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Contralateral needling at unblocked collaterals for hemiplegia following acute ischemic stroke

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Research Highlights

(1) Hemiplegia caused by stroke indicates the dysfunctions of the neurological network between the brain and limbs. Under this condition, conventional acupuncture at the acupoints on the affected side can not transmit stimulus signal to the brain. Contralateral needling at unblocked collaterals can transmit signal into the brain and then regulate the affected limb.

(2) This study performed contralateral needling at acupoints *Chize* (LU5) and *Jianliao* (TE14) in 106 stroke patients presenting complete hemiplegia and found that contralateral needling at these two acupoints can significantly promote the recovery of affected limb function of stroke patients with therapeutic effects superior to conventional acupuncture.

Abstract

Hemiplegia caused by stroke indicates dysfunction of the network between the brain and limbs, namely collateral shock in the brain. Contralateral needling is the insertion of needles into acupoints on the relative healthy side of the body to treat diseases such as apoplexy. However, there is little well-designed and controlled clinical evidence for this practice. This study investigated whether contralateral needling could treat hemiplegia after acute ischemic stroke in 106 randomly selected patients with acute ischemic stroke. These patients were randomly assigned to three groups: 45 in the contralateral needling group, receiving acupuncture on the unaffected limbs; 45 in the tional acupuncture group, receiving acupuncture on the hemiplegic limbs; and 16 in the control group, receiving routine treatments without acupuncture. Acupuncture at acupoints *Chize* (LU5) in the upper limb and *Jianliao* (TE14) in the lower limb was performed for 45 minutes daily for 30 consecutive days. The therapeutic effective rate, Neurological Deficit Score, Modified Barthel Index and Fugl-Meyer Assessment were evaluated. The therapeutic effective rate of contralateral needling was higher than that of conventional acupuncture (46.67% vs. 31.11%, $P < 0.05$). The neurological deficit score of contralateral needling was significantly decreased compared with conventional acupuncture ($P < 0.01$). The Modified Barthel Index and Fugl-Meyer Assessment score of contralateral needling increased more significantly than those of conventional acupuncture (both $P < 0.01$). The present findings suggest that contralateral needling unblocks collaterals and might be more effective than conventional acupuncture in the treatment of hemiplegia following acute ischemic stroke.

Key Words

neural regeneration; acupuncture; stroke; hemiplegia; collateral; neurological function; cerebral ischemia; grants-supported paper; neuroregeneration

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INTRODUCTION

Stroke has become the leading cause of total adult deaths in China^[1]. The consensus surrounding stroke treatment is that early rehabilitative intervention may determine the outcome of neurological rehabilitation^[2]. Hemiplegia caused by stroke indicates the dysfunction of the neurological network between the brain and limbs, namely collateral shock in the brain and any part of the movement control system^[3-4].

Collateral disease theory^[3], a modern branch of traditional Chinese medicine, is a clinical discipline within the studies of traditional Chinese medicine that focuses on pathology of the collateral system^[4-5]. Collaterals are transversely divergent branches of the 12 regular channels that form a multi-layer network system that maintains the vital activities and homeostasis of the body. Collateral disease appears extensively in tractable internal diseases, miscellaneous diseases, and severe conditions that are contracted externally. The appearance of affected collaterals refers to the functional impairment or structural damage to the collateral vessels due to any pathogenic factors^[5]. Collateral diseases refers to the specific pathogenic factors affecting the collateral system, including secondary pathological changes of *zang* and *fu* tissues (viscera, the large organs inside the body, such as the heart, liver, and stomach).

Acupuncture therapy was also based mainly on channel theory, later developing into an independent clinical discipline^[6-9]. For generations, physicians have emphasized channel theory while devaluing the collaterals; therefore, an in-depth study into collateral disease was rarely considered^[5]. Unlike 12 regular channels, collaterals do not have a specific running course, so our understanding of their pathology is much less clear. Actually, the state of science and technology at that period in history naturally prevented academic study of the microscopic realm. Furthermore, a clear scientific explanation of collaterals and their pathological changes cannot be obtained through the traditional inspection me-

thod. This also greatly limits the development of collateral disease theory^[4-5]. However, the rapid development of modern science and technology and breakthroughs in biomedical microscopy now make it possible for us to study the physiological actions and pathological changes of collaterals from the viewpoint of modern reductionism^[5]. The establishment of a system of syndrome differentiation and treatment for collateral disease can help improve therapeutic efficacy in the treatment of biomedical diseases^[4-5].

Acupuncture for stroke treatment has long been accepted in many countries, including China^[10-11], and has been enrolled in the catalog of fundamental medical care in China for decades^[12]. However, acupuncture methods vary with different physicians. Therefore, therapeutic efficacy has varied largely^[13-16]. There is little evidence supporting the effectiveness of acupuncture in the treatment of stroke, mainly because of poor methodological quality and small sample size. Further high-quality, randomized controlled trials with long-term follow-up are needed and economic analysis is necessary^[17].

It is accepted in traditional Chinese medicine from the oldest *Nei Jing* that contralateral needling is more effective than conventional acupuncture in the treatment of stroke^[18]. Therefore, it is reasonable to expect that contralateral needling may have a predominant clinical therapeutic effect^[19]. However, there is little evidence from randomized controlled clinical trials^[20-23]. Although systematic review of acupuncture interventions has been published in Chinese journals, the reporting quality is troubling^[24-25]. This study was designed to evaluate the efficacy of contralateral needling in the treatment of acute ischemic stroke.

RESULTS

Quantitative analysis of participants

A total of 115 first-time onset acute ischemic stroke patients were included in this study.

According to exclusion criteria, nine patients were rejected and the remaining 106 patients with unilateral complete hemiplegia received basal treatment and were then assigned to three groups: 45 in the contralateral needling group (acupuncture on the unaffected side), 45 in the conventional acupuncture group (routine acupuncture), and 16 in the non-acupuncture group (no acupuncture). All 106 patients were included in the final analysis.

Baseline data

The general conditions of the patients in age, stroke onset and illness course were strictly controlled according to the study design. No significant differences in age, stroke onset and illness course were observed among the three groups (Table 1).

Table 1 Patient demographics on admission

Item	Contralateral needling group (n = 45)	Conventional acupuncture group (n = 45)	Control group (n = 16)
Sex (male/female, n)	22/23	21/24	7/9
Age (mean ± SD, year)	55.3±5.1	54.8±5.0	55.9±5.9
Illness course (mean ± SD, day)	1.0±0.9	1.0±0.9	1.1±1.0
Ischemic basal ganglia and cortex [n(%)]	40(88.9)	43(95.6)	13(81.3)
Body mass index (mean ± SD, kg/m ²)	30.6±2.7	29.9±8.9	30.6±9.0
Hypertension [n(%)]	40(88.9)	41(91.1)	13(81.3)
Type 2 diabetes [n(%)]	40(88.9)	41(91.1)	10(62.5)

There was no significant difference in baseline data among the three groups. The chi-square test was used to compare proportions, and the independent samples *t*-test was used to compare continuous variables.

Comparison of total effective rate among groups

The total effective rate was assessed according to Disease Diagnosis and Cure Standards issued by the Ministry of Health of the Chinese People's Liberation Army General Logistics Department^[26]. After 30-day treatment, the total effective rates in the contralateral needling, conventional acupuncture and control groups were 46.67% (21/45), 31.11% (14/45) and 18.75% (10/45), respectively. There was a significant difference in total effective rate among the three groups ($P < 0.05$).

Comparison of neurological function among groups

Statistical results showed that before treatment, there was no significant difference in Neurological Deficit Score (NDS) among the contralateral needling^[27], conventional acupuncture and control groups. After 30-day treatment, NDS was decreased in all patients ($P < 0.01$). Compared with the control group, NDS in the contralateral needling and conventional acupuncture groups was

significantly decreased ($P < 0.01$), and the decrease in NDS was more obvious in the contralateral needling group ($P < 0.01$; Table 2).

Table 2 Effects of contralateral needling on Neurological Deficit Score in patients with acute ischemic stroke

Group	n	Before treatment	After treatment
Contralateral needling	45	34.3±1.6 ^a	22.3±2.1 ^{bc}
Conventional acupuncture	45	34.0±2.2 ^a	27.0±1.6 ^b
Control	16	34.9±1.7 ^a	30.5±1.7

^a $P < 0.01$, vs. after treatment (paired *t*-test); ^b $P < 0.01$, vs. control group (after treatment, one-way analysis of variance and Dunnett's test); ^c $P < 0.01$, vs. conventional acupuncture group (after treatment, one-way analysis of variance and Dunnett's test). Data are expressed as mean ± SD. A score of 0 indicates no neurological injury. Higher scores reflect more severe neurological injury.

Comparison of activities of daily living (ADL) among groups

The Modified Barthel Index (MBI) is regarded as a good indicator of the ADL of stroke patients. A score of 100 points indicates no neurological injury and 0 points indicates severe neurological injury^[28]. In this study, before treatment, MBI averaged 35 points, indicating that patients' MBI was at the severe injury level (Figure 1).

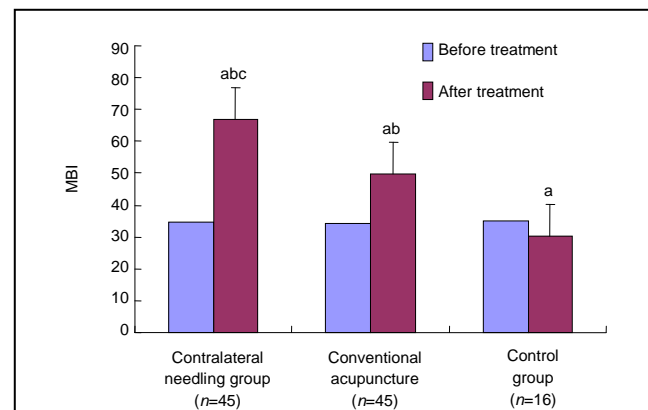


Figure 1 Effects of contralateral needling on Modified Barthel Index (MBI) in patients with acute ischemic stroke.

^a $P < 0.01$, vs. after treatment (paired *t*-test); ^b $P < 0.01$, vs. control group (after treatment, one-way analysis of variance and Dunnett's test); ^c $P < 0.01$, vs. conventional acupuncture group (after treatment, one-way analysis of variance and Dunnett's test). Data are expressed as mean ± SD. An MBI score of 100 indicates normal and a score of 0 indicates severe injury.

There was no significant difference in the average MBI score before treatment among the contralateral needling, conventional acupuncture and control groups ($P > 0.05$). After 30-day treatment, compared with before treatment, the MBI in the contralateral needling and conventional acupuncture groups increased significantly ($P < 0.01$),

but the MBI in the control group was not significantly altered ($P > 0.05$). The MBI in the conventional acupuncture group and in particular in the contralateral needling group was significantly increased compared with the control group ($P < 0.01$). These findings suggest that both contralateral needling and conventional acupuncture were better than no acupuncture in improving ADLs.

Effect of acupuncture on motor function in patients with acute ischemic stroke

Before treatment, the Fugl-Meyer Assessment (FMA) score averaged less than 50 points, which indicates that the patients had severe motor disorders as shown in Figure 3. Before treatment, there was no significant difference in average FMA scores among the contralateral needling, conventional acupuncture and control groups ($P > 0.05$). After 30-day treatment, FMA increased significantly in three groups ($P < 0.05$ or $P < 0.01$). The FMA score in the conventional group, and in particular in the contralateral needling group was significantly higher than that in the control group ($P < 0.05$ or $P < 0.01$; Table 5). These results suggest that contralateral needling was better than conventional acupuncture in improving the motor function of hemiplegic limbs after ischemic stroke (Table 3).

Table 3 Effect of contralateral needling on Fugl-Meyer Assessment (FMA) score in patients with acute ischemic stroke

Group	n	Before treatment	After treatment
Contralateral needling	45	39.15±3.05	81.95±4.45 ^{ac}
Conventional acupuncture	45	39.65±3.35	71.30±4.93 ^{ad}
Control	16	40.05±3.82	57.45±4.32 ^b

^a $P < 0.01$, ^b $P < 0.05$, vs. before treatment (paired *t* test); ^c $P < 0.01$, ^d $P < 0.05$, vs. control group (after treatment, one-way analysis of variance and Dunnett's test); ^e $P < 0.01$, vs. conventional acupuncture group (after treatment, one-way analysis of variance and Dunnett's test). Data are expressed as mean ± SD. An FMA score of 100 indicates normal and a score of 0 indicates severe injury. The FMA before treatment was averaged less than 50 points, which indicates that the patients have severe motor disorders.

DISCUSSION

Contralateral needling following ischemic stroke may produce better therapeutic effects than conventional acupuncture in the treatment of apoplexy and Bell's palsy (idiopathic facial paralysis)^[29-33]. It is not very difficult to understand that conventional acupuncture at the regular dose would produce no response if the acupoints were on the choked meridian. By contrast, acupuncture at the

healthy meridians would move the healthy meridians and vessels to expel the pathogenic factors and to rectify the abundant or downward *qi* and blood. Therefore, contralateral needling would regulate the disturbed *qi* and blood, thus finally balancing *yin* and *yang*^[34].

The *qi* collaterals function to transport channel-*qi*, warm, nourish, and defend the body, convey information, and regulate vital activities. The vessel collaterals function to transport blood, nourish the body, supply *qi* and blood, perform fluid-blood transformation, and fulfill nutritive metabolism. Traditional Chinese medicine holds that "*qi* is the commander of blood, and blood is the mother of *qi*", where the close relationship between *qi* and blood leads to high correlation between the functions of *qi* and vessel collaterals. Based on the relationships between *qi* collaterals and neuroendocrine-immunological regulation, and also between vessel collaterals and medium or small-sized capillary microcirculation, the "*qi* collateral-*NEI* (nerve, endocrine and immune) network and the "vessel collateral-vascular system" were re-established^[34-38].

Apparently, smoothly functioning collateral and normal circulation of *qi* and blood are the very foundations of vital activities. Owing to the structural characteristics of collaterals, such as transverse divergence, multi-layer subdivision, a thready and narrow shape, and reticular distribution, the *qi* and blood in the collaterals circulates slowly and diffuses extensively. These qualities also determine the pathogenic features and concepts of collateral diseases, such as susceptibility to stagnation and stasis, ease in entering and difficulty in exiting, and susceptibility to masses. The possible pathological changes include collateral-*qi* stagnation (deficient stagnation), stasis obstruction of the collaterals, contracture of the collaterals, and stasis blockage of collaterals. The underlying nature of collateral disease is "blockage".

The ultimate aims of traditional Chinese medical therapies are to remedy defects, regulate *yin-yang* balance, and to restore the normal physiological state of the body. The *Nei Jing* states, "When analyzing the pathogenesis, one must begin from the five *zangs*, and then regulate *qi* and blood circulation to obtain balance". Since the collaterals are passageways of *qi* and blood circulation, the fundamental purpose in the treatment of collateral disease is to keep the collateral smooth. The general principle of "unblocking the collaterals" exactly targets the physiological characteristics of the collateral disease^[3].

Despite the general principle of unblocking the collaterals, collateral unblocking methods can vary according to the

differences in etiological factors, pathological patterns, and clinical manifestations. The *Yi Xue Zheng Zhuan* (Orthodox Transmission of the Study of Medicine) by Shizong Gao (Qing Dynasty) reports, "There are varieties of collateral-unblocking methods. For example, regulating *qi* to harmonize blood or regulating blood to harmonize *qi*, up-regulating the adverse down-bearing *qi*, or reinforcing the body's resistance to disease"^[39]. The pathological state of the collateral disease can be regulated by eliminating the etiological factors, unblocking collaterals with collateral-entering medicinals, and dealing with the secondary pathological changes of *zang-fu* tissues. The etiological factors of collateral disease include six external pathogenic factors, epidemic *qi*, and retention of phlegm, chronic disease or pain.

Therefore, the treatment methods include regulating *qi*, supplementing *qi*, removing wind, dissipating cold, resolving phlegm and dampness, and removing toxic substance. Besides removing the etiological factors, collateral-unblocking medicinals such as acrid-property herbs, worms, insects, and vines can be added to improve clinical efficacy. These medicinals have been summarized by physicians from Zhongjing Zhang to Tianshi Ye, and they act to directly unblock the collaterals. Since collateral disease may also cause secondary pathological changes of *Zang-fu* organs, bones, tendons, muscles, and skin, medicinals that can repair these secondary pathological changes should be selected as well. Collateral disease can occur in different pathological states and manifest in different patterns, such as collateral-*qi* stagnation (deficient stagnation), stasis obstruction of the collaterals, contracture of the collaterals, stasis blockage of collaterals, retention of toxic-heat in the collaterals, collateral masses, impairment of the collaterals, and malnourishment of the collaterals. Consequently, all of the above factors should be taken into consideration in the determination of an appropriate treatment strategy and formula.

Previous experiences in the use of collateral-unblocking medicinals have certain academic value in the treatment of collateral diseases^[3-4]. It is of great theoretical and clinical significance for explaining the nature of collateral disease and for improving clinical efficacy to investigate the mechanism of action of these medicinals by means of modern experimental methods. However, these methods are still in their preliminary stages, possibly because there is no systematic theoretical system on collaterals and collateral disease, and also because paradoxical phenomena sometimes occur as a result of there being no standardized classification criteria for these

medicinals.

Unlike twelve regular channels, collaterals do not have a specific running course; thus, understanding of their pathology is much less clear. The state of science and technology during ancient times prevented academic study of the microscopic realm. A clear scientific explanation of collaterals and their pathological changes cannot be obtained through the traditional inspection method. This limited the development of collateral disease theory. This unique acupuncture named as contralateral needling is originally recorded in Chapter 63 of Plain Questions, *Nei Jing* (Internal Classic), an ancient traditional Chinese medical text. The main purpose of contralateral needling is to normalize the injured streams of *qi* and blood through activating the acupoints on the relative healthy part of the body under the condition that the conventional acupuncture given to the affected abnormal area would be less effective. By following this philosophical concept, this kind of acupuncture is indicated clinically for meridian impotency^[40-42], and *qi*-blood circulation resulting from *yin-yang* unbalance.

Meridians, *qi* and blood of the body communicate from the left and the right physiologically and pathologically. As the specific inter-stimulus intervals were assumed to relate to transmission within specific motor pathways, it is argued that changes in the corticospinal transmission were pathway-specific^[43]. The anatomical and physiological basis of contralateral needling in terms of regulating the functions of the brain are meridians, *qi* and blood, and *yin* and *yang* adjusting each other and filling each other up^[44]. Acupuncture at different acupoints belonging to the same anatomic segment can exert different modulatory effects on the reorganizations of post-acupuncture resting state networks. The heterogeneous modulation patterns between two conditions may relate to the functionally specific modulatory effects of acupuncture^[45].

Therefore acupoints in the upper limb are *Chize* (LU5), *Hegu* (LI4), *Quchi* (LI11), *Waiguan* (SJ5) and *Jianliao* (TE14); and *Futu* (ST32), *Zusanli* (ST36), *Fenglong* (ST40), *Weizhong* (BL40) and *Huantiao* (GB30) in the lower limb. For example, *Chize* (LU5) is the point of the lung channel which originates in the middle jiao, and can clear all forms of heat (whether deficiency or excess) from the lung and descending stomach *qi*^[46-47]. The lung and heart are intimately associated with the upper jiao. The heat in the lung may injure the blood vessels and give rise to bleeding. *Waiguan* (SJ5) is used in the liver *yang* hyperactivity pattern^[48-49]. *Zusanli* (ST36) is for retention of phlegm in the triple energizer^[50-53]. *Quchi* (LI11)

is for *qi* and blood deficiency^[54-60].

In this study, the therapeutic effects of contralateral needling in the treatment of hemiplegia due to first time ischemic stroke were evaluated using a prospective randomized controlled study. The results suggested that contralateral needling namely on the relatively healthy side of the human body was better than conventional acupuncture which on the hemiplegic side after 30 days treatment using modern rehabilitation evaluation methods from three different levels reflecting neurological injury deficiency, motor function of the extremity, and ADL after hemiplegia. In the contralateral needling group, the NDS decreased, while the MBI and the FMA increased significantly when compared with the conventional acupuncture group. Limitations of the present study included the small number of patients in each group; therefore, no major conclusions can necessarily be applied to other patients. In addition, the patients were selected based upon history of stroke, neurological evaluation and MRI; thus, there is likely some bias in patient selection for this study. Another limitation is a less extensive statistical analysis of patient variables such as body weight and the relationship with the ischemic brain lesion. It is hoped that further studies will be directed toward this end.

According to the findings of this study, this randomized, single-blinded control study showed that contralateral needling was better than conventional acupuncture in improving the recovery of neurological function, ADLs, and motor function of the hemiplegia due to acute ischemic stroke. However, large-scale clinical trials are needed to further investigate the effectiveness of the contralateral needling unblocking-collaterals technique.

SUBJECTS AND METHODS

Design

A randomized, controlled, single-blinded clinical trial.

Time and setting

This study was performed at People's Hospital of Ningxia Hui Autonomous Region, People's Hospital of Rizhao City and the Second Affiliated Hospital of Qingdao University Medical College, China between December 2008 and June 2012.

Subjects

Patients with first-time onset acute ischemic stroke (left or right) who received treatment from December 2008 to June 2012 were included in this study. The patients with

acute ischemic stroke were confirmed by MRI.

Inclusion criteria

The inclusion criteria were based on The Criteria for the Diagnosis and Therapeutic Effects of Traditional Chinese Medicine issued by the State of Administration of Traditional Chinese Medicine^[26].

- (1) Patients with first-time onset ischemic stroke;
- (2) Stable vital signs;
- (3) Symptoms and objective signs of ischemic stroke lasting more than 24 hours;
- (4) Computed tomography showing no cerebral hemorrhage;
- (5) Transcranial Doppler Sonography showing non-insufficiency of vertebral basal artery blood flow.

Exclusion criteria

- (1) Patients with severe heart, liver, or kidney diseases;
- (2) Cerebral hemorrhage;
- (3) Subarachnoid hemorrhage;
- (4) Transient ischemic attack;
- (5) Recurrent stroke.

A total of 106 patients, 58 males and 48 females, aged 55.6 ± 5.8 (range, 50–65) years were included in this study. Individual participants in this study gave written informed consent after the study procedures had been fully explained. Permission to use data was obtained from patients. Ethical approval to undertake this study was in accordance with the *Declaration of Helsinki* and the Medical Research Council's Good Clinical Practice Guidelines^[25].

Methods

Blinding method and quality control of clinical treatments

Interaction between the patient and the acupuncturist was limited to the time required for needling. The patients' allocation to the study and the list of registration were blind to acupuncturists. Both randomization and allocation lists were sent to the analyst after the last patient had been enrolled in this study. The patients' allocation was un-blinded only after all data analysis had been completed. During this study, across 1.5 years, the acupuncturists were the same, and the techniques were unchanged to control the study quality.

Acupuncture treatment

All patients received medicine (aspirin tablet, 0.1 g daily, *per os*) and nursing as per the stroke management routine of the Department of Neurology. Acupoints in the upper limb (left or right) are *Chize* (LU5), *Hegu* (LI4), *Quchi* (LI11), *Waiguan* (SJ5) and *Jianliao* (TE14). Acu-

points in the lower limb are *Futu* (ST32), *Zusanli* (ST36), *Fenglong* (ST40), *Weizhong* (BL40) and *Huantiao* (GB30). These acupoints also locate on the pathways of nerve impulse transmission from the brain to the extremities or from the terminals to the brain.

Disposable sterile acupuncture needles 2 inches in length (0.35 mm × 50.00 mm, Suzhou Medical Instruments Factory, Suzhou, Jiangsu, China) were inserted into the muscle layer at the selected acupoints to a depth of 15–20 mm. Manual acupuncture was performed by established acupuncturists from the Department of Traditional Chinese Medicine, 45 minutes daily for a consecutive 30 days.

Effective rate assessment

Criteria for the curative effect were based on Disease Diagnosis and Cure Standards formulated by the Ministry of Health of the Chinese People's Liberation Army General Logistics Department and were as follows^[26]. (1) Deteriorated: function defect score increased within 18%. (2) Without change: no changes in function defect scores or increased/decreased by less than 17%. (3) Improved: function defect score reduced by 18–45%. (4) Significantly improved: function defect score reduced by 46–90%, with level 1–3 disability. (5) Basically cured: function defect score reduced by 91–100%, with level 0 disability. Total effective rate (%) = (basically cured + significantly improved + improved) / total case numbers × 100%.

NDS assessment

Neurological evaluation was performed using NDS^[27] before and 30 days after treatment. Neurological deficits including hemiparesis, hemianopia, and aphasia were assessed. The Chinese version of NDS is relatively simple, and suitable for a stroke of the carotid artery system. In NDS, 0 point equals no neurological injury; mild injury is scored 0–15 points, moderate injury 16–30 points, and severe injury 31–45 points.

MBI assessment

MBI was used to measure the disability of stroke patients in terms of ADLs, such as dressing, feeding and walking before and 30 days after treatment. This index was modified^[28]: a score of 100 indicated normal and 0 indicated severe injury. Dependence level was ranked according to achieved performance: complete dependence (0–24 points), severe dependence (25–50 points), medium dependence (51–75 points), and minimum dependence (76–99 points).

FMA assessment

Functional limitation of the upper and lower extremities is one of the most common disabilities caused by stroke. The FMA, which is composed of 33 items related to movements of the proximal and distal parts of the upper extremities and the 17-item lower-extremity subscale, is the measure most frequently used to evaluate extremity impairment. It is a good predictor of disability after stroke^[29-30]. The items of the FMA are mainly scored on a 3-point scale, from 0 to 2. The total score on the upper extremities ranges from 0 to 66, and ranges from 0 to 34 in the lower extremities.

The extremity motor functions after hemiplegia due to ischemic stroke were evaluated by FMA before and 30 days after treatment. Based on the total points, the FMA scales were classified according to the following assessments: 0–50 points indicate severe motor disability, 51–84 points obvious motor disability, 85–94 points moderate motor disability, and 95–99 points mild motor disability.

Statistical analysis

Data were presented as mean ± SD or percentage. SPSS 13.0 software (SPSS, Chicago, IL, USA) was used for statistical analysis. Paired *t*-test was used for data comparison before and after treatment in each group. Two-sample *t*-test or chi-square test was used for comparison of baseline data between groups. One-way analysis of variance was used for comparison of means among groups. Dunnett's test was used for pairwise comparison of means between groups. A level of $\alpha = 0.05$ was considered statistically significant.

Research background: Hemiplegia caused by stroke indicates the dysfunction of the neurological network between the brain and limbs. Under this condition, conventional acupuncture at the acupoints on the affected side cannot transmit stimulus signal to the brain.

Research frontiers: This study compared the therapeutic effects of contralateral needling and conventional acupuncture at acupoints *Chize* (LU5) and *Jianliao* (TE14) on hemiplegia in 106 stroke patients and investigated whether acupuncture at unblocked collaterals by contralateral needling can significantly promote the recovery of affected limb function of stroke patients.

Clinical significance: This study compared the therapeutic effects of contralateral needling versus conventional acupuncture at acupoints and found that acupuncture at unblocked collaterals by contralateral needling can promote neurological function recovery from acute ischemic stroke, which provides reference evidence for clinical treatment of stroke.

Academic terminology: Acupuncture at unblocked collaterals

by contralateral needling is an acupuncture therapy that is used to treat diseases by inserting needles into acupoints on the relative healthy side of the body.

Peer review: By means of NDS, MBI and FMA, this study compared the therapeutic effects of acupuncture at unblocked collaterals by contralateral needling and conventional acupuncture in stroke patients. This topic is of actual value and clinical significance. There are few reports describing the scientific design and procedure of acupuncture for stroke treatment in China. There are some limitations in this study. For example, whether disease duration influences the therapeutic effect of contralateral needling is yet to be determined. In addition, the pathological mechanism of stroke and the severity of disease were not classified. The sample size was also too small in the control group. All these problems should be taken into consideration in future studies.

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