Am J Transl Res 2021;13(9):10843-10849
www.ajtr.org /ISSN:1943-8141/AJTR0134418

Original Article

Clinical effect of Chinese herbal medicine for removing blood stasis combined with acupuncture on sequelae of cerebral infarction

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Received April 18, 2021; Accepted July 2, 2021; Epub September 15, 2021; Published September 30, 2021

Abstract: Objective: To assess the clinical efficacy of Chinese herbal medicine for removing blood stasis combined with acupuncture in the treatment of sequelae of cerebral infarction. Methods: Ninety patients with cerebral infarction admitted to our hospital from April 2018 to April 2020 were enrolled and equally allocated to an experimental group and a control group. The control group was treated with aspirin, and the experimental group was treated with Chinese herbal medicine for removing blood stasis combined with acupuncture. The recovery of the ability of daily living (ADL), recovery of hemiplegic limb function, blood viscosity, total cholesterol (TC), triglyceride (TG), and quality of life were evaluated. Results: After treatment, the ADL of patients in the two groups witnessed a remarkable recovery, with superior results in the experimental group than the control group ($P < 0.05$). The hemiplegic limb recovery of the experimental group was observed to be significantly improved when compared with the control group ($P < 0.05$). Remarkably lower blood viscosity-related indexes of TC and TG of the experimental group compared to the control group were identified ($P < 0.05$). As to the total remission rate (TRR), the experimental group demonstrated a higher level than the control group ($P < 0.05$). The scores of quality of life of patients in the experimental group after treatment were evidently higher than those of the control group ($P < 0.05$). Conclusion: Chinese herbal medicine for removing blood stasis combined with acupuncture treatment can better improve the hemiplegic limb function and the quality of life, and reduce blood viscosity of patients with sequelae of cerebral infarction.

Keywords: Chinese herbal medicine for removing blood stasis, acupuncture treatment, cerebral infarction, sequelae

Introduction

Cerebral infarction is a common critical cerebrovascular disease, whose pathological mechanism mainly lies in insufficient blood supply to the brain tissue. A long-term shortage of blood oxygen supply to brain tissue will lead to local necrosis of brain tissue. The patients may suffer great damage as there are many nerves and blood vessels in the infarct focus [1-4], and the treatment of cerebral infarction is considered arduous. Moreover, irreversible injury triggered by infarct focus will cause sequelae, such as mouth-eye vortex, limb weakness, and hemiplegia. The resultant cerebral infarction sequela is also complex and diverse. The middle-aged and elderly population are more susceptible to cerebral infarction due to their weak autoimmune mechanism and poor self-repair ability, which also increases the risk of sequelae of cerebral infarction. Consequently, effective prevention and treatment measures can help reduce the disability rate and improve the quality of life. Chinese herbal medicines for removing blood stasis bear a promising therapeutic effect on sequelae of cerebral infarction, whose combination with acupuncture and moxibustion can play a role in smoothing qi and blood, warming meridians, and dredging collaterals. Based on this, this study was to examine the clinical efficacy of Chinese herbal medicines removing blood stasis combined with acupuncture in the treatment of sequelae of cerebral infarction. This study innovatively used traditional Chinese medicine for removing blood stasis and acupuncture to treat the sequelae of cerebral

infarction, which exerts a promising therapeutic effect in optimizing the limb function and quality of life of patients and reducing blood viscosity.

Data and methods

General data

Ninety patients with cerebral infarction referring to our hospital from April 2018 to April 2020 were selected and equally randomized into the experimental group and the control group.

Inclusion criteria: (1) All patients met the diagnostic criteria for cerebral infarction in "Guidelines for Diagnosis and Treatment of Cerebrovascular Diseases" [5], and underwent limb assessment and cranial nerve assessment. (2) The patients were diagnosed with qi deficiency and blood stasis by herbalist doctors and met the diagnostic criteria of stroke sequela in "Basis of TCM Syndrome Evaluation" [6]. (3) Approval was obtained from the Ethics Committee, and informed consent was obtained from the patients and their families. This study strictly complied with the requirements of the ethics committee, with the ethics committee number: 2017-12-23. https://clinicaltrials.gov/, ClinicalTrials.gov Identifier: NCT03186444.

Exclusion criteria: (1) Patients with language dysfunction. (2) Patients with mental and other cognitive disorders. (3) Patients without a legal guardian. (4) Patients who refused to cooperate in the experiment.

Methods

The control group was given routine treatments, including oxygen inhalation, blood pressure regulation, blood coagulation reduction, and brain circulation improvement. On this basis, patients were given aspirin (Guo Yao Zhun Zi H44021139, Guangdong Jiuming Pharmaceutical Co., Ltd., 100 mg*30/tablet) three times a day, 0.3 g per time.

The experimental group was treated with Chinese herbal medicines for removing blood stasis combined with acupuncture. The prescription comprised Pheretima, Angelica sinensis, Eupolyphaga Seu Steleophaga, and Hirudo, 10 g each, Carthamus tinctorius, Achyranthes bidentata, Radix Paeoniae Rubra, Rhizoma Chuanxiong and Notoginseng Radix, 30 g each, Caulis Spatholobi of 15 g and Radix Astragali of 60 g. Chinese medicines were mixed and decocted in warm water twice a day (general expression: twice a day), and patients were given the prescription for 2 weeks as a course, with a total of 3 courses. Acupuncture was applied to Yangming meridian points of the hands and feet of patients. With the focus on the affected side, more punctures can be applied on the healthy side, which can significantly improve the nerve conduction velocity and limb motor function in patients with stroke sequelae. Patients with hemiplegia were given acupuncture treatment at Neiguan, Sanyinjiao, Fengshi, Yaoyangguan, Quchi, Zusanli, Weizhong, Yangling, and Jianyu. Patients with mouth-eye vortex inclination were given acupuncture treatment at Dicang, Renzhong, Yamen, Taiyang, Fengfu, Xiaguan, and Lianquan. Four needles were used on the line from the point of Baihui to the temple on the lesion side by the relay acupuncture method. Acupuncture on the scalp points can significantly improve the muscle strength of the upper limbs, hands, and lower limbs of stroke patients, with a more apparent immediate effect on the muscle strength of the upper limb and lower limb. After the acupuncture points were chosen and the skin of the acupoints was disinfected, the skin at the needle entry site was tightened with the left hand, and a 20 G puncture needle was used for acupuncture with the right hand. According to the different acupuncture points, the depth of penetration into the skin differed. And acupuncture methods such as lifting, thrusting, twisting, and rotating were used for treatment, and the needles were kept for 30 min, once a day. Five days after treatment, they were treated at intervals of 2 days for 2 consecutive months [7-10].

Observation indicators

The Barthel Index Scale [11] was used to evaluate the functional recovery of hemiplegic limbs of patients, with scores ranging from 0 to 100 points. The higher the score, the better the recovery of patients. The time points before and after treatment were set as T0 and T1, and the Barthel index scores of the two groups were compared.

Table 1. Comparison of general data between two groups of patients [n (%)]

	Experimental group (n = 45)	Control group (n = 45)	χ^2 or t	P
Age (years old)	56.96 ± 3.12	57.97 ± 3.42	1.464	0.147
Gender			0.182	0.670
Male	22 (48.89)	21 (46.67)		
Female	23 (51.11)	24 (53.33)		
BMI (kg/m^2)	22.01 ± 1.61	22.02 ± 1.52	0.030	0.976
Education level				
Primary school and below	11 (24.44)	9 (20.00)	0.257	0.612
Junior high school	12 (26.67)	13 (28.89)	0.055	0.814
High school and technical secondary school	14 (31.11)	13 (28.89)	0.052	0.818
College and above	8 (17.78)	10 (22.22)	0.277	0.598
Smoking			0.500	0.655
Yes	31 (68.89)	29 (64.44)		
no	14 (31.11)	16 (35.56)		
Drinking alcohol			0.194	0.660
Yes	28 (62.22)	30 (66.67)		
no	17 (37.78)	15 (33.33)		

The activity of daily living (ADL) was used to evaluate the recovery of patients' ADL [12], with a range of 0-100 points. A higher score indicates a better recovery.

The blood viscosity was compared between patients. The fibrinogen, plasma concentration, whole blood viscosity, TC and TG were proportional to the degree of neurological injury of patients.

The therapeutic effects were compared between the two groups. The therapeutic effects can be divided into significantly effective (≥ 80 points), effective (≥ 60 points), and ineffective (≤ 59 points). TRR = significantly effective rate + effective rate.

With the MOS 36-item short-form health survey (SF-36) [10], the social functioning (SF), mental health (MH), physical functioning (PF), role physical (RP), and quality of life were compared between the two groups. The total score of the scale was 100 points, and the higher the score, the better the patient's quality of life.

Statistical analysis

The data analysis was done using SPSS20.0 software and graphed by GraphPad Prism 7 (San Diego, USA). The count data was expressed as [n (%)], and compared by using χ^2 test, while measurement data were presented as ($\bar{x}$ ± s) and compared by using *t*-test. Significance was determined at a level of a *P* value less than 0.05.

Results

Comparison of general data

The general information regarding age, gender, BMI, educational level, smoking, drinking, and residence were similar in the two groups ($P > 0.05$), as shown in **Table 1**.

Comparison of Barthel scores and ADL scores between two groups

Figure 1A, **1B** displays that Barthel scores and ADL scores of patients in both groups after treatment increased greatly ($P < 0.05$), and a more significant increase was found in the experimental group compared to the control group ($P < 0.05$).

Comparison of blood viscosity

With regard to the fibrinogen, plasma concentration, whole blood viscosity, TC and TG, a higher level was seen in the control group when compared to the experimental group ($P < 0.05$), as shown in **Table 2**.

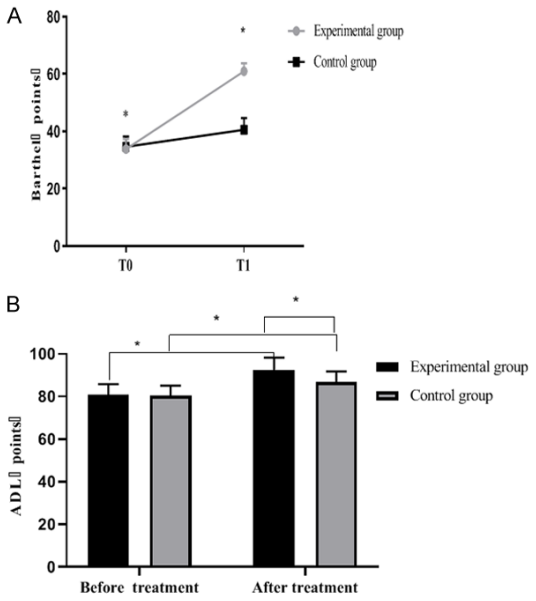

Figure 1. Comparison of Barthel scores and ADL scores between two groups ($\bar{x}$ ± s). Note: A. The abscissa indicates T0 and T1, and the ordinate indicates Barthel score (points). Barthel scores in the experimental group at T0 and T1 were (31.31 ± 5.04) and (58.93 ± 4.01), respectively. Barthel scores of patients in control group before and after treatment were (32.13 ± 5.06) and (37.69 ± 5.76), respectively. Barthel scores of patients in experimental group are significantly different between T0 and T1 (t = 28.747, $^*P$ < 0.05);There was a significant difference in Barthel scores of patients in control group between T0 and T1 (t = 4.865, $^*P$ < 0.05). B. The abscissa indicates before and after treatment, and the ordinate indicates ADL score (points). The ADL scores of patients in the experimental group before and after treatment were (77.42 ± 6.93) and (88.69 ± 7.93), respectively. The ADL scores of patients in control group before and after treatment were (77.15 ± 6.58) and (83.12 ± 7.21), respectively. There was a significant difference in ADL scores before and after treatment in the experimental group (t = 7.189, $^*P$ < 0.05); The ADL scores of patients in control group were significantly different before and after treatment (t = 4.103, $^*P$ < 0.05). There was a significant difference in ADL scores between the two groups after treatment (t = 3.486, $^*P$ < 0.05).

Comparison of therapeutic effects and treatment effects between the two groups

The experimental group exhibited a significantly higher total clinical effective rate in therapeutic effects than the control group (P < 0.05), as shown in **Table 3**.

Comparison of SF-36 scores between two groups

Table 4 details that the scores of SF, RP, MH, and PF of the experimental group were found to be higher than the control group (P < 0.05).

Discussion

Cerebral infarction is caused by blockage of blood circulation and insufficient blood oxygen supply in the brain, which will cause irreversible injury to the brain function of patients. Cerebral infarction is characterized by acute onset, high mortality, and disability rate, with a propensity to various sequelae, which undermines the ADL of patients and brings burden to the patients and their families [13-17]. Some studies have underlined the following principles of clinical medication in the recovery period or sequelae period of cerebral infarction: (1) Continuous treatment should be implemented according to the causes of the disease, with emphasis on preventing the formation of arteriosclerosis thrombus, and the duration of efficacy and the full efficacy should be guaranteed. (2) Reduction in drug resistance, patients' dependence on drugs, toxic and side effects of drugs. The damage of drugs to the liver and kidney function of patients should be reduced to ensure the safety of the medication. (3) Reasonable selection of the dosage of oral drugs. The efficacy of the drug should be ensured and the medication-caused burden to the patients should be monitored. In view of the poor curative effects of drugs applied during the sequela period, acupuncture treatment can help promote vasodilation, increase cerebral blood flow, improve the energy metabolism ability of brain tissue and enhance the recovery of limb activity function of patients.

In traditional medicine, cerebral infarction is categorized into the stroke mainly induced by deficiency of primordial qi, unsmooth blood circulation, and blood stasis and pulse obstruction. Accordingly, due attention should be given to the promotion of blood circulation and the removal of blood stasis in clinical treatment, and it is indispensable to choose herbs in TCM with the effects of promoting blood circulation and removing blood stasis. For example, Astragalus membranaceus can invigorate qi, Achyranthes bidentata can relax veins and activate blood, Pheretima can regulate veins, and Chuanxiong has the effect of activating qi and blood. The combination of TCM herbs can significantly reduce the blood viscosity of patients, inhibit platelet aggregation, and repair necrotic nerve cells, which can substantially optimize the prognosis and sequelae of cerebral infarction. Acupuncture can improve blood circulation, abate muscle spasms and enhance limb

Table 2. Comparison of blood viscosity, TC and TG between two groups ($\overline{x}$ ± s)

Group	n	Plasma viscosity (mpa•s)	Fibrinogen (g/L)	Whole blood viscosity (mpa•s)	TC (mmol/L)	TG (mmol/L)
Experimental group	45	1.32 ± 0.13	3.46 ± 0.22	3.03 ± 0.06	5.17 ± 0.94	1.69 ± 0.34
Control group	45	1.74 ± 0.36	4.28 ± 0.46	4.23 ± 0.26	5.70 ± 1.34	2.37 ± 1.14
X^2		7.361	10.788	30.168	4.236	5.369
P		0.025	0.001	0.025	0.001	0.002

Table 3. Comparison of therapeutic effects and treatment effects between the two groups [n (%)]

Index	experimental group (n = 45)	control group (n = 45)	X^2	*P*
therapeutic effect				
Significantly effective	27 (60.00)	22 (48.89)		
Effective	15 (33.33)	8 (17.78)		
Invalid	3 (6.67)	15 (33.33)		
Total effective rate	42 (93.33)	30 (66.67)	9.641	0.002
treatment effects				
markedly effective	26 (57.78)	21 (46.67)		
effective	16 (35.56)	10 (22.22)		
ineffective	3 (6.67)	14 (31.11)		
total effective	42 (93.33)	31 (68.89)	8.775	0.001

activities [18]. The blood viscosity of the patients in the experimental group was obviously improved after being treated with Chinese herbal medicines for removing blood stasis combined with acupuncture, and the effect was apparently better than that of the control group.

This study confirmed that the TRR of the experimental group was 93.33%, significantly better than the control group (68.89%), which was consistent with the research results of Aritoshi Hattori et al. [19] who pointed out that the TRR of the experimental group was 92.96%, significantly better than the TRR of 69.1% in the control group. This demonstrates that the treatment of patients with acute cerebral infarction with Chinese herbal medicines for removing blood stasis showed a remarkable clinical effect. Acupuncture is used for the treatment of patients as it can regulate the yin and yang of qi and blood, dredge meridians, stimulate the cerebral cortex, promote blood circulation in the brain, and repair damaged cells. Chinese herbal medicines for removing blood stasis combined with acupuncture and moxibustion are effective in treating sequelae of cerebral infarction, and can evidently improve various clinical symptoms of patients. TCM believes that the occurrence of cerebral infarction is caused by the six pathogenic factors and the seven negative emotions, which gives rise to the imbalance of qi-transformation in the internal organs, phlegm production, blood stasis removal, and meridian blockage. In the self-made Tongluo Huoxue Decoction by Xu and Bai [20], angelica sinensis, chuanxiong, peach seed, safflower, white peony root enjoys the effects of promoting blood circulation and removing blood stasis to eliminate blood stasis without hindering the blood and qi; Arisaema with Bile, Pinellia ternata, Pummelo Peel reduces qi, removes dampness and reduces phlegm; Rhizoma Gastrodiae Ganping, extinguishing wind can relieve spasm, earthworm can clear heat, relieve convulsions, and dredge collaterals; the two drugs cooperate to treat hemiplegia. The TC and TG of the study group are lower than those of the control group. As the increase of blood viscosity can block the microvessels, the microcirculation blood flow is significantly reduced, the blood perfusion pressure is decreased, the blood flow shear rate is reduced, which results in greater aggregation of the red blood cells. The reduction of TC and TG levels can further drive down the blood viscosity and promotion blood flow, avoiding the formation of a vicious circle. As the change of cerebral blood supply mainly depends on the regulation of blood viscosity, the increase of blood viscosity and blood resistance will exacerbate the ischemia of the focal area. Previous studies have shown that acupuncture at Sishencong can regulate the blood flow of large blood vessels in the brain, enhance the establishment of cerebrovascular collateral circulation, increase cerebral perfu-

Table 4. Comparison of SF-36 scores between two groups ($\bar{x} \pm s$)

Group	n	Material life state	Social function	Psychological function	Somatic function
Experimental group	45	15.46 ± 2.11	15.46 ± 3.17	16.01 ± 3.66	16.41 ± 2.06
Control group	45	10.14 ± 2.31	11.42 ± 4.15	10.21 ± 3.34	11.39 ± 2.51
χ^2		11.407	5.190	7.852	10.371
P		0.001	0.002	0.014	0.015

sion and the number of brain cholinergic nerve fibers, regulate cortical function, and accelerate patients with sequelae of cerebral infarction rehabilitation [21].

The limitation of this study lies in the absence of medium and long-term follow-up trials, which results in the deficiency of long-term efficacy basis. Moreover, the number of patients included was rather small and future study will be expanded and the follow-up time will be extended to obtain more rigorous data of cerebral infarction patients.

To sum up, chinese herbal medicines for removing blood stasis combined with acupuncture are effective in the treatment of sequelae of cerebral infarction, which can accelerate the recovery of limb function and ADL of patients with hemiplegia.

Disclosure of conflict of interest

None.

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