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Effects of Acupuncture and Tuina Combined with Rehabilitation Therapy on Oxidative Stress Response and Motor Function in Stroke Hemiplegia Patients

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Abstract: *Objective:* To explore the effects of acupuncture and tuina combined with rehabilitation therapy on oxidative stress response and motor function in stroke hemiplegia patients. *Methods:* Sixty stroke hemiplegia patients were randomly divided into observation and control groups, with 30 cases each. The control group received conventional rehabilitation therapy, while the observation group also underwent acupuncture and tuina. After 8 weeks of treatment, oxidative stress indicators [malondialdehyde (MDA), superoxide dismutase (SOD), glutathione peroxidase (GSH-Px)], neurological deficit scores (NIHSS), Fugl-Meyer motor function scores (FMA), and activities of daily living (Barthel Index) were compared between the two groups. *Results:* Before treatment, there were no significant differences in MDA, NIHSS scores, FMA scores, and Barthel Index between the two groups ($P > 0.05$). After 8 weeks, the observation group had lower MDA and NIHSS scores, but higher SOD, GSH-Px, FMA scores, and Barthel Index compared to the control group, with statistically significant differences ($P < 0.05$). *Conclusion:* Acupuncture and tuina combined with rehabilitation therapy can effectively improve oxidative stress levels, promote neurological recovery, enhance motor function, and improve daily living activities in stroke hemiplegia patients. This combined therapy is recommended for clinical application.

Keywords: Acupuncture; Tuina; Rehabilitation therapy; Stroke; Hemiplegia

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1. Introduction

Stroke, commonly referred to as “apoplexy,” is a disease characterized by a sudden disruption in cerebral blood circulation. With high incidence, disability, and mortality rates, it has become a major public health issue,

severely threatening human health. Stroke is classified as a common cerebrovascular disease, primarily caused by insufficient or interrupted blood supply to the brain, with sudden onset and severe consequences. Even with timely treatment after onset, it often leaves behind various functional impairments, with hemiplegia being one of the most common [1]. Stroke is one of the leading causes of death and disability, with a complex pathogenesis linked to oxidative stress, inflammatory responses, and apoptosis. After a stroke, the brain tissue develops two regions: the ischemic core and the ischemic penumbra. While neurons in the ischemic core are already necrotic, those in the penumbra can still be salvaged. Timely restoration of blood perfusion to this region can promote nerve cell repair and facilitate recovery of limb function [2,3]. Acupuncture and tuina are external treatment techniques in traditional Chinese medicine (TCM), rooted in ancient medical theory and validated through thousands of years of clinical practice. By applying acupuncture or tuina to disease-related acupoints, these treatments can unblock meridians, regulate qi and blood, activate circulation, and dispel stasis, achieving effects like enhancing righteousness and expelling pathogenic factors. When applied to stroke hemiplegia patients, these methods effectively improve motor function and mobility [4]. Mechanistically, acupuncture likely works by unblocking meridians, regulating qi and blood, and improving local blood circulation, which collectively promotes neurological recovery. Tuina stimulates acupoints and meridians through manual manipulation, relieving muscle spasms and promoting motor recovery. This study aims to investigate the effects of acupuncture and tuina combined with rehabilitation therapy on oxidative stress response and motor function in stroke hemiplegia patients, providing a theoretical basis for clinical treatment.

2. Materials and methods

2.1. General information

Sixty stroke hemiplegia patients treated at our hospital from December 2022 to December 2023 were selected. The inclusion criteria were: (1) meeting the diagnostic criteria for stroke [5], confirmed by CT or MRI; (2) first occurrence of stroke with a course of disease within three months; (3) hemiplegia limb classification of Brunnstrom grade III or above; (4) age no more than 80 years; (5) signed informed consent. Exclusion criteria included: (1) severe dysfunction of the heart, liver, kidneys, etc.; (2) hemorrhagic stroke; (3) cognitive impairment or mental illness; (4) poor compliance and unable to cooperate with treatment.

2.2. Methods

2.2.1. Control group

The control group received conventional rehabilitation therapy, which included the following training and guidance:

(1) Limb function training: including passive movement, active movement, and resistance movement, performed twice daily, 30 minutes each session.

(2) Speech training: including pronunciation training, vocabulary training, and grammar training to improve language abilities, performed twice daily, 30 minutes each session.

(3) Swallowing training: including tongue muscle training, lip muscle training, and pharyngeal muscle training to improve swallowing function, performed three times daily, 10 minutes each session.

(4) Psychological counseling: professional psychological counseling was provided to help patients build confidence in overcoming the disease and alleviate anxiety, performed once daily, 30 minutes each session.

2.2.2. Observation group

In addition to the conventional rehabilitation therapy, the observation group also received acupuncture and tuina treatment:

(1) Acupuncture treatment:

(a) Acupoints: Mainly selected acupoints on the affected side, including head acupoints (e.g., Baihui, Fengchi, Taiyang, Yifeng), upper limb acupoints (e.g., Jianyu, Quchi, Hegu, Shousanli, Waiguan), and lower limb acupoints (e.g., Huantiao, Yanglingquan, Zusanli, Sanyinjiao, Jiexi, Taichong).

(b) Procedure: The patient was placed in a supine or side-lying position, and the acupoints were disinfected. Sterile disposable acupuncture needles (Huatuo Brand, Suzhou Medical Supplies Co., Ltd.) sized 0.30 mm × 40 mm or 0.30 mm × 25 mm were used for rapid needle insertion. After achieving "Deqi" (the sensation indicating effective acupuncture), the needles were retained for 30 minutes. The treatment was performed once daily, five times per week.

(2) Tuina treatment:

(a) Acupoints: Mainly on the affected side, including head acupoints (e.g., Baihui, Taiyang, Fengchi), upper limb acupoints (e.g., Jianjing, Jianliao, Quchi, Hegu, Waiguan), and lower limb acupoints (e.g., Huantiao, Chengfu, Weizhong, Zusanli, Yanglingquan, Jiexi, Taichong).

(b) Procedure: The patient was placed in a supine or side-lying position. The practitioner applied rolling, pressing, kneading, point pressing, pinching, and plucking techniques on the acupoints and affected limbs. Each treatment lasted 30 minutes, performed once daily, five times per week.

2.2.3. Treatment duration

Both groups underwent continuous treatment for eight weeks to assess the efficacy and safety of different rehabilitation measures.

2.3. Observation indicators

2.3.1. Oxidative stress indicators

Before and after treatment, venous blood samples were collected from patients to measure the following oxidative stress-related indicators:

(1) Malondialdehyde (MDA): A marker of lipid peroxidation, MDA levels reflect the degree of oxidative damage in the body.

(2) Superoxide dismutase (SOD): An important antioxidant enzyme. Higher SOD activity indicates stronger antioxidant capacity.

(3) Glutathione peroxidase (GSH-Px): Another key antioxidant enzyme that effectively removes hydrogen peroxide and protects cells from oxidative damage.

2.3.2. Neurological deficit

The National Institutes of Health Stroke Scale (NIHSS) was used to assess the degree of neurological deficit. This scale evaluates various aspects such as consciousness, language, and motor function, resulting in a total score. A higher score indicates more severe neurological deficits.

2.3.3. Motor function

Motor function was assessed using the Fugl-Meyer Assessment (FMA) scale [6]. This scale is specifically designed to evaluate motor recovery, covering both upper and lower limb movement abilities. Higher scores indicate better motor function.

2.3.4. Activities of daily living

The Barthel Index was used to evaluate the patient's ability to perform activities of daily living. This tool assesses the level of independence in daily tasks (e.g., eating, grooming, dressing, toileting). Higher scores indicate stronger daily living abilities and better rehabilitation outcomes.

2.4. Statistical analysis

Data were analyzed using SPSS 25.0 statistical software. Measurement data were expressed as mean ± standard deviation (SD) or [*n* (%)] and subjected to *t*-tests or χ^2 tests. $P < 0.05$ was considered statistically significant.

3. Results

3.1. Comparison of general data between the two groups

There were no statistically significant differences in gender, age, and disease duration between the two groups ($P > 0.05$), as shown in **Table 1**.

Table 1. Comparison of general data between the two groups

Group	*n*	Gender (*n*)		Age (mean ± SD, years)	Average disease duration (mean ± SD, months)
		Male	Female		
Control group	30	12	18	64.25 ± 8.52	2.15 ± 0.81
Observation group	30	14	16	62.85 ± 7.71	2.35 ± 0.87
χ^2 / *t*-value		0.272		0.286	0.922
P-value		0.602		0.776	0.361

3.2. Comparison of oxidative stress indicators before and after treatment between the two groups

Before treatment, there were no significant differences in MDA, SOD, and GSH-Px levels between the two groups ($P > 0.05$). After 8 weeks of treatment, the MDA level in the observation group was significantly lower than in the control group ($P < 0.05$), and the levels of SOD and GSH-Px were significantly higher in the observation group than in the control group ($P < 0.05$), as shown in **Table 2**.

3.3. Comparison of neurological deficit, motor function, and activities of daily living before and after treatment between the two groups

Before treatment, there were no significant differences in NIHSS scores, FMA scores, and Barthel Index between the two groups ($P > 0.05$). After 8 weeks of treatment, the NIHSS score in the observation group was significantly lower than in the control group ($P < 0.05$), and the FMA scores and Barthel Index in the observation group were significantly higher than in the control group ($P < 0.05$), as shown in **Table 3**.

Table 2. Comparison of oxidative stress indicators before and after treatment between the two groups (mean ± SD)

Group	*n*	MDA (μmol/L)		SOD (U/mL)		GSH-Px (U/mL)	
		Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Control group	30	4.51 ± 1.28	4.12 ± 1.02	100.25 ± 14.93	108.04 ± 13.19	21.38 ± 3.79	22.17 ± 3.42
Observation group	30	4.65 ± 1.15	3.28 ± 0.95	102.36 ± 14.26	118.84 ± 13.76	20.31 ± 3.53	26.43 ± 4.10
t-value		0.446	3.318	0.560	3.103	1.132	4.370
P-value		0.658	0.002	0.578	0.003	0.263	< 0.001

Table 3. Comparison of neurological deficit, motor function, and activities of daily living before and after treatment (mean ± SD, points)

Group	*n*	NIHSS score		FMA score		Barthel index	
		Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Control group	30	8.20 ± 2.50	7.18 ± 2.02	44.87 ± 11.64	51.27 ± 9.80	54.61 ± 14.49	60.17 ± 13.42
Observation group	30	8.51 ± 2.34	5.64 ± 1.82	45.32 ± 12.14	62.74 ± 10.54	55.61 ± 3.53	72.56 ± 12.91
t-value		0.496	3.102	0.147	4.365	0.367	3.644
P-value		0.622	0.003	0.884	< 0.001	0.715	< 0.001

4. Discussion

After a stroke, the body's vital energy is damaged, and the depletion of qi and blood leads to a lack of nourishment in the meridians and muscles, resulting in impaired limb movement. Therefore, treatment should focus on stimulating brain function, promoting blood circulation, and unblocking meridians [7]. Acupuncture and massage, as common traditional Chinese medicine therapies, stimulate specific acupuncture points to effectively promote blood circulation, relieve muscle tension, and nourish the meridians. These therapies have been widely used in the treatment of stroke and its complications [8]. Acupuncture can unblock the meridians, regulate qi and blood, improve cerebral blood circulation, and promote the recovery of neurological function. Massage helps relieve muscle spasms and improve limb function. During treatment, acupuncture and massage enhance blood flow in ischemic areas around brain tissue, stimulate neuronal reorganization, activate afferent fibers, enhance the conduction between the central and peripheral nervous systems, reduce oxidative stress damage, and promote the elimination of free radicals, thereby achieving antioxidant effects and significantly improving neurological function [9]. Additionally, these therapies can inhibit the excitability of the spinal cord and neural pathways, stimulate tendon organs between muscles and tendons, reduce the stretch reflex, promote centripetal contraction of muscle fibers, and decrease the excitability of motor neurons, thus alleviating spasms and improving muscle strength [10].

The results of this study indicate that the combination of acupuncture and massage with rehabilitation therapy can significantly reduce serum MDA levels in stroke patients with hemiplegia, while increasing SOD and GSH-Px levels, thereby improving the oxidative stress state. This mechanism may work by regulating the body's neuroendocrine-immune network, enhancing antioxidant capacity, eliminating free radicals, and reducing oxidative stress damage. Furthermore, this combined therapy significantly improved neurological

deficits, motor abilities, and daily living activities in stroke patients with hemiplegia. This may be attributed to the therapy's ability to improve cerebral blood circulation, promote the recovery of neurological function, and relieve muscle spasms, thereby facilitating the recovery of limb function and enhancing the quality of life.

5. Conclusion

In conclusion, the combination of acupuncture and massage with rehabilitation therapy shows good efficacy in improving oxidative stress response and motor function in stroke patients with hemiplegia, making it worthy of clinical promotion.

Disclosure statement

The authors declare no conflict of interest.

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