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Acupuncture for post-stroke depression: a systematic review and network meta-analysis

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Abstract

Background Patients with post-stroke depression (PSD) usually experience anxiety, hopelessness, and insomnia, which have a negative impact on their daily activities and post-stroke rehabilitation. Acupuncture (AC), as a minimally invasive technique, has become a popular choice for improving depression symptoms. However, it is still unclear which therapy is associated with the best outcomes for PSD. In this review, we aimed to explore the impact of AC in alleviating symptoms of PSD and to evaluate the difference in effectiveness between AC combined with pharmacotherapies and various non-pharmacotherapies.

Methods Six databases and three clinical trials registration platforms were searched from inception to March 2023. Randomized clinical trial comparing needle-based AC with pharmacotherapy, and other non-pharmacotherapy or invalid group were included. Two independent reviewers identified eligible studies, and collected data using a pre-made form. A Bayesian network meta-analysis was conducted to assess and compare different techniques using RStudio 3.6.0 with the package 'GEMTC' V.0.8.1. The primary outcome was the efficacy for PSD assessed by scales measuring depressive symptoms. The secondary outcomes were effectiveness for neurological function and the quality of life. The ranking probabilities for all treatment interventions was performed using the Surface Under the Cumulative Ranking curve (SUCRA). The risk of bias was assessed by using the Revised Cochrane Risk of Bias tool 2.

Results Sixty-two studies, involving 5308 participants published from 2003 to 2022, were included. The results showed that compared with western medicine (WM) (defined as pharmacotherapy for PSD), AC alone or with repetitive transcranial magnetic stimulation (RTMS), Traditional Chinese medicine (TCM) alone or with WM, were superior for alleviating depression symptoms. Compared to Usual Care, AC alone or plus other therapies could significantly decrease scores on the Hamilton Depression Rating scale. According to result of SUCRA, AC plus RTMS had the highest probability of improving depressive symptoms with a probability of 49.43%.

Conclusions The results of this study indicate that AC alone or combined with other therapies appears to be effective in improving depression symptoms of stroke survivors. Moreover, in comparison to WM, AC alone or plus

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RTMS, TCM, TCM with WM, or WM, were more effective in improving depression symptoms of PSD. Also, AC with RTMS seems to be the most effective with the highest probability.

Registration This study was registered in the International Prospective Register of Systematic Reviews (PROSPERO) database in November 2020 and updated in July 2021. The registration number is CRD42020218752.

Keywords Acupuncture, Post-stroke depression, Network meta-analysis

Background

Stroke is the second leading cause of death, according to the World Health Organization (WHO) in 2019, responsible for approximately 11% of total deaths [1]. Moreover, it is also one of the leading causes of disability worldwide, and causes the loss of a great number of healthy life-years due to serious post-stroke sequelae (such as paralysis, aphasia, dysphagia, epilepsy, and cognitive difficulty) [2–5]. Facing severe symptoms and different physical disabilities, stroke survivors might face tremendous health challenges, and they are more likely to suffer from psychological disorders. Depression is one of the most common complications after stroke, with a prevalence of 30–33% [6–9]. Patients with post-stroke depression (PSD) usually experience anxiety, hopelessness, unwillingness to communicate, and insomnia, which could have a negative impact on daily activities and post-stroke rehabilitation [10]. Moreover, it is suggested that PSD is associated with an increased risk of mortality in stroke survivors [6]. Therefore, it is quite crucial to devise an effective and safe treatment for PSD. Selective serotonin reuptake inhibitors (SSRIs) are commonly recommended as the first-line pharmacological treatments [11]. However, there still exists a debate on whether SSRIs could increase the risk of intracerebral hemorrhage and subsequent stroke [12, 13].

Acupuncture (AC), as a minimally invasive technique, has been widely used for improving symptoms of a variety of health problems in China and worldwide [14–16]. Many published studies have investigated the effectiveness of AC for PSD. One meta-analysis by Xin Yan Zhang etc. included seven studies comparing the effectiveness rate of AC with control group in alleviating the symptoms of PSD. Their results supported that AC was an effective and safe treatment for PSD[17]. (RR 1.16, 95% CI 1.08–1.24). Another study by Xue Wang, etc. evaluated the effectiveness of AC combined with western medicine for PSD based on 24 studies. The meta-analysis showed AC combined with fluoxetine was superior to fluoxetine alone for relieving depressive symptoms [18]. Moreover, more clinical trials evaluated whether there was a better effect when AC combined with other non-pharmacotherapies for PSD. The study by Zhang LIN etc. investigated the efficacy of AC plus Tai Chi in recovering the neurological function and treating depression in PSD [19]. Another study compared the difference between

AC combined plus cognitive therapy with paroxetine [20]. The authors of Yaqun WANG etc. enrolled 103 participants to evaluate the effect of AC plus Jieyu Qingxin Decotion (a Traditional Chinese herbal medicine) combined compared with paroxetine.

In this review, we aimed to explore the true effect of AC in alleviating symptoms of PSD based on both direct and indirect evidence using the network meta-analysis (NMA) method [21]. Moreover, we also aimed to evaluate the difference in effectiveness between AC with pharmacotherapies and other non-pharmacotherapies in order to provide optimized guidance and advice for clinical personnel.

Methods

This review was reported in accordance with the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) for Network Meta-Analyses (Appendix 1), [22] and was registered in the International Prospective Register of Systematic Reviews (PROSPERO) database in November 2020 and updated in July 2021 (Registration no.: CRD42020218752) [23].

Literature search

The Cochrane Library, PubMed, EMBASE, China National Knowledge Infrastructure (CNKI), Wanfang Database, Chongqing VIP Database (CQVIP) were searched for systematic reviews of published articles from inception to March 2023. The clinical trials registration platform and websites were additionally searched, including the International Clinical Trials Registry Platform (ICTRP) (https://www.who.int/clinical-trials-registry-platform), ClinicalTrials.gov (https://www.clinicaltrials.gov/), ISRCTN registry (http://www.isrctn.com/editAdvancedSearch), https://scholar.google.com.tw/, https://xueshu.baidu.com/, https://www.geenmedical.com/. There was no restriction in language or publication year. Besides, the references of relevant reviews and systematic reviews were retrieved to search for potential eligible studies. The search strategy of this study is shown in Supplementary Appendix 2.

Inclusion Criteria and Exclusion Criteria

Studies comparing needle-based AC (alone or combined with other treatments) with pharmacotherapy, other non-pharmacotherapy or invalid groups (including

placebo, waitlist and blank control) were included. The specific inclusion criteria are following:

P - Participants who were clinically diagnosed with stroke, 18 years or older, and with any degree of stroke impairment severity.

I - AC treatments alone or combined with other treatments (pharmacotherapy and non- pharmacotherapy therapies). AC treatments are specified as needle-based AC, including but not limited to manual, electro-AC, fire AC, warm AC, ear (auricular) AC, head AC, and more.

C - Pharmacotherapy, other non-pharmacotherapy, or invalid groups, including placebo, waitlist and no treatment.

O - Primary outcome was the efficacy for PSD assessed by scales measuring depressive symptoms. Secondary outcomes were the effectiveness for neurological function and quality of life.

S - Only randomized controlled trial (RCT).

Exclusion criteria were: (1) studies comparing with different types of AC; (2) total sample size was less than 30.

Literature selection and data extraction
Two independent reviewers extracted data from selected RCTs. The basic characteristics such as first author, study title, participants (gender, age, sample size), study design (randomization, blinding), details of interventions, outcome measures, results and adverse events were abstracted and recorded into a pre-made form. Any disagreements were reviewed by a third reviewer and resolved by discussion among all reviewers.

Risk of bias assessment
The risks of bias of included RCTs were assessed based on the Revised Cochrane Risk of Bias tool 2 [24]. Five domains were evaluated: Domain 1: Risk of bias arising from the randomization process; Domain 2: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention); Domain 3: Missing outcome data; Domain 4: Risk of bias in measurement of the outcome; Domain 5: Risk of bias in selection of the reported result. Each domain was evaluated as low risk, some concerns, or high risk. The overall bias was ranked as "low risk of bias" if all domains were rated as low, or as "some concerns" if there was no high risk of bias, and all domains were rated as low or some concerns, or as "high risk of bias" if one or more domains were rated as high risk of bias. Two reviewers independently performed risk of bias assessment. Disagreements were resolved by consensus; failing that, a third reviewer made the final decision. The appraisal of acupuncture procedures was assessed by Revised Standards for Reporting Interventions in Clinical Trials of Acupuncture (STRICTA) [25].

Assessing certainty of the evidence
The Confidence in Network Meta-Analysis (CINeMA) system, a free and open-source CINeMA software (https://cinema.ispm.unibe.ch/), was used to assess credibility of results from network meta-analyses, which is based on the Grading of Recommendations Assessment, Development and Evaluation (GRADE) s [26, 27] and simplifies the evaluation process. Six domains were evaluated, including: (a) within- study bias, (b) reporting bias, (c) indirectness, (d) imprecision, (e) heterogeneity, and (f) incoherence. Each domain was rated at 3 levels "no concerns", "some concerns", or "major concerns".

Statistical analysis
Pairwise meta-analysis
Risk ratios with 95% credible intervals were used for dichotomous outcomes. Mean differences or with 95% credible intervals were used for continuous outcomes. We assessed clinical and methodological heterogeneity through examination of the characteristics of the included trials. Heterogeneity across trials was assessed by X^2 and I^2 statistics. Publication bias was examined using Begg's and funnel plot method when applicable. The contour-enhanced funnel plot was obtained as an aid to distinguish asymmetry due to publication bias.

Network meta-analysis
A network plot was drawn to present the geometry of the network of comparisons across trials to ensure the network meta-analyses were feasible. Trials were excluded if they were not connected by interventions.

We performed Bayesian network meta-analyses to compare the effects of different prophylactic agents because it calculates the posterior distribution of the parameters using the data to update prior information and is more common than frequentist approaches. Markov chains were used to generate samples. Model convergence was assessed using the Brooks-Gelman-Rubin plots method. Global heterogeneity was assessed on the bias of the magnitude of heterogeneity variance parameter estimated from the network meta-analyses models. All included interventions were included for synthesis of data. However, if there were treatments which could not be able to form a connected loop with other interventions, they would not be compared and analyzed in the network meta-analysis. A node-splitting method was used to examine the inconsistency between direct and indirect comparisons when a loop connecting three arms existed. The ranking probabilities for all treatments were estimated, and a treatment hierarchy using the probability of being the best treatment could be obtained. This process was performed using the Surface Under the Cumulative Ranking curve (SUCRA). We used the frequentist approach to compare stability if necessary.

Statistical analysis was performed with STATA 15.0 and RStudio 3.6.0 with the package 'GEMTC' V.0.8.1.

Results

Search results

Initially, 8, 130 records were identified. After screening titles and abstracts, 5,864 records were excluded and the remaining were considered potentially eligible for full-text screening. Finally, 62 studies [20, 28–89] involving 5,500participants published from 2003 to 2022 were included in this review. The flow chart of the process of
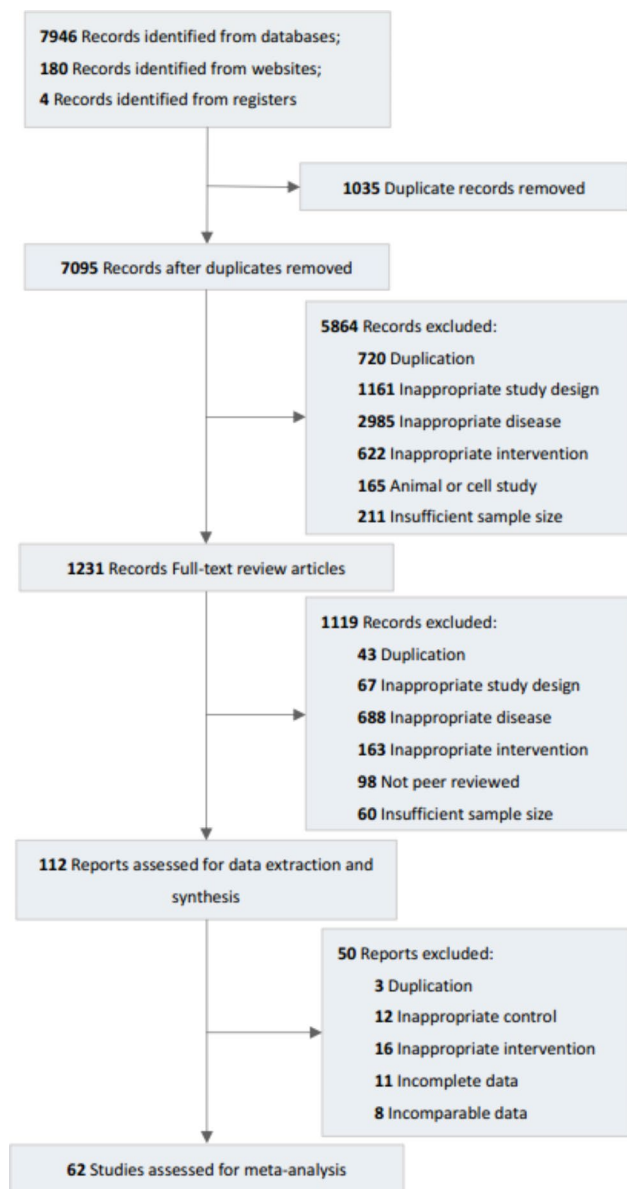

Fig. 1 Flow diagram outlining the guideline selection process
#Cochrane Library- 1032; PubMed- 2786; EMBASE- 2204; China National Knowledge Infrastructure (CNKI) -1065; Wanfang Database- 561; Chongqing VIP Database (CQVIP) – 298

study selection and studies considered for inclusion is shown in Fig. 1.

Characteristics of included studies

The main characteristics of the included studies are shown in Table 1. Sixty-two studies involving 5,500 participants were included. All of them were from China. Apart from Usual Care (UC) (defined as controlling blood pressure and blood sugar, physical exercise or pharmacotherapy for stroke rehabilitation, and no special treatment for depression), twelve various treatments were included. Among them, acupuncture (AC) with pharmacotherapy, which is divided into AC with Western Medicine (WM) and AC with Traditional Chinese Medicine (TCM), (in this case, traditional Chinese herbal remedies), and AC with both TCM and WM. There were also five therapies comprising AC plus non-pharmacotherapy, including repetitive transcranial magnetic stimulation (RTMS), Tai Chi, Cognitive Therapy (CT), psychotherapy, and moxibustion (AM). There was one RCT exploring the treatment difference between AC with RTMS and AC alone. One study investigated the efficacy of AC combined with Tai Chi in comparison with WM. Another study evaluated AC combined with psychotherapy. Eleven studies were divided into three groups, while others were based on two groups. Twenty-eight explored the effect of AC alone in comparison with WM or UC.

Assessment results of risk of Bias and Reporting Quality based on STRICTA

The quality assessment results are given in Fig. 2. Seven studies (7, 11.86%) had low risk of bias arising from the randomization process (Domain 1). Nine studies (9, 15.25%) were evaluated as "low" for the risk of bias due to deviations from the intended interventions (Domain 2). In terms of overall risk of bias, 26 studies were ranked as "high", 27 as "some concern", and 6 as "low". The assessment results for each domain were presented in the Supplementary Appendix 3.

The reporting quality specifically for acupuncture procedures was evaluated by STRICTA tool with 17 items. The assessment results showed that all of the studies (100%) reported the style of acupuncture (Item 1a), and 41 RCTs (66.1%) demonstrated the needle type (Item 2 g) (Fig. 3). There were 39 (66.1%) studies that presented the "response sought" (Item 2d). Only 20 (32.2%) reported the "number of needle insertions per subject per session" (Item 1c). None illustrated the "setting and context of treatment, including instructions to practitioners, and information and explanations to patients" (Item 4b) and "rationale for the control or comparator" (Item 6a). The details of the STRICTA assessment for each study are listed in Supplementary Appendix 3.

Table 1 Description of included studies

Study	Age (Treatment /Control)	Arm	Sample size (Treatment /Control)	Interventions Group 1	Group 2	Group 3	Treatment duration
Xin TONG 2012[58]	58.5±8.4	2	30/30	AC+WM	WM	-	8w
Yan-xiang LIU 2010[48]	male 63.8±10.0/female 59.8±8.7	2	40/40	AC	UC	-	4w
Si-qi WU 2020[64]	60.1±10.7/58.3±11.2	2	30/30	AC+WM	WM	-	8w
Xiao-ling Wu 2009[65]	56±9.63	2	38/36	AC+WM	WM	-	40d
Li-jun YAO 2017[20]	65±11/63±12	2	30/30	AC+CT	WM	-	4w
Lei JIANG 2011[42]	58.93±3.58/59.67±3.43	2	30/30	AM+WM	WM	-	6w
Pei-yang SUN 2013[56]	58±8/59±9	2	30/30	AC	WM	-	4w
Pei-yang SUN 2015[55]	59±7/58±8	2	33/30	AC	WM	-	4w
Xiao CHANG 2012[28]	56.8/55.9	2	32/30	AC+TCM	WM	-	6w
Zhong-jin ZHANG 2011[82]	56.7±12.1/55.8±9.7	2	40/38	AC	UC	-	3w
Gui-bo ZHANG 2010[81]	65±5/66±5	2	30/30	AC+WM	WM	-	4w
Ru ZHANG 2011[71]	50.1–71.2/49.9–68.7	2	39/39	AC+RTMS	AC	-	4w
Lin ZHANG 2017[70]	59±9/58±8	2	30/30	AC	WM	-	8w
Gang XU 2014[67]	59.4±7.6/60.8±6.9	2	20/18	AC+WM	WM	-	6w
Shu-qing DAI 2010[33]	64.36±5.46/65.32±5.09	2	24/24	AC+TCM	WM	-	4w
Jian ZHU 2012[85]	NR	2	20/20	AM+WM	WM	-	6w
Yong-gang ZHU 2012[74]	67.3±4.5/68.9±6.1	2	21/21	AC	WM	-	8w
Li LI 2011[45]	65±13/63±12	2	20/19	AC	WM	-	4w
Hongjie LI 2011[79]	29-60/32-63	2	23/20	AC	WM	-	6w
Zi-ling LIN 2010[46]	52-84	2	20/20	AC	UC	-	4w
Yun WU 2011[62]	62±11/64±11	2	36/36	AC	WM	-	8w
Hai-feng JIAO 2012[44]	43-78,63.3/45-76	2	17/16	AC+WM	WM	-	4w
Lai-qun WANG 2010[59]	40-70/40-68	2	30/30	AC+TCM	WM	-	8w
Chang-chang YAN 2018[88]	62.1±13.5/62.3±13.6	2	45/45	AM+WM	WM	-	4w
Yuan CHENG 2007[31]	72±8/69±7/69±6	3	19/20/21	special AC	AC	UC	6w
Yuan CHENG 2008[32]	61.7±8.1/63.2±7.9/62.9±7.3	3	20/20/20	special AC	AC	UC	6w
Rong-rong NIE 2011[50]	64.2±9.85/63.1±9.55	2	33/30	AC	WM	-	4w
Zhi-wei SU 2010[53]	55.8±6.1/54.2±6.5	2	30/30	AC	WM	-	30d
Guo-min JIANG 2007[78]	60.5	2	25/25	AC+Psych	Psych	-	4w
Zhen-ya JIANG 2011[43]	60.32±3.26/61.18±2.94	2	33/33	AC+WM	WM	-	4w
Xiao-bing ZHAO 2012[87]	56±13.9/57±12.8	2	45/45	AC+WM	WM	-	20d
Ai-song GUO 2011[36]	40-65	3	32/31/32	AC	WM	AC+WM	6w
Ai-wen CHEN 2017[29]	57±11/58±11	2	30/30	AC	UC	-	4w
Lu-jie CHEN 2018[30]	62.37±6.28/60.21±5.78	2	30/30	AC	WM	-	4w
Ru-hua SUI 2009[54]	62.93±7.25	2	36/36	AC	UC	-	4w
Wa GAO 2017[35]	58.12±3.27	2	33/33	AC	AC+Cupping+Psych	-	10d
Shi-le HUANG 2014[41]	61.43±9.91/62.10±8.11/62.77±9.32	3	30/30/30	AC	WM	AC+WM	6w
Long HUANG 2011[40]	65.22±8.69/65.39±11.26/63.25±10.28	3	30/30/30	AC+TCM	TCM	WM	60d
Ai-bing ZHANG 2009[80]	63±11total	2	40/35	AM+TCM	WM	-	30d
Xiao-jing DUAN 2012[77]	58.80±9.60/60.22±8.12	2	30/30	AC	WM	-	8w
Feng-kui ZHU 2010[75]	NR	2	30/30	AC+WM	WM	-	4w
Ya-hui WANG 2016[60]	66±6/65±7/66±8	3	30/30/30	AC	UC	-	4w

Table 1 (continued)

Study	Age (Treatment /Control)	Arm	Sample size (Treatment /Control)	Interventions Group 1	Group 2	Group 3	Treatment duration
Wen-ge SUN 2012[57]	54.7±2.9/54.2±3.1	2	50/40	AC+TCM	UC	-	3w
Rui-you GUO 2009[37]	65.8±9.61/67.6±12.43/64.5±12.07	3	40/40/40	AC	WM	UC	6w
Su-kun LIU 2006[47]	60.0±9.8/59.6±8.9	2	101/145	AC	WM	-	6w
Ya-fen ZHOU 2014[84]	64±15/65±11	2	75/72	AC+WM	WM	-	8w
Hui-yuan PENG 2011[51]	64.6±11.3/73.7±11.8	2	58/59	AC	WM	-	4w
Wei ZHANG 2011[72]	28–80/30–83/44–85	3	52/49/49	AC+TCM	AC	TCM	45d
Ya-qun WANG 2020[61]	70.44±5.62/70.53±6.44	2	52/51	AC+TCM+WM	WM	-	60d
Rong-rong NIE 2013[49]	64±10/63±10/64±10	3	42/41/40	AM+WM	AM	WM	4w
Hong ZHAO 2003[86]	NR	2	50/50	AC	WM	-	8w
Wei XIAO 2009[66]	53±6/51±8	2	40/40	AC+WM	WM	-	30d
Hui-qin DING 2020[34]	54.63±3.51/54.27±3.43	2	61/61	AC+WM	WM	-	4w
Jia-ping WU 2010[63]	56.2±9.2/55.7±9.4	2	150/150	AC	WM	-	60d
Shu-chang SONG 2014[52]	57.25±11.32/57.46±11.57	2	100/100	AC	WM	-	8w
L. ZHANG 2018[76]	63.7±6.8/62.4±7.6	2	45/45	AC+Tai Chi	WM	-	30d
Zhi-en ZHOU 2020[73]	64.52±1.10/65.16±12.60	2	140/85	AC+TCM+WM	WM	-	12d
Jun HE 2007[39]	53.16±11.20/53.86±12.34	2	180/76	AC	WM	-	30d
Xi-jun HE 2005[38]	41–72/39–71	2	86/86	AC	WM	-	8w
Wa CAI 2022[87]	67.8±10.91/66.7±11.42	2	33/32	AC	UC	-	4w
Xiao-Jun YIN 2022[88]	58.9±7.6/61.9±10.0	2	30/30	AC	UC	-	4w
Yanli YOU 2020[89]	NR	2	34/33	AC+WM	WM	-	4w

NOTE: AC, Acupuncture; AM, Acupuncture and moxibustion; TCM, Traditional Chinese medicine; WM, Western medicine; UC, Usual care; RTMS, Repetitive transcranial magnetic stimulation; CT, Cognitive therapy; NR, not reported
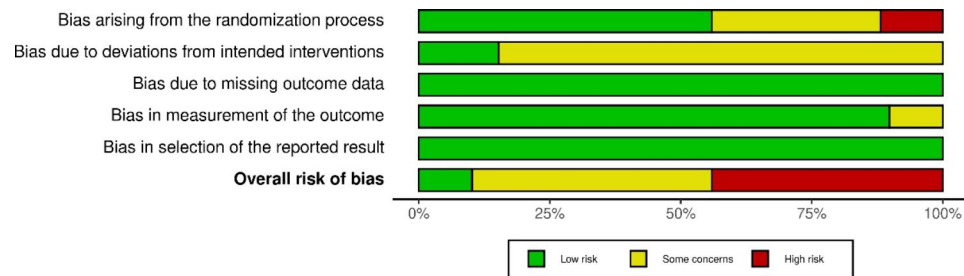
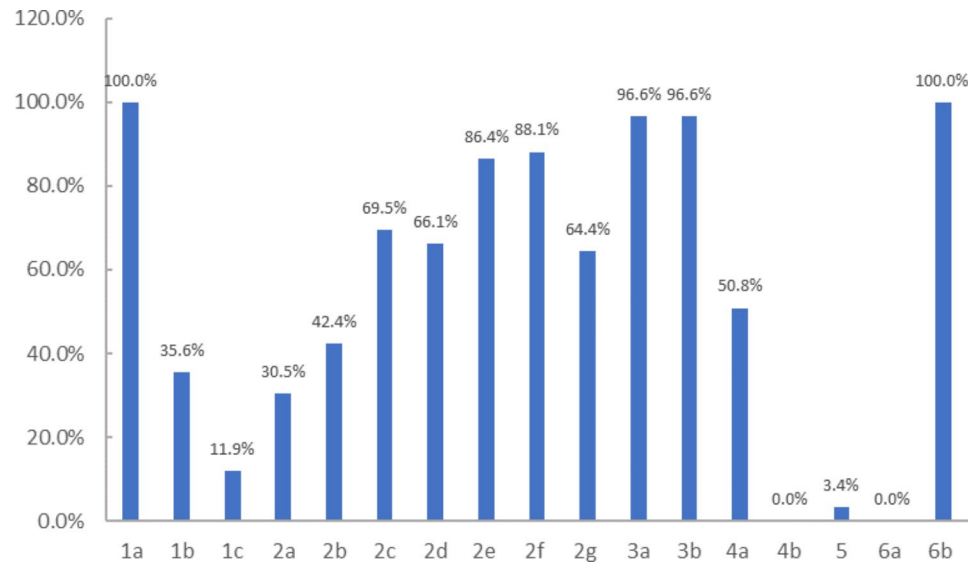**Fig. 2** The results of ROB 2 assessment for included studies

Fig. 3 The results of STRICTA assessment for included studies

Note: 1a) Style of acupuncture (e.g. Traditional Chinese Medicine, Japanese, Korean, Western medical, etc.); 1b) Reasoning for treatment provided, literature sources, and/or consensus methods, with references where appropriate; 1c) Extent to which treatment was varied; 2a) Number of needle insertions per subject per session (mean and range where relevant) ; 2b) Names (or location if no standard name) of points used (uni/bilateral) ; 2c) Depth of insertion, based on a specified unit of measurement; 2d) Response sought (e.g. de qi or muscle twitch response); 2e) Needle stimulation (e.g. manual, electrical) ; 2f) Needle retention time; 2 g) Needle type (diameter, length, and manufacturer) ; 3a) Number of treatment sessions; 3b) Frequency and duration of treatment sessions; 4a) Details of other interventions administered to the acupuncture group (e.g. moxibustion, cupping, herbs, exercises); 4b) Setting and context of treatment, including instructions to practitioners, and information and explanations to patients; 5) Description of participating acupuncturists (qualification or professional affiliation, other relevant experience) ; 6a) Rationale for the control or comparator in the context of the research question, with sources that justify this choice; 6b) Precise description of the control or comparator. If sham acupuncture or any other type of acupuncture-like control is used, provide details as for Items 1 to 3 above

Network meta-analysis

The network evidence plots are presented in Fig. 4. The main results were the NMA for depression. Fifty-three studies involving 4,739 patients reported changes in depression scores on the Hamilton Depression Rating Scale (HAMD), 24 for HAMD-17, 1 for HAMD-21, 28 for HAMD-24. The scores of different versions of HAMD were standardized. One study comparing the treatment of acupuncture combined with psychotherapy was excluded due to its failure to directly or indirectly connect with other interventions [78]. Six three-armed-based studies and 46 two-arm-based studies were included. A total of 110 arms were included, 42 arms for WM, 30 for AC, 12 for AC with WM, 9 for UC, 4 for AC with TCM, 4 for AM with WM, 2 for AM with TCM with WM, 2 for TCM, 1 arm for AC with RTMS, 1 for AC with Tai Chi, 1 arm for AM with TCM, 1 for AC with CT, 1 for AM. Among these studies, the largest number of studies were those comparing AC with WM (n=20). The following comparison types of studies were AC with WM versus WM (12, 23%) and AC versus UC (9, 17%). The main results of the NMA for depression are displayed in Table 2. The results of direct comparison and indirect comparison were provided in Supplementary Appendix 4.

On the whole, interventions administering combined therapies were more effective in comparison with those using single therapy. The results of NMA showed that compared with WM alone, the administration of AC with RTMS were superior in alleviating depression symptoms
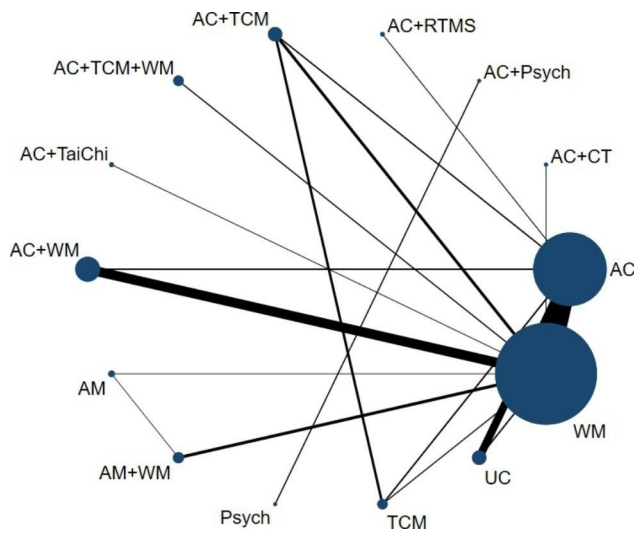
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Fig. 4 Network plot
NOTE: The estimates of mean difference of treatments in the columns versus rows presented in the lower diagonal elements (while those of the row treatments vs. column treatments are presented in the upper diagonal elements). The MD of significant difference was presented in bold font. AC, Acupuncture; AM, Acupuncture and moxibustion; TCM, Traditional Chinese medicine; WM, Western medicine; UC, Usual care; RTMS, Repetitive transcranial magnetic stimulation; CT, Cognitive therapy

(MD: -8.73, 95% CI: -16.64, -0.79). There were similar results when comparing AC with TCM and WM, AC with TCM, TCM alone, AC with WM, and AC alone. Compared to UC, AC alone or in combination with other interventions could lower HAMD scores (*AC with RTMS*: MD, -13.30, 95% CI: -21.47, -5.13; *AC with TCM with WM*: MD, -10.40, 95% CI: -16.55, -4.27; *AC with TCM*: MD, -11.35, 95% CI: -15.77, -6.74; *AC with Tai Chi*: MD, -9.09, 95% CI: -17.34, -0.85; *AC with CT*: MD, -8.54, 95% CI: -16.80, -0.28; *TCM*: MD, -9.98, 95% CI: -15.91, -4.06; *AM*: MD, -6.91, 95% CI: -14.45, -0.12; *AC with WM*: MD, -9.00, 95% CI: -12.66, -5.36; *AM with WM*: MD, -6.91, 95% CI: -11.83, -2.05; *AC*: MD, -8.03, 95% CI: -10.63, -5.45; *WM*: MD, -4.56, 95% CI: -7.61, -1.55). However, no significant difference was found among AC, WM, and TCM with AC plus any other treatment (AC with RTMS, AC with TCM, AC with TCM with WM, AC with Tai Chi, AC with WM, AC with CT, AM and AM with WM).

The analysis of heterogeneity showed the I^2 of direct comparison was 97.66%, and the global I^2 was 97.38%. The I^2 of each comparison group was seen in Supplementary Appendix 5. Examination of consistency with the node-splitting analysis approach indicated that there was

Table 2 The result of NMA for depression

AC+RTMS	AC+TCM+WM	AC+TCM	AC+Tai Chi	AC+CT	TCM	AM	AC+WM	AM+WM	AC	WM	UC
AC+RTMS											
-2.90 (-12.45, 6.67)	**AC+TCM+WM**										
-2.07 (-10.64, 6.55)	0.84 (-5.55, 7.23)	**AC+TCM**									
-4.22 (-15.19, 6.81)	-1.31 (-10.65, 8.06)	-2.14 (-10.57, 6.28)	**AC+Tai Chi**								
-4.77 (-15.77, 6.29)	-1.85 (-11.21, 7.51)	-2.69 (-11.12, 5.73)	-0.55 (-11.4, 10.3)	**AC+CT**							
-3.32 (-12.71, 6.12)	-0.40 (-7.94, 7.08)	-1.25 (-6.48, 3.95)	0.90 (-8.4, 10.2)	1.43 (-7.87, 10.76)	**TCM**						
-6.39 (-16.89, 4.15)	-3.49 (-12.18, 5.25)	-4.31 (-12.03, 3.34)	-2.18 (-12.46, 8.14)	-1.62 (-11.89, 8.66)	-3.06 (-11.74, 5.59)	**AM**					
-4.29 (-12.45, 3.9)	-1.39 (-7.17, 4.39)	-2.23 (-6.32, 1.88)	-0.09 (-8.05, 7.9)	0.46 (-7.5, 8.45)	-0.98 (-6.65, 4.73)	2.09 (-5.12, 9.28)	**AC+WM**				
-6.37 (-15.16, 2.41)	-3.47 (-10.05, 3.15)	-4.31 (-9.5, 0.87)	-2.16 (-10.76, 6.44)	-1.62 (-10.21, 6.97)	-3.07 (-9.57, 3.45)	0 (-6.86, 6.84)	-2.09 (-6.52, 2.34)	**AM+WM**			
-5.26 (-13.01, 2.49)	-2.36 (-7.96, 3.25)	-3.20 (-6.93, 0.53)	-1.05 (-8.9, 6.8)	-0.51 (-8.36, 7.37)	-1.95 (-7.29, 3.41)	1.11 (-5.96, 8.16)	-0.97 (-3.61, 1.67)	1.11 (-3.09, 5.31)	**AC**		
-8.73 (-16.64, -0.79)	**-5.82 (-11.17, -0.46)**	**-6.67 (-10.15, -3.18)**	-4.52 (-12.18, 3.15)	-3.97 (-11.64, 3.71)	**-5.42 (-10.67, -0.14)**	-2.36 (-9.21, 4.51)	**-4.44 (-6.62, -2.26)**	-2.35 (-6.19, 1.49)	**-3.47 (-5.15, -1.78)**	**WM**	
-13.30 (-21.47, -5.13)	**-10.40 (-16.55, -4.27)**	**-11.23 (-15.77, -6.74)**	**-9.09 (-17.34, -0.85)**	**-8.54 (-16.80, -0.28)**	**-9.98 (-15.91, -4.06)**	**-6.91 (-14.45, -0.12)**	**-9.00 (-12.66, -5.36)**	**-6.91 (-11.83, -2.05)**	**-8.03 (-10.63, -5.45)**	**-4.56 (-7.61, -1.55)**	**UC**

NOTE: The estimates of mean difference of treatments in the columns versus rows presented in the lower diagonal elements (while those of the row treatments vs. column treatments are presented in the upper diagonal elements). The MD of significant difference was presented in bold font. AC, Acupuncture; AM, Acupuncture and moxibustion; TCM, Traditional Chinese medicine; WM, Western medicine; UC, Usual care; RTMS, Repetitive transcranial magnetic stimulation; CT, Cognitive therapy

Table 3 Ranking probability of different interventions

	Treatments	Cumulative Probability
1	AC + RTMS	49.39%
2	AC + TCM + WM	11.11%
3	AC + TCM	10.61%
4	AC + Tai Chi	10.34%
5	AC + CT	8.13%
6	TCM	7.32%
7	AM	2.53%
8	AC + WM	0.37%
9	AM + WM	0.16%
10	AC	0.01%
11	WM	0.00%
12	UC	0.00%

NOTE: AC, Acupuncture; AM, Acupuncture and moxibustion; TCM, Traditional Chinese medicine; WM, Western medicine; UC, Usual care; RTMS, Repetitive transcranial magnetic stimulation; CT, Cognitive therapy

no significant inconsistency (*P*>0.05) (Supplementary Appendix 6).

Table 3 presents the values of SUCRA, the hierarchy of thirteen treatments. According to SUCRA, AC plus RTMS had the highest probability of improving depressive symptoms with a probability of 49.39%. The next were AC with TCM with WM (11.11%), AC with TCM (10.61%), AC with Tai Chi (10.34%), which were very close. The probability of AC with CT and TCM were 8.13% and 7.32% respectively. The figure for SUCRA is attached in Supplementary Appendix 7.

Pairwise meta-analysis

Ten studies [29, 36, 40, 45, 54–56, 58, 62, 64] used the Modified Edinburgh-Scandinavian Stroke Scale (MESSS) to measure neurological impairment. As shown in Fig. 5, the results of pairwise meta-analysis showed that AC was significantly associated with better neurological function improvement than UC or WM (MD, -8.45, 95% CI: -12.85, -4.05; MD, -5.11, 95% CI: -6.50, -3.73, respectively). Similarly, AC with WM and AC with TCM were superior to WM (MD, -5.07, 95% CI: -8.41, -1.73; MD, -5.32, 95% CI: -8.89, -1.66, respectively).

The confidence assessment result of NMA

The CINeMA system (https://cinema.ispm.unibe.ch/) was used to classify the confidence in the results of
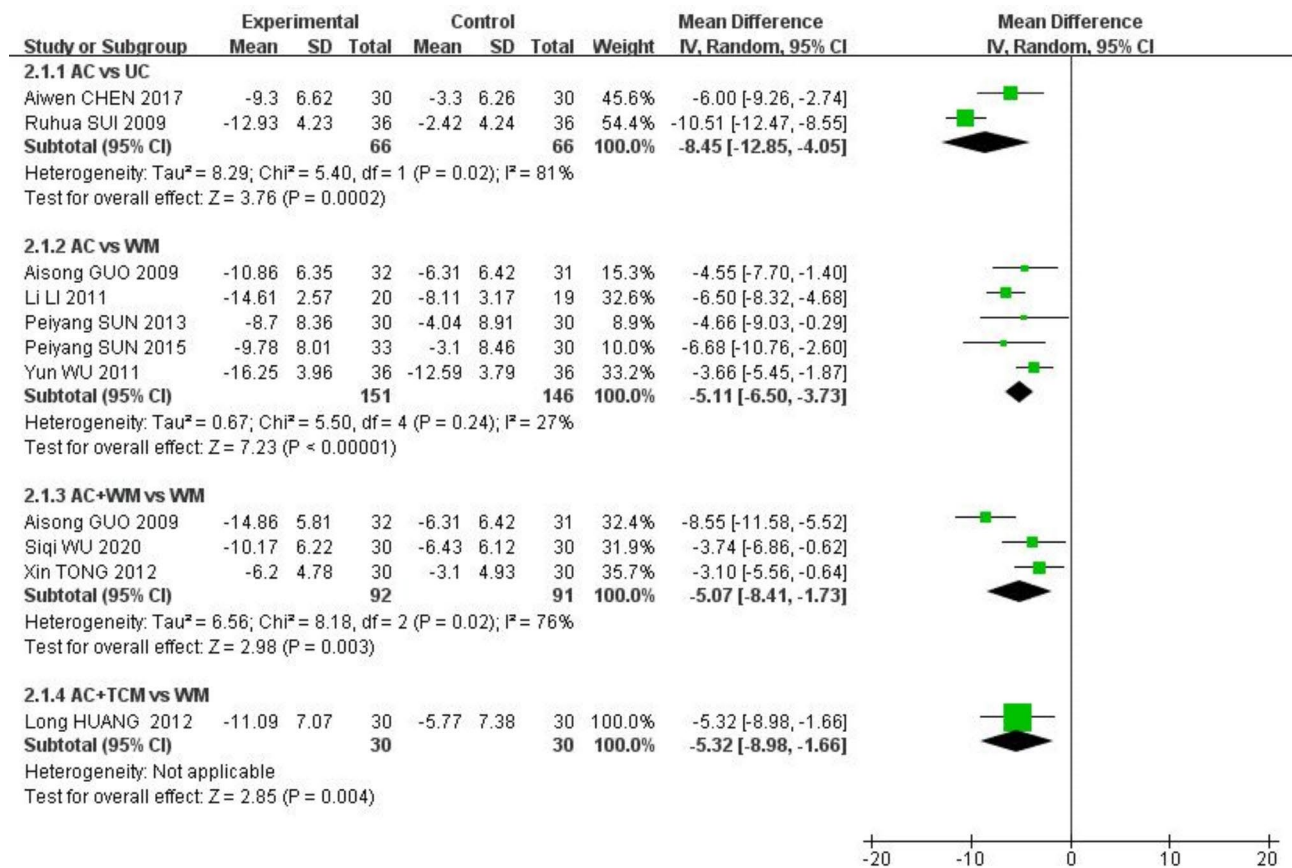
Fig. 5 The forest plot for neurological impairment

NMA, which six domains was evaluated, including: (a) within- study bias, (b) reporting bias, (c) indirectness, (d) imprecision, (e) heterogeneity, and (f) incoherence. One comparison (AC versus AC with TCM) was ranked "high"; eight were "moderate"; eight were "low". The details are presented in Table 4.

Discussion

This network meta-analysis, involving sixty-two studies, found that compared with WM, AC alone or in combination with RTMS, TCM, WM, or TCM with WM seemed to be more effective in improving depression symptoms of PSD. When compared with UC, AC alone or combined with any other therapy (including AC with RTMS, AC with TCM, AC with TCM and WM, AC with Tai Chi, AC with WM, AC with CT, AM, and AM with WM) was superior. Additionally, the pairwise meta-analysis showed that combined therapies of AC with WM, AC with TCM, and AC alone were significantly associated with better

neurological function improvement in contrast to UC or WM.

The results of SUCRA showed that AC with RTMS had the highest probability of being the most effective therapy to alleviate depressive symptoms. It is reported that RTMS, as a non-invasive approach, could induce excitability changes in the motor cortex via a wire coil generating a magnetic field that passes through the scalp. However, as a novel approach to treat depression, the physiological mechanisms of RTMS after-effects are yet to be clear [90]. The updated evidence-based guidelines by Lefaucheur et al. demonstrated that RTMS has a significant effect in several psychiatric diseases. It is also highly recommended (Level A) for major depression, [91]. which was consistent with our findings. A randomised trial explored the effectiveness of intermittent theta burst stimulation versus high-frequency RTMS (10 Hz) for patients with treatment-resistant depression. It found that of intermittent theta burst stimulation

Table 4 The result of certainty assessment for depression scores

Comparison	Number of studies	Within-study bias	Reporting bias	Indirectness	Imprecision	Heterogeneity	Incoherence	Confidence rating
AC vs. AC with RTMS	1	Major concerns	No concerns	No concerns	Some concerns	Some concerns	No concerns	Low
AC vs. AC with TCM	1	No concerns	No concerns	No concerns	Some concerns	No concerns	No concerns	High
AC vs. AC with WM	2	Some concerns	No concerns	No concerns	No concerns	Major concerns	No concerns	Low
AC vs. TCM	1	No concerns	No concerns	No concerns	Some concerns	Some concerns	No concerns	Moderate
AC vs. UC	9	Some concerns	No concerns	No concerns	No concerns	Some concerns	No concerns	Moderate
AC vs. WM	21	Some concerns	No concerns	No concerns	No concerns	Some concerns	No concerns	Moderate
AC with CT vs. WM	1	Some concerns	No concerns	No concerns	Some concerns	Some concerns	No concerns	Moderate
AC with TCM vs. TCM	2	Major concerns	No concerns	No concerns	Some concerns	Some concerns	No concerns	Low
AC with TCM vs. WM	4	Major concerns	No concerns	No concerns	No concerns	Some concerns	No concerns	Low
AC with TCM with WM vs. WM	2	Some concerns	No concerns	No concerns	Some concerns	No concerns	No concerns	Moderate
AC with Tai Chi vs. WM	1	Major concerns	No concerns	No concerns	Some concerns	Some concerns	No concerns	Low
AC with WM vs. WM	11	Some concerns	No concerns	No concerns	No concerns	Some concerns	Some concerns	Moderate
AM vs. AM with WM	1	Some concerns	No concerns	No concerns	Major concerns	No concerns	No concerns	Low
AM vs. WM	1	Some concerns	No concerns	No concerns	Some concerns	Some concerns	No concerns	Moderate
AM with WM vs. WM	4	Some concerns	No concerns	No concerns	No concerns	Major concerns	No concerns	Low
TCM vs. WM	1	Major concerns	No concerns	No concerns	Some concerns	No concerns	No concerns	Low
UC vs. WM	1	Some concerns	No concerns	No concerns	No concerns	Some concerns	No concerns	Moderate

NOTE: AC, Acupuncture; AM, Acupuncture and moxibustion; TCM, Traditional Chinese medicine; WM, Western medicine; UC, Usual care; RTMS, Repetitive transcranial magnetic stimulation; CT, Cognitive therapy

was non-inferior to 10 Hz RTMS for the treatment of depression, which both treatments had low numbers of side-effects, safety, and tolerability profiles [92, 93]. Nonetheless, it needs to be interpreted with caution because there was only one eligible study included which compared AC alone and AC with RTMS in this network meta-analysis. More relevant research is needed to confirm the true function and safety of RTMS for patients with PSD.

In this study, various combined therapies were evaluated, including AC with RTMS, AM with TCM, AC with Tai Chi, AC with TCM with WM, AC with TCM, AC with CT, AC with WM, AM with WM. We first explored the difference in effectiveness for PSD between these therapies using the network meta-analysis approach, which synthesized the direct comparison evidence and indirect comparison evidence. However, some comparisons contained only a few eligible studies, such as those on AC with RTMS versus AC, AC with CT versus WM, and AC with Tai Chi versus WM. Therefore, it is suggested that future research could focus on the effectiveness of these different comparisons for patients with PSD. We will also conduct an update if further studies are published.

Moreover, it is noticeable that the treatment duration among included studies was various and ranged from 2 weeks to 8 weeks, which could be signaled as a potential modifier. Therefore, we explored pairwise meta-analyses for all direct comparisons (Supplementary Appendix 8). A total of seventeen pairwise meta-analysis were conducted, including AC vs. WM (20 studies), AC with WM vs. WM (11 studies), AC vs. UC (7 studies), AC with TCM vs. WM (4 studies), AM with WM vs. WM (4 studies), AC vs. AC with WM (2 studies), AC with TCM vs. TCM (2 studies), AC with TCM with WM vs. WM (2), AC vs. AC with RTMS (1 studies), AC vs. AC with TCM (1 studies), AC vs. TCM ((1 studies), AC with CT vs. WM (1 studies), AC with TJ vs. WM (1 studies), AM vs. AM with WM (1 studies), AM vs. WM (1 studies), TCM vs. WM (1 studies), and UC vs. WM (1 studies). The six subgroup analysis was explored, in which the treatment duration was divided into short-term group (≤4 weeks) or long-term group (>4 weeks). However, it failed to show subgroup effects regarding treatment duration.

One published network meta-analysis by Hang et al. compared the effect of different acupuncture approaches for specific parts in treating patients with PSD [94]. Twelve acupuncture therapies were included in their study, and they found that scalp acupuncture plus conventional acupuncture was the most effective method based on the ranking probability. For this study, we put more focus on the effectiveness of acupuncture combined with other therapies for PSD. Due to the complexity in the nature of acupuncture treatments and

their procedures, we were not able to conduct a relevant quantitative subgroup analysis. Therefore, we could only differentiate the types of acupuncture by their main characteristics, which induced huge heterogeneity among acupuncture treatments. The details were presented in Supplementary Appendix 9. The most frequently used acupoints included Bai-Hui, Shen-Ting, and Nei-Guan.

This is the first review to compare the effectiveness of acupuncture with other therapies for PSD using a network meta-analysis, which may provide novel and useful guidance for clinicians and readers. However, there are still several limitations. Firstly, although we conducted a systematic search for eligible studies, only Chinese studies were eligible and subsequently included. Secondly, the newest assessment tool of ROB 2 was used to evaluate the quality of included RCTs, and the assessment results indicated that the overall quality of RCTs was not high. Therefore, more high-quality RCTs are needed.

Conclusions

In our review, we provide an overview of the current research evidence on the effectiveness of AC alone or in combination with other therapies for the treatment of PSD. Twelve different treatments are included. Among them, there are five therapies of AC plus non-pharmacotherapy (RTMS, Tai Chi, CT, psychotherapy, moxibustion), while AC plus pharmacotherapy treatments also include AC with WM and AC with TCM. The results of NMA indicate that combined therapies, including AC with RTMS, AC with TCM, AC with TCM with WM, AC with WM, and AC alone may be more effective in alleviating depression symptoms as compared with WM. With the highest probability, AC with RTMS seems to be the most effective with the highest probability in treating PSD. Nonetheless, more high-quality studies are needed to provide sufficient evidence.

Abbreviations
AC	Acupuncture
AM	Acupuncture and moxibustion
TCM	Traditional Chinese medicine
WM	Western medicine
UC	Usual care
RTMS	Repetitive transcranial magnetic stimulation
CT	Cognitive therapy
PSD	Post-stroke depression
RCTs	Randomized clinical trials
NMA	Network meta-analysis
SUCRA	Surface Under the Cumulative Ranking curve
HAMD	Hamilton Depression Rating Scale

Supplementary Information
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Supplementary material 1. Reporting checklist (PRISMA-NMA)

Supplementary material 2. Search strategies in PubMed

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Authors' contributions
Linda Zhong and AYL were responsible for the conception and design of this study.WCL and HJL performed the search and evaluated studies for inclusion. LY and WCL extracted data from selected RCTs. JC and SL assessed the quality of selected RCTs. CSY and Bacon Ng assessed the quality of certainty of the evidence. HJL and ECL Yu performed data analysis. ZXB and AYL reviewed the work. WCL and HJL drafted the paper. All authors critically revised and approved the final paper.

Data availability
All data generated or analyzed during this study are included in this published article and its supplementary information files.

Declarations

Competing interests
The authors declare that they have no competing interests.

Ethics approval and consent to participate
Not applicable.

Consent for publication
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References
1. Feigin VL, Brainin M, Norrving B, Martins S, Sacco RL, Hacke W, Fisher M, Pandian J, Lindsay P. World Stroke Organization (WSO): global stroke fact sheet 2022. Int J Stroke. 2022 Jan;17(1):18–29. https://doi.org/10.1177/17474930211065917.
2. Fridriksson J, Hillis AE. Current approaches to the treatment of Post-Stroke Aphasia. J Stroke. 2021;23(2):183–201.
3. Kim CY, Kim HD. Effect of crossed-education using a tilt table task-oriented approach in subjects with post-stroke hemiplegia: a randomized controlled trial. J Rehabil Med. 2018;50(9):792–9.
4. Fang J, Tuo M, Ouyang K, Xu Y. Statin on post-stroke epilepsy: a systematic review and meta-analysis. J Clin Neurosci. 2021;83:83–7.
5. Weaver NA, Kuijf HJ, Aben HP, Abrigo J, Bae HJ, Barbay M, et al. Strategic infarct locations for post-stroke cognitive impairment: a pooled analysis of individual patient data from 12 acute ischaemic stroke cohorts. Lancet Neurol. 2021;20(6):448–59.
6. Cai W, Mueller C, Li YJ, Shen WD, Stewart R. Post stroke depression and risk of stroke recurrence and mortality: a systematic review and meta-analysis. Ageing Res Rev. 2019;50:102–9.
7. Das J, G KR. Post stroke depression: the sequelae of cerebral stroke. Neurosci Biobehav Rev. 2018;90:104–14.
8. Ahmed ZM, Khalil MF, Kohail AM, Eldesouky IF, Elkady A, Shuaib A. The prevalence and predictors of Post-Stroke Depression and anxiety during COVID-19 pandemic. J Stroke Cerebrovasc Dis. 2020;29(12):105315.
9. Schottke H, Giabbiconi CM. Post-stroke depression and post-stroke anxiety: prevalence and predictors. Int Psychogeriatr. 2015;27(11):1805–12.
10. Oni OD, Olagunju AT, Olisah VO, Aina OF, Ojini FI. Post-stroke depression: prevalence, associated factors and impact on quality of life among outpatients in a nigerian hospital. S Afr J Psychiatr. 2018;24:1058.
11. Villa RF, Ferrari F, Moretti A. Post-stroke depression: mechanisms and pharmacological treatment. Pharmacol Ther. 2018;184:131–44.
12. Hackam DG, Mrkobrada M. Selective serotonin reuptake inhibitors and brain hemorrhage: a meta-analysis. Neurology. 2012;79(18):1862–5.
13. Lee YC, Lin CH, Lin MS, Lin JW, Chang CH, Lai MS. Effects of selective serotonin reuptake inhibitors versus tricyclic antidepressants on cerebrovascular events: a nationwide population-based cohort study. J Clin Psychopharmacol. 2013;33(6):782–9.
14. Lu L, Zhang XG, Zhong LL, Chen ZX, Li Y, Zheng GQ, et al. Acupuncture for neurogenesis in experimental ischemic stroke: a systematic review and meta-analysis. Sci Rep. 2016;6:19521.
15. Vickers AJ, Vertosick EA, Lewith G, MacPherson H, Foster NE, Sherman KJ, et al. Acupuncture for Chronic Pain: update of an individual Patient Data Meta-Analysis. J Pain. 2018;19(5):455–74.
16. Zhang Y, Lin L, Li H, Hu Y, Tian L. Effects of acupuncture on cancer-related fatigue: a meta-analysis. Supportive care in cancer: official journal of the Multinational Association of Supportive Care in Cancer. 2018;26(2):415–25.
17. Zhang XY, Li YX, Liu DL, Zhang BY, Chen DM. The effectiveness of acupuncture therapy in patients with post-stroke depression: an updated meta-analysis of randomized controlled trials. Med (Baltim). 2019;98(22):e15894.
18. Wang X, Xiong J, Yang J, Yuan T, Jiang Y, Zhou X, et al. Meta-analysis of the clinical effectiveness of combined acupuncture and Western Medicine to treat post-stroke depression. J Tradit Chin Med. 2021;41(1):6–16.
19. Zhang L, Zhao J, Quan S-l, Liu Y-h, Shi X-h, Li Z-g, et al. Effect of acupuncture plus Tai Ji Quan on the recovery of neurological function and depression state in post-stroke depression patients. J Acupunct Tuina Sci. 2018;16(2):96–103.
20. Yao L-j, Zhaoqing L, Jin Z, Keli W. Clinical study of tongdu Tiaoshen Acupuncture combined with cognitive therapy on intervention of post-stroke depression patients *(Chinese)*. World Science and Technology-Modernization of Traditional Chinese medicine. 2017;19(08):1319-23.
21. Shim SR, Kim SJ, Lee J, Rücker G. Network meta-analysis: application and practice using R software. (2092–7193 (Electronic)).
22. Hutton BSG, Caldwell DM, Chaimani A, Schmid CH, Cameron C, Ioannidis JP, Straus S, Thorlund K, Jansen JP, Mulrow C, Catalá-López F, Gøtzsche PC, Dickersin K, Boutron I, Altman DG, Moher D. THE PRISMA Extension Statement for reporting of systematic reviews incorporating Network Meta-analyses

of Health Care Interventions: Checklist and Explanations. Ann Intern Med. 2015;162(11):777–84.

23. Wai Ching LAMCSY, Peijing Y, Cheung HYuJ, Lidan Zhong. Acupuncture treatments for post-stroke rehabilitation: a systematic review and network meta-analysis. PROSPERO 2020 CRD42020218752 Available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42020218752.

24. Sterne JACSJ, Page MJ, Elbers RG, Blencowe NS, Boutron I, Cates CJ, Cheng H-Y, Corbett MS, Eldridge SM, Hernán MA, Hopewell S, Hróbjartsson A, Junqueira DR, Jüni P, Kirkham JJ, Lasserson T, Li T, McAleenan A, Reeves BC, Shepperd S, Shrier I, Stewart LA, Tilling K, White IR, Whiting PF, Higgins JPT. RoB 2: a revised tool for assessing risk of bias in randomised trials. BMJ. 2019;366:l4898.

25. MacPherson H, Altman DG, Hammerschlag R, Youping L, Taixiang W, White A, et al. Revised STandards for reporting interventions in clinical trials of acupuncture (STRICTA): extending the CONSORT statement. PLoS Med. 2010;7(6):e1000261.

26. Citation NA, HJ, Papakonstantinou T, Chaimani A, Del Giovane C, Egger M, et al. CINeMA: an approach for assessing confidence in the results of a network meta-analysis. PLoS Med. 2020;17(4):e1003082. https://doi.org/10.1371/journal.pmed.1003082.

27. Guyatt G, Oxman Ad Fau - Akl EA, Akl Ea Fau -, Kunz R, Kunz R, Fau - Vist G, Vist G, Fau - Brozek J, Brozek J, Fau - Norris S et al. GRADE guidelines: 1. Introduction-GRADE evidence profiles and summary of findings Tables (1878–5921 (Electronic)).

28. Xiao C. Clinical study of combined acupuncture and medicine in the treatment of depression after stroke. Chin community doctors. 2012;14(11):237–8.

29. Chen A-w, Yuan G, Guantao W, LI J, Shen W. -d. Effects of early acupuncture intervention on post-stroke depression: a randomized controlled study *(chinese)*. Chin Acupunct moxibustion. 2018;38(11):1141–4.

30. Loujie C, Fangyuan S, Yaqi H, Dandan L. Effect of wake - up and open - closing acupuncture on post-stroke depression and its influence on serum 5-HT content *(chinese)*. GUIDING J TCM. 2018;24(14):38–40.

31. Cheng Y, Qisheng T. A randomized controlled observation of abdominal acupuncture in the treatment of depression syndrome of Liver depression and spleen deficiency syndrome after cerebral apoplexy in the elderly *(Chinese)*.Chinese Tissue Engineering Research and Clinical Rehabilitation. 2007(39):7791–4.

32. Chen Y, Zhao J-j. A randomized controlled clinical study of abdominal acupuncture in the treatment of post-stroke depression *(Chinese)*.chinese archives of traditional chinese medicine. 2007(09):1888–91.

33. Shuqing D, Xiuyuan S, Xaioyu L. Clinical observation on treatment of post-stroke depression with Bupleurum plus Longguoyasu decoction and acupuncture *(chinese)*. Chin J Integr Traditional Western Med Cardio-cerebro-vascular Dis. 2010;8(09):1054–5.

34. Huiqin D, Handong D, Jingjuan Y. Clinical study of electroacupuncture through point and body acupuncture combined with fluoxetine in the treatment of post-stroke depression *(chinese)*. J New Chin Med. 2020;52(03):143–6.

35. Gao W. Clinical study of acupuncture and moxibustion combined with cupping therapy for depression after stroke *(chinese)*. Electron J Clin Med literature. 2017;4(87):17088.

36. Aisong G, Ai-hong L, Xin C, Junyan C, Qinfeng W. Effect of electroacupuncture combined with fluoxetine on depressive state and neurological function in patients with post-stroke depression *(chinese)*. Shandong Med J. 2011;51(25):9–11.

37. guo R-y, Liu SUNL. Wang C-x. ffect of Linggui eight methods on curative effect and quality of life of patients with post-stroke depression *(chinese)*. Chin Acupunct moxibustion. 2009;29(10):785–90.

38. Xijun H, Jilin T, Benguo W, Yingying L. Clinical observation of 86 cases of post-stroke depression treated by Xingnao Kaiqiao acupuncture *(Chinese)*. ChinJRehabil Theory Pract. 2005(06):467–8.

39. Jun H, Shen P-f. Clinical effect of acupuncture on post-stroke depression *(Chinese)*.Acupuncture Research. 2007(01):58–61.

40. HUANG L. 30 cases of post-stroke depression treated by TCM combined with acupuncture *(chinese)*. J Emerg traditional Chin Med. 2011;20(05):802–3.

41. HUANG S-l, Wei Y, Zhang Z. Clinical randomized controlled study of electroacupuncture "Shenwuxing Group point" combined with western medicine in the treatment of post-stroke depression *(chinese)*. Shanghai J Traditional Chin Med. 2014;48(07):33–6.

42. Lei J. Jun z. Clinical study of acupuncture and moxibustion combined with drugs in the treatment of post-stroke depression *(chinese)*. J Clin Acupunct moxibustion. 2011;27(11):15–7.

43. Jiang Z, Gao L, Li C, Li J. Clinical Study of Electroacupuncture at "Niwan Bazhen" Point in the Treatment of Depression after Stroke *(Chinese)*.World Journal of Acupuncture-Moxibustion. 2007(01):11–6.

44. Jiao H-f, Liu W-m, Hao X, Zhang L. Clinical observation of electroacupuncture and paroxetine in the treatment of post-stroke depression in 33 cases *(chinese)*. Med Rev. 2012;18(06):950–1.

45. li L, Jiali J. Clinical observation of electroacupuncture combined with paroxetine in the treatment of post-stroke depression *(chinese)*. J gansu Coll traditional Chin Med. 2011;28(01):53–4.

46. Ziling L, Jun Z, Fanqiang L. Effect of acupuncture on rehabilitation of post-stroke depression (chinese). China Practical Medical. 2010;5(08):59–60.

47. Liu S, ZHAO S, Xi Z. Incidence of post-stroke depression and acupuncture treatment *(Chinese)*.Chinese acupuncture and moxibustion. 2006(07):472–4.

48. Yanxiang L, Liping C, Ziqi Z, Chen X-l. Influence of "Wisdom three acupuncture" and syndrome differentiation on the curative effect of post-stroke depression *(chinese)*. GUIDING J TCM. 2010;16(05):116–7.

49. NIE R. Efficacy and safety of acupuncture in the treatment of post-stroke depression *(chinese)*. Chin Acupunct moxibustion. 2013;33(06):490–4.

50. Nie R, HUANG C. FU W-b. Observation on the effect of treating post-stroke depression from spleen and stomach *(chinese)*. Chin Acupunct moxibustion. 2011;31(04):325–8.

51. Peng H, Ye J, He X, Tan J, Zhang Z. Clinical randomized controlled study of electroacupuncture and fluoxetine capsule in the treatment of post-stroke depression *(chinese)*. JILIN J traditional Chin Med. 2011;31(10):990–2.

52. Shuchang S, Zhi L, Runyun W, Hua C. Effect of acupuncture on cerebral apoplexy depression and neurological rehabilitation *(chinese)*. J Clin Acupunct moxibustion. 2014;30(10):7–9.

53. Su Z-w, Zhang Z-w. Thirty cases of post-stroke depression treated by pricking blood and channeling Meridian *(Chinese)*. Shaanxi J Tradit Chin Med. 2010;31(12):1651–2.

54. RuHua S, lei Z, RuBo S. Clinical observation of 72 cases of acute stroke depression treated by acupuncture *(chinese)*. Chin ethnic folk Med. 2009;18(11):94–5.

55. Peiyang S, Haoran C, LI P-f W, Fang P, Jie W et al. Effect of Tongdu Tiaoshen acupuncture on drug treatment of post-stroke depression *(Chinese)*. Chinese acupuncture and moxibustion. 2015;35(08):753-7.

56. Peiyang S, Haoran C, Li P-f, Ying W, Fei L, Xia J-g, et al. The treatment of post-stroke depression with acupuncture therapy: a randomized controlled study *(chinese)*. Chin Acupunct moxibustion. 2013;33(01):3–7.

57. Wenge S, Shukai H, Cao W-j, Sun Z-y, Jianhui L, Yongfa Z, et al. Effect of tonifying Qi and resolving phlegm and collaterals prescription combined with external and internal meridian acupuncture on depressive state of patients with shoulder and hand syndrome after stroke *(chinese)*. Chin Med Guide. 2012;18(03):16–8.

58. Tong X, Liu D-d, Wei Y, Kou J, Yang T, Qiao L. Intervention effect of regulating spirit and regulating liver acupuncture on post-stroke depression *(chinese)*. China Med Pharm. 2012;2(03):127–8.

59. Laiqun W. Analysis of application of acupuncture and medicine in treating apoplexy sequelae (chinese). Chin Traditional Med Mod distance Educ. 2010;8(11):216–7.

60. wang Y-h, Shuqin H, Lijing C, Baoli Z, Jun X. Effects of early rehabilitation training combined with abdominal therapy on motor function and mental disorders in stroke patients *(chinese)*. Chin Acupunct moxibustion. 2016;36(06):577–80.

61. Wang Y, Zhou T, Xiang S, Yonglei Z, Fang W. Observation on curative effect of Jieyu Qingxin Decoction combined with Tongdu Tiaoshen acupuncture on post-stroke depression *(chinese)*. Traditional Chin Med Sichuan Province. 2020;38(08):135–9.

62. WU X, sun X-h XINGY. Intervention effect of penetrating acupuncture on post-stroke depression and influence on plasma cortisol level *(chinese)*. Shanghai J Acupunct Moxibustion. 2011;30(03):153–4.

63. Jiaping W. Clinical observation on 150 cases of post-apoplexy depression treated by acupuncture syndrome differentiation *(chinese)*. Acupunct Res. 2010;35(04):303–6.

64. Siqi W, Ouyang B. Clinical observation on treatment of post-stroke depression with liver and kidney deficiency by penetrating acupuncture *(chinese)*. J Shanxi Coll traditional Chin Med. 2020;36(05):39–41.

65. Xiaoling W. Effect of oral Prozac plus acupuncture on depression after stroke *(chinese)*. Mod Doctor China. 2009;47(27):87–8.

66. Wei X, Hongbing K, Zhen W, Ying W, section, Yonglei W et al. Z,. Clinical study of xiang Cong acupuncture combined with fluoxetine in the treatment

of post-stroke depression *(Chinese)*. Clinical Journal of Traditional Chinese Medicine. 2009;21(04):330-1.

67. XU G. A randomized parallel control study of acupuncture combined with fluoxetine in the treatment of depression after stroke *(chinese)*. J practical traditional Chin Intern Med. 2014;28(11):158–60.

68. Changchang Y, Shaoyong S, Genka T, Zhanli Y. Effect of acupuncture on post-stroke depression *(chinese)*. Shaanxi J Tradit Chin Med. 2018;39(01):122–4.

69. YUE L. Observation on the curative effect of head acupuncture combined with auricular point sticking in the treatment of post-stroke depression *(Chinese)*.Shanghai Journal of Acupuncture and Moxibustion. 2016;35(07):796–8.

70. Lin Z, Yan Z, QUAN S, Yehui L, Xuehui S, LI Z, et al. Acupuncture combined with auricular point pressing in the treatment of post-stroke depression: a randomized controlled study *(chinese)*. Chin Acupunct moxibustion. 2017;37(06):581–5.

71. Zhang R, WANG X. Treatment of 39 cases of depression after cerebral apoplexy by tiaoshen Tongluo acupuncture combined with repeated transcranial magnetic stimulation *(chinese)*. Shaanxi J Tradit Chin Med. 2011;32(01):86–7.

72. Zahng W, Shaolu C, Lin A-j, Ye XIEJ, Wu Q. Effects of combination of acupuncture and medicine on depressive state and daily living ability of patients with post-stroke depression *(chinese)*. Shanghai J Acupunct Moxibustion. 2011;30(12):823–5.

73. Zhien Z, Ping L, Xiangwen X, Weifu D. A multicenter randomized parallel control study of Anshen Jieyu Decoction combined with acupuncture at Baihui Point in the treatment of post-stroke depression *(chinese)*. Shaanxi J Tradit Chin Med. 2020;41(03):390–3.

74. zhu Y-g, Qin Z. to BX, su Q-l. Treatment of post-stroke depression by cephalic acupuncture combined with auricular sticking *(Chinese)*. Journal of clinical acupuncture and moxibustion. 2012;28(02):17 – 8.

75. FengKui Z, Jun Z, Yong D. Clinical observation of acupuncture combined with medicine in the treatment of depression after stroke. J Clin Acupunct moxibustion. 2010;26(05):10–1.

76. Zhang L, Zhao J, Quan SL, Liu YH, Zhong Y. Effect of acupuncture plus Tai Ji Quan on the recovery of neurological function and depression state in post-stroke depression patients. J Acupunct Tuina Sci. 2018;16(2):96–103.

77. Xiaojing D, Junming F. Clinical observation on acupuncture treatment of depression after stroke. Med Innov China. 2012;09(003):107.

78. Guomin J. Observation on the therapeutic effect of psychological counseling combined with electroacupuncture on post-stroke depression *(Chinese)*. Chinese Journal of Modern Nursing Modern Nursing. 2007(35).

79. LI H, ZHONG B, FAN Y, HU H. Acupuncture for post-stroke depression: a randomized controlled study *(chinese)*. Chin Acupunct moxibustion. 2011;031(001):3–6.

80. Aibing Z. tan L. Clinical study of combined acupuncture and medicine in the treatment of post-stroke depression *(Chinese)*. World Health Digest. 2009;6(8):59–60.

81. Guibo Z, ling Y, Qian Z. Effect of acupuncture on depression after stroke. Shanghai Journal of Acupuncture and Moxibustion. 2010(10):636–7.

82. Zhongjin Z, Jianhua C, Guifen X. Effect of early acupuncture combined with rehabilitation training on rehabilitation of depression after cerebral infarction *(chinese)*. Massage and rehabilitation medicine. 2011;02(006):54–5.

83. Zhao X-B. Effect of acupuncture on post-stroke depression. China Healthc Innov. 2012;07(006):38–9.

84. Yafen Z, Louni C, chao W. fang C, fang J-q. Single center randomized controlled trial of acupuncture for post-stroke depression.Journal of Zhejiang Traditional Chinese Medicine University. 2014(11):1322–5.

85. Zhu J. Effect analysis of acupuncture and moxibustion combined with drugs in the treatment of post-stroke depression. Massage and rehabilitation medicine. 2012;3(011):372.

86. ZHAO H. One hundred patients with post-stroke depression treated by Xingnao Kaiqiao acupuncture were randomized controlled by stratification *(Chinese)*.Chin J Clin Rehabil. 2003(31):117.

87. Cai W, Ma W, Li YJ, Wang GT, Yang H, Shen WD. Efficacy and safety of electroacupuncture for post-stroke depression: a randomized controlled trial. Acupunct Med. 2022 Oct;40(5):434–42. Epub 2022 Mar 2. PMID: 35232229.

88. Yin XJ, Wang F, Lin GP, Gong XL, Yao MY. Effects of auricular acupressure on depression in stroke patients: a single-blind randomized controlled trial. Complement Ther Clin Pract. 2022 Aug;48:101596. https://doi.org/10.1016/j.ctcp.2022.101596. Epub 2022 Apr 23. PMID: 35483297.

89. You Y, Zhang T, Shu S, Qian X, Zhou S, Yao F. Wrist-ankle acupuncture and Fluoxetine in the treatment of post-stroke depression: a randomized controlled clinical trial. J Tradit Chin Med. 2020 Jun;40(3):455–460. doi: https://doi.org/10.19852/j.cnki.jtcm.2020.03.014. PMID: 32506860.

90. Klomjai W, Katz R, Lackmy-Vallée A. Basic principles of transcranial magnetic stimulation (TMS) and repetitive TMS (rTMS). Annals of Physical and Rehabilitation Medicine. 2015;58(4):208–13.

91. Lefaucheur JP, Aleman A, Baeken C, Benninger DH, Brunelin J, Di Lazzaro V, et al. Evidence-based guidelines on the therapeutic use of repetitive transcranial magnetic stimulation (rTMS): an update (2014–2018). Clin Neurophysiol. 2020;131(2):474–528.

92. Somani A, Kar SK. Efficacy of repetitive transcranial magnetic stimulation in treatment-resistant depression: the evidence thus far. Gen Psychiatry. 2019;32:e100074. https://doi.org/10.1136/gpsych-2019-100074.

93. Blumberger DM, Vila-Rodriguez F, Thorpe KE, Feffer K, Noda Y, Giacobbe P, Knyahnytska Y, Kennedy SH, Lam RW, Daskalakis ZJ, Downar J. Effectiveness of theta burst versus high-frequency repetitive transcranial magnetic stimulation in patients with depression (THREE-D): a randomised non-inferiority trial. Lancet. 2018 Apr 28;391(10131):1683–1692. doi: https://doi.org/10.1016/S0140-6736(18)30295-2. Epub 2018 Apr 26. Erratum in: Lancet. 2018 Jun 23;391(10139):e24. PMID: 29726344.

94. Hang X, Li J, Zhang Y, Li Z, Zhang Y, Ye X, et al. Efficacy of frequently-used acupuncture methods for specific parts and conventional pharmaceutical interventions in treating post-stroke depression patients: a network meta-analysis. Complement Ther Clin Pract. 2021;45:101471.

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