the levels in observation group were significantly lower than those of control group (P<0.05). **Conclusion:** The adjuvant therapy of Huanglian polysaccharide has obvious therapeutic effects on T2DM patients with insulin resistance and can significantly improve the insulin-related and blood rheological indexes of patients.

1 Introduction

Type 2 diabetes (T2DM) is a metabolic disease characterized by chronic hyperglycemia, the major pathological mechanism of which is insulin hyposecretion and insulin resistance caused by islet β-cell dysfunction [1,2]. Insulin resistance attacks over 80% of T2DM patients: the transduction of insulin signaling is obstructed or weakened; cells of insulin target tissues including liver, adipose tissue and muscle decrease insulin sensitivity and patients is unable to consume glucose effectively or inhibit glycogenolysis [3,4]. Current treatment in clinic for patients with T2DM complicated with insulin resistance mainly depends on medication such as biguanides, thiazolidinediones and α - glucosidase inhibitors, but there still exist limitations and adverse reactions [5,6]. With the further studies about the mechanism of traditional Chinese medicine on insulin resistance, traditional Chinese medicine has unique advantages like remarkable efficacy as well as few adverse reactions in treatment of T2DM complicated with insulin resistance [7]. The present work explored the treatment effect of Huanglian polysaccharide adjuvant therapy on patients with T2DM complicated with insulin resistance, providing the reference for the clinical treatment.

2 Materials and methods

2.1 Clinical data

A total of 100 cases with T2DM complicated with insulin resistance in our hospital from April 2019 to September 2020 were selected and divided into observation group (n=50) and control group (n=50) using random number table. Observation group: 27 males and 23 females; age, 41-69 years; average age, 55.24 ± 7.33 years; course of disease, 2-10 years; average course of disease, 6.14±2.15 years. Control group: 26 males and 24 females; age, 38-68 years; average age, 56.95±6.85 years; course of disease, 3-11 years; average course of disease, 6.85±2.27 years. The general data of the two groups were not significantly different ($P > 0.05$) and were comparable ($P>0.05$). Inclusion criteria were as follows: patients aged 35-70 years old; patients those have 2-15 years of disease duration; patients meeting the diagnostic criteria of T2DM; patients meeting the diagnostic criteria of insulin resistance: hyperinsulinemia. Exclusion criteria were as follows: patients with severe endocrine and autoimmune diseases; patients with mental disorders and cognitive impairment.

2.2 Methods

The control group was given oral metformin (0.5 g for once, three times a day; Liaoning Qierkang Pharmaceutical Co., Ltd., Liaoning, China) combined with subcutaneous injection of 0.2 U/(kg•d) insulin glargine (Gan & Lee Pharmaceuticals, Beijing, China), and the dose was adjusted according to the blood glucose level of patients. The observation group was given oral Huanglian polysaccharide (20 mL for once, twice a day) combined with insulin glargine: Huanglian polysaccharide was extracted from *Rhizoma Coptidis* (10 g Coptis powder at 1:20 solid liquid ratio was decocted with water for 3 h to collect the filtrate). The use of insulin glargine was the same as the control group. Two weeks were regarded as one course to the two groups and the treatment lasted for 3 courses.

2.3 Therapeutic effect criteria

The clinical efficacy of two groups before and after treatment was evaluated and compared. Fasting plasma glucose (FPG) and 2-hour postprandial blood glucose (2hPG) were detected by Blood Glucose Monitoring System (Abbott, USA), as HbA1c level was tested through High Performance Liquid Chromatography. The criteria were as follows: marked effect, FPG ≤ 7.2 mmol/L, 2hPG ≤ 8.3 mmol/L, decrease of HbA1c level after treatment relative to that before treatment ≥ 30%; effect, FPG ≤ 8.3 mmol/L, 2hPG ≤ 10.0 mmol/L, 10% ≤ decrease of HbA1c level after treatment relative to that before treatment ≤ 29%; ineffectiveness, decrease of HbA1c level after treatment relative to that before treatment < 10%. Total effective rate = (the number of marked effect and effect cases/the number of total cases) × 100%.

2.4 Outcome measures

Insulin-related and blood rheological indexes of the two groups before and after treatment were observed. Insulin-related indexes: fasting insulin (FINS) was assessed by radioimmunoassay and Homeostasis model assessment was employed to calculate insulin sensitivity index (IAI; IAI=1/ (FPG×FINS)) and insulin resistance index (IRI; IRI= FPG×FINS/22.5). Blood rheological indexes: the levels of whole blood high-cut reduction viscosity, whole blood low-cut reduction viscosity, and plasma viscosity and fiber protein (FIB) were measured through a LBY-N6COMPACT automatic blood rheometer (Beijing Precil Instrument Co., Ltd., Beijing, China).

2.5 Statistical analysis

Statistical analysis was made through SPSS 19.0 (IBM, Armonk, NY, USA). The enumeration data were analyzed by the χ^2 test and the measurement data were performed as the means ± standard deviation with Student's *t* test adopted for comparison. A statistically significant difference was accepted when $P < 0.05$.

3 Results

3.1 Clinical efficacy

After treatment, the total effective rate of control group was 82.0% whereas that of observation group was 96.0% (Table 1). The total effective rate of observation group was significantly higher than that of control group (Table 1, P <0.05).

Table 1 Clinical efficacy between two groups

Group	Case	Marked effect	Effect	Ineffectiveness	Total effective rate（%）
Observation	50	27（54.0）	21（42.0）	2（4.0）	48（96.0）
Control	50	22（44.0）	19（38.0）	9（18.0）	41（82.0）
χ^2					5.005
P					0.025

3.2 Insulin-related indexes

Before treatment, there was no prominent difference of IAI, IRI and FINS between two groups (Table 2, P>0.05). After treatment, IAI of the two groups was appreciably higher than that before treatment (Table 2, P<0.05) while IRI and FINS of two groups were dramatically lower than those before treatment (Table 2, P<0.05). Moreover, IAI of observation group was notably increased when contrasted with that of control group (Table 2, P<0.05), as IRI and FINS of observation group obviously reduced when compared with those of control group (Table 2, P<0.05).

3.3 Blood rheological indexes

The levels of whole blood high-cut reduction viscosity, whole blood low-cut reduction viscosity, plasma viscosity and FIB did not differ among the two groups before treatment (Table 3, P>0.05). After treatment, both groups declined these levels in comparison with those before treatment (Table 3, P<0.05), and the levels in observation group were significantly lower than those in control group (Table 3, P<0.05).

Table 2 Insulin-related indexes between two groups

Group	Case	IAI		IRI		FINS（mU/L）	
		Before	After	Before	After	Before	After
Observation	50	-5.41±0.27	-4.18±0.37[a]	9.54±2.08	4.15±1.26[a]	23.16±2.54	14.25±1.89[a]
Control	50	-5.52±0.33	-4.75±0.35[a]	9.76±1.95	6.88±1.31[a]	22.49±2.73	18.63±2.17[a]
t		1.824	7.914	-0.546	-10.621	1.271	-10.763
P		0.071	0.000	0.587	0.000	0.207	0.000

Note: compared with before treatment，$^{a}P < 0.05$.

Table 3 Blood rheological indexes between two groups

Group	Case	whole blood high-cut reduction viscosity（mPa/s）		whole blood low-cut reduction viscosity（mPa/s）		plasma viscosity（mPa/s）		FIB（ρ/g·L^{-1}）	
		Before	After	Before	After	Before	After	Before	After
Observation	50	4.94±0.52	3.12±0.38^{a}	10.65±2.24	8.44±1.89^{a}	2.65±0.48	1.42±0.37^{a}	5.75±0.84	3.45±0.59^{a}
Control	50	4.86±0.55	4.35±0.41^{a}	9.85±2.38	9.25±1.66	2.59±0.52	1.89±0.41^{a}	5.69±0.91	4.34±0.62^{a}
t		0.747	-15.558	1.731	-2.277	0.600	-6.018	0.343	-7.353
P		0.457	0.000	0.087	0.025	0.550	0.000	0.733	0.000

Note: compared with before treatment，$^{a}P < 0.05$.

4 Discussion

There were approximate 4,200,000 people dying of diabetes and its complications with patients showing a trend of getting younger, among which T2DM accounted for 95% [8,9]. China possesses the largest population of diabetes in the world. It is reported that the key link of the pathogenesis of diabetes is insulin resistance, leading to a consequence that the biological effect of insulin on the body is lower than the actual level it should be. Hence, effective regulation, control and prevention of insulin resistance have an important significance to T2DM treatment [10,11]. Former researches have proven that traditional Chinese medicines like *Rhizoma Coptidis*, *Cortex Lycii* and *Euonymus alatus (Thunb.) Sieb.* could ameliorate insulin resistance of T2DM patients through multiple links, ways, levels and targets [12,13]. In our study, Huanglian polysaccharide adjuvant therapy adopted to treat patients with T2DM complicated with insulin resistance was found to have a notable therapeutic effect and appreciably improve insulin-related and blood rheological indexes.

The traditional Chinese medicine *Rhizoma Coptidis* have been widely used in clinical treatment of diabetes due to the various pharmacological effects including anti-diabetes, anti-inflammation and anti-cancer [14]. A recent report has presented that *Rhizoma coptidis* decoction performed more obvious hypoglycemic activity than the active compounds (berberine or total alkaloids) of *Rhizoma coptidis*, and Huanglian polysaccharide was one of the water-soluble components of *Rhizoma coptidis* decoction [15]. Our research discovered that the total effective rate of observation group was dramatically higher than that of control group after treatment (P<0.05), implying the anti-diabetes activity of Huanglian polysaccharide. Besides, after treatment, the IAI level of patients in observation group prominently rose in contrast with that in control group (P<0.05) whereas IRI and FINS levels of observation group were lower than those of control group (P<0.05). The upregulation of IAI and down-regulation of IRI and FINS exhibited that the insulin sensitivity of patients was elevated and insulin resistance was ameliorated, which attributed to the functions of Huanglian polysaccharide on anti-diabetes and improving insulin resistance. In addition, its anti-oxidative stress could activate PI3K signaling pathway and increase the expression of glucose transporters so as to ameliorate insulin-related indexes.

Owing to a long-term state of hyperglycemia and the damage of vascular endothelial cells, T2DM patients usually perform a tendency of hypercoagulation which refers to a high blood viscosity, a poor anti-coagulation effect and high levels of blood rheological indexes. Of blood rheological indexes, the whole blood high-cut reduction viscosity, whole blood low-cut reduction viscosity and plasma viscosity are associated with blood viscosity, whose down-regulation shows a reduction of blood viscosity and increase of fluidity; FIB is a human coagulation

index and its down-regulation indicated an enhancement of anti-coagulation function. It was observed that after treatment, the whole blood high-cut reduction viscosity, whole blood low-cut reduction viscosity, plasma viscosity and FIB levels in observation group significantly declined relative to those of control group (P<0.05), which suggested that Huanglian polysaccharide adjuvant therapy on T2DM markedly decreased blood viscosity, increased blood fluidity and improved blood rheology. Taken all above together, Huanglian polysaccharide realized the effects on modulating insulin resistance and metabolic disorder as well as effectively scavenging free radical. What's more, it also could mediate blood circulation system of patients by antioxidation to elevate the ability of oxygen supply and ameliorate blood rheological indexes.

In summary, the adjuvant therapy of Huanglian polysaccharide had obvious therapeutic effects on T2DM patients with insulin resistance and could significantly improve the insulin-related and blood rheological indexes of patients.

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Conflict of Interest

The authors declare no conflicts of interest.

Author contributions

Conceptualization, L.F.J and S.J.C; Data curation,Z.Q.Y; Formal analysis, L.F.J; Methodology, S.J.C; Writing-Original draft, Z.Q.Y and L.F.J; Writing-review and editing, S.J.C and Z.Q.Y; All authors have read and agreed to the published version of the manuscript.

Ethics Approval and Consent to Participate

The study was approved by the Medical Ethics Committee, and the patients were informed and consented.

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Availability of Data and Materials

The data presented in this study are available on request from the corresponding author.

Supplementary Material

Not applicable

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