


Clinical observation of acupuncture combined with modern rehabilitation in the treatment of limb motor dysfunction after ischemic stroke

A randomized controlled trial

Hongyu Xie, MD^a , Zhiqun Gao, MD^a, Yinqiu Fan, PhD^a, Jie Shi, MD^a, Youbin Tang, MD^a, Bixiang Cha, MD^a, Rong Shen, BD^a, Pingping Xu, MD^b, Aihong Yuan, PhD^{a,*}

Abstract

Background: Motor dysfunction is a common sequela of ischemic stroke. This study aimed to explore the effective treatment of ischemic stroke by combining acupuncture and modern rehabilitation training.

Methods: This study was a single-center, randomized controlled clinical trial conducted at the First Affiliated Hospital of Anhui University of Traditional Chinese Medicine, 90 cases were finally included, divided into 45 cases each in the body acupuncture group and the head acupuncture group.

Interventions: Both groups received basic drug treatment, modern rehabilitation training, and basic life care guidance; the body acupuncture group was treated with reference to acupuncture points from the classic textbook of acupuncture and moxibustion, and the head acupuncture group was given Zhu's scalp acupuncture treatment based on the body acupuncture group. Primary outcome index: unassisted muscle strength grading scale; secondary outcome index: assessment of activities of daily living; simplified Fugl-Meyer motor function rating scale.

Results: The Barthel scale score, Manual Muscle Testing scale score (upper and lower limbs), and simplified Fugl-Meyer scale score (upper and lower limbs) in the 2 groups were improved ($P \leq .05$), and the efficacy of the head-acupuncture group was better than that of the body-acupuncture group ($P \leq .05$); there was no significant improvement in the simplified Fugl-Meyer scale (hand) score in both groups ($P \geq .05$). There was no significant improvement in these scores ($P \geq .05$). The difference in efficiency between the 2 groups was not statistically significant ($P \leq .05$), and the apparent efficiency in the cephalic needle group was higher than that in the body needle group ($P \leq .05$).

Conclusions: Simultaneous treatment with Zhu's scalp acupuncture and body acupuncture combined with modern rehabilitation training can significantly improve limb motor function in patients with ischemic stroke, and its efficacy is better than that of body acupuncture alone combined with modern rehabilitation training.

Abbreviations: CONSORT = consolidated standards of reporting trials, MBI = modified Barthel index, MMSE = mini-mental state examination, MMT = manual muscle testing.

Keywords: acupuncture, clinical observation, hemiplegia, ischemic stroke, recovery

1. Introduction

Stroke is a clinically common acute cerebrovascular disease caused by rupture or obstruction of cerebral blood vessels, resulting in insufficient blood supply to the brain tissue oxygen demand and causing brain tissue damage, including ischemic stroke and

hemorrhagic stroke. Ischemic stroke, also known as cerebral infarction, accounts for 60% to 70% of the total number of strokes, and the age of onset is mostly above 40 years, with more men than women.^[1] With the improvement of people's living standard in China, the incidence of ischemic stroke has been increasing year by year, and the number of incidence has reached 15.61

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The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

^a Second Department of Acupuncture Rehabilitation, The First Affiliated Hospital of Anhui University of Traditional Chinese Medicine, Hefei, Anhui Province, China,

^b Anhui University of Traditional Chinese Medicine, Hefei, Anhui Province, China.

* Correspondence: Aihong Yuan, Second Department of Acupuncture Rehabilitation, The First Affiliated Hospital of Anhui University of Traditional

Chinese Medicine, No. 117 Meishan Road, Hefei, Anhui Province, China (e-mail: 490603279@qq.com).

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million in 2017.^[2] According to statistics, there are more than 13 million new cases worldwide each year, making it the second most common cause of death and disability worldwide. The incidence in young adults (18–50 years) has increased significantly, making it a serious burden on global health problems.^[3] Ischemic stroke is treated clinically by thrombolysis and antiplatelet aggregation,^[4] resulting in the ischemic state of the lesion within a very short time after the onset, maintaining the blood supply to the ischemic semi-dark zone, minimizing nerve damage, and preserving limb motor function; however, the use of thrombolytic agents increases the risk of bleeding at other sites.^[5] Limb motor dysfunction is the most common sequela of ischemic stroke, with follow-up reports indicating that nearly 60–70% of patients develop limb dysfunction 5 years after ischemic stroke.^[6] Therefore, it is becoming increasingly important to explore effective treatment options to improve limb function in patients with ischemic stroke.

Zhu's scalp acupuncture is a scalp acupuncture point naming system established by Professor Zhu Ming-qing on the basis of the "scalp acupuncture point naming standardization scheme." Its therapy focuses on the combination of acupuncture and guidance, and modern rehabilitation training methods are also part of the guidance system. More and more clinical studies have combined traditional Chinese medicine with modern rehabilitation training, with significant effects on post-stroke limb dysfunction.^[7,8] This study further validates the clinical efficacy of Zhu's scalp acupuncture combined with modern rehabilitation training for the treatment of limb movement dysfunction in ischemic stroke from the perspectives of clinical efficacy, safety, and compliance, and provides a new protocol for the treatment of this disease, which is reported below.

2. Methods

2.1. Study design, participants, and sample size

This single-center, randomized controlled clinical trial was conducted from January 2018 to January 2021 in the wards and outpatient clinics of the Second Department of Acupuncture and Rehabilitation, The First Affiliated Hospital of Anhui University of Traditional Chinese Medicine. This study was approved by the Ethics Committee of the First Affiliated Hospital of the Anhui University of Traditional Chinese Medicine (approval number:2020AH-XJS38).

Inclusion criteria: meeting the diagnostic criteria of Western medicine and Chinese medicine; the diagnostic criteria of Western medicine referred to the Diagnostic Points of Various Cerebrovascular Diseases adopted by the Fourth National Cerebrovascular Disease Conference of the Chinese Medical Association in 1995^[9] and the Diagnostic Guidelines for the Diagnosis and Treatment of Acute Ischemic Stroke in China 2014 formulated by the Neurology Branch of the Chinese Medical Association,^[10] and the diagnostic criteria of Chinese medicine referred to the Diagnostic Criteria in the 1996 Diagnostic Criteria in the "Diagnostic and Efficacy Assessment Criteria for Stroke Diseases (for trial implementation)" formulated by the State Administration of Traditional Chinese Medicine.^[11] age ≥ 40 years, ≤ 80 years; first onset and duration of disease within 6 months; no other neurological diseases affecting functional recovery; patients who had not taken Western or Chinese sedative drugs or muscle relaxants recently; clear consciousness, Mini-Mental State Examination (MMSE) score > 24 points indicating no dementia; and those who signed the informed consent and voluntarily participated in this study. Those who signed the informed consent form voluntarily participated in the study. The exclusion criteria were as follows: transient ischemic attack, cranial CT/MRI suggestive of cerebral hemorrhage, combined aphasia, deafness, inability to communicate normally, contraindications to milli-fire acupuncture and comprehensive rehabilitation, participation in other clinical trials, physical disability before cerebral infarction, and AIDS, tuberculosis, hepatitis B, and other infectious diseases. Exclusion criteria were

as follows: those who did not follow medical advice after inclusion in the trial and adopted other treatments on their own without being able to determine the efficacy; changes in conditions not related to this treatment occurred during the treatment period; use of prohibited drugs in the application protocol; those who could not cooperate to complete the 28-day treatment; and those who could not continue for various other reasons.

A total of 97 patients with ischemic stroke and limb motor dysfunction were enrolled in this study. The random numbers generated were placed in an opaque sealed envelope using a random number table, and the envelopes were drawn sequentially according to the order in which the patients were seated and randomly divided into a head-needle group and body-needle group according to a 1:1 ratio, 7 cases were shed during the trial (4 cases were dislodged in the head needle group, 3 cases due to change in condition, 1 case due to receiving other treatment; the body needle group had 3 cases of shedding, 2 cases received other treatment due to changes in their condition, and 1 case gave up treatment because their home address was too far from the hospital), and finally 45 cases in each group. The trial study protocol design, treatment operation, data collection, and analysis were completed by 3 different groups of personnel, who did not participate in each other.

2.2. Interference

Both groups were administered basic medication, modern rehabilitation training, and basic life-care instructions.

Basic medication: The Chinese Guidelines for Secondary Prevention of Ischemic Stroke and Transient Ischemic Attack 2014.^[12] The 2014 Chinese Guidelines for the Diagnosis and Treatment of Acute Ischemic Stroke include the following drugs: antiplatelet aggregation drugs; nerve-nourishing and brain cell-activating drugs; control of risk factors (hypertension, abnormal lipid metabolism, hyperhomocysteinemia, abnormal glucose metabolism, diabetes mellitus, etc.); Chinese herbal or proprietary Chinese medicine to benefit Qi and invigorate blood; and prevention and management of related complications.

Modern rehabilitation therapy includes motor relearning rehabilitation training methods, such as upper limb functional training, orofacial functional training, bedside sit-up functional training, sitting balance functional training, standing and sitting functional training, and walking balance functional training. The rehabilitation treatment was conducted by therapists with the same medical education background and more than 3 years of experience, and there was no change in rehabilitation therapists during the treatment of the same patient.

The body acupuncture group treatment was based on the classic textbook of acupuncture and moxibustion^[13] acupuncture points: upper limb (all on the affected side): Hegu, Waiguan, Hand Sanli, Quchi, Shoulder; lower limb (all on the affected side): Kunlun, Xiexi, Foot Sanli, Yanglingquan, Huanjiao. Operation: Select a millineedle (0.30 mm \times 40 mm), sterilize the skin routinely, break the skin quickly with the millineedle, then pierce 10–25 mm directly, and keep the needle for 30 minutes after getting the qi, every 15 minutes. Treatment was administered 5 times a week for 2 weeks, 2 courses of treatment, a total of 20 times courses of treatment.

Head acupuncture group treatment: Head acupuncture group on the basis of body acupuncture group to administer Zhu's scalp needle treatment. Specific operation: The patient took a sitting position, the scalp treatment area was disinfected, the upper limb area on the opposite side of the affected limb (fontanel point toward the head dimension), the top parietal perineal ankle area (Baihui as the center, the front and back sides of each side open 0.5 inch), and the lower jiao area (the front parietal toward Baihui 1 inch) were selected. A 0.30 mm \times 25 mm gauge millineedle was selected, with the tip of the needle at an angle of approximately 15° to 30° to the scalp, and twisted rapidly through the skin using finger force. The treatment frequency was the same as that in the

body needle group. Pumping technique: when the above needle is advanced along the subcutaneous to the subcapsular tendon layer, the operator's finger holding the needle feels not loose but tight and has a sense of suction, perform the pumping technique, that is, the needle body lying flat, the right hand squeezes the needle handle, the left hand presses the scalp at the point of needle entry, with explosive force to quickly pull the needle outward 3 times, and then slowly push the needle back inward (inserted to 1 inch), with tight lifting and slow insertion, the same technique to transport the needle 10 times, about 5 minutes. Acupuncture with daoyin manipulation at the same time, at the end of the acupuncture time, the body needles are removed and the head needles are retained for modern rehabilitation training. The duration of each needle stay was 8 hours.

During acupuncture, the upper and lower extremities of the affected side of the patient are exposed and covered by a screen to protect the privacy of the patient. The acupuncture treatment personnel were all attending physicians with more than 5 years of experience in our department, and we did not change the treatment personnel during the treatment of the same patient.

During acupuncture treatment, if the patient suddenly experiences dizziness, panic, chest tightness, nausea, and vomiting, or even fainting, it is considered a phenomenon of needle sickness, which is often caused by the patient's poor physical condition, emotional stress, exertion, hunger, or strong needle sensation. In the event of a sudden accident, prompt symptomatic treatment should be provided and the patient's vital signs should be observed to assess whether to continue to participate in the trial. The corresponding treatments were as follows: for mild acupuncture fainting, quickly removing the acupuncture needles, helping the patient to reach an open space, lying flat on the bed, and eating hot water or food with high sugar content as appropriate; for severe acupuncture fainting, the patient was placed flat on the floor, bird-pecking moxibustion treatment at the Baihui point, pinch, and press the Neiguan point, and attention was paid to avoid burns when moxibustion until consciousness was restored.

2.3. Observation index

Each scale was completed before and after the treatment, and it took approximately 30 minutes to complete all tests each time.

2.3.1. Main outcome indicators. Manual muscle testing (MMT): grade 0, no measurable muscle contraction; grade I, slight contraction, but unable to cause joint movement; grade II, able to make full range of joint movement in a reduced weight state; grade III, able to make full range of joint movement against gravity, but unable to resist resistance; grade IV, able to resist gravity, resist some resistance movement; grade V, can resist gravity and resist full resistance movement.

2.3.2. Secondary outcome indicators.

- (1) Assessment of activities of daily living

The modified Barthel index (MBI) was used to assess the ability of activities of daily living, including bowel control, dressing, eating, bathing, bed and chair transfer, going up and down stairs,

and walking on level ground. Scores were 100 for self-care, 99-61 for mild dysfunction, 60-41 for moderate dysfunction, and 40-0 for severe dysfunction to 0 for severe dysfunction.

(2) Simplified Fugl-Meyer Motor Function Rating Scale

There are 50 items in total, mainly used for clinical assessment of upper and lower extremity function, of which the total score of upper extremity function score is 66 (including a hand function score of 27) and the total score of lower extremity function score is 34. It is divided into 4 grades: Grade I, <50 as severe motor impairment; Grade II, 50-84 as significant motor impairment; Grade III, 85-95 as moderate motor impairment; Grade IV, 96-99 as mild motor impairment.

2.4. Efficacy evaluation criteria

The Guiding Principles for Clinical Research on New Chinese Medicines^[14] were combined with the MMT scale scores of the upper and lower extremities before and after treatment to formulate the efficacy evaluation criteria. Significant effect: MMT grading improved by ≥ 3 ; effective: MMT grading improved by ≥ 1 ; ineffective: MMT grading did not improve.

2.5. Safety assessment meter

Patients were observed for the occurrence of adverse reactions during treatment, recorded and dealt with immediately, and promptly returned the day after the symptoms were relieved.

2.6. Statistical processing

SPSS software (version 22.0) was used for data analysis. The measurement data were expressed as mean \pm standard deviation (\pm SD), and the paired *t* test (data were normally distributed) or Wilcoxon test (data were not normally distributed) was used for intragroup comparison. The *t* test for 2 independent samples (data were normally distributed) or the Mann-Whitney *U* test (data were not normally distributed) was used for intergroup comparison. The Chi-square test was used for counting data, and $P \leq .05$ was set at $P \leq .05$.

3. Results

- (1) Comparison of general patient information between the 2 groups

When comparing the general data of sex, age, and disease duration between the 2 groups, the differences were not statistically significant ($P \geq .05$) and were comparable (Table 1).

- (2) Comparison of Barthel scale scores between the 2 groups before and after treatment

The difference between the Barthel scale scores of the 2 groups before treatment was not statistically significant ($P \geq .05$) and was comparable. After treatment, the Barthel scale scores of both groups improved compared to those before treatment, and

Table 1

Comparison of general information between 2 groups of patients ($\bar{x} \pm s$).

Demographics Characteristics		Body needle group	Head needle group	X ²	t	P
Gender	Male	21 (46.7%)	23 (51.1%)	0.178		.673
	Female	24 (53.3%)	22 (48.9%)			
Age/yr		60.24 \pm 11.28	59.36 \pm 10.26		0.391	.370
Onset time		2.85 \pm 1.51	2.92 \pm 1.51		-0.244	.808

P = associated probability, X² = Establish assumptions, t = independent samples *t* test.

the efficacy of the head-acupuncture group was significantly better than that of the body-acupuncture group ($P \leq .05$) (Table 2).

(3) Comparison of MMT grades between the 2 groups of patients before and after treatment

There was no statistically significant difference in the MMT grading of the upper and lower limbs between the 2 groups before treatment ($P \geq .05$). After treatment, the MMT scale grading of the upper and lower extremities in both groups was higher than before treatment; the efficacy of the head acupuncture group was better than that of the body acupuncture group, and the difference was statistically significant ($P \leq .05$) (Table 3).

(4) Comparison of the Fugl–Meyer scores between the 2 groups before and after treatment

The difference between the Fugl–Meyer scale (upper limb, lower limb, and hand) scores of the 2 groups before treatment was

not statistically significant ($P \geq .05$) and was comparable. After treatment, the Fugl–Meyer scale (upper limb and lower limb) scores of both groups improved compared to those before treatment, and the efficacy of the head-acupuncture group was better than that of the body-acupuncture group, and the difference was statistically significant ($P \leq .05$). The difference between the Fugl–Meyer scale (hand) scores of the 2 groups after treatment was not statistically significant ($P \geq .05$) (Table 4).

(5) Comparison of clinical efficacy between the 2 groups

The efficiency of the head-acupuncture group was 91.1%, and the efficiency of the body-acupuncture group was 82.2%, the difference was not statistically significant ($P \geq .05$), the apparent efficiency of the head-acupuncture group was 42.2%, and the apparent efficiency of the body-acupuncture group was 22.2%, the difference was statistically significant ($P \leq .05$), see Table 5.

Table 2

Comparison of Barthel scale scores between the 2 groups of patients before and after treatment ($\bar{x} \pm s$).

Group	Time	n	Mean	SD	t	df	P
Body needle group	Pretest	45	42.56	21.34	-9.005	44	.000
	Posttest		51.00	21.65			
Head needle group	Pretest	45	38.78	20.43	-15.162	44	.000
	Posttest		60.11	20.77			

P = associated probability, SD = standard deviation, t = independent samples t test, df = freedom.

Table 3

Comparison of MMT scale grading between the 2 groups of patients before and after treatment.

Group	Number of cases	Upper and lower limb	Time	0 level	I level	II level	III level	IV level	V level	Z	P
Body needle group	45	Upper limb	Pretest	4	20	12	7	2	0	-4.479	.000
			Posttest	1	9	16	12	7	0		
		Lower limb	Pretest	3	15	20	6	1	0	-5.665	.000
			Posttest	0	4	11	21	7	2		
Head needle group	45	Upper limb	Pretest	3	12	16	12	2	0	-5.529	.000
			Posttest	0	4	9	17	12	3		
		Lower limb	Pretest	2	9	13	10	11	0	-5.231	.000
			Posttest	0	1	7	11	20	6		

P = associated probability, Z = values of standardized Wilcoxon statistics.

Table 4

Comparison of Fugl–Meyer scales between the 2 groups before and after treatment ($\bar{x} \pm s$).

Group	Position	Time	n	Mean	SD	t	df	P
Body needle group	Upper limb	Pretest	45	15.51	6.85	-8.961	44	.000
		Posttest		16.62	6.86			
	Lower limb	Pretest	45	16.93	6.18	-10.436	44	.000
		Pretest		18.04	6.18			
Hand	Pretest	45	9.71	5.17	-1.431	44	.160	
	Pretest		9.76	5.16				
Head needle group	Upper limb	Pretest	45	15.31	6.06	-14.646	44	.000
		Posttest		19.24	5.43			
	Lower limb	Pretest	45	16.69	5.81	-19.000	44	.000
		Pretest		20.49	5.18			
Hand	Pretest	45	10.49	4.86	-1.773	44	0.083	
	Pretest		10.56	4.84				

P = associated probability, SD = standard deviation, t = independent samples t test, df = freedom.

Table 5

Comparison of clinical efficacy between the 2 groups of patients before and after treatment.

Group	Number of cases	Conspicuous effect	Effective	Invalid	Efficient/%	χ^2	P	Phantom efficient/%	χ^2	P
Body needle group	45	19	22	4	91.11	0.865	.352	42.22	4.121	.042
Head needle group	45	10	27	8	82.22			22.22		

P = associated probability, χ^2 = establish assumptions.

4. Discussions

Ischemic stroke can be classified as unconsumed or unconsumed in Chinese medicine according to its clinical manifestations. The ancient doctors named the disease by associating the symptoms of the disease with similar natural phenomena, i.e., “like hitting a stone, like the speed of a storm,” naming it metaphorically. The disease is mostly caused by poor qi and blood flow, blood stagnation in the ligaments, or yin deficiency in the lower part of the body, liver yang disturbing the upper part of the body, combined with phlegm and fire, phlegm and stagnation of each other, resulting in phlegm clouding the upper part of the body, drowsiness, and confusion. The Yellow Emperor’s Classic of Internal Medicine has a lot of records on stroke, such as the Spiritual Pivot—Five Disorders, which states: “Disorder in the head is convulsions, heavy head and vertigo,” where convulsions are related to stroke. Paraplegia is one of the most important sequelae of stroke, which refers to the patient’s reduced function of facial and tongue muscles, impaired movement of the limbs, or even complete inability to move, as recorded in Acupuncture and Moxibustion Dacheng: “Yang evidence, those who have a stroke and are speechless and paralyzed in the hands and feet; Yin evidence, those who have a stroke and are partially paralyzed.”

Acupuncture treatment is based on the holistic concept of Chinese medicine through the regulation of the patient’s overall functions to achieve the effect of harmonizing qi and blood, dredging the meridians, and activating the channels. Head acupuncture, also known as “scalp acupuncture,” is a method of acupuncture on the head that is based on the anatomical positioning of brain functions and the corresponding body projection to determine the brain acupuncture points, and the cortical function distribution combined with the internal organs and meridian theory to determine the head acupuncture stimulation area, the millineedle piercing into the subcapsular tendon layer of the head to achieve the purpose of disease treatment.^[15] Modern medicine believes that cephalometric stimulation can afferent reflex loops in the system, promote the recovery of sensory function and afferent impulses through proprioceptors, promote neuronal synaptic regeneration, establish new synaptic connections, integrate central nervous system functions, and improve the motor function of the affected limb.^[16] Zhu’s scalp acupuncture used in this clinical trial was guided by the theory of Chinese medicine and is based on the doctrine of internal organs and meridians. Chinese medicine believes that the points of the head run through the 3 main areas of the top, forehead, and temporal, involving the 3 Yang meridians of the Governor’s Vessel, the Foot Sun, and the Foot Shaoyang. Based on the above concept as the positioning principle, with Baihui as the midpoint and the governor’s vessel as the center line, the hairy parts of the head are divided into 4 parts: front is Yin, back, left, and right; front is Yin, back is Yang, and back is Yang. Combining the meridian circulation lines of the head, according to the distribution of the cranial bones, on the frontal bone, parietal bone and occipital bone, along the line of circulation of the Governor’s Vessel and the line on both sides of the foot solar bladder meridian, from the forehead to the back of the occiput, the treatment areas are designated as the head and face, chest and abdomen, neck and collar, back, lumbosacral area and upper and lower extremities in turn. During the treatment, we use a unique acupuncture technique called the “pumping technique,” and when performing the technique, we calm the mind and guard the spirit, and make the spirit be in the needle. The interactive acupuncture theory emphasizes “synchronization of acupuncture and rehabilitation” and is widely used in rehabilitation treatment.^[17] Compared to traditional acupuncture, interactive head acupuncture emphasizes the interaction between the doctor and patient and the patient’s guarding of the spirit, while changing the “waiting for qi into an active one, guiding the patient to promote “getting qi and to “guard carefully not to lose it.”^[18]

Clinical trials confirm^[19,20] and can effectively improve the limb motor function of ischemic stroke patients and their ability to perform activities of daily living. Interactive head acupuncture is easy to perform, is suitable for movement with needles, and can fully mobilize the essence of the doctor and patient, thus maximizing the therapeutic effect.

Modern medicine believes that,^[21] post-stroke limb paralysis is caused by damage to the upper motor neurons, which affects the innervation of lower motor neurons and reduces the control of motor neurons in the anterior horn of the spinal cord, resulting in decreased muscle strength of the limb, which is manifested by reduced random movements, rather than by damage to the peripheral nervous system. The aim of exercise rehabilitation is to establish as many connections between neurons as possible in a short period of time, to induce the creation of new motor neural pathways, to achieve further consolidation, and to restore the innervation and motor control of brain nerve function.^[22] Research reports^[23] have shown that exercise therapy can improve neurological function, reduce the degree of hemiplegia of the limbs, and improve the living ability of post-stroke patients. In this clinical trial, the motor-relearning rehabilitation method was used. The recovery of motor function in hemiplegic limbs is a relearning process, based on homework or functional activities, and the patient’s subjective willingness to cooperate. The scientific rehabilitation training method is used to rebuild the patient’s motor function, and the training content is combined with daily life, so that the patient can return to society as soon as possible.

5. Conclusion

In this study, the body acupuncture group used body acupuncture combined with modern rehabilitation training, and the head acupuncture group added Zhu’s scalp acupuncture. From the test results, it can be seen that both groups can effectively improve the dysfunction of limb movement after stroke, and have an improvement effect on the MMT scale (upper and lower limbs), Barthel scale score, simplified Fugl–Meyer scale (upper and lower limbs) score, and the efficacy of the head acupuncture group was better than that of the body acupuncture group; both groups had no significant improvement effect on the simplified Fugl–Meyer scale (hand) score. The difference in efficiency between the 2 groups was not statistically significant, and the head acupuncture group had a better apparent efficiency than the body acupuncture group. In conclusion, Zhu’s scalp acupuncture and body acupuncture combined with modern rehabilitation training can significantly improve the limb motor function of patients with ischemic stroke, and the efficacy was better than that of body acupuncture combined with modern rehabilitation training. The following conclusions were drawn from this clinical trial: Those with no significant improvement in the scale in this trial were those with a long duration of disease, while those with significant improvement were mostly those with a short duration of disease. From the perspective of Western medicine, the nervous system is highly modifiable, and early rehabilitation training treatment can make better use of brain plasticity by remodeling synaptic function, establishing cerebral lateral branch circulation, lateral branch germination, repairing and compensating for the peri-lesion tissue and using the replacement effect of the contralateral cerebral cortex, etc.^[24] therefore, post-stroke acupuncture and rehabilitation should be intervened as early as possible; To further study the effects of Zhu’s scalp acupuncture and modern rehabilitation training on post-stroke limb movement disorders, we divided the Fugl–Meyer scale into 3 parts: upper limb, lower limb, and hand for statistical analysis, and concluded that the recovery speed of the lower limb was better than that of the upper limb, while the scores of hand function increased but were not statistically significant, probably because the hand is located in a relatively

large projection area of the cerebral cortex, and the hand The reason for this may be that the hand is located in a relatively large projection area of the cerebral cortex and the fine movements of the hand are innervated only by the primary motor cortex (M1) and the local corticospinal tract,^[25] there are fewer neural pathways available for recovery after injury, so recovery from subcortical stroke tends to be slower, while recovery from cortical stroke and mixed stroke is better at the same rehabilitation intensity^[26]; (3) Research findings,^[27] The combination of head acupuncture and exercise therapy in the treatment of post-stroke hemiplegia has 2 meanings; on the one hand, the 2 indications are similar; on the other hand, the 2 have strong complementarity and synergy in the cognition and treatment of the pathogenesis of post-stroke hemiplegia. From the analysis of the theory of yin and yang in Chinese medicine, the patient is in the “resting state” when receiving head acupuncture therapy, which is passive and “yin,” while he/she is in the “active state” when receiving movement therapy, which is “yang.” The combination of the 2 is in line with the theory of balance between the yin and yang of the human body, emphasizing the combination of passive and active movement and static movement, which can enhance the therapeutic effect.

In this study, we found through clinical observations that acupuncture combined with modern rehabilitation training can significantly improve limb motor function in patients with ischemic stroke. However, this study has some limitations: the observation indexes in this study are all paper mass scales, and their measurement results are highly subjective. In a later study, we could objectively respond to the changes in limb strength with the help of surface electromyography, as well as use modern medical imaging technology to visually observe the changes in brain tissue before and after treatment, and conduct further research on the mechanism; we can strengthen the follow-up after treatment for long-term longitudinal comparative study after treatment, so that the study can be more in-depth and accurate.

Author contributions

Hongyu Xie designed this study; Zhiqun Gao and Pingping Xu collected the clinical medical records; Bixiang Cha and Rong Shen performed data extraction and analysis; Hongyu Xie and Yinqiu Fan drafted and wrote the paper; Jie Shi and Youbin Tang critically revised the discussion of this experiment; Aihong Yuan performed the final review and acquired funding.

Data curation: Zhiqun Gao, Bixiang Cha, Pingping Xu.

Investigation: Rong Shen.

Project administration: Aihong Yuan.

Software: Yinqiu Fan.

Supervision: Jie Shi.

Validation: Youbin Tang.

Writing—original draft: Hongyu Xie.

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