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The Effects of the Jiangzhi Granule, a Traditional Chinese Medicine, on Dyslipidemia in Patients with HIV Infection Receiving Highly Active Antiretroviral Therapy: A Randomized, Double-Blind, Two-Group Trial

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Abstract

Background and Importance: Antiretroviral therapy-associated side effects may lead to an increased risk of dyslipidemia on HIV patients. Exploring an alternative approach to treat antiretroviral therapy (ART)-associated dyslipidemia, especially for those who cannot tolerate statins is important. This study investigated whether the Jiangzhi granule is effective and safe on dyslipidemia in patients with HIV infection receiving highly active antiretroviral therapy.

Methods: Design, setting, and participants- A randomized, double blind, multicenter and placebo-controlled clinical trial of the Jiangzhi granule vs placebo in a factorial design for 24 weeks was conducted in 286 patients infected with HIV with dyslipidemia who were receiving ART at five Class III Grade I hospitals in China between November 2013 to September 2015.

Interventions: Daily oral Jiangzhi granule compared with placebo.

Main outcomes and measures: The primary outcomes included total cholesterol (TC), triglyceride (TG), high density cholesterol (HDL), and low-density cholesterol (LDL) at 24 weeks. The secondary outcomes included apolipoprotein, immune index, viral load, clinical symptoms and WHO Quality of Life Scale at 24 weeks. The primary outcomes were based on the rules: (a) Blood lipid test reached to one of the following items is excellent: TC decreased value ≥ 20%; TG decreased value ≥ 40%; HDL-C increased value ≥ 0.26 mmol/L; TC-HDL-C/HDL-C decreased value ≥ 20%; blood lipid test returned to normal; (b) blood lipid test reached to one of the following items is effective: TC decreased value ≥ 10% but <20%; TG decreased value ≥ 20% but <40%; HDL-C increased value ≥ 0.104 mmol/L but <0.26 mmol/L; TC-HDL-C/HDL-C decreased value ≥ 10% but <20%; (c) blood lipid test did not reach to one of the above items (considered not efficacious). The effective rate is the value sum of excellent and effective divide by the value of all analyzed patients.

Results: There were 286 participants enrolled and randomized into the study. Of these, 250 participants were ART-naive throughout this study. In intent-to-treat analysis, the Jiangzhi granule was found to reduce the TG value and rise the HDL-C value of patients. Stratified analyses of the TC value show that the Jiangzhi granule can reduce the TC value of patients older than 45 years (p=0.02). Stratified analyses of the HDL-C value show that the Jiangzhi granule can increase the HDL-C value of patients (p=0.03). In the study period, the blood and urine routine examination of the patients and the liver and renal function of the patients were normal. We found no serious adverse reactions.

Conclusions and Relevance: In ART-HIV-infected adults with dyslipidemia, 24-weeks treatment with the Jiangzhi granule was found to be safe and significantly reduced the TG value and raised the HDL-C value. The Jiangzhi granule may be effective medicine in ART-HIV-infected adults with dyslipidemia.

Keywords: HIV; Dyslipidemia; Traditional Chinese Medicine

Introduction

Combination antiretroviral therapy (ART) for HIV infection represents a triumph for modern medicine. HIV-associated morbidity and mortality have been dramatically reduced because of ART widely clinical practice, and the survival and quality of life in people living with HIV (PLWHIV) have been improved. HIV infection has turned into a manageable chronic disease spanning several decades of patient's life. However, Chronic suppressive treatment does not fully restore immune health; as a result, several inflammation-associated or immunodeficiency complications are increasing in importance [1]. Such as, cardiovascular diseases and metabolic abnormalities have been increasingly reported in PLWHIV, which rising the risk of death.

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Several studies have shown that treatment with ART medications is associated with metabolic changes, such as lipodystrophy (body fat redistribution), insulin resistance, hyperglycemia, and dyslipidemia [2-4]. It has been confirmed that patients infected with HIV have a high risk of developing dyslipidemia [5-7].

Statins are the agents of choice to treat dyslipidemia, and they may reduce by 18% to 55% the serum concentrations of LDL and by 7% to 30% the concentrations of TG, and increase by 5% to 10% the concentrations of HDL-C. However, most agents of statins are metabolized by cytochrome P450, which also metabolizes the PI (protease inhibitor) [8]. Thus, the serum levels of statins may cause toxicity in the liver and skeletal muscles, and other negative side effects [9]. The pathogenetic mechanism of dyslipidemia after HAART is specificity compared to common dyslipidemia, but there is still no clear conclusion. Study reports the characteristic of dyslipidemia after HAART is the significant rise of TG and very low-density lipoprotein (VLDL), but the rise of LDL is not obvious [10]. New therapeutic approaches that treat or prevent dyslipidemia due to HAART are preferred. Traditional Chinese Medicine (TCM) has long historical clinical practice in China and is different with modern medicine [11-13].

Researches about treating HIV/AIDS with TCM has lasted almost three decades, after the first case of HIV infected was reported in the late of 1980s. Usually, PLWH seek Traditional Chinese Medicine (TCM) for four main reasons: to enhance immune function, to treat symptoms, to improve quality of life, and to reduce side effects related to medications [14]. Weixia et al. reported TCM has a positive effect in the prevention and treatment of dyslipidemia [15]. Integrated Taohong Siwu decoction and Erchen decoction, Xiaozhi granules and Xuezhikang capsules can be used to control the hyperlipidaemia associated with highly active antiretroviral therapy as one of the main Chinese native medicine preparations [16].

Intermin-gled phlegm and blood stasis are the basic pathogenesis according TCM theory, reducing phlegm and eliminating blood stasis are major functions of the Jiangzhi granule. It is made up of Huangqi (astragalus root) 24 g, Chishao (red paeony Root) 15 g, Fabanxia (prepared pinellia tuber) 12 g, Huzhang (giant knot weed) 18 g, Shanzha (maybush) 15 g, Jianghuang (turmeric) 12 g, Juemingzi (cassia seed) 15 g, Chuanxiong (ligusticumwallichii) 9 g, Yujin (radix curcumae) 15 g, Zexie (Alismaplantago-aquatica) 12 g, Danshen(Salvia miltiorrhiza) 15 g, Yinyanghuo (epimedium) 12 g, Yinchen (oriental wormwood) 15 g. In this study, we aimed to explore the effects of the Jiangzhi (reducing phlegm and eliminating blood stasis) granule on dyslipidemia in patients with HIV infection receiving HAART, exploring an alternative approach to treat ART-associated dislipidemia, especially for those who could not tolerate statins.

Research Methodology

This is a randomized, double-blind, multi-center, placebo-controlled trial, conducted by in China Academy of Chinese Medical Science, which consisted of a pretreatment phase screened and followed up by randomization of participants into 2 groups in a design for a 24-week treatment protocol. A cohort of 286 adults who were HIV-infected with dyslipidemia was recruited and followed up for 24 weeks through five Class III Grade I hospitals in China from November 2013 until September 2015.

Diagnostic criteria

Diagnosis of AIDS was based on the Diagnostic Criteria of AIDS and HIV infection from the Ministry of Public Health of China （WS293-2008) as HIV antibody positive confirmed by Western Blot test [17]. Diagnosis of dyslipidemia was based on Guidelines on Prevention and Treatment of Blood Lipid Abnormality in Chinese Adults, taking into detail of Total Cholesterol (TC) > 5.18 mmol/L or Total Triglyceride (TG) > 1.70 mmol/L [18].

Inclusion criteria

The participants were required to also meet the diagnosis of dyslipidemia guidelines, be between the ages of 18 to 70 years, and had already received HAART treatment. The blood fat of the patients is required to be normal before receiving HAART treatment and the serum TC > 5.72 mmol/L but <10.00 mmol/L, or TG >1.70 mmol/L but <5.00 mmol/L.

The study protocol was approved by the China Academy of Traditional Chinese Medicine (2013 No.003) and was registered in the Chinese Clinical Trial Registry (Registration number: ChiCTR-TRC-13003717). Informed consent was obtained, and the clinical research was conducted in accordance with the Declaration of Helsinki and the International Conference on Harmonization Tripartite Guideline on Good Clinical Practice, and the authors' institutions [19]. The purpose, procedures, and potential risks and benefits of the study were explained to the prospective participants, and written informed consent was obtained.

Randomization and intervention

Randomization was controlled by an independent clinical research coordinator (CRC) and patients were randomly allocated to the Jiangzhi granule with HAART group (Jiangzhi Group) or placebo with HAART group (Placebo Group) at a ratio of 1:1. The primary objective was to determine whether the Jiangzhi granule with HAART is preferable to HAART alone, in comparison with placebo, in improving dyslipidemia and immune function for ART-HIV-infected adults.

First, basic information about the patients including age, sex, race, body-mass index was transmitted to the independent statistician. The statistician allocated a randomization number based on the allocation sequence generated by a random number creation program (SPSS 13.0) in advance. Then the CRC informed the investigators of the identification number. In this trial, investigators did not contact the CRC or statistician and the CRC was separated from all researchers. The statistician was not allowed to contact with researchers.

The randomization flow chart is shown in the Figure 1. The study physicians and nurses screened individuals and conducted randomization phase to obtain written informed consent, confirm eligibility, and identify potentially non-adherent individuals. Demographic characteristics were collected, and the participants were counseled on adherence to the Jiangzhi granule. Eligible participants were then randomly assigned into one of the study groups using the next sequential number from the randomization list generated by China Academy of Chinese Medical Sciences Data Center.

In each group, the participants were treated with the drugs of HAART in accordance with the drugs before they participated in the study. In the Jiangzhi Group, the participants were treated by taking the Jiangzhi granule orally twice a day, 1 to 2 hours after breakfast and dinner. There must be a 1-hour time lag between taking the Jiangzhi granule and antiviral drugs. The primary function of Jiangzhi granule is "tonifying qi", invigorating the circulation of blood and Qi, warming the kidney, reducing phlegm and drying dampness. All the above herbs are granule of TCM and are manufactured by the Jiangyin Tianjiang pharmaceutical company (Lot number: 121109).

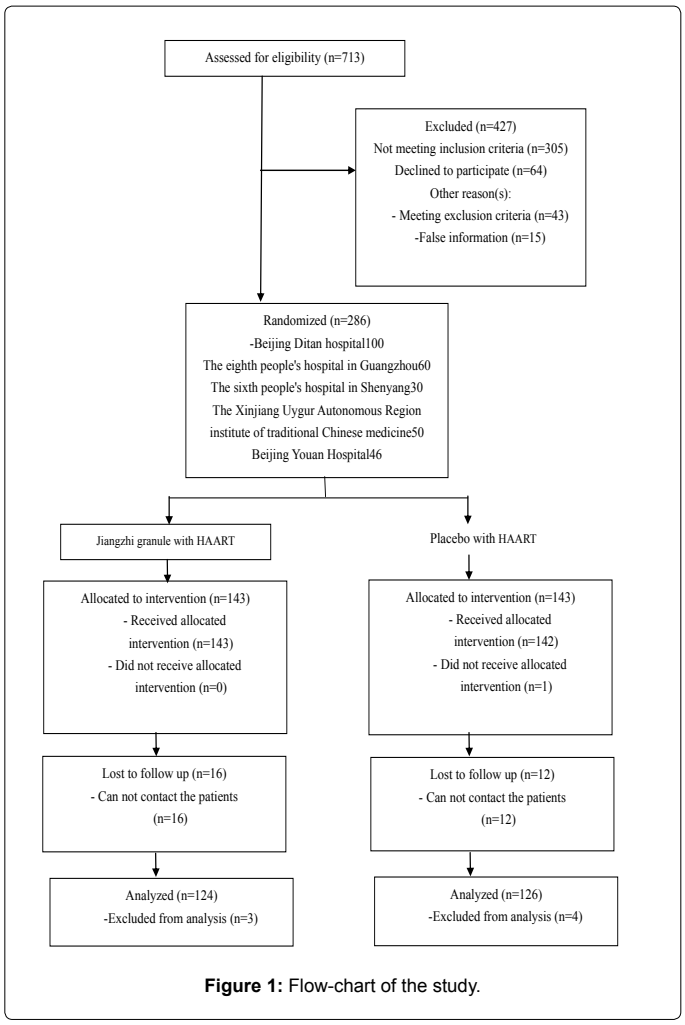

Figure 1: Flow-chart of the study.

In Placebo Group, the participants were treated by taking placebo orally twice a day, 1 to 2 hours after breakfast and dinner. There must be 1-hour time lag between taking the placebo and antiviral drugs. The placebo is the same as the Jiangzhi granule in appearance and taste and was manufactured by the Jiangyin Tianjiang pharmaceutical company.

These Jiangzhi granules were chosen because improvement in immune function and improving dyslipidemia with their use was demonstrated in our previous study [20]. Granules were indistinguishable in shape, size, and color. They were labeled during the study period with the identification numbers according to the assignment list, using double-blind masking by the pharmacist. During the monthly visits, the remaining granules from the previous month were counted to assess adherence.

Assessments

At baseline, 12 weeks, and 24 weeks, a nurse or a physician performed a physical examination, obtained a medical record, and collected a blood sample for assessment of TG, TC, HDL and LDL.

Study outcomes

The primary end points included TG, TC, HDL and LDL at 24 weeks. The secondary end points included apolipoprotein, immune index, viral load, clinical symptoms and WHO Quality of Life Scale at 24 weeks. The above indexes were assessed by each sub-center.

Outcome measures included (a) blood lipid test reached to one of the above items is excellent: TC decreased value ≥ 20%;TG decreased value ≥ 40%; HDL-C increased value ≥ 0.26 mmol/L; TC-HDL-C/HDL-C decreased value ≥ 20%; blood lipid test returned to normal (TC lower 5.72 mmol/L,TG lower 1.70 mmol/L); (b) blood lipid test reached to one of the following criteria was considered effective: TC decreased value ≥ 10% but <20%; TG decreased value ≥ 20%, but <40%; HDL-C increased value ≥ 0.104 mmol/L but <0.26 mmol/L; TC-HDL-C/HDL-C decreased value ≥ 10% but <20%; (c) blood lipid tests that did not reach to one of the preceding items was considered not efficacious. The effective rate is the value sum of excellent and effective divide by the value of all analyzed patients.

Safety evaluation

Safety indices included red blood cell count (RBC), white blood count (WBC), Aspartate transaminase (AST), alanine aminotransferase (ALT), blood urea nitrogen (BUN), Serum creatinine (Scr) examinations, electrocardiography and general physical examination at 24 weeks. The above indexes were inspected by each research centers.

Sample size

The incidence rate of dyslipidemia after HAART in HIV infected patients is about 40% according to the previous studies [21]. Assuming that the incidence rate reduces to 20%, 130 cases in each group were deemed sufficient to achieve 80% power in detecting a difference between the therapeutic interventions, through the test of bilateral differences taking α =0.05, using the granule of n1=P(1-P)[(u1-A+u1-B)/D]2(1+c)/c,n2=cn1. With a dropout rate for follow-up of 10%, the sample size for each group was more than 143, and more than 286 for the two groups' altogether.

Statistical analysis

Statistical analysis was performed using SPSS 13.0. All statistical tests were two-sided, and P values less than 0.05 were considered statistically significant. Missing values were imputed by the last-observation-carried-forward method. The quantitative parameters were measured by mean ± standard deviation (x ± s) while Wilcoxon test method and t-test for comparison between groups. Chi-square criterion was used in the enumeration data.

Data and safety monitoring

The Data Safety Monitoring Board (DSMB) reviewed the safety and efficacy of the supplements before the initiation of the study and annually and unblended data at midpoint and at the end of the study. The stopping boundary was used for early stopping with nominal P <0.001 for efficacy endpoints and P=0.05 for safety endpoints [19]. All adverse events were characterized using the adverse events form rating scale, which has a scale of 1, remote; 2, possible; 3, probable; and 4, definite [22].

Results

Of 713 HIV infected patients screened, 427 were randomized and 286 completed the study. Baseline demographic parameters were well matched between groups (Table 1).

Comparison of effective rate

Although the effective rate of the Jiangzhi Group was higher than Placebo Group at week 24, which was respectively 69.4% (25.8%+43.6%) and 57.9% (18.2%+39.7%), there was no significant difference (P=0.304) (Table 2).

Comparison of TC, TG, LDL-C, HDL-C

The value of TG at week 24 both significantly declined to before treatment in two groups, but that of Jiangzhi Group decreased more significantly compared to Placebo Group (P=0.045). A significant increase was shown in the value of HDL-C in Jiangzhi Group compared to Placebo Group at week 24 (P=0.028) (Table 3).

We found a significantly lower value of TC (P = 0.021) among age >45 subgroup in Jiangzhi Group compared to Placebo Group at week 24. It means Jiangzhi granule can reduce the TC value of patients older than 45 years old (Table 4).

Comparison of safety

There was no significant difference in blood and urine routine examination between Jiangzhi Group and the placebo with HAART group at week 24. We did not find a significant difference in liver and renal function examination between Jiangzhi Group and the placebo with HAART group at week 24. In the study period, the blood and urine routine examination of the patients and the liver and renal function of the patients was normal.

Discussion

In this study, ART-HIV-infected adults with dyslipidemia, 24-weeks treatment with the Jiangzhi granule was found to be ameliorated the abnormality of serum lipid safely and significantly. So, it was concluded that The Jiangzhi granule may be effective medicine in ART-HIV-infected adults with dyslipidemia. There were three findings in our study: Firstly, the Jiangzhi granule was found to reduce the TG value of ART-HIV-infected patients. Secondly, the Jiangzhi granule may rise the HDL-C value of patients. Thirdly, the Jiangzhi granule can reduce the TC value of patients older than 45 years. In the study period, the blood and urine routine examination of the patients and the liver

Items	Jiangzhi granule with HAART	Placebo with HAART	P-value
Age in years (x ± s)	39.67 ± 9.76	38.74 ± 8.78	0.41
Sex (Men/Women)	124/20	126/18	0.728
Ethnicity (Han/Others)	125/18	127/15	0.593
Allergy (Yes/No)	11/132	20/122	0.083
Marital status (Married/ Single)	76/67	67/75	0.208
Height in cm (x ± s)	170.47 ± 7.22	171.38 ± 7.30	0.478
Weight in kg (x ± s)	68.18 ± 9.37	69.65 ± 10.99	0.284
Process in day (x ± s)	1061.89 ± 964.77	1255.83 ± 1303.57	0.543
AIDS-related disease (Yes/No)	24/115	19/120	0.507
TC in mmol/L (x ± s)	5.04 ± 1.2	5.1 ± 1.56	0.875
TG in mmol/L (x ± s)	3.59 ± 2.28	3.75 ± 2.13	0.319
HDL-C in mmol/L (x ± s)	1.02 ± 0.27	1.01 ± 0.25	0.806
LDL-C in mmol/L (x ± s)	2.62 ± 1.01	2.57 ± 0.89	0.938
CD3+T cell in cell/mm^3 (x ± s)	1423.31 ± 601.93	1429.07 ± 614.19	0.845
CD4+T cell in cell/mm^3 (x ± s)	409.6 ± 211.48	401.09 ± 181.28	0.831
CD8+T cell in cell/mm^3 (x ± s)	1496.43 ± 6505.28	918.08 ± 450.78	0.824

Table 1: Demographics and baseline information between Jiangzhi group and placebo group.

Group	n	Excellent (%)	Effective (%)	Inefficacious (%)	P-value
Jiangzhi Group	124	32 (25.8)	54 (43.6)	38 (30.6)	0.304
Placebo Group	126	23 (18.2)	50 (39.7)	53 (42.1)	

Table 2: Therapeutic effect comparison in Jiangzhi group and placebo group.

Item	Group	N	Before treatment	Week 12	Week 24	Difference-value week 24 to before treatment	P-value
TC	Jiangzhi Group	124	5.04 ± 1.2	5.04 ± 1.5	5.09 ± 1.2*	-0.05 ± 0.93	0.763
	Placebo Group	126	5.1 ± 1.56	4.84 ± 1.12	5.03 ± 1.19*	0.06 ± 1.35	
TG	Jiangzhi Group	124	3.59 ± 2.28	3.47 ± 2.39	3.19 ± 2.25*	0.43 ± 1.98	0.045
	Placebo Group	126	3.75 ± 2.13	3.54 ± 2.54	3.42 ± 2.29*	0.32 ± 2.1	
HDL-C	Jiangzhi Group	124	1.02 ± 0.27	1.05 ± 0.26	1.09 ± 0.35	-0.07 ± 0.29*	0.028
	Placebo Group	126	1.01 ± 0.25	1.03 ± 0.23	1.05 ± 0.289	-0.05 ± 0.24*	
LDL-C	Jiangzhi Group	124	2.62 ± 1.01	2.68 ± 0.93	2.79 ± 0.94*	-0.15 ± 0.83	0.731
	Placebo Group	126	2.57 ± 0.89	2.6 ± 0.93	2.71 ± 0.83*	-0.14 ± 0.69	

Table 3: TC, TG, LDL-C, HDL-C result's comparison in Jiangzhi group and placebo group before and after treatment (x ± s).

Group	N	Before treatment	Week 12	Week 24	Difference-value week 24 to before treatment
Jiangzhi Group	33	5.35 ± 1.38	4.77 ± 1.08	4.96 ± 1.16*	-0.31 ± 1.08
Placebo Group	33	5.05 ± 1.39	5.65 ± 1.95	5.66 ± 1.35*	0.09 ± 1.13

Table 4: TC results' comparison (among age>45 subgroup) in Jiangzhi group and placebo group before and after treatment (x ± s).

and renal function of the patients were normal. We found no serious adverse reactions.

According to TCM theory, dysfunction of spleen in transportation, deficiency of kidney and liver dysfunction are the pathogenesis of dyslipidemia [23-29]. The Jiangzhi granule is a traditional. The selection of the traditional Chinese herbs of Jiangzhi granule is according to the base of former studies of Center of AIDS Treatment with TCM. Its function is tonifying qi, invigorating the circulation of blood and reducing phlegm.

As the important content and the guiding ideology of traditional Chinese medicine, holistic view includes the following aspects: each viscera of human body is an integrated whole; body, emotion and thought are integrated whole; human with natural environment (climate, region) and social environment are integrated whole [30]. Syndrome differentiation and treatment is the feature of TCM and the quintessence of Chinese traditional treatment. TCM has been described as a type of "Precision medicine" [31]. "Zheng" (pattern of syndrome) is not only the core peculiar to TCM, but also the basis of syndrome differentiation and treatment [32]. "Zheng" is the summarization of clinical characteristics at a certain stage of disease development, consisting of etiological factors, pathological change, the property of disease (Yin, Yang, Xu, Shi), and the relevant organs. According to the theory of TCM, the core of the disease is not the organic illness, but the functional disturbance [33]. Chinese herbs have many advantages, such as long action time, less toxic side effect, low price, and long-term use [34].

Overeating fat, dysfunction of spleen in transportation, deficiency of kidney and liver dysfunction are the pathogenesis of dyslipidemia in TCM [23-29]. There are differences between dyslipidemia after HAART and common dyslipidemia [35]. Deficiency in origin and enrichment in symptom are characteristics of "Zheng" in dyslipidemia after HAART. The relevant organs are liver, spleen, kidney and heart. The etiological factors of dyslipidemia after HAART are phlegm, blood stasis, damp, qi stagnation, qi deficiency, yang deficiency, and yin deficiency. The pattern of "Zheng" primarily are the spleen-deficiency and phlegm-stagnation type, the phlegm-accumulation stasis syndrome type, the interior dampness-heat type, the liver depression and qi stagnation type, and the deficiency of spleen and kidney type [36-41].

The efficacy of Huangqi is tonifying qi and strengthening the spleen. The efficacy of Chishao is cooling the blood and activating blood. The efficacy of Fabanxia is drying dampness and resolving phlegm. The efficacy of Huzhang is drying dampness, resolving phlegm and dissipating blood stasis. The efficacy of Shanzha is promoting digestion, relieving stasis, promoting qi and dissipating blood stasis. The efficacy of Jianghuang is promoting qi, activating blood and dredging the meridian. The efficacy of Juemingzi is clearing heat, brightening the eyes, lubricating the intestines and facilitating feces excretion. The efficacy of Chuanxiong and Yujin is promoting qi and activating blood. The efficacy of Zexieis is clearing damp, promoting diuresis and clearing heat. The efficacy of Danshen is activating blood, dissipating blood stasis and regulating menstruation. The efficacy of Yinyanghuo is warming kidney, enhancing yang, dispelling wind and eliminating dampness. The efficacy of Yinchen is eliminating dampness and heat, benefiting bile and eliminating jaundice. The primary function of Jiangzhi granule is tonifying qi, invigorating the circulation of blood and qi, warming the kidney, reducing phlegm and drying dampness. It has been shown that some of above substances may regulate blood lipid metabolism [42-48].

In addition to treating dyslipidemia, the Jiangzhi granule can also regulate the balances of Yin-Yang and Qi-Blood, and the function of the heart, liver and spleen. As one of the basic therapeutic principles of TCM, Sanyinzhiyi (suit measures according to three categories of etiological factors system) means adjusting measures to patient's individuality, changing circumstances and local conditions. The patient's individual characteristics include age, gender, and physical health [49]. The Jiangzhi granule is convenient to add and subtract drugs according to patients' age, gender and physical health. So, it is more targeted using Jiangzhi granule. To explore the effects of Jiangzhi granule on dyslipidemia after HAART in HIV infected patients, the participants are treated by a unified granule, without adding or subtract drugs, in the experiment.

Through the experiment, we preliminarily deemed that Jiangzhi granule can be used for the therapy of dyslipidemia after highly active antiretroviral therapy in HIV infected patients. It can not only regulate blood lipid, but also improve the symptoms such as: weak, breathe hard, sensation of chill and dyspepsia. And it is safe for the subjects according to our safety assessments of the experiment. For the patients who received statins and had severe side effects or worried about the side effects of conventional medicines, we recommend them to take the Jiangzhi granule. According to Guidelines on Prevention and Treatment of Blood Lipid Abnormality in Chinese Adults, statins can reduce the TC, LDL-C, TG and raise the HDL-C [21]. The curative effect of Jiangzhi granule is obvious in decreasing the TG value and rise the HDL-C value, but it has a weakness in reducing LDL-C. The reason maybe is relevant to the compatibility of Chinese herbal medicine, so we are planning to adjust the granule to make it more balance in ameliorating dyslipidemia. The stratified analysis showed that Jiangzhi granule can especially reduce the TC value of patients older than 45 years and rise the HDL-C value of patients whose BMI $\leq$ 24. Perhaps this means that Jiangzhi granule has its sensitive suitable group. And we need to take a more targeted and larger sample size research to verify the effect of the sensitive suitable group. But there are still some deficiencies in this experiment.

Conclusion

Taking account of the progresses of disease and the drug safety of patients of placebo with HAART, we granulated the course of treatment as half a year. Although the Chinese herb medicine for dyslipidemia always need to be taken continuously for about 4 months to 10 months to gain the optimal and stable effects. The herbs of the Jiangzhi granule are explicit but there are also some chemical components are undefined. What is more, the price of Jiangzhi granule for one day is about 1-1.5 dollars. It is a somewhat expensive by Chinese standards, if we make it into Chinese patent drug or extract its active ingredient, its price will likely decrease. This clinical trial showed that Jiangzhi granule may regulate dyslipidemia in patients receiving highly active antiretroviral therapy safely. This study provided clues for the treatment of AIDS-related hyperemia with TCM.

Contributors

LY and WJ designed and completed the study. LY, ZW, YQ, XQ, ZF, MJ, ZM, LW, and HJ over saw data collection and laboratory testing. LX, YQ, XQ and ZW did the statistical analysis. LY and ZW participated equally in revising and the final approval of the manuscript.

Declaration of Interests

We declare no competing interests.

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