Journal of Experimental and Clinical Application of Chinese Medicine

CLINICAL RESEARCH

Effect of Baduanjin Combined with a Cold-dispelling and Yang-reinforcing Foot Bath Prescription on the Low back Pain and the Muscle Strength of the Lower Limbs in Osteoporosis Patients

Wujie Zhai[1]* & Yanhui Zhang[1#]

[1]The 8th Medical Center of the PLA General Hospital

Keywords

Baduanjin, Quhan Buyang foot bath prescription, Osteoporosis, Waist and back pain, Muscle strength of lower limbs

Correspondence

Wujie Qu, No.8 Medical Center, PLA General Hospital, No.17, Heishan Hu Road, Haidian District, Beijing.

Received: 13 November 2020; Accepted: 10 December 2020; Published online: 17 January 2021

***Journal of Experimental and Clinical Application of Chinese Medicine* 2021; 2(1): 21-27**

Abstract

Objective： To explore the efficacy of treatment via Baduanjin combined with a cold-dispelling and Yang-reinforcing foot bath prescription in patients with osteoporosis, and the effect on the low back pain and the muscle strength of the lower limbs. **Methods：** A total of 138 patients with osteoporosis in our hospital from Jan. 2018 to Jun. 2020 were divided into control groups and study groups by using the random number table method. With the basic conventional therapy of the both groups, the control group was treated with a Cold-dispelling and Yang-reinforcing foot bath prescription, and the study group was treated with Baduanjin exercises combined with the Cold-dispelling and Yang-reinforcing foot bath prescription. The clinical symptoms, visual analgesia score (VAS), bone density, muscle strength of the lower limbs before and after treatment, and the adverse reactions were compared between the both groups. **Results：** The clinical symptoms and VAS score of both groups after treatment were obviously decreased in comparison with those before treatment, and those in the study group were obviously decreased in comparison with those in the control group; The bone density of the lumbar spine $L_{2\text{-}4}$ and femoral neck, and the slow-speed and medium-speed muscle strength of the extensors, and flexors of both groups after treatment were obviously increased in comparison with those before treatment, and those in the study group was obviously increased in comparison with those in the control group; There was no significant difference in the incidence rate of adverse reactions between the both groups. **Conclusion:** The efficacy of Baduanjin combined with a cold-dispelling and Yang-reinforcing foot bath prescription in the treatment of patients with osteoporosis is significant, and it can alleviate the clinical symptoms and relieve the low back pain of the patients, which improves the bone density and muscle strength of the lower limbs.

Introduction

Osteoporosis is a systemic bone disease characterized by low bone mass and bone microstructure degradation, leading to impaired bone strength and an increased risk of fracture [1-2]. Currently, western medicine is mainly used to treat osteoporosis patients in clinical practice, and the commonly used drugs include bisphosphonates, calcitonin, parathyroid hormone, calcium and vitamin D, etc. [3]. However, western medicine treatment can cause adverse reactions, and some patients have poor compliance with the long-term use of these western medicines. In recent years, traditional Chinese medicine (TCM) therapy has been gradually applied in the clinical treatment of osteoporosis. In traditional Chinese medicine, kidney-Yang deficient is the most common syndrome of osteoporosis, and patients with kidney-Yang deficient osteoporosis are clinically manifested as chills, fatigue and lumbar and back pain, which brings great negative effects on the physical and mental health of the patients [4]. TCM foot bath is a TCM-based external treatment method, which uses Chinese medicine water made by boiling of Chinese medicine to soak the feet to thereby exert the therapeutic effect of drugs, and can be applied to osteoporosis to improve physical fitness, regulate the body, and treat the disease. Some studies have suggested that [5] exercise therapy can achieve good results in the clinical treatment of osteoporosis. Baduanjin is a traditional Chinese medicine exercise technique, which can improve the bone density and muscle strength of patients in the clinical treatment of osteoporosis, and is helpful for the patients' recovery. This study applied Bduanjin combined with a cold-dispelling and Yang-reinforcing foot bath prescription to treat patients with kidney-Yang deficient osteoporosis, and observed its clinical effect and its influence on the lower back pain and lower limb muscle strength of the patients, aiming to explore an effective method for treating patients with kidney-Yang deficient osteoporosis. The research results are reported as follows.

Materials and Methods

Clinical information

General information

A total of 138 patients diagnosed with kidney-Yang deficient osteoporosis and treated in our hospital from January 2018 to June 2020 were divided into control groups (n=69) and study groups (n=69) by the random number table method. The control group: 30 males and 39 females, who were aged 52-80 years old, with an average age of (65.74±7.85) years old, and had a 1-7-year disease course, with an average disease course of (3.76±1.22) years; The study group: 33 males and 36 females, who were aged 50-78 years, with an average age of (64.67±8.15) years old, and had a 1-6-year disease course, with an average disease course of (3.48±1.13) years; There was no statistically significant difference between the two groups of patients in general information such as gender, age, and disease course (P>0.05), which however indicated comparability. This study was approved by the Ethics Committee of our hospital, and all patients voluntarily participated and had signed the informed consent

Inclusion and exclusion criteria

Inclusion criteria

Those who meet the diagnostic criteria for osteoporosis in the "Guidelines for the Diagnosis and Treatment of Primary Osteoporosis 2017"[6]; those who meet the diagnostic criteria of the kidney-Yang deficiency type in the "Guiding Principles for Clinical Research on New Chinese Medicines"[7]; those who receive foot baths therapists; those without limb dysfunction.

Exclusion criteria

Patients who are allergic to the study drug; parents with or without a history of open soft tissue injury, serious infection and serious thrombosis in the foot; patients with osteoporosis combined with malignancy, renal failure, heart failure, sepsis and other diseases; patients suffering from acute infectious diseases, surgical emergencies or poisoning; patients with coronary heart disease, hypertension, pulmonary heart disease and other chronic diseases.

Therapeutic method

Patients in both groups were given basic treatment: Oral treatment with calcium carbonate D3 tablets (Wyeth Pharmaceutical Co., Ltd., National Medicine Standard H10950029, specification: 600 mg*30 tablets) taken 1200 mg/time, 1 time/d, and at night; Oral treatment with calcitriol capsules (China Taiwan Wellfield International Pharmaceutical Co., Ltd., registration number HC20171001, specification: 0.25 ug*10 capsules) taken 0.25 μg/time, 2 times/d; treatment was performed for 6 consecutive months.

Control group

The control group was given a foot bath prescription, which comprised Weilingxian, extended-jin grass, bone-penetrating grass Qianghuo, red peony, angelica, cassia twigs, artemisia argyi leaves, sappanwood and Asarum, with 20 g for each. The traditional Chinese medicine was put in 1500 ml of water, soaked for 30 min, fried for 15 min with martial fire, and then simmered for 15 min. After the juice was taken, the remanent juice was added with 1500 ml of water, and again decocted for 30 min. Then, the juice was taken and mixed with the formerly taken juice. The mixed juice was put into the basin and used for soaking of both the feet and ankles before bedtime. The temperature of the juice was controlled at 42℃ (to avoid scalding skin). The juice was given 20-30 min/time, 1 time/day for a continuous treatment of 18 courses (10 day is 1 course). The foot bath time should not be too long, and should not be performed half an hour after a meal; if patients had felt uncomfortable, they should have immediately stopped the foot bath and taken a rest.

Study group

On the basis of the control group, the study group performed Baduanjin exercises every morning either outdoors or indoors. The bedridden patients could do Baduanjin exercise in the sitting position, 30 to 45 min/time, 1 time/day, for continuous exercise of 6 months. At the time of the patient's visit, the materials of the exercise plan, essentials, and precaution events of the exercise program and Baduanjin video clips were given to the patient.

Observation index

Clinical symptoms and evaluation with (visual analogue score, VAS): The clinical symptoms of the two groups of patients were scored according to the scoring criteria in the "Guiding Principles for Clinical Research of New Chinese Medicines (Trial)" [8], with a total score of 0-27; the higher the total score is, the more severe the clinical symptoms of the patients are. The VAS scale [9] was used to evaluate the low back pain of patients in the two groups, with a total score of 0~10, 0 for no pain and 10 for severe pain. The higher the total score is, the more severe the low back pain of patients are.

Bone density: A dual-energy X-ray bone densitometer (Xuzhou Pinyuan Medical Technology Co., Ltd., model Dexa Pro-I) was used to determine the bone density of the lumbar spine $L_{1\sim4}$ and the femoral neck of the two groups of patients.

Muscle strength of the lower limbs: Before and after treatment, the multi-joint isokinetic test system (BIODEX Medical Systems, USA, model S4Pro) was used to examine the muscle strength indices (including slow speed extensor strength, slow speed flexor strength, medium speed extensor strength and medium speed flexors strength) of the lower limbs of the two groups of patients, with the angular velocity, and joint range of motion set at 600/s (slow speed) and 1200/s (medium speed) respectively. At the same time, the patients were instructed to repeatedly flex and extend the knee joint with the maximum strength.

Adverse reactions: nausea and vomiting were observed in the two groups.

Statistical analysis

Statistical analysis was performed using SPSS 22.0. Count data were compared using the χ^2 test. Measurement data were presented by mean ± standard deviation ($\bar{x}\pm s$), and compared by the *t* test. $P<0.05$ was considered statistically significant.

Results

Compression of clinical symptoms and VAS scores

between the two groups

Before treatment, there was no significant difference in clinical symptoms and VAS scores between the two groups (P>0.05). Compared with those before treatment, the clinical symptoms and VAS scores of the two groups of patients were significantly reduced after treatment (P<0.05), and those of the study group was significantly lower than those of the control group (P<0.05), as shown in Table 1.

Comparison of bone mineral density between the two groups

Before treatment, there was no significant difference between the two groups in the bone density of the lumbar spine $L_{2\text{-}4}$ and femoral neck bone (P>0.05). Compared with that before treatment, the bone density of the lumbar spine $L_{2\text{-}4}$ and femoral neck of the two groups was significantly increased after treatment (P<0.05), and that in the study group was significantly higher than that in the control group (P<0.05), as showed in Table 2.

Table 1 Compression of clinical symptoms and VAS scores between the two groups

Groups	Number of cases	Clinical symptoms		VAS	
		Before treatment	After treatment	Before treatment	After treatment
Study group	69	18.86±4.60	8.77±2.14*	7.14±1.82	1.84±0.61*
Control group	69	19.20±3.95	11.65±2.83*	6.95±1.77	2.72±0.83*
t		-0.466	-6.743	0.622	-7.097
P		0.642	0.000	0.535	0.000

Note: Compared with those before treatment: *P<0.05

Table 2 Comparison of bone mineral density between the two groups (g/cm^2)

Groups	Number of cases	Lumbar spine $L_{2\text{-}4}$		Femoral neck bone	
		Before treatment	After treatment	Before treatment	After treatment
Study group	69	0.68±0.15	0.84±0.18*	0.62±0.12	0.80±0.15*
Control group	69	0.66±0.14	0.75±0.17*	0.64±0.14	0.72±0.18*
t		0.810	3.020	-0.901	2.836
P		0.420	0.003	0.369	0.005

Note: Compared with that before treatment: *P<0.05

Comparison of the muscle strength of the lower limb between the two groups

Before treatment, there was no significant difference between the two groups in the patients' slow speed extensor strength, slow speed flexor strength, medium speed extensor strength and medium speed flexors strength (P>0.05). Compared with that before treatment, the slow speed extensor strength, slow speed flexor strength, medium speed extensor strength and medium speed flexors strength were increased significantly after treatment in the two groups (P<0.05), and those in the study group were significantly increased, compared with those in the control group (P<0.05), as shown in Table 3.

Adverse reactions in the two groups

There were no adverse reactions related to traditional Chinese medicine foot bath in the two groups; 5 patients in the study group had nausea and vomiting, and 7 patients in the control group had nausea and vomiting. There was no significant difference in the incidence of adverse reactions between the two groups (χ^2=0.365, P=0.546).

Table 3 Comparison of the muscle strength of the lower limb between the two groups (N • m)

Groups	Number of cases	Slow speed extensor strength		Slow speed flexor strength		Medium speed extensor strength		Medium speed flexors strength	
		Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
SG	69	83.42±12.56	115.64±22.38*	44.56±7.38	68.34±10.62*	64.52±9.55	92.64±12.45*	36.74±7.58	58.62±9.95*
CG	69	81.56±10.83	102.74±18.64*	43.60±8.25	60.72±9.91*	62.88±11.56	83.74±10.85*	37.52±8.77	49.37±10.22*
t		0.932	3.679	0.720	4.358	0.909	4.477	-0.559	5.387
P		0.353	0.000	0.473	0.000	0.365	0.000	0.577	0.000

Note: SG=Study group CG=Control group Compared with those before treatment: $^{*}P<0.05$

Discussion

Osteoporosis is a kind of systemic metabolic bone disease mainly occurring in postmenopausal women and elderly men, and it can be divided into primary osteoporosis and secondary osteoporosis. The occurrence of osteoporosis is related to the dynamic disorder of osteoblasts and osteoclasts. This disorder is caused by a negative bone metabolism balance resulting from the increase in bone resorption in the body and the decrease in bone formation, which eventually leads to bone loss and osteoporosis [10]. In TCM, osteoporosis belongs to the categories of "bone wilt", "bone arthritis" and "bone dryness"; due to the deficiency of kidney Qi and insufficient kidney essence, there exists no way to nourish the bone marrow, leading to bone weakness and spleen deficiency, which result in a lack of energy for transportation and a lack of source of qi and blood to generate an acquired inability to nourish the congenital bone marrow, thus triggering bone marrow dystrophy and causing osteoporosis. Kidney-Yang deficiency is the common syndrome type of osteoporosis. Its pathogenesis is kidney-Yang exhaustion and deficiency, stagnation of yin and cold, unsmooth blood flow staying to form stasis, and pain due to blockage. Therefore, the treatment of osteoporosis patients with kidney-Yang deficiency should focus on tonifying kidney, invigorating spleen, promoting blood circulation, removing blood stasis, strengthening the tendons and bones [11]. In this study, based on the same treatment basis, the control group was treated with a cold-dispelling and Yang-reinforcing foot bath prescription, while the research group was treated with Baduanjin combined with a cold-dispelling and Yang-reinforcing foot bath prescription. It was found that Baduanjin combined with a cold-dispelling and Yang-reinforcing foot bath prescription had a better therapeutic effect on patients with kidney-Yang deficiency osteoporosis.

The clinical manifestation of osteoporosis patients is the pain in the lower back. In this study, the clinical symptom VAS score of the two groups of patients were significantly reduced after treatment, and that of the study group was lower than that of the control group, which indicates that treatment via Bduanjin combined with a cold-dispelling and Yang-reinforcing foot bath prescription for patients with kidney-Yang deficient osteoporosis can alleviate clinical symptoms and relieve the pain in the lumbar and back of the patients. The cold-dispelling and Yang-reinforcing foot bath prescription comprises Weilingxian, extended-jin grass, bone-penetrating grass Qianghuo, red peony, angelica, cassia twigs, artemisia argyi leaves, sappanwood and Asarum, among which Weilingxian has effects, namely dispelling wind, removing dampness, dredging the collaterals and relieving pain; extended-jin grass has properties including dispelling wind, relieving pain, relaxing the tendons and activating the collaterals; bone-penetrating grass is able to dispel blood stasis, reduce swelling, remove toxic substances and relieve pain; Qianghuo can perform functions including alleviating wind-cold syndrome via dispelling cold, and expelling wind to relieve pain; Red peony has effects such as clearing heat and cooling blood as well as promoting blood circulation and removing blood

stasis; Angelica plays a role by tonifying blood, regulating the meridians, promoting blood circulation and relieving pain; Cassia twigs exert effects including helping Yang transform into Qi and warming the meridians to activate the pulse beat; Artemisia argyi leaves can warm the meridians and stop bleeding and also dispel cold and relieve pain; Sappanwood has properties such as promoting blood circulation, healing wounds, removing blood stasis and dredging the meridians; Asarum is able to alleviate wind-cold syndrome via dispelling cold, and expel wind to relieve pain; The orchestrated use of all medicines exerts effects including dredging the meridians and activating the collaterals, replenishing qi and nourishing blood, refilling the essence and supplementing the marrow. Moreover, the angelica in the cold-dispelling and Yang-reinforcing foot bath prescription can inhibit the mitogen-activated protein kinase (MAPK) signaling pathway, inhibit ERK activation, restrain osteoclast proliferation, reduce bone resorption, restore bone transformation balance, thereby improving the patient's clinical symptoms to promote the recovery of patients. The cinnamaldehyde in cassia twigs can inhibit the receptor activator of nuclear factor kappa B ligand (RANKL)/the receptor activator of nuclear factor kappa B (RANK) pathway which leads to downregulated the expression of RNAK, thus inhibiting the differentiation and maturation of osteoclasts, reducing bone resorption, and improving the microstructure of bone. Baduanjin exercise can increase the physical mechanical stress of the bone, stimulate bone cells, promote the synthesis of osteocytes, increase the body's bone density, promote bone formation, and inhibit bone resorption, which can effectively improve the clinical symptoms of the patients. The stretching action to stretch the tendons and pull the bones in the Baduanjin can improve the flexibility of the exerciser's muscles, increase the range of the muscle movement, and improve the muscle strength; at the same time, Baduanjin exercise can improve bone biomechanics, regulate bone growth and development, promote local blood circulation in the bone, increase osteocyte viability, and improve bone turnover, thereby reducing the pain of the patient and effectively promoting the recovery of the patient [12].

Bone density is an important marker of bone quality, and can reflect the degree of osteoporosis in the body. Osteoporosis patients suffer from pain due to decreased bone density and bone mass loss, leading to deterioration of body function. The results of this study showed that the bone density of the lumbar $L_{2\sim4}$, femur and tibia, and the slow speed extensor strength, slow speed flexor strength, medium speed extensor strength and medium speed flexors strength were significantly increased in the two groups after treatment, and those in the study group were significantly elevated, compared to those in the control group, which indicates that treatment via Bduanjin combined with the cold-dispelling and Yang-reinforcing foot bath prescription for patients with kidney-Yang deficient osteoporosis can improve the patients' bone density and lower limb muscle strength. The Weilingxian in the prescription contains saponins, which can enhance the activity of alkaline phosphatase, promote the synthesis of osteoblasts, increase the concentration of cyclic adenosine phosphorus in osteoblasts, promote bone formation, increase bone density and restore body function. The isoflavones in sappanwood can decrease osteoclast viability, reduce bone resorption, promote osteoblast-regulated secretion of collagenase, increase osteoblast viability, promote bone formation, and maintain the dynamic balance between osteoblasts and osteoclasts. Baduanjin exercise is based on muscle isometric contraction exercises, which can train the muscles of the lower limbs, increase the stability of the lower limbs, improve the muscle strength of the lower limbs, and increase the bone density; meanwhile, it can promote blood circulation, facilitate calcium absorption, and make blood calcium transport into the bone to promote the deposition of bone mineral salts and accelerate the proliferation of osteoblasts, thereby reducing bone loss and increasing bone density. In addition, in this study, there was no statistically significant difference in the incidence of adverse reactions between the two groups, indicating that Bduanjin combined with the cold-dispelling and

Yang-reinforcing foot bath prescription has a certain degree of safety in the treatment of patients with kidney-Yang deficient osteoporosis.

Declaration of conflict-of-interest

The authors declare no conflict-of-interest.

References

[1] Kanis JA, Cooper C, Rizzoli R, et al. European guidance for the diagnosis and management of osteoporosis in postmenopausal women[J]. Osteoporos Int. 2019, 30(1):3-44.

[2] Tarantino U, Iolascon G, Cianferotti L, et al. Clinical guidelines for the prevention and treatment of osteoporosis: summary statements and recommendations from the Italian Society for Orthopaedics and Traumatology[J]. J Orthop Traumatol. 2017, 18(Suppl 1):3-36.

[3] Yanhong Li, Futai Gong, Shiyao Wu ,et al. Current situation and research progress of integrated traditional Chinese and western medicine in treatment of primary osteoporosis [J]. Chinese Journal of Osteoporosis, 2017,23(05):690-694.

[4] Jie Cheng,Ying wang, Jianhua Ji , et al. Curative effect of Gushukang capsule in the treatment of kidney-yang deficient osteoporosis and its influence on the patients' bone metabolism [J]. Shaanxi Journal of Traditional Chinese Medicine,2019,40(09):1232-1234+1250.

[5] Long Wang, Jie Yang, Jianming Gong, et al. Clinical study of osteoporosis therapy equipment combined with exercise therapy in the treatment of osteoporosis [J]. Southeast National Defense Medicine, 2020,22(01):38-42.

.

[6] Weibo Xia, Zhenlin Zhang, Hua Lin, et al. Guidelines for diagnosis and treatment of primary osteoporosis (2017)[J]. Chinese Journal of Osteoporosis, 2019,25(03):281-309.

[7] Shangming Meng. Clinical Study on the treatment of 70 cases of Spleen-Kidney Yang deficient osteoporosis by Duhuojisheng decoction conbined with western medicine[J]. Sichuan Traditional Chinese Medicine, 2018,36(05):140-142.

[8] Wei Liu, Peijian Tong, Luwei Xiao, et al. Treatment with Oral Yigu Decoction combined with Taijiquan exercise for senile osteoporosis with kidney-yang deficiency syndrome[J]. Traditional Chinese Medicine Bonesetting,2018,30(11):6-12.

[9] Ye Xia, Yiru Wang, Wen Mo, et al. Observation on the clinical efficacy of Tiaoshen Tongbi Decoction combined with medicine slag ironing in the treatment of senile primary osteoporosis[J]. Hebei Medicine,2018,24(12):2105-2108.

[10] Yulian Yin, Hongfeng Chen. Advances in the pathogenesis and treatment of osteoporosis in Chinese and Western medicine [J]. Journal of Liaoning University of Traditional Chinese Medicine, 2017,19(10):89-93.

[11]Yuqing Zeng, Dingyan Ben, Zhan Yi, et al. Clinical Study on the treatment of senile osteoporosis with medicinal cake-separated Moxibustion[J]. Chinese Acupuncture and Moxibustion, 2017,37(05):473-476.

[12] Jianhua Su, Qiang Deng. Clinical study of Ba Duan Jin combined with anti-osteoporosis drugs in the treatment of postmenopausal osteoporosis [J]. Journal of Traditional Chinese Medicine, 2018, 46(03):84-88

