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Research Article
Clinical Efficacy of Heel Vessel Catgut Embedding in the Treatment of Primary Restless Legs Syndrome

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Abstract

Background and Objective: Primary restless leg syndrome is a common nervous system syndrome and the effect of drug treatment is not stable having various adverse effects. This study investigated the clinical efficacy of heel vessel catgut embedding in the treatment of primary restless legs syndrome. **Materials and Methods:** A total of 42 patients with primary restless legs syndrome were randomly divided into an observation group and a control group, with 21 patients in each group. Patients in the observation group were treated with heel vessel catgut embedding therapy, while those in the control group were treated with Madopar for 2 cycles (8 weeks). The two groups of patients were assessed before and after treatment using the International restless legs syndrome rating scale score (IRLS score), Pittsburgh Sleep Quality Index score (PSQI score), self-rating anxiety scale score (SAS score) and restless legs syndrome efficacy assessment and compared. **Results:** Compared with pre-treatment data, the IRLS score, PSQI score and SAS score all showed varying degrees of reduction after treatment in both groups ($p<0.05$); compared with the control group, the IRLS score, PSQI score and SAS score were significantly reduced after treatment in the observation group ($p<0.05$) and the effective rate by restless legs syndrome efficacy assessment was significantly higher after treatment in the observation group ($p<0.05$). **Conclusion:** Heel vessel catgut embedding can effectively improve the clinical symptoms of patients with primary restless legs syndrome, improve patient's quality of sleep and reduce anxiety.

Key words: Restless legs syndrome, heel vessel catgut embedding, Madopar, clinical efficacy, international restless legs syndrome rating scale score

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Primary Restless Legs Syndrome (RLS) is a common neurological syndrome with the main clinical manifestation of an urge to move the legs. It is often accompanied by sensory abnormalities and occurs or aggravates at rest or night[1], severely affecting sleep[2,3], increasing the incidence of depression[4,5] and the risk of cardiocerebral vascular diseases[6]. According to the 2014 epidemiological surveillance in Shanghai, the total incidence rate of RLS is 1.4%, which has been increasing yearly[7]. Only a small proportion (approximately 21.9%) of patients receive correct diagnosis and treatment[8]. The pathogenesis of primary RLS is not clear and it may be related to the abnormal metabolism of dopamine[9], so dopaminergic drugs and dopamine receptor agonists are preferably selected for drug therapies. However, despite the fact that such drugs can alleviate the symptoms, the inter-individual variability is large and the efficacy is not always satisfactory. Common adverse reactions such as aggravation of restless legs, insomnia, postural hypotension and hallucinations may occur during medicine treatment[10]. This study aimed to investigate the clinical efficacy of heel vessel catgut embedding in the treatment of primary RLS.

MATERIALS AND METHODS

General information: Forty-two patients with primary RLS admitted to the outpatient clinic of the Department of Traditional Chinese Medicine and Rehabilitation of the Shanghai Second Rehabilitation Hospital from September, 2021 to March, 2024 were enrolled in the study and were randomly divided into an observation group and a control group. There were 21 subjects in the observation group, with 9 males and 12 females, who were aged 45-72 years and had suffered the disease for 4 months to 10 years. There were 21 subjects in the control group, with 10 males and 11 females, who were aged 43-74 years and suffered the disease for 6 months to 8 years. There were no significant differences between the two groups in terms of gender, age and disease course ($p>0.05$), indicating that the two groups were comparable in baseline data.

Ethical consideration: This study has been approved by the Ethics Committee of Shanghai Second Rehabilitation Hospital. All study participants provided written informed consent before participating in the study.

Inclusion criteria

Diagnostic criteria for primary RLS: By the International Restless Legs Syndrome Study Group (IRLSSG) consensus diagnostic criteria for RLS in 2014: (1) An urge to move the legs, usually accompanied or caused by uncomfortable and unpleasant sensations in the legs; (2) Urge to move or unpleasant sensations begin or worsen during periods of rest or inactivity such as lying or sitting; (3) Urge to move or unpleasant sensations are partially or totally relieved by movement, such as walking or stretching, at least as long as the activity continues; (4) Urge to move or unpleasant sensations are worse in the evening or night than during the day or only occur in the evening or night; (5) Occurrence of the above features is not solely accounted for as symptoms primary to another medical or a behavioral disorder (e.g., myalgia, venous stasis, leg edema, arthritis, leg cramps, positional discomfort and habitual foot tapping). (1) Strong willingness to move both lower limbs at rest, often accompanied by discomfort in both lower limbs, or discomfort aggravated the willingness to move; (2) A strong desire to move, accompanied by any discomfort, occurring at rest or when the patient is in a lying or sitting position or when the above is not suitable for resting; (3) During activities (such as walking or stretching legs), the above discomfort can be partially or completely relieved and the intensity of the willingness to move is reduced; (4) Strong willingness to move and the accompanying discomfort only appear in the evening or at night or the above symptoms worsen in the evening or at night; (5) These clinical manifestations are not caused by a definite disease or phenomenon, such as myalgia, venous stasis, lower limb edema, arthritis, lower limb spasm, postural discomfort and habitual foot patting.

Treatment: Patients in the observation group received acupoint catgut embedding therapy, with two groups of acupoints selected for catgut embedding: (1) Shenmai (BL62), Zhaohai (K16), Sanyinjiao (SP6) and Chengshan (BL57). (2) Fuyang (BL59), Jiaoxin (K18), Zusanli (ST36) and Yanglingquan (SP9). Treatment frequency: The 2 groups of acupoints were subjected to catgut embedding alternatively once every 2 in 4 weeks cycles. The treatment lasted for a total of 8 weeks, i.e., 2 cycles. The method of acupoint catgut embedding: The operation method of acupoint catgut embedding: Disposable medical embedding needle (ISO13485) was selected as the embedding tool and catgut (medical sterile absorbable surgical collagen suture) 3-0 was used. The operator wore sterile gloves on both hands. After

disinfecting the patient's acupoint regions, a section of catgut was taken and placed into the tip of the embedding needle. After identifying the acupoint with the left hand and determining the needle insertion site, the acupoint region was disinfected again. The operator inserted the needle quickly with the right hand and the catgut was injected into the tissue between the fat layer and the muscle layer with the embedded needle once the patient had a feeling of soreness (Deqi). The embedding needle was then withdrawn the acupoint was pressed for hemostasis and medical sterilization tape was applied after stop of bleeding. Patients were allowed to remove the tape by themselves after 3 hrs. In addition, patients were instructed to have a light diet during the treatment period and should not bathe until 24 hrs after treatment.

Patients in the control group were given Madopar 125 mg, which was taken once daily at bedtime in 4 weeks cycles. The treatment lasted for a total of 8 weeks, i.e., 2 cycles.

Observation indicators: The patients' IRLS score, PSQI score and SAS score were recorded before treatment and after 2 cycles of treatment to evaluate the treatment efficacy. (1) International restless legs syndrome scale (IRLS) score: The changes in patient's symptoms before and after treatment were quantified. The scale covers 10 questions and each question is followed by 5 options, which are scored 0-4 by order, with a total score of 0-40 points. Grading of symptoms: 0 points, no symptoms; 1-10 points, mild; 11-20 points, moderate; 21-30 points, severe and 31-40 points, very severe. The higher the IRLS score, the more severe the symptoms and a greater decrease in the score after treatment indicates better overall improvement in symptoms. (2) Pittsburgh Sleep Quality Index (PSQI): This scale covers 7 dimensions: Sleep onset, sleep duration, sleep quality, sleep efficiency, sleep disorder, use of sleeping medication and daytime dysfunction. Each dimension is divided into 4 grades (0-3 points) and the cumulative score of the 7 dimensions is the total score, which ranges from 0 to 21 points. A total PSQI score of $\geq$8 indicates a sleep disorder and the higher the score, the more serious the sleep disorder. (3) Self-assessment scale for anxiety (SAS): This scale includes 20 questions, each question is scored on a four-point scale (1-4 points) and the final score = the cumulative score of all questions $\times$ 1.25. The scores should be based on the actual situation of the patient in the past week. A final score of $\leq$50 indicates no anxiety; 51-60 indicates mild anxiety; 61-70 indicates moderate anxiety; $\geq$70 indicates severe anxiety.

Response evaluation criteria: (1) Basically cured: Complete disappearance of discomfort in both legs and the patient can sleep at night, with no recurrence and no impact on sleep; (2) Marked effective: Symptoms of both legs improve significantly and the patient can basically sleep normally at night, with occasional recurrence but does not affect daily activities or work; (3) Effective: Symptoms of both legs are somewhat relieved and the patient's sleep quality improves, with limited impact on daily activities and work and (4) Ineffective: Symptoms of both legs do not improve or even worsen and the patient suffers insomnia at night, with impact on daily activities and work.

Statistical analysis: EpiData 3.1 was used to establish the database and SPSS 23.0 was used for statistical analysis. Measurement data that conform to normal distribution were described by $\bar{\chi}\pm s$ and t-test was used. The $p<0.05$ was considered statistically significant. Count data were described as [cases (%)] and Fisher's exact test was used.

RESULTS

IRLS score: Before treatment, the difference between the IRLS scores of the 2 groups of patients was not statistically significant ($p>0.05$), indicating that the two groups were comparable. After treatment, significant ($p<0.05$) decreases in IRLS scores were observed in both groups compared with the pre-treatment scores. The post-treatment decrease in IRLS score in the observation group was greater than that in the control group and the difference was statistically significant ($p<0.05$). The details were listed in Table 1.

PSQI score: Before treatment, the difference in the PSQI scores between the 2 groups of patients was not statistically significant ($p>0.05$), indicating that the two groups were comparable. After treatment, statistically significant ($p<0.05$) decreases in PSQI scores were observed in both groups as compared with the pre-treatment scores. The post-treatment decreases in PSQI score in the observation group was greater than that in the control group and the difference was statistically significant ($p<0.05$). The details were listed in Table 2.

SAS score: Before treatment, the difference between the SAS scores of the 2 groups of patients was not statistically significant ($p>0.05$), indicating that the two groups were comparable. After treatment, statistically significant ($p<0.05$) decreases in SAS scores were observed in both groups compared with the pre-treatment scores. The post-treatment decrease in SAS score in the observation group was greater than that in the control group and the difference was statistically significant ($p<0.05$). The details were listed in Table 3.

Table 1: IRLS scores before and after treatment in the 2 groups ($\bar{\chi}\pm s$, points)

Group	Number of cases (n)	Time	IRLS score
Observation group	21	Before treatment	28.14±8.862
		After treatment	24.67±8.303[ab]
Control group	21	Before treatment	27.24±9.348
		After treatment	25.00±8.718[a]

[a]p<0.05: Compared with pre-treatment score and [b]p<0.05: Compared with the control group

Table 2: PSQI scores before and after treatment in the 2 groups ($\bar{\chi}\pm s$, points)

Group	Number of cases (n)	Time	PSQI score
Observation group	21	Before treatment	14.24±4.603
		After treatment	11.48±4.045[ab]
Control group	21	Before treatment	14.14±4.498
		After treatment	12.05±4.376[a]

[a]p<0.05: Compared with pre-treatment score and [b]p<0.05: Compared with the control group

Table 3: SAS scores before and after treatment in the 2 groups ($\bar{\chi}\pm s$, points)

Group	Number of cases (n)	Time	SAS score
Observation group	21	Before treatment	62.57±8.010
		After treatment	58.67±8.015[ab]
Control group	21	Before treatment	62.57 ± 8.316
		After treatment	59.25±7.938[a]

[a]p<0.05: Compared with pre-treatment score and [b]p<0.05: Compared with the control group

Table 4: Comparison of efficacy in the two groups of patients (cases (%))

Group	Cured	Marked effective	Effective	Ineffective	Overall effectiveness
Observation group (n = 21)	2 (9.52)	10 (47.61)	8 (38.09)	1 (4.76)	20 (95.23)[b]
Control group (n = 21)	1 (4.76)	8 (38.09)	10 (47.61)	2 (9.52)	19 (90.47)

[b]p<0.05: Compared with the control group

Comparison of efficacy in the two groups of patients after treatment: The overall effective rate of the observation group was higher than that of the control group after treatment; the marked effective rate of the observation group was higher than that of the control group; the difference in overall effective rates of the 2 groups of patients was statistically significant (p<0.05). The details were listed in Table 4.

DISCUSSION

The main clinical manifestation of primary RLS is an urge to move the legs and the frequency of moving the legs is proportional to the severity of RLS. It is often accompanied by sensory abnormalities and occurs or aggravates at rest or night, which is relieved after exercise. These symptoms may increase the incidence of cardiocerebral vascular diseases and seriously affect the patient's mental status and sleep. Portaluppi *et al.*[6] found that RLS can disrupt the circadian blood pressure rhythm of the patient, causing the patient's blood pressure to rise rapidly at night and even causing thickening of the left ventricle, which contributes to the high morbidity and mortality rates of cardiovascular disease. The RLS may also affect the patient's mental health, especially increasing the risk of depression. Piritta evaluated depression of 1,190 patients with RLS using the Beck Depression Inventory and 22.1% of them were diagnosed with depression, ranging from low mood and disjointed thinking to suicide attempt[4]. The RLS also has a serious impact on sleep quality[2]. Romero-Peralta *et al.*[3] showed that RLS leads to an increase in the prevalence of sleep apnea, which has a serious impact on the quality of sleep of patients.

The pathogenesis of primary RLS is unclear and may be related to abnormal dopamine metabolism[9], damage to cholinergic neurons[11], iron deficiency[12] and endogenous opioid release[13]. The currently recognized mechanism for primary RLS is damage to dopaminergic neurons in the non-nigrostriatal system of the CNS[13]. Supplementation with dopamine or dopamine agonists may provide some relief[14]. Therefore, dopaminergic drugs and dopamine receptor agonists are preferably selected as the first-line medications[10]. Although such drugs can alleviate the symptoms, the inter-individual variability is large and the efficacy is not always satisfactory. Common adverse reactions such as aggravation of restless legs, insomnia, postural hypotension and hallucinations, as well as severe adverse reactions such as diffuse interstitial lung disease and cardiac dysfunction, may occur during drug treatment.

The RLS does not have an exact term in Chinese medicine, but the symptoms can be found in some Chinese medical writings. As early as in the "Miraculous Pivot (Ling Shu)-The Beginning of All Diseases", there are descriptions of "derangement of meridian Qi generates foot disorders" and "foot disorders generate shin coldness, which causes the blood vessels to become astringent". There are also records of "shin soreness" and "marrow soreness" in "Miraculous Pivot (Ling Shu)" and "Yellow Emperor's Canon of Medicine Plain Conversation (Su Wen)". The relevant descriptions regarding the etiology and pathogenesis of RLS in ancient Chinese medical books are as follows: The liver stores blood and the kidney stores essence; deficiency of Yin-blood results in failure to nourish the meridians and channels, which aggregates at night and leads to the desire to move the limbs; deficiency of Yin-blood gives rise to Yang and causes imbalance between Yin and Yang and hyperactivity of Yang disturbs the mind and the spirit, causing agitation and unrest and sleeplessness at night.

Therefore, the cause of RLS in Chinese medicine can be concluded as deficiency of Yin in the liver and kidney, loss of nourishment in the meridians and channels, failure of Yin to control Yang and imbalance between Yin and Yang. Treatment should be aimed at nourishing Yin subduing Yang and harmonizing Qi and blood. Yin and Yang heel vessels belong to the eight extraordinary Qi vessels, which can coordinate Yin and Yang and harmonize Qi and blood; as described in "Miraculous Pivot (Ling Shu)-Evil Guests": "Defensive Qi does not enter Yin at night and Yang heel vessel is in excess". Defensive Qi runs around the blood vessel and cannot enter Yin. Defensive Qi running externally leads to excess Yang Qi, which fulfills the Yang heel vessel; excess Yang and deficient Yin cause failure of Yin to control Yang when Yin and Yang convert, leading to sleeplessness at night[15]. Nutritive and defensive Qi meet at the Yin-Yang heel vessels and coordinating Yin-Yang heel vessels can reconcile Yin and Yang. The Yin-Yang heel vessels are part of the eight extraordinary Qi vessels, which can reserve and regulate the Qi and blood of the twelve meridians and sufficient Qi and blood can nourish the legs. Therefore, for the treatment of RLS, the Shenmai on the Yang heel vessel and the Zhaohai on the Yin heel vessel were chosen for the treatment. Shenmai is an acupoint on the bladder meridian of foot-Taiyang and Yang heel vessel, located in the lateral part of the foot, in the depression site directly below the outer ankle, which is the place where the Qi of Yang heel vessel originates; Zhaohai is an acupoint on the kidney meridian of foot-Shaoyin and Yin heel vessel, located on the medial side of the foot, in the depression site directly below the inner ankle, which is the place where the Qi of Yin heel vessel originates. The two acupoints are the meeting points of the eight extraordinary Qi vessels and the combined treatment of the two acupoints can regulate the meridian-Qi of the Yin-Yang heel vessels, nourish Yin and subdue Yang and restore the Yin-Yang balance, treat the lack of nourishment for meridians and channels and the imbalance between Yin and Yang caused by excess Yang. In addition to these two main acupoints, the combination of other acupoints can enhance the efficacy. For example, Zusanli is a He-Sea acupoint of the stomach meridian of foot-Yangming, which contains abundant Qi and blood and dredging the He-Sea acupoint of this meridian helps to clear and activate the channels and collaterals. The spleen and stomach are the foundation of acquired essence and the source for the production and transformation of Qi and blood. Acupuncture of Zusanli can tonify Qi and blood in the legs and relieve rigidity of muscles in the legs[16]. Sanyinjiao is an acupoint on the spleen meridian of foot-Taiyin, the spleen governs muscle and acupuncture of this acupoint tonifies the muscle[17]; Sanyinjiao is also the meeting point of three foot Yin meridians, in addition to strengthening the spleen and blood, tonifying the liver and kidneys, treatment of this acupoint also has the effect of tranquilizing the mind and aiding sleep[18]. Chengshan is an acupoint on the bladder meridian of foot-Taiyang, acupuncture of this acupoint can regulate the movement of the legs[19]; bladder meridian and kidney meridian reinforce each other and acupuncture of Chengshan can dredge the meridian Qi of the two meridians[20]; Yanglingquan is a He-Sea acupoint on the gallbladder meridian of foot-Shaoyang, but also the influential point of tendons among the eight influential points, tendons are governed by the liver and acupuncture of Yanglingquan can sooth the tendons and subdue Yang, dredge collaterals and restrain abnormal movements[21]. "Miraculous Pivot (Ling Shu)-Discussion on Zhongshi" stated: "Acupuncture for the chronically ill should be deeper and longer". It means that when acupuncture is performed for chronic disease, needle insertion should be deeper and hold for a longer time. However, such exercise during ordinary acupuncture is prone to sticking the needle and needle breakage, causing unwanted pain in the patients. Acupoint catgut embedding, rooted in the idea of deep-insertion and long-staying acupuncture, provided an ideal solution to improve efficacy while avoiding accidents. Acupoint catgut embedding is a new type of complex therapy based on traditional acupuncture therapy.

The author's research team specializes in treating RLS, sleep post-stroke dystonia and other diseases through heel vessel catgut embedding therapy. The Yin-Yang heel vessel catgut embedding therapy can regulate Qi and blood, coordinate Yin and Yang, dredge the meridians and channels and nourish the liver and kidneys. This therapy takes acupuncture and meridian theory as the basis and regulation of the Yin and Yang heel vessels as the fundamental treatment. The main acupoints for treatment are Shenmai and Zhaohai. Shenmai is an acupoint on the bladder meridian of foot-Taiyang, which is the originating site of Yang heel vessel Qi; Zhaohai is an acupoint on the kidney meridian of foot-Shaoyin, which is the originating site of Yin heel vessel Qi. The two acupoints are both meeting points of the eight extraordinary Qi vessels and combined treatment of the two acupoints can regulate the Yin and Yang heel vessels to restore the Yin-Yang balance, thereby treating insomnia. The treatment of adjuvant acupoints can enhance the therapeutic effect of the main acupoints. As a highly efficient treatment technique, acupoint catgut embedding therapy is not only convenient and quick but also improves the therapeutic effect.

This study demonstrates that heel vessel catgut embedding can effectively improve the clinical symptoms of patients with primary RLS, improve the quality of sleep and reduce anxiety. The heel vessel catgut embedding therapy can be included in the research of primary RLS to form an effective heel vessel catgut embedding regimen for promotion. It provides patients with a long-term, efficient, affordable, safe and effective means of treatment and helps to alleviate RLS patients' pressure of inconvenient access to medical care and the discomfort of long-term medication to some extent.

CONCLUSION

Heel vessel catgut embedding can effectively improve the clinical symptoms of patients with primary restless legs syndrome, improve patient's quality of sleep and reduce anxiety. The heel vessel catgut embedding therapy can be included in the research of primary RLS to form an effective heel vessel catgut embedding regimen for promotion. It provides patients with a long-term, efficient, affordable, safe and effective means of treatment and helps to alleviate RLS patients' pressure of inconvenient access to medical care and the discomfort of long-term medication to some extent.

SIGNIFICANCE STATEMENT

Qiao pulses embedding acupuncture is widely used in clinical practice, but there is no relevant study on the improvement of non-motor symptoms of primary restless leg syndrome. The non-motor symptoms of primary restless leg syndrome have a great impact on the quality of life of patients. At present, there is insufficient evidence of Western medicine therapy and a non-drug therapy is urgently needed to improve the non-motor symptoms of such patients safely and effectively. In clinical practice, it has been observed that Qiao pulses embedding acupuncture can improve the non-motor symptoms of sleep, anxiety and lower limb discomfort in such patients. Therefore, this study aims to reveal whether Qiao pulses embedding acupuncture can improve the non-motor symptoms, improve the sleep quality and improve the anxiety of patients with primary restless leg syndrome. This treatment has long time, high efficiency, economical value, safety and effectiveness and can relieve the pressure of patients' inconvenient medical treatment and the discomfort of long-term drug use to a certain extent.

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