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Acupuncture in Poststroke Rehabilitation

A Systematic Review and Meta-Analysis of Randomized Trials

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Background and Purpose—Acupuncture is a low-risk treatment with purported claims of effectiveness for poststroke rehabilitation. To comprehensively assess the efficacy of acupuncture in poststroke rehabilitation, we conducted a systematic review and meta-analysis of all randomized clinical trials of acupuncture for poststroke rehabilitation.

Methods—We searched 7 English and 2 Chinese databases from inception to September 2009. Eligible studies included randomized clinical trials that evaluated the clinical efficacy of acupuncture in adult patients with disability after stroke. We extracted data on trial quality, protocol, and outcomes assessed. A summary OR was calculated based on pooled dichotomous results. I^2 was used to infer heterogeneity and we conducted metaregression to determine if specific covariates explained heterogeneity.

Results—Thirty-five articles written in Chinese and 21 articles written in English were included. The overall quality of the studies was "fair" and most studies were small (median n=86; range, 16 to 241). The majority (80%) of the studies reported a significant benefit from acupuncture; however, there was some evidence of publication bias. In 38 trials, data were available for meta-analysis and metaregression, yielding an OR in favor of acupuncture compared with controls (OR=4.33, 95% CI: 3.09 to 6.08; I^2=72.4%). Randomization, modes of delivery, method of control, study source country, and reporting of randomization may explain some of the heterogeneity observed between the studies.

Conclusions—Randomized clinical trials demonstrate that acupuncture may be effective in the treatment of poststroke rehabilitation. Poor study quality and the possibility of publication bias hinder the strength of this recommendation and argue for a large, transparent, well-conducted randomized clinical trial to support this claim and implement changes to clinical practice. **(*Stroke*. 2010;41:e171-e179.)**

Key Words: acupuncture ■ cerebral infarct ■ cerebrovascular disease ■ meta-analysis ■ metaregression ■ systematic review ■ therapy

Stroke is responsible for increasingly high rates of mortality and disability worldwide. Due to an aging population, dietary changes, and work-related stress, stroke morbidity is on the rise and the age at first occurrence is getting younger.[1–3] According to the latest data issued by the American Heart Association, each year approximately 600 000 people experience a new stroke and 185 000 a recurrent stroke.[3] Besides resultant mortality, the high incidence (>50%) of poststroke disability brings a heavy burden to patients and their caregivers.[3] In the United States, the total societal and healthcare costs have risen from $53.6 billion in 2004[2] to $68.9 billion in 2009.[3]

Acupuncture (Ac) has been used in traditional Chinese medicine for >3000 years as a treatment for many diseases and its use for poststroke rehabilitation in China is based on a large body of preclinical and clinical research.[4] The lack of English language publications has, however, impeded any serious consideration of Ac as a treatment for poststroke rehabilitation in the Western world.

Four systematic reviews have been completed assessing the use of Ac for poststroke rehabilitation[5–8] and one for acute stroke rehabilitation.[9] Three of these reviews[5,6,8] included both English and Chinese language publications and one considered only Chinese language (Mandarin or Cantonese) was also written in Mandarin.[7] Although 3 of the reviews[6–8] found that Ac may be effective in improving poststroke impairment, all 4 of them reported inconclusive results due to extensive heterogeneity across trial outcomes and a high risk of bias. Knowing that a large number of clinical studies had been completed since the last review was completed, we aimed to conduct an up-to-date systematic review of publications irrespective of language of publication. Noting the

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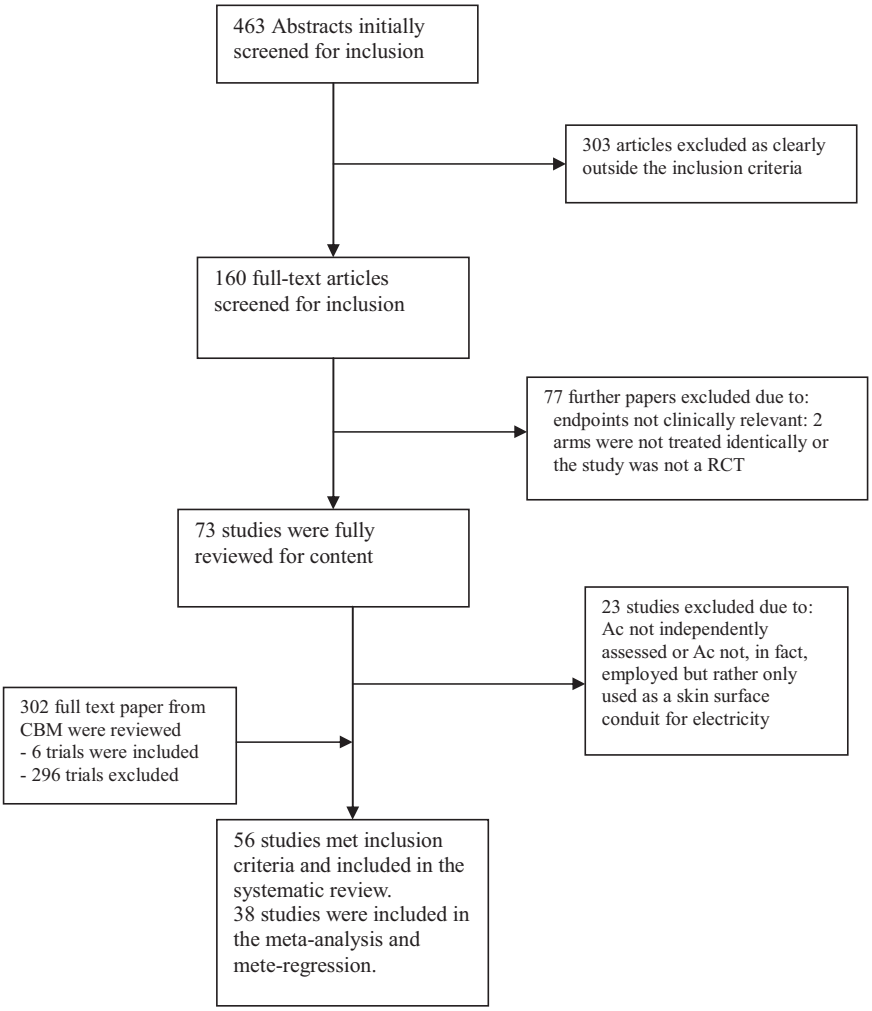

Figure 1. Flow chart depicting studies included in the systematic review.

disparity of previous results, we were also interested whether the use of metaregression, not applied in the other reviews, could explain potential factors impacting between-study heterogeneity.

Methods

Search Strategy, Trial Eligibility Criteria, and Data Retrieval

Inclusion criteria for our systematic review required studies conducted in adult patients (>18 years) with disability due either to ischemic or hemorrhagic stroke. Reports had to indicate that patients had to be randomly allocated to either active Ac treatment or a control group given sham Ac or no Ac treatment. Any cointerventions had to be reported as the same in both groups. We excluded studies that reported only laboratory values rather than clinical responses. Comparisons in which Ac was not independently assessed were also excluded.

One of us (P.W.) searched the following English electronic databases: MEDLINE, AMED, Alt Health Watch, CINAHL, Nursing and Allied Health Collection: Basic, and Cochrane Database of Systematic Reviews from inception to September 2009. In addition, P.W. and Y. H. Liang, fluent in Mandarin, searched the Chinese database CNKI, CBM (1978 to September 2009), and Wan Fang (1994 to September 2009) independently. No language of publication restrictions was placed on the searches. The search strategy is provided in the supplemental material, available online at http://stroke.ahajournals.org.

Three reviewers (D.S., P.W., and H.L.) assessed eligibility based on the full-text papers and conducted data extraction independently using a standard prepiloted form. Disagreements were resolved by consensus or by a third reviewer (E.M.). If the required information was not available in the published article, we attempted to obtain additional information from the corresponding authors.

We extracted all outcome measures including physical assessment, disability and motor assessments, and any other validated scales for stroke assessment. We documented the dichotomous data of efficacy as reported in each trial. In addition, we extracted data on sequence generation, allocation concealment, blinding, descriptions of patient withdrawal, language of publication, and Ac-specific STandards for Reporting Interventions in Controlled Trials of Acupuncture (STRICTA) criteria[10] (accounting for treatment rationale, needling methods, treatment regime, and equality of the cointerventions). We extracted data on the type of stroke (hemorrhagic or ischemic), patient status (acute or not acute), and intervention treatment duration. We also noted the language in which the paper was written and the setting. These criteria were not used for weighting covariates in the meta-analysis; instead, these were considered a priori explanations for study heterogeneity.

Statistical Analysis

The use of OR was used for meta-analysis as patients begin with the disease (stroke) and we are examining events as a decrease in disease (rehabilitation). In situations of zero outcome events in either arm of a trial, we used the Haldane method and added 1 to each arm as suggested by Sheehe.[11] We first pooled studies on all

Table 1. General Information of Patient Characteristics in Each Trial

Year	Author	Country or Area Where Trial Took Place	Language of Publication	No. of Participants	No. in Ac Group	No. in Control Groups	Type of Stroke	Subgroup Diagnosed by TCM Criteria	No. of Dropouts During Treatment	Poststroke Treatment Within 1 Month	Treatment Duration Weeks
1992	Naeser[26]	USA	English	16	10	6	Infarction	N	0	N	4
1993	Hu[27]	Taiwan	English	30	15	15	Infarction	N	0	Y	4
1993	Jahansson[28]	Sweden	English	78	38	40	Mix	N	18	Y	10
1996	Zhen[29]	China	Chinese	70	40	30	Hemorrhage	Y	0	Y	NA
1997	Kjendahl[30]	Norway	English	45	24	21	Mix	N	4	N	6
1998	Gosman-Hedstrom[31]	Sweden	English	104	37	34/33	Infarction	N	2	Y	10
1998	Si[32]	China	English	42	20	22	Infarction	N	NA	Y	5
1998	Wang[33]	China	Chinese	160	80	80	Infarction	N	0	Y	6
1998	Yin[34]	China	Chinese	150	100	50	Infarction	Y	0	Y	4
1999	Jin[35]	China	Chinese	120	60	60	Infarction	N	0	Y	6
1999	Li[36]	China	Chinese	64	30	34	Hemorrhage	N	0	Y	4
1999	Lun[37]	China	Chinese	109	61	48	Mix	N	0	N	4
1999	Wong[39]	Taiwan	English	118	59	59	Mix	N	0	Y	2
1999	Zhang[38]	China	Chinese	241	145	96	Mix	Y	0	Y	4
2000	Liu[40]	China	Chinese	120	60	60	Infarction	N	4	N	3
2001	Chen[41]	China	English	37	21	16	Infarction	N	0	Y	4
2001	Johansson[42]	Sweden	English	99	48	51	Mix	N	9	Y	10
2001	Liu[43]	China	Chinese	160	120	40	Infarction	Y	0	Y	8
2001	Pei[44]	China	English	86	43	43	Infarction	N	NA	Y	4
2001	Tao[45]	China	Chinese	46	26	20	Mix	N	0	Y	4
2002	Jing[46]	China	Chinese	186	96	90	Hemorrhage	Y	NA	Y	3
2002	Su[47]	China	Chinese	83	43	40	Infarction	N	0	Y	4
2002	Sze[48]	Hong Kong	English	106	62	44	Mix	N	14	Y	10
2002	Zhou[49]	China	Chinese	183	149	34	Hemorrhage	Y	0	Y	4
2004	Alexander[50]	USA	English	32	16	16	Mix	N	3	Y	2
2004	Fink[51]	German	English	25	13	12	Mix	N	NA	N	4
2004	Zhang[52]	China	Chinese	80	40	40	Mix	Y	0	Y	3
2005	Lei[53]	China	Chinese	69	43	26	Infarction	Y	0	N	7
2005	Park[54]	USA	English	116	56	60	Mix	N	18	Y	2
2005	Wang[55]	China	Chinese	120	60	60	Infarction	N	0	Y	4
2005	Wayne[57]	USA	English	33	16	17	Mix	N	9	N	10
2005	Zeng[56]	China	Chinese	101	49	52	Infarction	N	5	Y	4
2006	Ge[21]	China	Chinese	46	25	21	Mix	N	0	Y	3
2006	Guo[58]	China	Chinese	76	51	25	Mix	N	0	Y	4
2006	Li[24]	China	Chinese	120	60	60	Mix	N	0	N	8
2006	Liu[20]	China	Chinese	80	40	40	Mix	N	0	Y	4
2006	Rao[23]	China	Chinese	40	20	20	Infarction	Y	0	Y	4
2006	Xu[22]	China	Chinese	80	40	40	Mix	N	0	Y	8
2007	Guo[59]	China	Chinese	80	40	40	Mix	N	0	Y	NA
2007	Heieh[15]	Taiwan	English	63	30	33	Infraction	N	0	Y	4
2007	Peng[17]	China	Chinese	80	40	40	Infarction	N	0	Y	2
2007	Shi[60]	China	Chinese	86	43	43	Mix	N	0	Y	6
2007	Yang[25]	China	Chinese	100	50	50	Mix	N	0	Y	8

(*Continued*)

Table 1. Contiuned

Year	Author	Country or Area Where Trial Took Place	Language of Publication	No. of Participants	No. in Ac Group	No. in Control Groups	Type of Stroke	Subgroup Diagnosed by TCM Criteria	No. of Dropouts During Treatment	Poststroke Treatment Within 1 Month	Treatment Duration Weeks
2007	Zhang[18]	China	Chinese	206	103	103	Mix	N	0	Y	4
2007	Zhang[19]	China	Chinese	220	110	110	Mix	N	0	Y	4
2007	Zhang[16]	China	English	90	30	60	Mix	N	0	Y	4
2008	Hopwood V61	UK	English	105	57	48	Mix	N	13	Y	4
2008	Zhang[62]	China	Chinese	120	60	60	Infarction	N	0	Y	4–6
2008	Ge[64]	China	English	150	75	75	Mix	N	0	Y	3
2009	Li[65]	China	English	63	31	32	Infarction	N	0	N	4
2008	Zhang[70]	China	English	90	45	45	Infarction	N	0	Y	4
2007	Shen[68]	China	Chinese	35	18	17	Infarction	N	0	Y	4
2009	Dai[63]	China	Chinese	145	72	73	Mix	N	0	N	8
2008	Liu[67]	China	Chinese	90	45	45	Mix	N	0	Y	4
2001	Yang[69]	China	Chinese	48	29	19	Infarction	N	0	Y	6
2009	Lin[66]	China	Chinese	56	37	19	Infarction	N	0	Y	3

Mix indicates either infarction or hemorrhage; N, no; Y, yes; NA; not available.

Ac interventions versus controls using the DerSimonian-Laird random effects method.[12] We calculated the I^2 statistic for each analysis as a measure of the proportion of the overall variation that is attributable to between-study heterogeneity.[13] Forest plots are displayed for the primary analysis showing individual study effect measures with 95% CIs and the overall DerSimonian-Laird pooled estimate. The funnel plot figure indicates the results of the Egger test to address the potential for publication bias.[14] We conducted a metaregression analysis using the unrestricted maximum likelihood method to determine if the a priori covariates of study source country (Chinese or other), electrostimulation Ac, use of sham controls, reporting of allocation concealment, and randomization could predict heterogeneity. We used Stats Direct and Comprehensive Meta-Analysis (Version 2) for all statistical procedures. All probability values are 2-sided and <0.05 was considered significant.

Results

The search identified 463 titles and/or abstracts, of which 150 were found likely to be relevant. Of these records, 73 fit the inclusion criteria. Twenty-three of the full-text articles were further excluded for one of 2 reasons: (1) either the Ac was not independently assessed; or (2) Ac was not, in fact, used but rather only used as a skin surface conduit for electricity. In addition, 302 full-text papers from CBM were screened and 6 trials included.

In total, 56 publications[15–6263–70] containing independent data fit the criteria for inclusion. Figure 1 details the literature retrieval process. Among the final 56 studies, 35[17–25,29,33-38,40,43,45–47,49,52,53,55,56,58–60,62,63,66–69] were published in Chinese and 21[15,16,26–28,30–32,39,41,42,44,48,50,51,54,57,61,64,65,70] were published in English. All the studies published in Chinese were conducted in China, whereas the studies written in English were conducted in Europe (6), the United States (4), Mainland China (42), Hong Kong (one), and Taiwan (3).

Characteristics of Included Studies

The 56 randomized clinical trials included 5650 patients, 3156 in the treatment groups and 2494 in the control groups. Classified based on cause of stroke, 4 trials[29,36,46,49] assessed hemorrhagic stroke, 24 trials[15,17,23,26,27,31–35,40,41,43,44,47,53,55,56,62,65,66,68–70] assessed ischemic stroke and 28 trials[16,18–20,22,24,25,28,30,37–39,42,45,48,50–52,54,57–61,63,64,67] assessed either hemorrhagic or ischemic stroke (mixed). Classified on the basis of Ac administered, 16 studies[15,17,20,26–28,31–33,35,39,41,42,44,57,68] used electro-Ac, 24 studies[18,20–24,26,27,30–32,35,40–42,44,50,57,59–61,63,67,69] used both scalp and body Ac, 28 studies[15–17,25,28,29,33,34,38,39,43,45-49,51–54,56,58,62,64–66,68,70] used body Ac, and 4 studies[19,36,37,55] used scalp Ac only. Sham Ac was used as control in 7 studies[26,31,42,51,54,57,61] (one of which[31] also included a second control in which no Ac was used), the remaining 41 studies did not use any type of sham Ac as a control. Physical rehabilitation, conventional medication, or traditional Chinese medicines were used equally in both intervention and control groups (Table 1. Forty-six studies[15–23,25,27–29,31–36,38,39,41–50,52,54–56,58–62,64,66–70] were conducted in patients whose Ac was given within acute status (1 month after stroke). Ten studies[24,26,30,37,40,51,53,57,63,65] tested the use of Ac in disability (0.8 to 24 years poststroke). The intervention duration ranged from 2 to 10 weeks (mean, 4.5 weeks; SD, 1.6).

The trials were relatively small (median n=86; range, 16 to 241) and 99 of 939 patients reported to have dropped out over 11 studies combined.[28,30,31,35,40,42,48,50,54,57,61] Four studies[32,44,46,51] provided no information on this issue and 100% completed treatment in the remaining 41 studies.

Thirty-nine[15,17–25,27,31–36,38–40,42,43,45,48,49,53–56,58–63,66–69] of the 56 studies provided detailed information based on the STRICTA guidelines.[10] Practitioner training was only mentioned in studies conducted outside of Mainland China. Supplemental Table I (available at http://stroke.ahajournals.org) provides a summary of details regarding trial methodology and outcomes for each of the respective randomized clinical trials.

The trials used various outcome measures to test for generalized or specific motor impairments. Overall, the outcomes

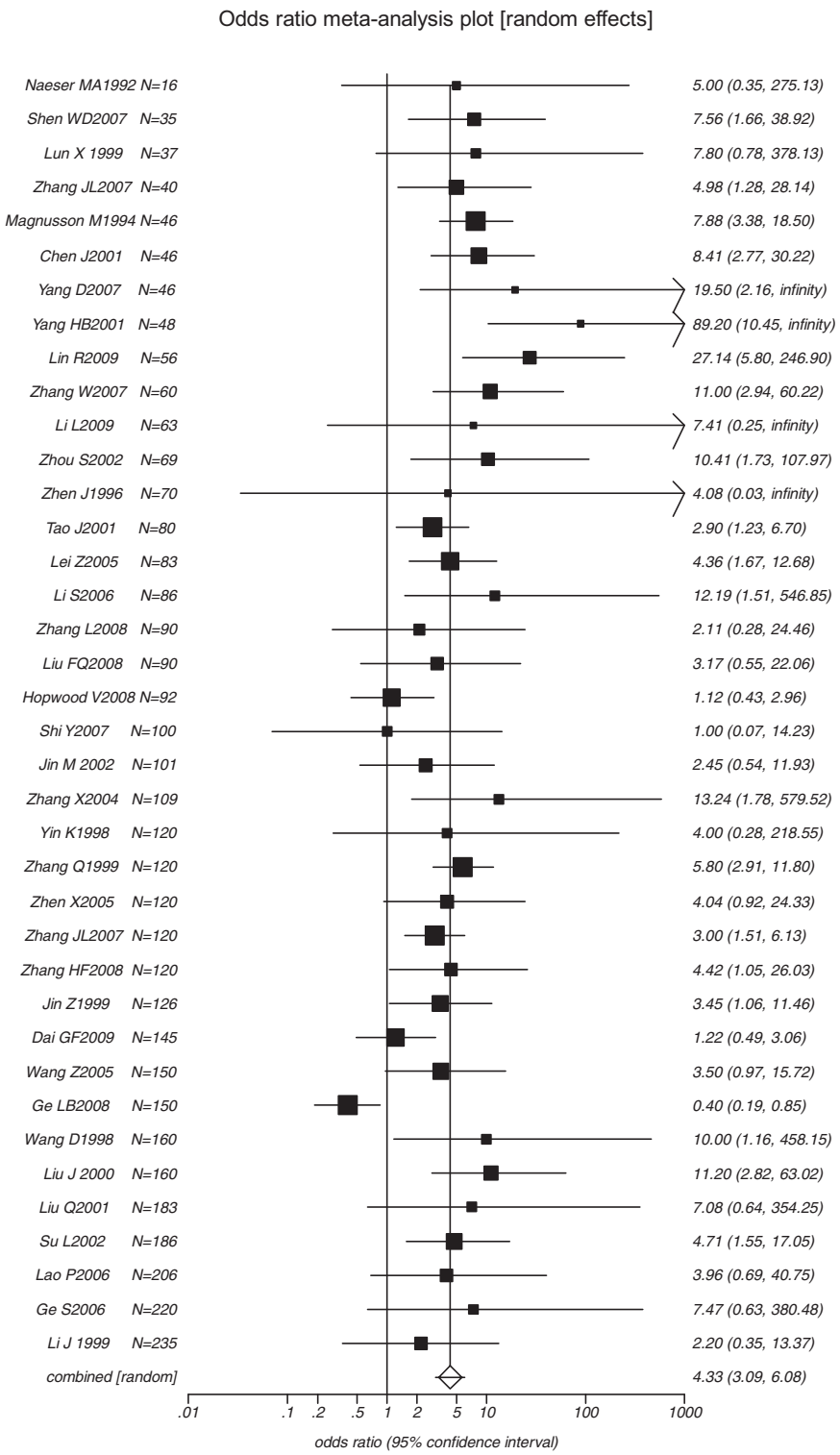

Figure 2. Efficacy in poststroke rehabilitation with Ac compared with no Ac.

assessed included motor impairment scales, generalized stroke scales, and disability assessments. Side effects were detailed in a few of the studies but were generally poorly reported.

Risk of Bias of the Trials

In general, randomization and allocation concealment were poorly reported. Only 25% of the studies (14 studies[15,21,23,31,42,48,54,56,57,59–62,64]) gave detailed accounts of how patients were randomized. The other studies did not provide detailed information on randomization and baseline comparisons between the groups were poorly described with respect to sex, age, or severity of clinical status. A total of 12.5% of the studies (7 studies[23,31,48,54,56,57,61]) adequately reported allocation concealment. Patients were blinded in 11% of the studies (6 studies[26,31,42,51,54,57]) in which sham Ac was used as a

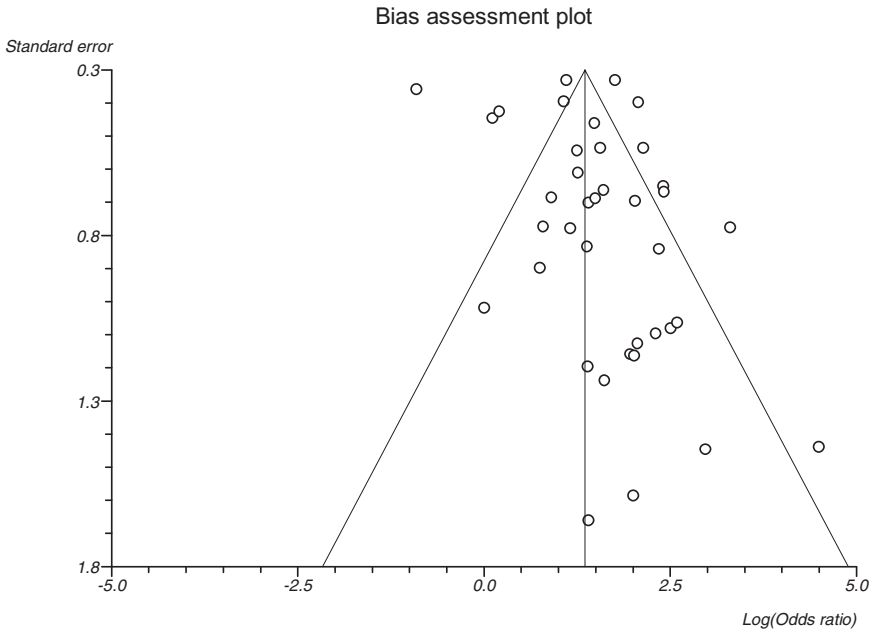

Figure 3. Funnel plot indicating potential for publication bias.

control. Assessor blinding was reported in a total of 28.6% studies (16 studies[15,21,23,26,30–32,42,48,50,51,54,56,57,59,61]).

Efficacy of Ac in Poststroke Rehabilitation

Positive results were reported in 45[15–22,24,25,27–30,32–41,43–47,49,52,53,55,58–60,62–70] of the 56 studies. Six studies[26,48,50,51,57,61] reported a positive benefit only in a subgroup analysis. No significant differences between Ac intervention and control were reported in 5 studies.[23,31,42,54,56]

Thirty-eight trials[16,18,19,21,23–25,31–40,42,43,48,49,51,53–57,60–70] provided numeric data for meta-analyses, the results of which yielded a highly significant OR demonstrating efficacy in poststroke rehabilitation with Ac compared with no Ac (OR=4.33, 95% CI: 3.09 to 6.08; I^2=72.4%; Figure 2). In the 35 studies conducted in China, the OR was 4.49 (95% CI=3.16 to 6.39, I^2=69.8%); in the 3 studies conducted outside of China, the OR was 3.33 (95% CI=0.75 to 14.88, I^2=2.49%). Supplemental Table II provides a summary of the outcomes measured for each of the trials. Figure 3 and Supplemental Figures I and II provide funnel plots for all the trials combined, the trials published in Chinese or English, respectively. The visual asymmetry was examined further using Egger regression test (Egger: bias=1.49 [95% CI=0.334 to 2.64], P=0.013 for all trials; Egger: bias=0.82 [95% CI=−0.19 to 1.82], P=0.106 for trials in Chinese; and Egger: bias=3.30 [95% CI=−0.10 to 6.70], P=0.055 for trials in English).

Metaregression was used to determine if a priori covariates contributed to study heterogeneity. In our analysis, the following covariates contributed to heterogeneity (the OR and 95% CI indicate contribution to heterogeneity): studies conducted in mainland China (OR=0.76, 95% CI: 0.54 to 0.99), the use of manual versus electric Ac (OR=0.57, 95% CI: 0.45 to 0.73), the use of sham controls (OR=0.35, 95% CI: 0.30 to 0.41), and the reporting of randomization (OR=0.35, 95% CI: 0.29 to 0.41). Thus, country of origin, manual Ac, sham control, and randomization may have affected the results. We found no significant effects of allocation concealment on heterogeneity.

Discussion

Our study has 2 important implications. First, there is compelling evidence that Ac may have a role in poststroke rehabilitation. Second, we found that many trials were conducted in China and yielded important differences in treatment effects than studies conducted elsewhere. The totality of the evidence found argues for an evaluation of Ac in poststroke patients within a large, well-conducted, and transparent clinical trial.

Our study builds on the findings of others about the heterogeneous quality of randomized trials from China. In our own experience within China, we have doubts that many principal methodological criteria of quality randomized trials were in fact conducted. A previous analysis, by Vickers et al and Wu et al, found that most trials conducted in China were reported as positive. However, most reports of randomized controlled trials published in some Chinese journals lacked an adequate description of randomization,[71,72] a finding our analysis supports.[8] Although several explanations for this phenomenon exist, a likely explanation is the slow uptake of evidence-based medicine and clinical trials methodology in academic research centers.[73] With the opening of the Chinese Cochrane Centre, we hope that clinical epidemiology will receive considerably more attention.[74]

Adequate understanding of the application of traditional Chinese medicine (TCM) in some of these studies needs to be recognized.[75] Based on the teachings of TCM, a practitioner might not use the same Ac treatment regimen in all patients with stroke but vary treatments according to the presenting symptomatology of each individual. Standardized treatment approaches are rarely used (even in randomized clinical trials) and typically treatment protocols are individualized. Unlike conventional medicine, the pathologies of stroke defined by TCM are often described as: (1) wind–evil attacking the channels; (2) deficiency of liver–yin and kidney–liver wind due to an excess of yang; and (3) obstruction of meridians by wind–phlegm, which

Table 2. Comparison of This Work With Other Systematic Reviews and Meta-Analyses

Author (Date)	No. of Studies Included	No. of Chinese Studies (Publication Dates)	No. of English Studies (Publication Date)	Results
Li[7] (2002)	9	9 (1994–2000)	0	Improved limb strength: OR=2.45 (1.62–3.72) Improved neurological function: OR=2.90 (1.98–4.26)
Sze[6] (2002)	14	4 (1981–2000)	9 (1966–2001)	Disability: OR=0.49 (0.03–0.96) Motor change: OR=1.01 (0.79–1.22) Interval to stroke >6 months No difference between real and sham Ac
Park (2001)[5]	9	3 (1990–1998)	6 (1969–1999)	Results were not pooled and reported separately
Wu[8] (2006)	5	4 (1997–2001)	1 (1966–2005)	Improvement of global neurological deficit: OR=6.55 (1.89–22.76)
This study	56	35 (1996–2009)	21 (1992–2009)	Clear clinical improvement: OR=4.33 (95% CI: 3.09–6.08)

will cause deficiency of Qi (energy) and blood. These pathologies clearly use terminology that is foreign to Western conventional medicine yet are well understood by TCM practitioners to indicate symptoms such as hemiplegia, aphasia, or facial paralysis that mirror the diagnosis of stroke.[76]

According to a conventional Western medical perspective, Ac has been described as increasing the pain threshold through needle activation of pain receptors by sending signals to the central nervous system to release opioid peptides.[4,77] In an analogous way, Ac may help in rehabilitation. A potential explanation is that analgesia achieved through Ac may relax muscles allowing for passive motion, an increased range of motion, and ultimately motor impairment rehabilitation.[78]

Another observed physiological effect of Ac is increased perfusion within peri-infarcts and low perfusion zones in the affected lobe as observed in MRIs of poststroke patients receiving Ac.[77] This possible effect could play a role in modifying tissue perfusion within cerebral areas affected by stroke, thus promoting a more rapid and effective recovery.[79] It has also been suggested that adaptive changes in response to stroke involve neuronal reorganization and increased dendritic volume in the cortical layers and number of synapses in the contralateral hemisphere within 30 days after central nervous system injury.[77] Ac may offer benefit in this reorganization process by stimulating the peripheral site of the lesion.

Strengths and Limitations

With respect to interpreting the results of this systematic review, there are several strengths to consider. Compared with previous systematic reviews, our study included a much larger number of studies published in both English and Chinese (Table 2). In the 38 studies that provided the quantitative data for meta-analysis, the combined OR was highly statically significant (OR=4.33,

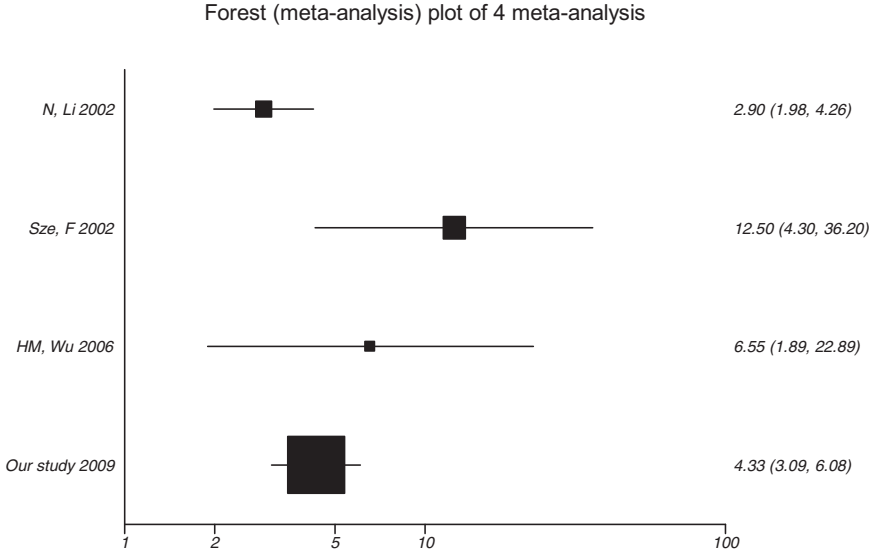

Figure 4. Comparison of OR results in 4 meta-analyses.

95% CI: 3.09 to 6.08; I^2=72.4%). Similar results were found in 2 of the other published meta-analyses[7,8] (OR=2.90 and 6.55, respectively; Figure 4). Furthermore, after metaregression analysis, not conducted in the other studies, we found that risk of bias indicators, randomization, and assessor blinding predicted between-study heterogeneity and explained some of the inflated effect sizes.

There are limitations to consider in interpreting our analysis. We were unable to meta-analyze all trials due to variability of the end points measured. However, we did examine the outcomes from the nonanalyzed trials and found they were not importantly different in the direction of effect. We identified a likely language bias in favor of positive findings, a finding consistent with reviews of Chinese medical literature.[71] In our study, we also found that all the studies in which sham Ac was used, no differential effectiveness from true Ac was found. Some potential factors that influence the applicability of "placebo" needling include not only intertester variability, but also the patient's knowledge and experience of Ac, Ac point selection, the visual impact of needling, and other contextual effects.[80]

Results from the metaregression analysis indicate that there is some utility in combining publications regardless of where they were conducted. Metaregression did not demonstrate that either jurisdiction or language of publication accounted for the heterogeneity of results. Indeed, it was the risk of bias indicator of well-described randomization that best explained heterogeneity. Future Ac studies should include adequate descriptive classifications of pathology based on TCM theory and, if possible, stratify patients according to those classifications. Trials should ensure that randomization is well conducted and described, assessors are well blinded, and assess for adequate power and sample size.

In conclusion, our study demonstrates that Ac is likely effective for improving poststroke rehabilitation. Given concerns about study quality, we are reticent to strongly endorse Ac from this review, but argue that there is compelling evidence for a large and well-conducted randomized clinical trial to confirm our findings and support implementation within clinical practice for poststroke rehabilitation.

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Disclosures

None.

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Table 1: Details of methodological criteria in each trial.

Year	**Author**	treatment group	control group	sample size calculation	Randomization described	Allocation concealment described	Patients blinded	Description of withdrawals	Assessor Blinded	Ac rationale described	Clear frequency of treatments	Depth of insertion or needle type	**Practitioner training described**	**Adverse events described**	**Follow-up evaluation**
1992	Naeser MA[26]	electro-scalp-body-Ac	sham Ac	N	N	N	Y	Y	Y	Y	Y	N	N	N	N
1993	HU HH[27]	electro-scalp-body-Ac	No Ac	N	N	N	N	Y	N	Y	Y	Y	Y	Y	Y
1993	Jahansson K[28]	electro-body-Ac	No Ac	N	N	N	N	Y	N	N	Y	Y	N	N	Y
1996	Zhen JG[29]	body Ac	No Ac	N	N	N	N	Y	N	Y	N	Y	N	N	N
1997	Kjendahl,A[30]	scalp-body-Ac	No Ac	N	N	N	N	Y	Y	N	Y	N	Y	N	Y
1998	Gosman-Hedstrom G[31]	electro-scalp-body-Ac	sham Ac & No Ac	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y
1998	Si GM[32]	electro-scalp-body-Ac	No Ac	N	N	N	N	N	Y	Y	Y	Y	N	N	N
1998	Wang D[33]	electro-body-Ac	No Ac	N	N	N	N	Y	N	Y	Y	Y	N	N	N
1998	Yin KJ[34]	body Ac	No Ac	N	N	N	N	Y	N	Y	Y	Y	N	N	N
1999	Jin Z[35]	electro-scalp-body-Ac	No Ac	N	N	N	N	Y	N	Y	Y	Y	N	N	N
1999	Li J[36]	scalp Ac	No Ac	N	N	N	N	Y	N	Y	Y	Y	N	N	N
1999	Lun X[37]	scalp Ac	No Ac	N	N	N	N	Y	N	N	Y	Y	N	N	N
1999	Wong AM[39]	electro-body-Ac	No Ac	N	N	N	N	Y	N	Y	Y	Y	N	N	N
1999	Zhang Q[38]	body Ac	No Ac	N	N	N	N	Y	N	Y	Y	Y	N	N	N
2000	Liu J[40]	scalp-body-Ac	No Ac	N	N	N	N	N	N	Y	Y	Y	N	N	N
2001	Chen J[41]	electro-scalp-body-Ac	No Ac	N	N	N	N	Y	N	Y	Y	N	N	N	N
2001	Johansson BB[42]	electro-scalp-body-Ac	sham Ac	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
2001	Liu QX[43]	body Ac	No Ac	N	N	N	N	Y	N	Y	Y	Y	N	N	N
2001	Pei J[44]	electro-scalp-body-Ac	No Ac	N	N	N	N	N	N	Y	Y	N	N	N	Y
2001	Tao JP[45]	body Ac	No Ac	N	N	N	N	Y	N	Y	Y	Y	N	N	N
2002	Jing M[46]	body Ac	No Ac	N	N	N	N	N	N	Y	Y	N	N	N	N
2002	Su L[47]	body Ac	No Ac	N	N	N	N	Y	N	Y	Y	N	N	N	N
2002	Sze FK[48]	body Ac	No Ac	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N
2002	Zhou S[49]	body Ac	No Ac	N	N	N	N	Y	N	Y	Y	Y	N	N	N
2004	Alexander DN[50]	scalp-body-Ac	No Ac	Y	N	N	N	Y	Y	Y	Y	N	Y	Y	N

2004	Fink M[51]	body Ac	sham Ac	N	N	N	Y	N	Y	Y	Y	N	Y	N	Y
2004	Zhang X[52]	body Ac	No Ac	N	N	N	N	Y	N	Y	N	N	N	Y	N
2005	Lei Z[53]	body Ac	No Ac	N	N	N	N	Y	N	Y	Y	Y	N	N	N
2005	Park J[54]	body Ac	sham Ac	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N
2005	Wang Z[55]	scalp Ac	No Ac	N	N	N	N	Y	N	Y	Y	Y	N	N	N
2005	Wayne PM[57]	electro-scalp-body-Ac	sham Ac	N	Y	Y	Y	Y	Y	N	Y	Y	Y	N	N
2005	Zeng XR[56]	body Ac	No Ac	N	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y
2006	Ge ZX[21]	scalp-body-Ac	No Ac	N	Y	N	N	Y	Y	Y	Y	Y	**Y**	**N**	**N**
2006	Guo ZJ[58]	Body Ac	No Ac	N	N	N	N	Y	N	Y	Y	Y	**N**	**N**	**N**
2006	Li SC[24]	scalp-body-Ac	No Ac	N	N	N	N	Y	N	Y	Y	Y	**N**	**N**	**N**
2006	Liu M[20]	electro-scalp-body-Ac	No Ac	N	N	N	N	Y	N	Y	Y	Y	**N**	**N**	**N**
2006	Rao P[23]	scalp-body-Ac	No Ac	N	Y	Y	N	Y	Y	Y	Y	Y	**N**	**Y**	**Y**
2006	Xu YL[22]	scalp-body-Ac	No Ac	N	N	N	N	Y	N	Y	Y	Y	**N**	**N**	**N**
2007	Guo DY[59]	scalp-body-Ac	No Ac	N	Y	N	N	Y	Y	Y	Y	Y	**N**	**N**	**Y**
2007	Heieh R[15]	electro-body-Ac	No Ac	N	Y	N	N	Y	Y	Y	Y	Y	**N**	**N**	**Y**
2007	Peng L[17]	electro-body-Ac	No Ac	N	N	N	N	Y	N	Y	Y	Y	**N**	**N**	**Y**
2007	Shi Y[60]	scalp-body-Ac	No Ac	N	Y	N	N	Y	N	Y	Y	Y	**N**	**N**	**N**
2007	Yang D[25]	body Ac	No Ac	N	N	N	N	Y	N	Y	Y	Y	**N**	**N**	**N**
2007	Zhang JL[18]	Scalp Ac	No Ac	N	N	N	N	Y	N	Y	Y	Y	**N**	**N**	**N**
2007	Zhang JL[19]	scalp-body-Ac	No Ac	N	N	N	N	Y	N	Y	Y	Y	**N**	**N**	**N**
2007	Zhang W[16]	Body-Ac	No Ac	N	N	N	N	Y	N	Y	Y	N	**N**	**N**	**N**
2008	Hopwood V[61]	scalp-body-Ac	Sham Ac	Y	Y	Y	N	Y	Y	Y	Y	Y	**Y**	**Y**	**Y**
2008	Zhang HF[62]	Body-Ac	No Ac	N	Y	N	N	Y	N	Y	Y	Y	**N**	**N**	**N**

Table 2: Outcomes for each trial

Year	Author	Total number of participants	Evaluation Criteria	Efficacy standard	Outcomes
1992	Naeser MA[26]	16	Boston motor inventory test-response	Ineffectiveness: improvement < 10% in isolated active range of motion for at least 2 of the 7 tests.	6/10 vs 6/6
1993	HU HH[27]	30	SSS; BI of ADL	Median difference in SSS improvement between 2 groups; Median difference in BI improvement between 2 groups;	SSS: 4, 95%CI:1-7; Subgroup in those SSS<24 BI (ADL)=20, 95%CI(10-30)
1993	Jahansson K[28]	99	BI of ADL; walking, motor function	Mean (SEM) score at Mon.3 and Mon12; Effectiveness: To maintain stance in 2.7year follow-up	BI: 90.4(2.2) vs 72.4(3.2); walking:3.9(0.3) vs 2.9(0.3); motor function:73.8(4.9) vs62.1(5.8); 17/21 vs 9/25

1996	Zhen JG[29]	70	MESSS	Ineffectiveness: the patients whose function deficiency score decrease <18%. MESSS score decrease from baseline.	1/40 vs 5/30 MESSS: 15.53(7.12) vs12.00(8.02)
1997	Kjendahl,A[30]	45	MAS; BI of ADL; NHP	Mean MAS, ADL, NHP at week 6	MAS: 29.1(9.7) vs 26.3(11.1) BI:24.8(6.6) vs 24.3(6.3) NHP: 11.4(11.4) vs 21.6(20.1);
1998	Gosman-Hedstrom, G[31]	104	SSS; BI of ADL and SI of ADL	Difference of changes in SSS, BI, SI between Ac group and 2 control groups at Mon.3	SSS: -0.85 (-4.3 to 2.6); 0.29 (-3.6 to 4.2) ADL: 2.1(8.4 to 12.6); 1.65(-9.6 to 12.9) SI (ADL):0.41 (-2.8 to 3.6); -0.18(-3.8 to 3.5)
1998	Si GM[32]	42	CSS	Change in CSS after treatment	CSS:8.2(3.4) vs 5.1(3.4)

1998	Wang D[33]	160	Clinical symptoms in myodynamia, live independent and speech	Not effectiveness: no change at myodynamia, which increase < 1level,	3/80 vs 13/80
1998	Yin KJ[34]	150	Clinical symptoms (myodynamia, speech, consciousness, prosopoplegia, sleeping, aesthema, tendon reaction)	Ineffectiveness: improvement in less than 1 symptom	16/100 vs 30/50
1999	Jin Z[35]	120	MESSS	Ineffectiveness: the patients whose function deficiency score decrease <18%	5/60 vs 26/60
1999	Li J[36]	64	MESSS	Ineffectiveness: the patients whose function deficiency score decrease <18%	0/30 vs 17/34
1999	Lun X[37]	109	1983 TCM stroke evaluation standard	Effectiveness: Not mentioned.	59/61 vs 25/48
1999	Wong AM[39]	118	FIM	Mean score change in FIM at 2nd week	FIM:21.4 (12.6) vs 17.0 (11.4)

1999	Zhang Q[38]	235	Clinical research guideline in stroke treatment using TCM	Ineffectiveness: no change in clinical symptom	0/139 vs 23/96
2000	Liu J[40]	120	Clinical symptoms (myodynamia, speech, prosopoplegia, , aesthema)	Inefficiency: no change in symptom after treatment.	3/60 vs 22/60
2001	Chen J[41]	37	MESSS	Ineffectiveness: the number of patients whose function deficiency score decrease <18%	0 /21 vs 2 /16
2001	Johansson BB[42]	150	RMI; BI of ADL	Median score after treatment	BI (ADL): 80vs 80 vs 79; RMI : 7 (3-13) vs 7(4-12) vs 7(4-13)
2001	Liu QX[43]	160	MESSS	Ineffectiveness: the patients whose function deficiency score decrease <18%	2/120 vs 6/40
2001	Pei J[44]	86	CSS;BI of ADL; BFM	Mean score (SD) at Mon.3	CSS: 8.1(1.24) vs 14.9(1.17) BMF: 73.5(5.36) vs 47.5(4.71)

					BI: 82.9(3.77) vs 60.4(3.26)
2001	Tao JP[45]	46	MESSS	Ineffectiveness: MESSS decrease <18%	0/26 vs 1/20
2002	Jing M[46]	186	MESSS	Ineffectiveness: the patients whose function deficiency score decrease <18%	89/96 vs 67/90
2002	Su L[47]	83	Myodynamia	Ineffectiveness: no change in myodynamia	1/43 vs 9/40
2002	Sze FK[48]	106	FMAM	Median score; Median score change from baseline to week10 based on BI	BI:3-10: 51.2 vs 53.3 BI:11-14: 89.8 vs 84.0 BI:3-10: 18.8 vs 14.5 BI:11-14: 9.8 vs 12.7
2002	Zhou S[49]	183	Stroke diagnosis and efficacy evaluation standard	Ineffectiveness: score change<11%	35/149 vs 16/34

2004	Alexander DN[50]	32	FM; FIM	Mean score change between baseline and week2	FM: 5.5(13.8) vs 7.7(12.3) FIM: 11.2(4.5) vs 8.5(3.8)
2004	Fink M[51]	25	MAS	Mean score after treatment	MAS: 3.3(1.1) vs 3.3(0.9)
2004	Zhang X[52]	80	MESSS	Ineffectiveness: the patients whose function deficiency score decrease <18%	2/40 vs 4/40
2005	Lei Z[53]	69	CSS	Ineffectiveness: The score reduce <20%	3/43 vs 5/26
2005	Park J[54]	116	BI of ADL	Median score change between baseline and post treatment	BI: 4 (0-8) vs 3 (0-7)
2005	Wang Z[55]	120	MESSS	Ineffectiveness: the patients whose function deficiency score decrease<18%.	2/60 vs 3/60
2005	Wayne PM[57]	33	upper-extremity(UE) function with (FMA)	FMA change between 2 groups at week 12	FMA: (-)0.05 (-4.2 to 4.1)

2005	Zeng XR[56]	101	BI of ADL, Mortality	Ineffectiveness: BI (ADL)<60 plus death and lost to follow-up (regard as death)	13/49 vs 15/52
2006	Ge ZX[21]	46	CSS	Ineffectiveness: function deficiency score change < 11%	1/25 vs 3/21
2006	Guo ZJ[58]	76	NFI, FMA, MBI.	The difference of each index between each group after treatment	BMI: 73.57 (13.45) vs 52.31(23.66) vs 39.00(23.92)
2006	Li SC[24]	120	Clinical symptoms (myodynamia, speech, prosopoplegia, , aesthema)	Inefficiency: no change in symptom after treatment.	1/60 vs 11/60
2006	Liu M[20]	80	FMA ; MBI	The difference of each index between each group after treatment	FMA 58.72(24.58) vs 43.66 (25.56) BMI 66.02(20.72) vs 50.88(15.73)
2006	Rao P[23]	40	SSS, BI of ADL, MRS; incidence of disability and mortality rate	SSS after the treatment. Incidence of disability and mortality rate at the 3rd	SSS: 28.55(9.26) vs 27.45(7.98) 5/20 vs 9/20

				month	
2006	Xu YL[22]	80	FMA	The difference of FMA between each group after treatment	28.44(6.43) vs 21.67(6.67)
2007	Guo DY[59]	80	FIM, NISSS,	mean score after the treatment	NISSS:21.13(6.12)vs27.78(8.63)
2007	Heieh R[15]	63	FMA, FIM	Mean score after the treatment	FMA: 27.4 vs 17.1 FIM:116.2(34.6) vs 125.8(43.3)*
2007	Peng L[17]	80	FMA, BI of ADL	Mean score after the treatment	FMA:46.73(33.81) vs 33.71(25.21) ADL:51.21(21.31) vs 43.21(21.21)
2007	Shi Y[60]	86	FMA, BI of ADL, MESSS	Ineffectiveness: the patients whose function deficiency score decrease <18%	3/43 vs 10/43

2007	Yang D[25]	100	CSS	Ineffectiveness: function deficiency score change < 18%	3/50 vs 11/50
2007	Zhang JL[18]	206	Clinical symptoms (myodynamia, speech, prosopoplegia, , aesthema)	Inefficiency: no change in symptom after treatment.	17/103 vs 48/103
2007	Zhang JL[19]	220	BI of ADL, MESSS	Ineffectiveness: the patients whose function deficiency score decrease<18%	17 /110 vs 39 /110
2007	Zhang W[16]	90	BI of ADL, FMA, Clinical therapeutic effect	Failed in therapeutic effect: No obvious improvement shown by FMA	17/ 60 vs 20/30
2008	Hopwood V[61]	105	BI MI NHP	Mean score between 2 groups Effectiveness: the patients whose BI increase from 0-12 range to 13-20 range	mean score of MI: 29.15 vs 40.20 at 3 weeks and no difference in the others 20/47 vs 17/45

2008	Zhang HF[62]	120	BI	Ineffectiveness: the patients whose BI score increase <10	4/60 vs 12/60

Scandinavian STROK Scale (SSS), Rivermead Index (RMI), Motor Assessment Scale (MAS), Boston Motor Inventory test, Fugl-Meyer Assessment (FMA), Brunnstorm-Fugl-Meyer test (BFM). Chinese Stroke Score (CSS), New Chinese Herbal Medicines in Stroke (UNCHMS), Modified Edinburgh-Scandinvian Stroke Scale (MESSS), NIH stroke scale NIHSS). Barthel ADL Index (BI), Functional Independence Measure (FIM), Sunnaas ADL index (SADLI).