Special Topic Study

Effect of acupuncture plus Tai Ji Quan on the recovery of neurological function and depression state in post-stroke depression patients

针刺联合太极拳练习对脑卒中后抑郁患者神经功能恢复及抑郁状态的影响

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Abstract
Objective: To observe the therapeutic efficacy of acupuncture plus Tai Ji Quan (Tai Chi) in recovering the neurological function and treating depression state in post-stroke depression patients, together with a 12-month follow-up.
Methods: A total of 105 eligible post-stroke depression patients were randomized into an acupuncture plus Tai Ji group (53 cases) and a control group (52 cases) based on their visiting sequence. The patients all received routine treatment and rehabilitation training for stroke. In addition, the control group was given oral administration of citalopram hydrobromide tablets, 1 month as a course of treatment, for 3 courses in total. Meanwhile, the acupuncture plus Tai Ji group received acupuncture and practiced Tai Ji Quan, for 1 month and 12 months respectively. Before the intervention, after 1-month intervention and 12 months later, the National Institute of Health stroke scale (NIHSS), Barthel index (BI) and Hamilton depression rating scale (HAMD) were adopted for efficacy evaluation.
Results: Prior to the intervention, there were no significant differences in HAMD, NIHSS and BI scores between the two groups (all $P>0.05$); after 1-month intervention, there were significant between-group differences in NIHSS, BI and HAMD scores ($P<0.05$ or $P<0.01$); the 12-month follow-up revealed significant between-group differences in NIHSS, BI and HAMD scores (all $P<0.01$). In the treatment of stroke, the total effective rate was 84.4% in the acupuncture plus Tai Ji group, significantly higher than 68.9% in the control group ($P<0.05$); in the treatment of depression, the total effective rate was 86.7% in the acupuncture plus Tai Ji group, significantly higher than 77.8% in the control group ($P<0.05$).
Conclusion: Acupuncture plus Tai Ji Quan can produce a significant efficacy in improving the limb motor function and depression in post-stroke depression patients.
Keywords: Acupuncture Therapy; Scalp Acupuncture; Scalp Stimulation Areas; Stroke; Poststroke Syndrome; Depression; Tai Ji; Neurologic Deficits

【摘要】目的：观察针刺联合太极拳练习对脑卒中后抑郁患者的神经功能恢复及抑郁状态的疗效及12月后随访。方法：将105名符合纳入标准的脑卒中后抑郁患者按就诊顺序随机分为针刺加太极组(53例)和对照组(52例)。所有患者均进行脑卒中的常规治疗及康复锻炼，对照组口服氢溴酸西酞普兰片片，1个月为1疗程，共治疗3疗程。针刺加太极组接受针刺加太极拳练习治疗，连续针刺治疗1个月，太极拳练习12个月。在治疗前、治疗1月及12个月后随访时采用美国国立卫生研究院卒中量表(NIHSS)、Barthel指数(BI)和汉密尔顿抑郁量表(HAMA)进行疗效评定。结果：治疗前，两组HAMD、NIHSS和BI评分差异均无统计学意义(均$P>0.05$)；治疗1月后，两组NIHSS、BI和HAMD评分差异均有统计学意义($P<0.05$或$P<0.01$)；治疗结束12月后随访时两组NIHSS、BI和HAMD评分均有统计学差异(均$P<0.01$)，脑卒中临床疗效方面针刺加太极组组总有效率为84.4%，高于对照组的68.9% ($P<0.05$)；抑郁疗效方面针刺加太极组总有效率为86.7%，高于对照组的77.8% ($P<0.05$)。结论：针刺联合太极拳练习对脑卒中后抑郁患者肢体功能恢复及抑郁症状的疗效显著。
【关键词】针刺疗法；头针；头针刺激区；中风；中风后遗症；抑郁；太极；神经功能缺损
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Post-stroke depression (PSD) is a common complication after stroke, with an incidence up to 30%-50%[1], mainly manifested by persistent low mood, loss of interest, and even abnormal behavior or suicide attempt[2]. PSD not only directly influences the rehabilitation, but also brings heavy burden to family and society. Intervention in early stage is significant in preventing and treating PSD. Our research group adopted acupuncture plus Tai Ji Quan in treating PSD, and the report is given as follows.

1 Clinical Materials

1.1 Diagnostic criteria

1.1.1 Diagnostic criteria of Western medicine

The diagnostic criteria of stroke referred to *Chinese Prevention and Treatment Guidance for Cerebrovascular Diseases*[3]; the diagnostic criteria of depression referred to the *Chinese Classification and Diagnosis of Mental Diseases*-3 (CCMD-3)[4].

1.1.2 Pattern differentiation criteria of traditional Chinese medicine (TCM)

The TCM pattern differentiation criteria were based on the differentiation criteria of depression syndrome in the *Criteria of Diagnosis and Therapeutic Effects of Diseases and Syndromes in Traditional Chinese Medicine*[5].

1.2 Inclusion criteria

Conforming to the above diagnostic criteria of both Western and Chinese medicine; head CT or MRI records available; the score of Hamilton depression rating scale (HAMD) ≥17; muscle strength of the affected limb ≥ grade Ⅲ, and the grading of modified Ashworth scale ≤ grade Ⅰ; age ≤75 years old; not on any psychotropic substances during the recent 2 weeks prior to the recruitment; approved of the treatment protocol and signed the informed consent form.

1.3 Exclusion criteria

Accompanied by systemic and primary diseases such as tumor, hematological and endocrine systems, or severe organic disorders involving heart, liver and kidney; those unable to cooperate due to severe mental retardation, speech dysfunction or mental disorders; with a history of psychosis.

1.4 Rejection criteria

Those with poor compliance, unable to strictly follow the treatment protocol; those lost to follow-up, quitted, or with incomplete information; those who used other medications during the research that may affect the study results.

1.5 Statistical method

The SPSS 21.0 version software was used for statistical analysis. The measurement data were expressed by mean ± standard deviation ($\bar{x} \pm s$), and analyzed by t-test if the data conformed to normal distribution and homogeneity of variance; nonparametric test was used when the data were of abnormal distribution and heterogeneity of variance. The enumeration data were analyzed by Chi-square test; the ranked data by rank-sum test. $P<0.05$ was considered to indicate a statistical significance.

1.6 General data

The patients were all diagnosed with post-stroke depression and recruited from the Stroke Department, the Second Affiliated Hospital of Hunan University of Chinese Medicine between September of 2014 and June of 2016. Initially, there were 200 subjects enrolled, but only 105 conformed to the inclusion criteria and were then randomized into a group of acupuncture plus Tai Ji (53 cases) and a control group (52 cases) based on the visiting sequence. However, at the end of the intervention, only 90 subjects completed the study and were recruited for statistical analysis, 45 cases in each group. The flow chart of the whole study is shown in Figure 1.
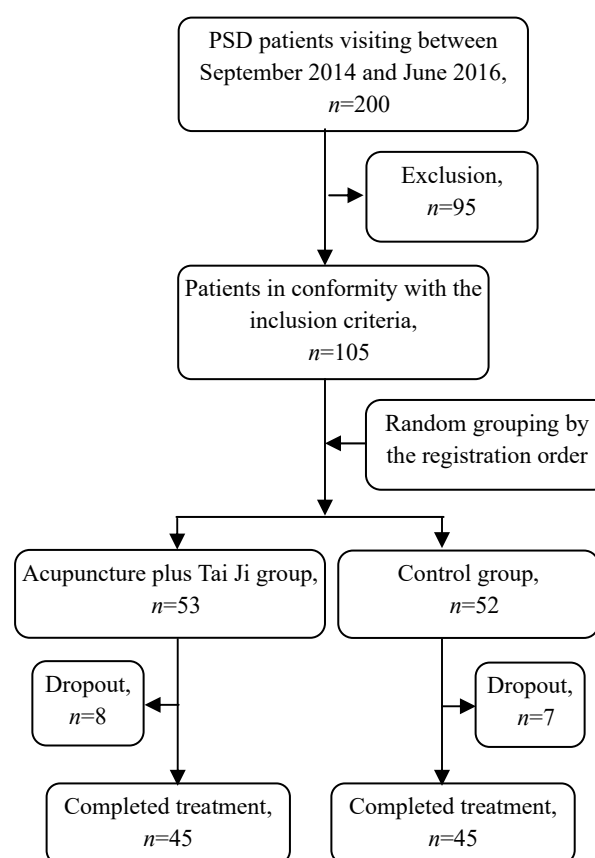

Figure 1. Study flow chart

There were no significant differences in the data of age, gender, disease duration and stroke type between the two groups ($P>0.05$), indicating the comparability (Table 1).

Table 1. Comparison of the general data

Group	n	Gender (case)		Average age ($\bar{x} \pm s$, year)	Average duration ($\bar{x} \pm s$, day)	Stoke type (case)	
		Male	Female			Cerebral infarction	Cerebral hemorrhage
Acupuncture plus Tai Ji	45	27	18	63.7±6.8	24.1±5.4	28	17
Control	45	25	20	62.4±7.6	21.9±4.8	26	19

2 Treatment Methods

All the subjects were given routine and basic treatment for stroke by following the *Chinese Prevention and Treatment Guidance for Cerebrovascular Diseases*[3], together with rehabilitation if necessary and possible.

2.1 Acupuncture plus Tai Ji group

2.1.1 Acupuncture treatment

The acupuncture treatment was conducted on the purpose of awakening the brain and opening the orifices.

Points or areas on the head: Middle Line of Forehead (MS 1), Anterior Oblique Line of Vertex- temporal (MS 6), Baihui (GV 20), Sishencong (EX-HN 1), Shenting (GV 24) and Yintang (GV 29).

Body points: Bilateral Shenmen (HT 7), Neiguan (PC 6), Taichong (LR 3) and Hegu (LI 4); Chize (LU 5), Quchi (LI 11), Shousanli (LI 10), Fengshi (GB 31), Xuehai (SP 10), Yanglingquan (GB 34) and Qiuxu (GB 40), all on the affected side.

Adjunct points based on pattern differentiation: Fenglong (ST 40) was added for pattern of wind-phlegm obstructing collaterals; Zusanli (ST 36) for pattern of qi deficiency and blood stagnation.

Method: The points were located according to the *Nomenclature and Location of Acupuncture Points* (GB/T12345-2006)[6]. Patient took a supine position. After proper sterilization for the to-be-treated areas, disposable filiform needles of 0.35 mm in diameter and 25 mm or 40 mm in length were used for acupuncture. For points on the head, needles were inserted horizontally by 5-15 mm; for body points, needles were punctured perpendicularly by 10-15 mm, according to the thickness of muscles in the area. When needling qi was obtained, even reinforcing-reducing manipulation (twirling manipulation for points on the head; lifting-thrusting and twirling manipulations for points on limbs) were performed for 1-3 min. The needles were then retained for 30 min. Five successive sessions of acupuncture treatment were given every week followed by a 2-day interval. One-month treatment was taken as a course, and the patients were given 1 course of treatment in total.

2.1.2 Tai Ji Quan practice

The patients were taught and guided to practice Yang's 24-form simplified Tai Ji Quan (Figure 2-Figure 25) by professional teachers during hospitalization. They were also supervised and guided via telephone after discharged from hospital. The Tai Ji Quan practice was performed 5 times a week, 40 min each time, for 12 months in total.

Figure 2. Beginning form

Figure 3. Part wild horse's mane

Figure 4. A white crane spreads its wings

Figure 5. Brush knee and step forward

Figure 6. Play the lute

Figure 7. Reverse reeling forearm

Figure 8. Left grasp sparrow's tail

Figure 9. Right grasp sparrow's tail

Figure 10. Single whip

Figure 11. Wave hands like clouds

Figure 12. Single whip

Figure 13. High pat on horse

Figure 14. Right heel kick
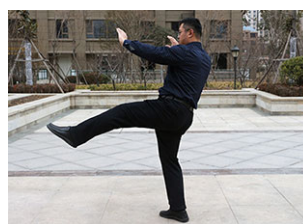
Figure 15. Strike to ears with both fists

Figure 16. Turn body and left heel kick

Figure 17. Left lower body and stand on one leg

Figure 18. Right lower body and stand on one leg

Figure 19. Shuttle back and forth

Figure 20. Needle at sea bottom

Figure 21. Fan through the back

Figure 22. Turn body, deflect, parry and punch

Figure 23. Appears closed

Figure 24. Cross hands

Figure 25. Closing form

2.2 Control group

Patients in the control group were asked to orally take citalopram hydrobromide tablets (lot No. H20120457, Xi'an Janssen Pharmaceutical Co. Ltd., China), at 20 mg/d but tailored by 10 mg each week according to the patient's condition (no more than 40 mg/d). One-month treatment was taken as a course, and a total of 3 courses were observed. If the treatment was satisfactory, the dosage of the medication would be reduced by 10 mg per week till termination. A 1-year follow-up study was conducted.

3 Therapeutic Observation

3.1 Observation items

Each observation item was scored prior to the treatment, after 1-month treatment, and 12 months later, respectively.

3.1.1 National Institutes of Health stroke scale (NIHSS)[7]

NIHSS is composed of 11 items including level of consciousness, horizontal eye movement, visual field test, facial palsy, motor arm, motor leg, limb ataxia, and sensory, etc. Each item scores a specific ability. The total score ranges from 0 to 42. A higher score is indicative of a severer neurologic deficit. A score from 0-1: no stroke symptoms; 1-4: minor stroke; 5-15: moderate stroke; 16-20: moderate to severe stroke; 21-42: severe stroke.

3.1.2 Barthel index (BI)[7]

BI consists of 10 variables, which are feeding, bathing, grooming, dressing, presence or absence of fecal incontinence, presence or absence of urinary incontinence, walking, and climbing stairs, etc. Each item is scored according to the level of accomplishment in order to evaluate the activities of daily living (ADL). The maximum total BI score is 100, and a higher score

indicates a higher level of independence. Total BI score >60 points: mild dysfunction; 60-41 points: moderate dysfunction; ≤40 points: severe dysfunction.

3.1.3 HAMD[4]

HAMD contains 24 items, such as depressed mood, feelings of guilt, difficulty in falling asleep, anxiety-psychic, insight and feelings of despair, to estimate the severity of depression. A higher total HAMD score is indicative of severer depression. Total HAMD score <8 points: no depression; ≥8 points but <20 points: possible existence of depression; ≥20 points but <35 points: mild or moderate depression; ≥35 points: severe depression.

3.2 Criteria of therapeutic efficacy

The evaluation of clinical efficacy in improving neurological function referred to the criteria of therapeutic efficacy for stroke recommended by the World Health Organization (WHO)[7], i.e. by taking the reduction rate of NIHSS score as the evaluation index. Reduction rate of NIHSS score = (Pre-treatment total NIHSS score − Post-treatment total NIHSS score) ÷ Pre-treatment total NIHSS score × 100%.

Basically recovered: Reduction rate of NIHSS score ≥91%.

Markedly effective: Reduction rate of NIHSS score ≥46% but <91%.

Effective: Reduction rate of NIHSS score ≥18% but <46%.

Failure: Reduction rate of NIHSS score <18%, or NIHSS score increased rather than dropped.

The evaluation of efficacy in treating depression was based on the reduction rate of HAMD score[4]. Reduction rate of HAMD score = (Pre-treatment total HAMD score − Post-treatment total HAMD score) ÷ Pre-treatment total HAMD score × 100%.

Recovered: Reduction rate of HAMD score ≥75%.

Markedly effective: Reduction rate of HAMD score ≥50% but <75%.

Effective: Reduction rate of HAMD score ≥25% but <50%.

Failure: Reduction rate of HAMD score <25%.

3.3 Results

3.3.1 Comparison of NIHSS score

NIHSS score decreased after 1-month treatment as well as in the 12-month follow-up in both groups compared to the score before the intervention, with statistical significances (all $P<0.01$). Before the treatment, there was no significant difference in NIHSS score between the two groups ($P>0.05$); after 1-month treatment, the between-group difference in the score was statistically significant ($P<0.05$); the 1-year follow-up showed that there was a significant difference in NIHSS score between the two groups ($P<0.01$), (Table 2).

3.3.2 Comparison of the clinical efficacy in treating stroke

The 12-month follow-up study showed that the total effective rate in treating stroke was 84.4% in the acupuncture plus Tai Ji group, versus 68.9% in the control group, and the between-group difference was statistically significant ($Z=−2.418$, $P=0.016$), suggesting that the acupuncture plus Tai Ji group should be superior to the control group in comparing the therapeutic efficacy (Table 3).

3.3.3 Comparison of BI score

BI score was found increased in both groups after 1-month treatment and in the 12-month follow-up study compared with the score before the treatment, with statistical significances (all $P<0.01$). Before the treatment, there was no significant difference in BI score between the two groups ($P>0.05$); the between-group difference in BI score was statistically significant after 1-month treatment and in the follow-up study (both $P<0.01$), (Table 4).

Table 2. Comparison of NIHSS score ($\overline{x} \pm s$, point)

Group	n	Pre-treatment	After 1-month treatment	Follow-up
Acupuncture plus Tai Ji	45	11.82±5.06	6.26±3.18[1)2)]	2.17±1.26[1)3)]
Control	45	12.43±4.81	7.86±3.29[1)]	5.24±3.12[1)]

Note: Intra-group comparison, 1) $P<0.01$; compared with the control group at the same time point, 2) $P<0.05$, 3) $P<0.01$

Table 3. Comparison of the clinical efficacy in treating stroke (case)

Group	n	Basically recovered	Markedly effective	Effective	Failure	Total effective rate (%)
Acupuncture plus Tai Ji	45	14	12	12	7	84.4
Control	45	7	8	16	14	68.9

Table 4. Comparison of BI score ($\overline{x}$ ±s, point)

Group	n	Pre-treatment	After 1-month treatment	Follow-up
Acupuncture plus Tai Ji	45	55.91±6.41	68.21±6.33[1)2)]	79.73±6.94[1)2)]
Control	45	56.12±6.36	62.28±5.76[1)]	72.43±7.31[1)]

Note: Intra-group comparison, 1) $P<0.01$; compared with the control group at the same time point, 2) $P<0.01$

3.3.4 Comparison of HAMD score

HAMD score was found decreased after 1-month treatment as well as in the 12-month follow-up in both groups compared to the score before the intervention, with statistical significances (all $P<0.01$). Before the treatment, there was no significant difference in HAMD score between the two groups ($P>0.05$); the between-group difference in HAMD score was statistically significant after 1-month treatment and in the follow-up study (both $P<0.01$), (Table 5).

3.3.5 Comparison of therapeutic efficacy in treating depression

The 12-month follow-up showed that the toal effective rate in treating depression was 86.7% in the acupuncture plus Tai Ji group, versus 77.8% in the control group, and the between-group difference was statistically significant ($Z=-2.056$, $P=0.040$), indicating that the acupuncture plus Tai Ji group should be superior to the control group in treating depression (Table 6).

Table 5. Comparison of HAMD score ($\overline{x}$ ±s, point)

Group	n	Pre-treatment	After 1-month treatment	Follow-up
Acupuncture plus Tai Ji	45	25.60±4.44	12.33±4.72[1)2)]	6.31±3.21[1)2)]
Control	45	24.44±4.58	15.68±4.59[1)]	8.26±3.32[1)]

Note: Intra-group comparison, 1) $P<0.01$; compared with the control group at the same time point, 2) $P<0.01$

Table 6. Comparison of the therapeutic efficacy in treating depression

Group	n	Recovered	Markedly effective	Effective	Failure	Total effective rate (%)
Acupuncture plus Tai Ji	45	13	12	14	6	86.7
Control	45	6	10	19	10	77.8

4 Discussion

Patients after stroke may experience emotional dysfunctions, such as PSD and anxiety. The pathogenesis of PSD is not completely clear yet, though it possibly involves brain injuries, neurologic deficit[8-10], stress response, and irregular secretion of neurotransmitters including norepinephrine (NE), 5-hydroxytryptamine (5-HT) and dopamine (DA)[11].

Treatment for PSD mainly includes medication, psychotherapy, and behavioral therapy. Medication is the most popular treatment, and selective serotonin reuptake inhibitors (SSRIs) are often used, though it may cause side effects or adverse events, such as mouth dryness, poor appetite, dizziness, and insomnia[12]. PSD belongs to the scope of depression syndrome in TCM, and phlegm and stasis obstructing meridians and collaterals, and yin-yang and qi-blood imbalance are considered to be the basic pathogenesis. PSD affects the brain, with wind-phlegm obstructing collaterals and disharmonious qi-blood as the root cause and liver-qi stagnation as the superficial cause. Therefore, the treatment should focus on soothing liver and relieving depression, calming mind and opening orifices,

regulating qi and activating blood circulation to unblock collaterals. Acupuncture has been extensively used in rehabilitation for stroke[13-16]. It's known that acupuncture-moxibustion is effective for PSD, with minor adverse reactions. It can boost the recovery of neurological function and improve depression symptoms, which has been well verified at home and abroad[13-16]. Waiguan (TE 5), Hegu (LI 4), Baihui (GV 20), Quchi (LI 11) plus Chize (LU 5) can produce a significant efficacy in improving the limb function in stroke[17-18]. Modern mechanism research has found that acupuncture can protect brain neurons, inhibit cell apoptosis[19], promote the establishment of compensatory circulation[20], increase blood supply to brain, and modulate blood lipids[21]. Meanwhile, as a safe effective treatment for PSD[22-23], acupuncture may play its role via regulating neurotransmitters such as NE, 5-HT and DA[24-25].

In this study, points on the head were selected according to the function zones of brain and the routes of meridians: Middle Line of Forehead (MS 1) governs emotions; Anterior Oblique Line of Vertex-temporal (MS 6) is in charge of motor function; Baihui (GV 20), a point of Governor Vessel, acts to open orifices and

awaken brain; Sishencong (EX-HN 1), Shenting (GV 24) and Yintang (GV 29) can calm the mind and open orifices, regulate and unblock meridians and collaterals. Of the selected body points, Neiguan (PC 6), the Luo-Connecting point of the Pericardium Meridian, and Shenmen (HT 7), the Yuan-Primary point of the Heart Meridian, can soothe the heart and calm the mind; Taichong (LR 3) can soothe the liver, resolve depression and regulate qi. Among all the body points, the points of Yangming meridians were mostly selected since these meridians are rich in qi and blood. Points around the affected joints were also used, including Chize (LU 5), Quchi (LI 11) and Shousanli (LI 10) on the upper limb, and Fengshi (GB 31), Xuehai (SP 10), Yanglingquan (GB 34) and Qiuxu (GB 40) on the lower limb, to regulate qi, activate blood flow and unblock collaterals. These points were used together to soothe the liver and resolve depression, calm the mind and open orifices, regulate qi and activate blood flow to unblock collaterals.

Tai Ji Quan originates in China and has a long history. It's composed of three factors, physical practice, mind practice and qi practice, which integrate both mental regulation and physiological regulation, and conform to the holism theory in TCM. During the practice of Tai Ji Quan, practitioners always have a high subjectivity, and such an active exercise can boost the activity of the motor center in cerebral cortex, increase the nerve excitability and promote the recovery of limb function[26]. Hart J, et al[26] found that Chen's Tai Ji can help recover the balance function. McGibbon CA, et al[27] discovered that Yang's Tai Ji can regulate the pattern of nerve and muscle movement, promote the restoration of patient's function, and improve depression and anxiety. Wang W, et al[28] found that Yang's Tai Ji can help the recovery of cognition after stroke, and improve sleep quality and depressive symptoms. Li Y, et al[29] and Rosenbaum S, et al[30] revealed that Tai Ji Quan in community sports can regulate neurotransmitters such as NE, 5-HT and DA, and a long-term practice can achieve an even better result. Therefore, the current study aimed to observe the short-term (1 month) and long-term (12 months) effects of acupuncture plus Tai Ji Quan in recovering neurological function and mental health in PSD, for achieving an aggregate treatment, merging the rehabilitation of hospital, community and family, and displaying the advantage of TCM.

Subjects recruited in this trial were majorly in sub-acute and remission stages with moderate-severe depression. During the study, we found that the rhythm, consistency and even speed of Tai Ji Quan enabled the patients to better control the muscles of upper and lower limbs. In clinic, patients with high muscle tension, spasm and low muscle strength can start from easy forms and practice gradually, to promote the

disengaging movement and reduce spasm. The results after 1-month treatment and the 12-month follow-up all showed that acupuncture plus Tai Ji Quan is effective in restoring the limb function and improving depression in PSD patients, and thus it's worthy of further promotion.

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