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Original Article

Efficacy of Jianpiyangxue granule on gastrointestinal autonomic nerve dysfunction and its impact on adverse reactions

Yaqing Zhou[1], Shenggang Wang[2]

[1]Department of Critical Care Medicine, Affiliated Hai'an Hospital of Nantong University, Nantong 226600, Jiangsu Province, China; [2]Department of Gastrointestinal and Anal Diseases Surgery, Affiliated Hospital of Weifang Medical University, Weifang 261000, Shandong Province, China

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Abstract: Objective: To explore the efficacy of Jianpiyangxue granules on gastrointestinal autonomic nerve dysfunction and their impact on adverse reactions. Methods: From September 2016 to September 2020, 120 patients with gastrointestinal autonomic nerve dysfunction treated in our hospital were retrospectively selected and randomly assigned to a treatment group (TG) which was administered Jianpiyangxue granules prepared by our hospital and a control group (CG) which was administered routine Western medicine treatment (B vitamins + oryzanol). There were 60 patients in each group. The clinical efficacy and incidences of adverse effects were compared between the groups. The gastrointestinal hormone indexes, the inflammatory cytokines, and the immune indexes were analyzed before and after the therapy. The gastrin (GAS) and motilin (MTL) levels were measured using the motilin stimulating method, and the somatostatin (SS) levels were measured using ELISA for comparison. The autonomic nerve dysfunction symptoms were used for the evaluation. The degree of neurological functional defects scale (NIHSS) was used to assess the neurological functional defect levels. The self-rating anxiety scale (SAS) and self-rating depression scale (SDS) scores were used to assess the patients' psychological statuses. Results: After the therapy, the GAS, MTL, and SS expressions in the TG were remarkably higher than they were in the CG. The CRP and IL-6 expressions in the TG were significantly lower than they were in the CG. The TG had higher IgG, IgM, and IgA levels as compared with the CG, higher grade 0 and grade 1 scores on the gastrointestinal autonomic nerve dysfunction, but lower grade 2 and 3 scores were observed compared to the CG. Significantly lower NIHSS, SAS, and SDS scores were recorded in the TG compared with the CG. The TG yielded more promising outcomes in terms of the total effective rate and the incidences of adverse reactions than the CG. Conclusion: Jianpiyangxue granules contribute to enhancing the clinical efficacy, reducing the incidence of adverse reactions, and improving the gastrin, somatostatin, and other indicators in treating gastrointestinal autonomic nerve dysfunction.

Keywords: Gastrointestinal autonomic nerve dysfunction, Jianpiyangxue granules, efficacy, gastrin, somatostatin

Introduction

The accelerated societal transformation and pace of life result in an increased in life pressure and great changes in lifestyle and diet habits [1], and an increasing number of patients with gastrointestinal dysfunction have suffered from pain in recent years [2]. Gastrointestinal dysfunction is characterized by repeated attacks and takes a toll on patients' quality of life. However, no organic disease can be found in patients after various examinations [3, 4]. Gastrointestinal dysfunction is frequently accompanied by autonomic nervous dysfunction such as insomnia, dreaminess, and mental stress [5], which aggravates patients' pressure and generates negative emotions [6]. Therefore, effective treatment and intervention are indispensable for improving the patients' conditions.

Research has shown that the onset of gastrointestinal autonomic nerve dysfunction is closely related to the aberrant performance of the heart, spleen, liver, kidneys, and other vital organs [7]. According to clinical observations, patients with the disease invariably suffer a long course of the disease, which, from the per-

spective of traditional Chinese medicine (TCM), results in deficiencies in the body, specifically, the deficiency of the spleen and the stomach and impaired hepatic function to store blood [8]. Accordingly, the intervention for the disease requires well-rounded therapies for the viscera in the body [9]. Clinically, vitamin B and oryzanol are frequently used to treat the condition [10]; however, gastrointestinal intolerance after medication undermines the clinical effectiveness of the drugs [11]. Jianpiyangxue granules are modified using sijunzi decoction combined with suanzaoren decoction. In accordance with the theory of TCM that "the spleen and stomach are the foundation of life-nourishing and the source of Qi and blood", Jianpiyangxue granules combine the codonopsis, atractylodes, tuckahoe, and tangerine peels that invigorate the spleen, regulate Qi, and replenish the blood, with ferrous ions to achieve the effect of nourishing the blood and Qi and quickly mitigating the symptoms of iron-deficiency, and hemorrhagic and nutritional anemia. With a mild medicinal property, it enhances the absorption of the blood-generating elements in the spleen and stomach. Rich in promoting blood cell growth factors, the drug stimulates the differentiation of the bone marrow hematopoietic stem cells and enhances bone marrow hematopoietic function to cure anemia. Moreover, it improves the rapid absorption of trace elements such as iron and vitamins in the stomach and intestines and boosts the production of red blood cells and hemoglobin to achieve rapid iron replenishment. Gastrointestinal autonomic nerve dysfunction is considered an anxiety response [12]. Spina date seed can tranquilize the mind by nourishing the heart and astringe energy dissipation. *Anemarrhena asphodeloide*s can clear away heat, purge pathogenic fire, nourish Yin and moisten dryness. *Poria* can clear dampness, promote diuresis, strengthen the spleen, tonify the lungs, calm the heart, and tranquilize the mind. Szechuan lovage rhizome promotes Qi to activate the blood and circulate Qi and the blood without stagnation. Licorice can harmonize various medicines [13]. Spina date seed nourishes the yin and blood, and it can be used with Szechuan lovage rhizome to regulate the blood and nourish the liver. Licorice can soften the liver. The combination of the three can nourish the blood for tranquilization, clear heat, relieve fidgetiness, dredge channels and collaterals, and relieve convulsions and hypnosis, which indicates more desirable effects [14]. A prior study has shown that the intervention of Jianpiyangxue granules combined with western medicine can effectively mitigate stomach pain and improve the eradication rate of HP for patients with chronic atrophic gastritis, without any significant adverse reactions after the treatment [15].

At present, there is little research on using Jianpiyangxue granules to treat gastrointestinal autonomic nerve dysfunction. This study was designed to observe the curative efficacy of Jianpiyangxue granules on gastrointestinal autonomic nerve dysfunction patients and to study its influence on the gastrin, somatostatin, and immune indexes, aiming to provide better information on the treatment of gastrointestinal autonomic nerve dysfunction patients. The innovation of this research lies in its use of Jianpiyangxue granules, which regulate the functions of the spleen and stomach, enables the digestive system to fully absorb nutrients and trace elements, and achieves the nutritional balance of the human body while enriching the blood. It is especially suitable for children and people with weak gastrointestinal function, so it is worthy of clinical exploration.

Materials and methods

Baseline data

From September 2016 to September 2020, 120 gastrointestinal autonomic nerve dysfunction patients treated in our hospital were selected and randomly assigned to the treatment group (TG), which was administered Jianpiyangxue granules prepared by our hospital, and the control group (CG) which was administered routine western medicine treatment (vitamin B +oryzanol), with 60 patients in each group. This study was reviewed by the Ethics Committee of the Affiliated Hospital of Weifang Medical University (2015-12-11), and all the patients signed an informed consent form.

Inclusion criteria: Patients diagnosed with gastrointestinal autonomic nerve dysfunction [16], patients with the main clinical manifestations of insomnia, dizziness, headache, anorexia, nausea or vomiting, abdominal distension, stomach cramps, pain in the lower abdomen,

and nervous vomiting or diarrhea. Patients with complete general clinical data, patients over 18 years old, and patients with a course of the disease over 5 years. After their diagnoses, the patients underwent follow-up treatment in our hospital.

Exclusion criteria: Pregnant or lactating women, patients with unstable hypertension and diabetes, patients comorbid with serious primary diseases such as those of the heart, brain, liver, renal and hematopoietic system, patients in an unstable condition, patients who were allergic to the drugs used in this study, patients who could not actively cooperate with this research, patients with mental illnesses, and patients who quit the experiment halfway.

Treatment methods

In the TG, the patients were treated with Jianpiyangxue granules made by our hospital: *Codonopsis pilosula* 15 g, *Rhizoma atractylodis* macrocephalae 12 g, fried wild jujube seed 30 g, poria with hostwood 20 g, Szechuan lovage rhizome 20 g, *Anemarrhena asphodeloides* 15 g, *Schisandra chinensis* 15 g, tuber fleeceflower stem 20 g and licorice 10 g (produced and provided by the Sichuan New Green Pharmaceutical Technology Development Co. LTD). The patients took the medicine dissolved in boiled water (150 ml) twice a day for 4 weeks.

In the CG, the patients were administered vitamin B1 (Yangzhou Aidi Pharmaceutical Co., Ltd., Jiangsu, China, H32024387) and oryzanol tablets (Hengjian Pharmaceutical Co., Ltd., Guangdong, China, H44020613), both of which were 10 mg. The patients took one tablet each time, three times a day for 4 weeks.

Outcome measures

Gastrointestinal hormone indexes: Venous blood (5 mL) was drawn from the patients in both groups before and after the therapy. The blood was centrifuged at 1500×g and 4°C for 10 min and stored in a cryogenic freezer at -70°C for later use. The gastrin (GAS, Rabbit polyclonal to Gastrin, ab232775, abcam) and motilin (MTL, Rabbit polyclonal to Motilin, ab14580, abcam) levels were measured using the motilin stimulating method, and the somatostatin (SS, Rabbit monoclonal [UMB1] to Somatostatin Receptor 2-C-terminal, ab-134152, abcam) levels were measured using enzyme linked immunosorbent assays (ELISA). The test was performed in strict accordance with the instructions of the ELISA kits (Yaji Biotechnology Co., LTD., Shanghai, China, YS-T10767).

Inflammatory factors: The serum inflammatory factor reactive protein (CRP) and interleukin-6 (IL-6) levels were examined using ELISA. The operation was carried out in strict accordance with the manual of the human CRP ELISA human IL-6 ELISA kit (Hengfei Biotechnology Co., LTD., Shanghai, China, CSB-E08617h-1, 130-095-352).

Immunization indicators: In the two groups, the immune indexes [IgA (Human IgA ELISA Kit, ab229396, abcam), IgG (Human IgG ELISA Kit, ab195215, abcam), IgM (Human IgM ELISA Kit, ab137982, abcam) were measured using ELISA.

Autonomic nerve dysfunction: A self-made questionnaire was used to evaluate the autonomic nerve dysfunction levels, which was divided into grades 0 to 3. Grade 0: no symptoms of neurological dysfunction; Grade 1: mild neurological disorder, but not seriously affecting the patients' work and life; Grade 2: the symptoms of neurological dysfunction had a certain impact on work and life, but the patients were still able to work; Grade 3: the neurological disorder symptoms affected the normal daily lives of the patients.

Negative emotions [18]: The total possible score on the SAS scale was 100 points. 50-70 points indicates mild anxiety, 71-90 points indicates moderate anxiety, and >90 points indicates severe anxiety. The higher the score, the more serious the anxiety. The total possible score on the SDS scale was 100 points. 50-70 points indicates mild depression, 71-90 points indicates moderate depression, and >90 points indicates severe depression. The higher the score, the more serious the depression.

Efficacy evaluation: This was divided into three parts: markedly effective, effective, and ineffective. After the therapy, the clinical manifestations and signs of TCM were significantly ameliorated, and the syndrome score was declined by ≥70%, indicating "markedly effective". After the therapy, the clinical manifesta-

tions and signs of TCM were ameliorated, and the syndrome score was reduced by ≥30%, indicating "effective". After the therapy, the clinical manifestations and signs of TCM showed no distinct improvement or even exacerbation, and the syndrome score was declined by <30%, indicating "ineffective". Total response rate = (markedly effective + effective)/total cases ×100%.

Adverse reactions: The adverse reactions were observed in the two groups during treatment.

Satisfaction: 4 weeks after therapy, the patients' satisfaction levels were investigated by telephone or using a self-made questionnaire. The questionnaire included 5 dimensions, which mainly investigated the patients' acceptance of the treatment methods, their digestive tract symptoms, their gastrointestinal function, their neurological function, and their satisfaction with the overall treatment. The total possible score was 50 points (10 points for each question), and the evaluation was divided into 3 grades: very satisfied (≥45 points), generally satisfied (40 to 44 points), and dissatisfied (<40 points). Satisfaction = (very satisfied + satisfied)/total cases ×100%.

Statistical methods

SPSS 21.0 statistical software (SPSS, Inc, Chicago, IL, USA) was used for the statistical analysis. GraphPad Prism 6 was used to draw the figures. The count data were represented by the number of cases/percentage [n (%)], and chi-squared tests were used for the comparisons of the count data between groups. When the theoretical frequency in a chi-square test was less than 5, continuous correction chi-square tests were used. The measurement data were expressed as the means ± standard deviations (mean ± SD). Independent-samples t-tests were used for the comparisons of the measurement data between groups. Paired t-tests were used for the intra-group comparisons before and after the therapy. There were significant differences when $P<0.05$.

Results

Baseline data

There were no significant differences in terms of the general clinical baseline data such as gender, age, weight, course of the disease, smoking history, drinking history, sports history, educational level, family economic status, or diet between the two groups ($P>0.05$) (**Table 1**).

Comparison of the gastrointestinal hormone changes between the two groups after the therapy

There were no great disparities in the GAS, MTL, or SS expressions between the two groups before the therapy ($P>0.05$). After the therapy, the GAS, MTL, and SS expressions in both groups witnessed a drastic increase, with higher results in the TG than in the CG ($P<0.05$) (**Table 2**).

Comparison of the inflammatory cytokine levels between the two groups before and after the therapy

No significant differences in the CRP or IL-6 levels between the two groups before the therapy were detected ($P>0.05$). After the therapy, the CRP and IL-6 expressions in both groups showed a decline, with markedly lower levels in the TG than in the CG ($P<0.05$) (**Figure 1**).

Comparison of the immune indexes between the two groups before and after the therapy

There were no significant differences in the IgG, IgM, or IgA expressions between the two groups before the therapy ($P>0.05$). After the therapy, the IgG, IgM, and IgA levels in the two groups were elevated, with higher levels observed in the TG than in the CG ($P<0.05$) (**Table 3**).

Comparison of the autonomic nerve dysfunction scores between the two groups before and after the therapy

The two groups had similar autonomic nerve dysfunction scores before the therapy ($P>0.05$). After the therapy, the grade 0 and grade 1 scores of autonomic nerve dysfunction in the TG were significantly higher than they were in the CG ($P<0.05$), while the grade 2 and grade 3 scores of autonomic nerve dysfunction in the TG were remarkably lower than they were in the CG ($P<0.05$) (**Table 4**).

Comparison of the psychological emotions between the two groups before and after the therapy

There was no significant difference in the SAS and SDS scores between the two groups before the therapy ($P>0.05$). After the therapy, both

Table 1. Comparison of the patient baseline data between the two groups [n (%)] (mean ± SD)

Category	TG (n=60)	CG (n=60)	t/χ^2 value	*P* value
Gender			0.302	0.582
Male	26 (43.33)	29 (48.33)		
Female	34 (56.67)	31 (51.67)		
Average age (years old)	43.27±4.18	43.54±4.21	0.352	0.725
Average weight (kg)	72.16±7.04	73.54±7.07	1.071	0.286
Average duration (years)	4.64±0.37	4.58±0.39	0.864	0.389
Smoking history			0.314	0.574
Yes	35 (58.33)	38 (63.33)		
No	25 (41.67)	22 (36.67)		
Drinking history			0.143	0.704
Yes	39 (65.00)	37 (61.67)		
No	21 (35.00)	23 (38.33)		
Sports history			0.037	0.845
Yes	19 (31.67)	20 (33.33)		
No	41 (68.33)	40 (66.67)		
Educational level			0.636	0.727
Junior high school and below	19 (31.67)	20 (33.33)		
Senior high school	27 (45.00)	23 (38.33)		
Junior college and above	14 (23.33)	17 (28.33)		
Family economic status (month/person)			0.135	0.712
≥3000 yuan	33 (55.00)	35 (58.33)		
<3000 yuan	27 (45.00)	25 (41.67)		
Diet			0.033	0.854
Light	28 (46.67)	27 (45.00)		
Spicy	32 (53.33)	33 (55.00)		

Table 2. Comparison of the gastrointestinal hormone changes between the two groups after the therapy (mean ± SD)

Grouping	n	GAS (ng/ml)		MTL (ng/mL)		SS (pg/L)	
		Before therapy	After therapy	Before therapy	After therapy	Before therapy	After therapy
TG	60	128.64±12.09	108.54±10.15	370.45±30.45	277.54±27.45	7.42±1.65	14.76±1.59
CG	60	129.54±12.14	95.16±9.45	371.46±30.49	243.15±20.95	7.69±1.61	10.07±2.02
t	-	0.567	7.473	0.181	7.843	0.907	14.130
P	-	0.571	<0.001	0.856	<0.001	0.366	<0.001

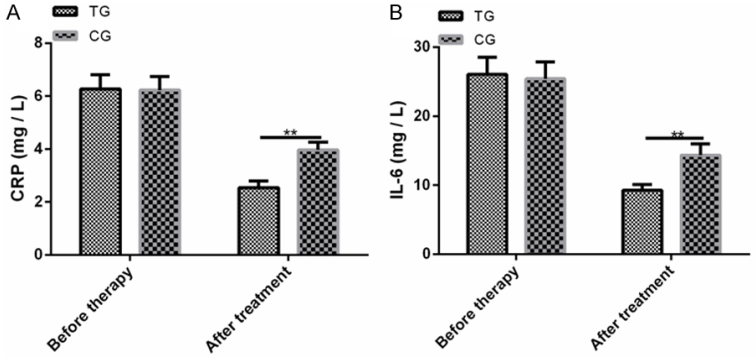

Figure 1. Comparison of the inflammatory factor levels between the two groups before and after the therapy. A: There was no significant difference in the CRP expressions between the two groups before therapy, but the expression of CRP in the TG was significantly lower than it was in the CG after the therapy. B: There was no significant difference in the IL-6 expressions between the two groups before therapy, but the expression of IL-6 in the TG was significantly lower than it was in the CG after the therapy. Note: Compared with before the therapy, *<0.05; Compared with the two groups after the therapy, **<0.01.

groups witnessed a drastic decline in terms of their SAS and SDS scores, with lower

Table 3. Comparison of the immune indexes between the two groups before and after the therapy (mean ± SD)

Grouping	n	IgG (g/L)		IgM (g/L)		IgA (g/L)	
		Before therapy	After therapy	Before therapy	After therapy	Before therapy	After therapy
TG	60	11.75±1.57	16.05±1.75	1.51±0.45	1.95±0.64	2.34±0.12	4.54±0.24
CG	60	12.06±1.59	13.19±1.54	1.54±0.43	1.62±0.57	2.36±0.15	2.72±0.18
t	-	1.075	9.503	0.373	2.983	0.806	46.990
P	-	0.284	<0.001	0.709	0.003	0.421	<0.001

Table 4. Comparison of the autonomic nerve dysfunction scores between the two groups before and after the therapy [n (%)]

Grouping	Before therapy				After therapy			
	Grade 0	Grade 1	Grade 2	Grade 3	Grade 0	Grade 1	Grade 2	Grade 3
TG (60)	0 (0.00)	12 (20.00)	31 (51.67)	17 (28.33)	25 (41.67)	21 (35.00)	10 (16.67)	4 (6.67)
CG (60)	0 (0.00)	11 (18.33)	30 (50.00)	19 (31.67)	14 (23.33)	11 (18.33)	23 (38.33)	12 (20.00)
χ^2	-	0.053	0.033	0.158	4.596	4.261	7.064	4.615
P	-	0.816	0.855	0.690	0.032	0.039	0.007	0.031

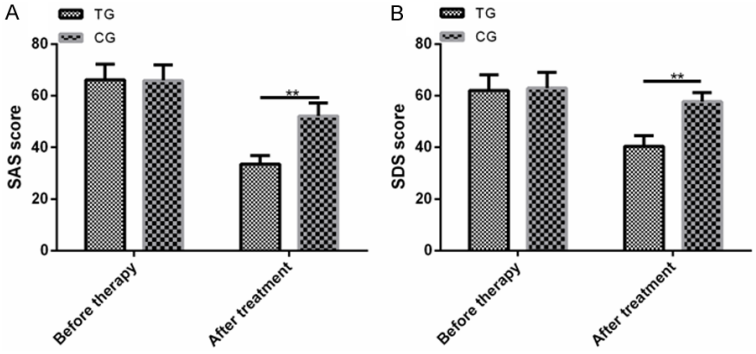

Figure 2. Comparison of the psychological emotions between the two groups before and after the therapy. A: There was no significant difference in the SAS scores between the two groups before the therapy, but the SAS scores in the TG were significantly lower than they were in the CG after the therapy. B: There was no significant difference in the SDS scores between the two groups before the therapy, but the SDS scores in the TG were significantly lower than they were in the CG after the therapy. Note: Compared with before the therapy, *<0.05; Compared with the two groups after the therapy, **<0.01.

results obtained in the TG than in the CG (P<0.05) (**Figure 2**).

Comparison of the therapeutic effects between the two groups after the therapy

After the therapy, the total response rate of 98.33% in the TG was significantly higher than the rate of 78.33% in the CG (P<0.05) (**Table 5**).

Comparison of the adverse reactions between the two groups after the therapy

The adverse effects that occurred during the therapy were observed in both groups. The incidence of total adverse reactions in the patients in the TG was 5.00%, while the rate in the CG was 18.33%. Compared with the CG, the total incidence of adverse reactions in the TG was significantly lower (P<0.05) (**Table 6**).

Comparison of the treatment satisfaction levels between the two groups

The patients in the TG were much more satisfied with the treatment, showing a satisfaction rate of 96.67%, which was remarkably higher than the rate of 73.33% in the CG (P<0.05) (**Table 7**).

Discussion

Autonomic nerve dysfunction is mainly caused by endocrine disorders [19]. Gastrointestinal autonomic nerve dysfunction is mostly characterized by a mental abnormality or a temporal nerve sensory abnormality, as well as significant headaches, palpitations, irritability, insomnia, and night sweats [20]. Due to the large number of system dysfunctions involved in this disease and the long course of the disease, patients show a greater propensity for negative emotions [21], resulting in more serious neurasthenia and autonomic nerve dysfunction

Table 5. Comparison of the therapeutic effects between the two groups after the therapy [n (%)]

Grouping	n	Markedly effective	Effective	Ineffective	Total effective rate (%)
TG	60	41 (68.33)	18 (30.00)	1 (1.67)	59 (98.33)
CG	60	19 (31.67)	28 (46.67)	13 (21.67)	47 (78.33)
χ^2	-	-	-	-	11.641
P	-	-	-	-	0.001

Table 6. Comparison of the adverse reaction rate between the two groups after the therapy [n (%)]

Categories	TG (n=60)	CG (n=60)	χ^2 value	*P* value
Nausea	1 (1.67)	4 (6.67)	1.878	0.170
Abdominal spasm	0 (0.00)	2 (3.33)	0.341	0.558
Poor appetite	1 (1.67)	3 (5.00)	1.034	0.309
Abdominal distension	1 (1.67)	2 (3.33)	0.341	0.558
Total incidence of adverse reactions	3 (5.00)	11 (18.33)	5.175	0.022

Table 7. Comparison of the treatment satisfaction levels in the two groups [n (%)]

Grouping	n	Satisfied	More satisfied	Dissatisfied	Satisfaction (%)
TG	60	39 (65.00)	19 (31.67)	2 (3.33)	58 (96.67)
CG	60	15 (25.00)	29 (48.33)	16 (26.67)	44 (73.33)
χ^2	-	-	-	-	12.811
P	-	-	-	-	0.001

[22], which impedes the treatment and rehabilitation of the patients.

In this study, Jianpiyangxue granules were used to treat the patients with gastrointestinal autonomic nerve dysfunction, and it was found that the patients' conditions were improved significantly after the therapy. A previous study found that the gastrointestinal hormone level are an important indicator of gastrointestinal function [23]. However, gastrointestinal autonomic nerve dysfunction may give rise to a gastrointestinal hormone secretion disorders, which leads to abnormal motilin, gastrin, and vasoactive intestinal peptide expressions, thus resulting in gastrointestinal dysfunction [24]. The findings of this study indicate that the GAS, MTL, and SS expressions in the TG were significantly higher than the expressions in the CG after the therapy, indicating that the treatment with Jianpiyangxue granules yielded a better regulatory effect on the gastrointestinal hormone secretion disorder. CRP is a phase protein synthesized by the liver, and it rises sharply in various inflammations, wounds, and infections, and it is a sensitive index to reflect the inflammatory state of the body [25]. Research has shown that IL-6 is an important pro-inflammatory factor. Markedly increased levels of IL-6 in the body and colon will lead to the impairment of colon barrier function [26]. The findings of this study show that the CRP and IL-6 expressions in the TG were remarkably lower than the expressions in the CG after the treatment. We found that the intervention with Jianpiyangxue granules contributes to alleviating patients' inflammatory reactions, thus correcting the gastrointestinal dysfunction. Studies have pointed out that IgA is the most abundant immunoglobulin in the body, and it is bound up with mucosal immunization, the progress of tolerance, and the protection of infection, and that IgG, IgM, and IgA are the key immunoglobulins in the respiratory and gastrointestinal tracts [27, 28]. The results of this study showed higher IgG, IgM, and IgA expressions in the TG than the CG after therapy. The reason may be that Jianpiyangxue granules can promote gastrointestinal peristalsis and meet the needs of metabolism, to further improve the immune indexes.

It has also been reported that gastrointestinal autonomic nerve dysfunction hinders patients' daily living, and timely and effective intervention can ameliorate the quality of life of patients [29]. However, conventional treatment fails to ensure complete control of the symptoms. Herein, patients were given Jianpiyangxue granules and prominently higher scores of grade 0 and grade 1 of autonomic nerve dysfunction and lower scores of grades 2 and 3 in the TG were found in contrast to the CG, which indicates that Jianpiyangxue granules can

effectively improve the symptoms of ischemia and hypoxia in patients' tissues, blood circulation disorders, and nerve transmission disorders. Recent research has revealed that depression is associated with significant gastrointestinal inflammation, autoimmune diseases, and neurodegenerative diseases [30]. However, patients with gastrointestinal autonomic nerve dysfunction may suffer from general pain and a flushed face due to indigestion, which may lead to excessive mental stress, thus aggravating the psychological pressure of the patients. Another study has stated that [31] gastrointestinal diseases lead to a decline in the patients' quality of life with autism and related symptoms, which underscores the significance of effective intervention in the improvement of gastrointestinal disease-related autism spectrum disorders. This is similar to the results of this study. The results of this research revealed more desirable results regarding the SAS and SDS scores in the TG than in the GC after the therapy, suggesting that Jianpiyangxue granules can help patients reduce the high sensitivity of their internal organs and reduce the pain mediator expressions, so as to eliminate the patients' negative emotions. After the intervention, the total response rate of the patients in the TG was significantly higher than it was in the CG, but the incidence of adverse reactions was lower than it was in the CG, indicating that Jianpiyangxue granules yielded a promising curative effect on gastrointestinal autonomic nerve dysfunction with few adverse reactions. We also invited the patients in the two groups to evaluate their treatment satisfaction with the two different treatment modes. The results indicated a higher treatment satisfaction rate in the TG, as compared with the CG. In light of the favorable treatment results of the digestive tract symptoms, neurological function, and overall treatment, the patients were highly satisfied with the treatment of Jianpiyangxue granules. Wang et al. [32] proposed that Jianpiyangxue granules are mainly aimed at the regulation of gastrin. In recent years, the role of gastrin as a simple gastrointestinal hormone has changed as it exists in the plasma and gastrointestinal tissues in many forms and is also a powerful transmitter of central and peripheral nerves. Based on the theory of TCM that the spleen governs the absorption of Qi and blood, the use of Jianpiyangxue granules to treat and regulate gastrin can succeed in adjusting the imbalance of yin and yang, and the Qi and blood in gastrointestinal autonomic nerve dysfunction, to further mitigate the clinical symptoms of the patients and to enhance the curative effect.

This study has confirmed the excellent efficacy of Jianpiangxue granules in gastrointestinal autonomic nerve dysfunction; nevertheless, the limitation of this study lies in its absence of an analysis of the patients' quality of life and a long-term investigation of the patients' conditions. As a result, future research will prolong the research time to further obtain more reliable medical data for clinical reference.

To sum up, Jianpiyangxue granules contribute to enhancing the clinical efficacy, reducing the incidence of adverse reactions, and improving the gastrointestinal hormone indexes such as gastrin and somatostatin in treating gastrointestinal autonomic nerve dysfunction. However, there are some limitations in this study. We included a small number of people and did not conduct *in vitro* experiments. In future experiments, we will supplement the basic experiment of Jianpiyangxue granules in the treatment of gastrointestinal autonomic nerve dysfunction or incorporate molecules or pathways to observe the effect of Jianpiyangxue granules on gastrointestinal autonomic nerve dysfunction.

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Disclosure of conflict of interest

None.

Address correspondence to: Shenggang Wang, Department of Gastrointestinal and Anal Diseases Surgery, Affiliated Hospital of Weifang Medical University, 2428 Yuhe Road, Kuiwen District, Weifang 261000, Shandong Province, China. Tel: +86-13583647235; E-mail: wsg111025@126.com

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