

# Clinical Efficacy of Shenqi Jiangtang Granules Combined with Acupuncture on Type 2 Diabetic Peripheral Neuropathy with Dual Deficiency of Qi and Yin

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## Keywords

Shenqi Jiangtang granules

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## Abstract

**Aim:** This study is devoted to anatomizing the clinical efficacy of Shenqi Jiangtang granules combined with acupuncture on type 2 diabetic peripheral neuropathy (T2DPN) with dual deficiency of qi and yin.

**Methods:** 48 patients with T2DPN and dual deficiency of qi and yin, who were admitted to our hospital and received treatment of Shenqi Jiangtang granules combined with acupuncture from April, 2021 to April, 2023 (termed observation group). Meanwhile, the other 48 patients with the same disease and symptoms receiving acupuncture treatment were set as a control group. Both groups were treated for 3 months. The traditional Chinese medicine (TCM) symptom scores, pancreas islet function indicators, nerve conduction level and adverse reactions during treatment were compared between the two groups. **Results:** The total clinical effective rate (93.75%) was higher in observation group than control group (79.17%) ( $p < 0.05$ ). After treatment, the TCM symptom scores, fasting insulin level, and insulin resistance index were decreased in the two group, and the decreasing trend was more apparent in observation group ( $p < 0.05$ ). Through treatments, the sensory nerve conduction velocity (SNCV) and motor nerve conduction velocity (MNCV) of median nerve, posterior tibial nerve and common peroneal nerve were elevated ( $p < 0.05$ ), and the velocity was faster in observation group than control group ( $p < 0.05$ ). Notably, no particularly severe adverse reactions were detected in the two groups during treatment. **Conclusion:** Shenqi Jiangtang granules combined with acupuncture has higher therapeutic efficacy on T2DPN with dual deficiency of qi and yin, which can help patients relieve clinical symptoms, improve pancreas islet functions and mitigate nerve injury, with high safety.



## 1 Introduction

Type 2 diabetic peripheral neuropathy (T2DPN) is the commonest chronic complication of diabetes, featuring numbness of limbs and spontaneous pain that seriously affect the life quality of patients [1]. The high blood glucose can incur the increase of advanced glycation end products and activate the advanced glycation end product and hexosamine pathways, so as to enhance inflammatory response signals, damage neurons, neurogliaocytes, vascular endothelial cells, etc., and ultimately trigger T2DPN [2,3]. Currently, in Western medicine, there is no specific treatment method for T2DPN but only symptom-based therapy, including metabolism regulation and nerve nourishing; however, the therapeutic efficacy is poor in some patients and other combined drugs are required [4]. Fortunately, traditional Chinese medicine (TCM) has clear efficacy against T2DPN, which combined with Western medicine is a common method for T2DPN clinically [5].

In TCM, T2DPN belongs to “blood impediment”, the pathogenesis of which is dual deficiency of qi and yin, as well as weakened blood circulation, resulting in phlegm turbidity, blood stasis, obstruction of meridians and collaterals, and ultimate numbness of limbs and pain; therefore, treatment of T2DPN should focus on transforming stasis, unblocking collaterals, nourishing yin and benefiting qi [6]. As a traditional therapy with a long history, acupuncture is mainly responsible for unblocking collaterals, regulating qi and blood, moving impediment disorder and alleviating pain, which exerts notable efficacy on reducing blood glucose and improving neuropathy [7]. Shenqi Jiangtang granules is composed of ginsenoside, Astragalus Radix, Dioscoreae Rhizoma, etc., with the efficacy of reinforcing qi and nourishing yin as well as strengthening kidney and nourishing spleen, which can effectively mitigate numbness of limbs and pain caused by qi stagnation, blood stasis, and stasis

obstructing the collaterals [8]. Shenqi Jiangtang granule is an effective and safe adjuvant therapy for type 2 diabetes mellitus [9]. In addition, it has been reported that Shenqi Jiangtang granule combined with Western medicine has a good therapeutic effect on gestational diabetes mellitus (GDM) patients, which can effectively control blood glucose and lipid levels, and reduce the incidence of adverse pregnancy outcomes [10,11].

On this basis, this study probes into the efficacy of Shenqi Jiangtang granules combined with acupuncture on T2DPN with dual deficiency of qi and yin, so as to provide valuable references to T2DPN treatment.

## 2 Materials and methods

### 2.1 General information

48 patients with T2DPN and dual deficiency of qi and yin, who were admitted to our hospital and received treatment of Shenqi Jiangtang granules combined with acupuncture from April, 2021 to April, 2023 (termed observation group). Meanwhile, the other 48 patients with the same disease and symptoms receiving acupuncture treatment were set as a control group. The general information of the two groups had no obvious difference and was comparable (Table 1). This study was authorized by the Ethics Committee of our hospital and the written informed consent was obtained from all patients.

### 2.2 Inclusion criteria

Patients who (1) suffered from T2DPN meeting the diagnostic criteria of Western medicine from Consensus on diagnosis and treatment of diabetic peripheral neuropathy [12]; (2) suffered from T2DPN belonging to symptoms of dual deficiency of qi and yin as well as blood stasis in Guiding principles for clinical research of new Chinese medicine [13], with the main symptoms of numbness, sense of coldness and formication of both lower limbs, accompanied by

frequent micturition with profuse urine, dry mouth and heavy drinking, blurred vision, and secondary symptoms of red tongue with little fluid, less and dry

tongue coating, as well as thin and hesitant pulse [13]; (3) had disease course of diabetes mellitus (DM) > 1 year; and (4) took no DPN drugs within 1 month.

**Table 1** The comparison of general information between the two groups of patients.

Group	Case	Sex (case)		Age (year old)	Course of disease (year)	FBG (mmol/L)
		Male	Female			
Observation group	48	26	22	60.57 ± 6.62	5.05 ± 0.60	8.73 ± 0.92
Control group	48	25	23	61.03 ± 6.38	5.09 ± 0.56	8.61 ± 0.88
	$\chi^2/t$	0.042		0.347	0.338	0.653
	$p$	0.838		0.730	0.736	0.515

  

Group	P2hBG (mmol/L)	HbA1c (%)	Complication (case)		
			Hyperlipidemia	Hypertension	Coronary heart disease
Observation group	14.38 ± 1.74	8.23 ± 0.91	13	16	8
Control group	14.45 ± 1.86	8.20 ± 0.90	12	15	8
	$\chi^2/t$	0.190	0.017		
	$p$	0.849	0.992		

**2.3 Exclusion criteria**

Patients who (1) suffered from peripheral neuropathy caused by other diseases; (2) failed to effectively control blood glucose; (3) were inappropriate for further treatment due to acute complications such as ketoacidosis and coma, and deterioration of disease; (4) were allergic to components of Shenqi Jiangtang granules; (5) were lactating or pregnant women; (6) complicated with heart, lung, liver and kidney dysfunction; and (7) were accompanied with malignant tumors.

**2.4 Treatment methods**

All patients stopped taking antidiabetic drugs and received unified conventional treatment, including healthy promotion and education, diet intervention, control of blood glucose using metformin alone or combined with insulin, and nerve nourishing using lipoic acid and mecobalamin. Based on conventional therapy, patients in control group received acupuncture, mainly with Yuan-primordial points of channels, including Zusanli, the sea of blood, Taixi, Taichong, Taibai, Chongyang, Qiuxu, and Chingku,

while patients complicated with upper limb symptoms had additional acupuncture in Yangchi, Hegu, Dalin, Taiyuan, Wangu and Shenmen. Concretely, following location of acupoint, iodophor disinfection was conducted, and filiform needle acupuncture was later performed according to balanced reinforcing and reducing methods; during the process, needle would be retained for 20 min when the desired sensation was brought about; the operation was conducted once every other day. On the basis of the treatment in control group, patients in observation group additionally took Shenqi Jiangtang granules (batch number:00116221, 00117096, 01180741, Lunan Hopu Pharmaceutical Co., Ltd., National medicine permission number: Z10950075, 3 g/bag) orally, 3 g/time and 3 times/day. All patients in the two groups were treated for a month and stopped taking drugs for a week, and the treatment lasted for 3 months.

**2.5 Observation indicators**

This study collected clinical data on TCM symptom scores, pancreas islet function indicators, nerve conduction index levels, etc. that were tested and registered during treatment in two groups of T2DPN

patients. Based on medical records, the changes in symptoms and the occurrence of adverse events during treatment were gathered.

(1) Clinical efficacy: the clinical efficacy was compared between the two groups of patients after 3 months of treatment. Obvious effectiveness: pain, numbness and other symptoms were greatly improved, tendon reflexes recovered significantly, and nerve conduction velocity (NCV) was increased by 5 m/s. Effectiveness: pain, numbness and other symptoms were relatively improved, tendon reflexes gradually recovered, and NCV was increased by over 3 m/s. Ineffectiveness: pain, numbness and other symptoms did not change, tendon reflexes did not recover, and NCV was increased less than 3 m/s. Total effectiveness = (Obvious effectiveness + Effectiveness)/Total cases × 100% [13].

(2) TCM symptom score: The TCM symptom score was contrasted between the two groups of patients before treatment and 3 months after treatment. According to TCM syndromes and clinical signs, a score scale was established, containing 6 items of excessive eating and frequent hunger, fatigue, lack of energy and laziness in speech, lukewarm hands and feet, rough and scaly skin, and numbness of limbs or pain in limbs. Before and after treatment, scores were given based on the severity of each item (0 point for no symptoms, 1 for mild symptom, 2 for moderate symptom, and 3 for severe symptom), with higher scores indicating more severe symptoms [13].

(3) Pancreas islet function: The pancreas islet function was compared between the two groups of patients before treatment and 3 months after treatment. 5 ml of fasting venous blood was extracted in the morning and centrifuged at 4000 r/min for 5 min. Fasting serum insulin level was measured using an immunochemiluminescence analyzer (Elecsys2010, Roche, Germany). The formula for calculating insulin resistance index: (fasting blood glucose × fasting

insulin)/22.5 [14].

(4) Nerve conduction condition: The nerve conduction level was contrasted between patients of the two groups before treatment and 3 months after treatment. Electromyography and evoked potential test devices were applied to detect the sensory nerve conduction velocity (SNCV) and motor nerve conduction velocity (MNCV) of median nerve, posterior tibial nerve and common peroneal nerve.

(5) Adverse reaction: The possible adverse reactions that may occur between two groups of patients were collected and compared during treatment.

## 2.6 Statistical analysis

SPSS 20.0 was employed to conduct statistical analyses. Statistical data were compared by  $\chi^2$  test, and measurement data were expressed by means ± standard deviation. The Kruskal-Wallis method was used for normality analysis of continuous variables, and t-test was for analyzing continuous variables that conform to normal distribution. Independent samples t-test was applied for two-group comparison, and paired samples t-test was for comparison before and after treatment in the same group.  $p < 0.05$  was considered to be statistically significant.

## 3 Results

### 3.1 Comparison of clinical efficacy in the two groups of patients

The total effective rate was higher in observation group than control group ( $p < 0.05$ , Table 2).

### 3.2 Comparison of TCM symptom score between the two groups of patients before and after treatment

Prior to treatment, there was no apparent difference between the two groups of patients in TCM symptom scores ( $p > 0.05$ , Table 3), but after treatment, the score was declined in the two groups of patients and

the decreasing trend was more remarkable in observation group than control group ( $p < 0.05$ , Table 3).

### 3.3 Comparison of pancreas islet function between the two groups of patients before and after treatment

Fasting insulin level and insulin resistance index were similar in the two groups of patients before treatment ( $p > 0.05$ , Table 4). Notably, the two indicators in both groups of patients were diminished following treatment, and the two indicators were lower in observation group than control group ( $p < 0.05$ , Table 4).

### 3.4 Comparison of nerve conduction level between the two groups of patients before and after treatment

The SNCV and MNCV of median nerve, posterior tibial nerve and common peroneal nerve were barely different in the two groups of patients before treatment ( $p > 0.05$ ), but later elevated by treatment ( $p < 0.05$ , Table 5). The elevation was more marked in observation group than control group ( $p < 0.05$ , Table 5).

### 3.5 Comparison of adverse reactions between the two groups of patients

There were no severe adverse reactions in the two groups of patients.

**Table 2** Comparison of clinical efficacy between the two groups of patients [case (%)].

Group	Case	Obvious effectiveness	Effectiveness	Ineffectiveness	Total effective rate
Observation group	48	32 (66.67)	13 (27.08)	3 (6.25)	45 (93.75)
Control group	48	28 (58.33)	10 (20.83)	10 (20.83)	38 (79.17)
	$\chi^2$				4.360
	$p$				0.037

**Table 3** Comparison of TCM symptom score between the two groups of patients (means  $\pm$  standard deviation, score).

Group	Case	Before treatment	After treatment
Observation group	48	8.21 $\pm$ 0.87	6.26 $\pm$ 0.76 *
Control group	48	8.25 $\pm$ 0.90	6.92 $\pm$ 0.81 *
	t	0.221	2.869
	$p$	0.825	0.005

Note: \*  $p < 0.05$  vs. before treatment.

**Table 4** Comparison of pancreas islet function between the two groups of patients before and after treatment (means  $\pm$  standard deviation).

Group	Case	Fasting insulin level (mIU/L)		Insulin resistance index	
		Before treatment	After treatment	Before treatment	After treatment
Observation group	48	9.74 $\pm$ 1.02	6.42 $\pm$ 0.71 *	3.25 $\pm$ 0.50	1.46 $\pm$ 0.28 *
Control group	48	9.45 $\pm$ 0.87	8.08 $\pm$ 0.82 *	3.19 $\pm$ 0.48	2.05 $\pm$ 0.40 *
	t	1.499	10.603	0.600	8.372
	$p$	0.137	<0.001	0.550	<0.001

Note: \*  $p < 0.05$  vs. before treatment.

**Table 5** Comparison of nerve conduction level between the two groups of patients before and after treatment (means ± standard deviation, m/s).

Group	Case	MNCV of median nerve		MNCV of posterior tibial nerve		MNCV of common peroneal nerve	
		Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Observation group	48	44.08 ± 4.12	51.60 ± 3.42 *	39.21 ± 3.05	45.20 ± 2.16 *	38.92 ± 3.27	46.67 ± 2.82 *
Control group	48	44.81 ± 4.23	47.05 ± 3.84 *	39.75 ± 3.31	43.66 ± 2.31 *	39.21 ± 3.38	43.62 ± 2.78 *
t		0.857	6.130	0.831	3.374	0.427	5.336
p		0.394	<0.001	0.408	0.001	0.670	<0.001

  

Group	Case	SNCV of median nerve		SNCV of posterior tibial nerve		SNCV of common peroneal nerve	
		Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Observation group	48	41.55 ± 3.45	47.12 ± 2.37 *	33.51 ± 3.01	40.26 ± 2.41 *	38.67 ± 3.06	45.92 ± 2.06 *
Control group	48	42.03 ± 3.31	45.81 ± 2.80 *	34.12 ± 3.12	37.26 ± 2.61 *	38.88 ± 3.17	42.81 ± 2.12 *
t		0.696	2.474	0.975	5.851	0.330	7.289
p		0.488	0.015	0.332	<0.001	0.742	<0.001

Note: \*  $p < 0.05$ . vs before treatment.

#### 4 Discussion

To delve into effective methods for T2DPN with dual deficiency of qi and yin, this study included 48 patients receiving treatment of Shenqi Jiangtang granules combined with acupuncture and the other 48 patients only undergoing acupuncture treatment, and compared the clinical efficacy between the two groups of patients. The results confirmed that the therapeutic efficacy was more significant in T2DPN patients with dual deficiency of qi and yin after treatment of Shenqi Jiangtang granules combined with acupuncture.

The chronic high blood glucose in T2DPN patients may cause reduced sensitivity of  $\beta$ -insulin cells to blood glucose, inhibit the secretion of insulin, and thereby affect pancreas islet functions of patients [15]. Our results indicated that Shenqi Jiangtang granules combined with acupuncture was more effective than acupuncture alone in alleviating clinical symptoms and improving pancreas islet functions of T2DPN patients with dual deficiency of qi and yin. Yuan-primordial points were the main acupoints for acupuncture, including Zusanli, the sea of blood, Taixi, Taichong, Taibai, Chongyang, Qiuxu, Chingku, etc. Acupuncture

at Zusanli acupoint can bi-directionally regulate gastrointestinal physiological activities, stimulate peroxidases such as GSH Px to promote hydrogen peroxide decomposition, protect epithelial cell membranes from damage, improve pancreas islet function, and relieve clinical symptoms of patients [16]. Acupuncture at Taichong acupoint can decrease the cytokine content in pancreatic islet  $\beta$  cells, increase insulin receptors, enhance pancreas islet function, improve insulin resistance, and thus alleviate symptoms such as excessive eating, frequent hunger and fatigue in patients [17]. Shenqi Jiangtang granules mainly consists of ginsenoside, Astragalus Radix, Poria cocos, Schisandra Chinensis Fructus, Dioscoreae Rhizoma, Rehmanniae Radix, Trichosanthis Radix, Ophiopogonis Radix, etc. Among them, ginsenoside can nourish spleen and lung, Astragalus Radix, can tonify spleen and benefit qi, Poria cocos can strengthen the spleen and stomach, Schisandra Chinensis Fructus can generate body fluids and stop sweating, Dioscoreae Rhizoma can nourish kidney and benefit essence, Rehmanniae Radix can nourish yin and strengthen kidney, Trichosanthis Radix can generate fluids and alleviate thirst, and



Ophiopogonis Radix can nourish yin and generate fluids. These medicinal materials together can benefit qi, nourish yin, tonify spleen and generate fluids [18]. Modern pharmacology revealed that Astragalus polysaccharides are one of the main activities of Astragalus Radix, which can increase the activity of hypothalamic-pituitary-adrenal axis, alleviate glucose and lipid metabolism disorders, regulate mitochondrial function to control metabolic memory, and effectively control blood glucose level, thereby improving symptoms such as fatigue, lack of energy, and laziness in speech [19]. Poria cocos polysaccharides, as Poria cocos extract, can repair function of pancreatic islet  $\beta$  cells, enhance pancreas islet function, increase the body's glucose uptake rate, and alleviate symptoms such as lack of energy, laziness in speech, and lukewarm hands and feet [20]. Moreover, Shenqi Jiangtang granules with multi-ingredients and multi-targets characteristics, it exhibited a beneficial effect on ameliorating insulin resistance [21]. Hence, treatment of Shenqi Jiangtang granules combined with acupuncture can alleviate excessive eating, frequent hunger, fatigue, lack of energy, laziness in speech and lukewarm hands and feet, and improve pancreas islet function in T2DPN patients with dual deficiency of qi and yin, which was more effective than acupuncture alone.

Chronic high blood glucose in T2DPN patients activates glucose bypass metabolism and metabolizes excess glucose through specific bypass pathways, during which a large amount of reduced coenzyme II is consumed, leading to insufficient synthesis of nitric oxide and the generation of substantial free radicals, and ultimately exacerbating nerve damage [22]. The results of this study proved that treatment of Shenqi Jiangtang granules combined with acupuncture had stronger effects than acupuncture treatment alone in relieving nerve damage in T2DPN patients with dual deficiency of qi and yin. Acupuncture at Taixi acupoint can promote the proliferation of  $\beta$  cells, enhance the

ability of adipose tissue to absorb glucose, boost muscle anaerobic glycolysis, hinder the absorption of glucose in the intestine and lower blood glucose by affecting the binding of cholinergic transmitters from nerve ends and their receptors in the vagus, thereby alleviating nerve damage [23]. Stimulating Taixi and Zusanli acupoints can reduce the level of malondialdehyde, increase the activity of superoxide dismutase, effectively alleviate oxidative stress, and promote sensory nerve repair [24]. Shenqi Jiangtang granule has anti-inflammatory activity, it can decrease the serum concentration of inflammatory cytokines (tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ), IL-6, and IL-1 $\beta$ ), along with suppressing the p-NF- $\kappa$   $\beta$  protein overexpression [21]. In line with modern pharmacology, ginsenosides in Shenqi Jiangtang granules are mainly responsible for repressing NF- $\kappa$  $\beta$  activation by blocking the binding of lipopolysaccharides (LPS) to immune cells such as Toll-like receptor 4 on macrophages, which thus generate a certain improving effect on neuroinflammatory damage in T2DPN patients [25]. Schisandra Chinensis Fructus water extract can block NF- $\kappa$  $\beta$  signaling pathway to inhibit TNF- $\alpha$  and induce the expression of matrix metalloproteinase-9, migration and production of reactive oxygen in human aortic smooth muscle cells (HASMCs), ultimately alleviating neurological damage [26]. Collectively, treatment of Shenqi Jiangtang granules combined with acupuncture was more effective in alleviating nerve damage in T2DPN patients with dual deficiency of qi and yin, relative to acupuncture treatment alone.

In addition, the SNCV of a patient can be reduced by DPN, which can affect sensation and movement. Studies have shown that acupoint therapy can improve SNCV and reduce DPN symptoms [27-29]. In this study, the SNCV and MNCV of median nerve, posterior tibial nerve and common peroneal nerve of T2DPN patients with dual deficiency of qi and yin were elevated after treatment with Shenqi Jiangtang

granules combined with acupuncture. It indicated that Shenqi Jiangtang granules combined with acupuncture has a good therapeutic efficacy for T2DPN patients. In addition, this study unveiled that no severe adverse reactions occurred during treatment in the two groups of patients, indicating the high safety of Shenqi Jiangtang granules combined with acupuncture in treating T2DPN patients with dual deficiency of qi and yin. However, there are some limitations to be addressed: (1) small samples; (2) a paucity of discussion on the long-term therapeutic effect of Shenqi Jiangtang granules combined with acupuncture. Hence, further in-depth research is required.

## 5 Conclusion

To conclude, Shenqi Jiangtang granules combined with acupuncture has specific therapeutic efficacy towards T2DPN with dual deficiency of qi and yin, which can relieve clinical symptoms, improve pancreas islet function and reduce nerve damage, with high safety.

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Not applicable.

## Conflicts of Interest

The authors declare no conflicts of interest.

## Author Contributions

Conceptualization, Y.J.; Data curation, Z.M.; Formal analysis, X.J.; Methodology, Y.J.; Writing-original draft, Z.M.; Writing-review and editing, X.J. All authors have read and agreed to the published version of the manuscript.

## Ethics Approval and Consent to Participate

This study was authorized by the Ethics Committee of our hospital and the written informed consent was obtained from all patients.

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## Availability of Data and Materials

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

## Supplementary Materials

Not applicable.

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