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TABLE OF CONTENTS

HEADER	1
ABSTRACT	1
PLAIN LANGUAGE SUMMARY	2
SUMMARY OF FINDINGS	3
BACKGROUND	5
OBJECTIVES	5
METHODS	5
RESULTS	8
Figure 1.	9
Figure 2.	11
Figure 3.	12
DISCUSSION	15
AUTHORS' CONCLUSIONS	16
ACKNOWLEDGEMENTS	16
REFERENCES	18
CHARACTERISTICS OF STUDIES	24
DATA AND ANALYSES	61
Analysis 1.1. Comparison 1 Acupuncture versus sham acupuncture, Outcome 1 Change in systolic blood pressure.	61
Analysis 1.2. Comparison 1 Acupuncture versus sham acupuncture, Outcome 2 Change in diastolic blood pressure.	62
Analysis 2.1. Comparison 2 Acupuncture versus RAS inhibitors, Outcome 1 Change in systolic blood pressure.	62
Analysis 2.2. Comparison 2 Acupuncture versus RAS inhibitors, Outcome 2 Change in diastolic blood pressure.	63
Analysis 3.1. Comparison 3 Acupuncture versus calcium antagonists, Outcome 1 Change in systolic blood pressure.	63
Analysis 3.2. Comparison 3 Acupuncture versus calcium antagonists, Outcome 2 Change in diastolic blood pressure.	64
Analysis 4.1. Comparison 4 Acupuncture versus beta-blocker, Outcome 1 Change in systolic blood pressure.	64
Analysis 4.2. Comparison 4 Acupuncture versus beta-blocker, Outcome 2 Change in diastolic blood pressure.	65
APPENDICES	65
CONTRIBUTIONS OF AUTHORS	69
DECLARATIONS OF INTEREST	69
SOURCES OF SUPPORT	70
DIFFERENCES BETWEEN PROTOCOL AND REVIEW	70
INDEX TERMS	70

[Intervention Review]

Acupuncture for hypertension

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ABSTRACT

Background

Elevated blood pressure (hypertension) affects about one billion people worldwide. It is important as it is a major risk factor for stroke and myocardial infarction. However, it remains a challenge for the medical profession as many people with hypertension have blood pressure (BP) that is not well controlled. According to Traditional Chinese Medicine theory, acupuncture has the potential to lower BP.

Objectives

To assess the effectiveness and safety of acupuncture for lowering blood pressure in adults with primary hypertension.

Search methods

We searched the Hypertension Group Specialised Register (February 2017); the Cochrane Central Register of Controlled Trials (CENTRAL) 2017, Issue 2; MEDLINE (February 2017); Embase (February 2017), China National Knowledge Infrastructure (CNKI) (January 2015), VIP Database (January 2015), the World Health Organisation Clinical Trials Registry Platform (February 2017) and ClinicalTrials.gov (February 2017). There were no language restrictions.

Selection criteria

We included all randomized controlled trials (RCTs) that compared the clinical effects of an acupuncture intervention (acupuncture used alone or add-on) with no treatment, a sham acupuncture or an antihypertensive drug in adults with primary hypertension.

Data collection and analysis

Two review authors independently selected studies according to inclusion and exclusion criteria. They extracted data and assessed the risk of bias of each trial, and telephoned or emailed the authors of the studies to ask for missing information. A third review author resolved disagreements. Outcomes included change in systolic blood pressure (SBP), change in diastolic blood pressure (DBP), withdrawal due to adverse effects, and any adverse events. We calculated pooled mean differences (MD) with 95% confidence intervals (CI) for continuous outcomes using a fixed-effect or random-effects model where appropriate.

Main results

Twenty-two RCTs (1744 people) met our inclusion criteria. The RCTs were of variable methodological quality (most at high risk of bias because of lack of blinding). There was no evidence for a sustained BP lowering effect of acupuncture; only one trial investigated a sustained effect and found no BP lowering effect at three and six months after acupuncture. Four sham acupuncture controlled trials provided very low quality evidence that acupuncture had a short-term (one to 24 hours) effect on SBP (change) -3.4 mmHg (-6.0 to -0.9) and DBP -1.9

Acupuncture for hypertension (Review)

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mmHg (95% CI -3.6 to -0.3). Pooled analysis of eight trials comparing acupuncture with angiotensin-converting enzyme inhibitors and seven trials comparing acupuncture to calcium antagonists suggested that acupuncture lowered short-term BP better than the antihypertensive drugs. However, because of the very high risk of bias in these trials, we think that this is most likely a reflection of bias and not a true effect. As a result, we did not report these results in the 'Summary of findings' table. Safety of acupuncture could not be assessed as only eight trials reported adverse events.

Authors' conclusions

At present, there is no evidence for the sustained BP lowering effect of acupuncture that is required for the management of chronically elevated BP. The short-term effects of acupuncture are uncertain due to the very low quality of evidence. The larger effect shown in non-sham acupuncture controlled trials most likely reflects bias and is not a true effect. Future RCTs must use sham acupuncture controls and assess whether there is a BP lowering effect of acupuncture that lasts at least seven days.

PLAIN LANGUAGE SUMMARY

Acupuncture for primary hypertension in adults

Background

Hypertension (high blood pressure) affects about one billion people worldwide. Moreover, hypertension increases the risk of stroke and heart attack. Acupuncture is an important part of Traditional Chinese Medicine, in which thin needles are inserted into the skin at defined points. Acupuncture has been used to lower blood pressure and relieve symptoms of hypertension.

Study characteristics

We performed a systematic review of medical databases to find clinical trials that compared the effects of acupuncture to controls (sham (pretend) acupuncture, no treatment, or medicines) on blood pressure and safety in adults with hypertension. The results are current to February 2017.

Key results and certainty of the evidence

We found 22 trials including 1744 people. The trials did not look at death and general health. Four trials compared acupuncture with sham acupuncture and suggested a small short-lasting (one to 24 hours) reduction in blood pressure. The other trials were of very poor quality. There was no evidence for a long-lasting lowering of blood pressure by acupuncture that would be useful in the treatment of hypertension. We could not assess the safety of acupuncture as few trials reported this. At present, there is no evidence that acupuncture is useful in the management of long-lasting hypertension. Future trials must be designed to measure a sustained blood pressure lowering effect of acupuncture.

SUMMARY OF FINDINGS

Summary of findings for the main comparison. Acupuncture compared to sham acupuncture for hypertension

Acupuncture compared to sham acupuncture

Patient or population: people with primary hypertension

Settings: outpatient

Intervention: acupuncture for 6-10 weeks

Comparison: sham acupuncture for 6-10 weeks

Outcomes	Mean difference (95% CI) mmHg	No of participants (studies)	Certainty of the evidence (GRADE)
Change in SBP shortly after last session	-3.4 (-6.0 to -0.9)	386 (4 studies)	⊕⊕⊕⊕ Very low ^{1,2,3}
Change in DBP shortly after last session	-2.0 (-3.6 to -0.3)	386 (4 studies)	⊕⊕⊕⊕ Very low ^{3,4}

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

CI: confidence interval; **DBP:** diastolic blood pressure; **SBP:** systolic blood pressure.

GRADE Working Group grades of evidence

High certainty: Further research is very unlikely to change our confidence in the estimate of effect.

Moderate certainty: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low certainty: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Very low certainty: We are very uncertain about the estimate.

¹Downgraded due to high risk of bias.

²Downgraded due to unexplained large heterogeneity ($I^2 = 76\%$).

³Downgraded due to small population and wide confidence intervals.

⁴Downgraded 2 levels due to high risk of bias.

Summary of findings 2. Safety of acupuncture for primary hypertension

Safety of acupuncture for primary hypertension

Patient or population: people with primary hypertension

Settings: primary care and community settings

Intervention: acupuncture for 6-10 weeks

Comparison: sham acupuncture and antihypertensive drugs

Outcomes	Impacts	No of participants (studies)	Certainty of the evidence (GRADE)
Adverse events	There were adverse events associated with acupuncture in treating hypertension. Most events were trivial, including pain sensation during needle insertion and small spot-bleeding (Kim 2012; Macklin 2006; Yin 2007). One study reported a serious adverse event, hypertensive emergency, in the acupuncture group (Flachskampf 2007). No deaths were reported from these trials.	426 (4 studies)	⊕⊕⊕⊕ ¹ Low

GRADE Working Group grades of evidence

High certainty: Further research is very unlikely to change our confidence in the estimate of effect.

Moderate certainty: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low certainty: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Very low certainty: We are very uncertain about the estimate.

¹Downgraded 2 levels due to limited available data for judgment and lack of consistency of reports across studies.

BACKGROUND

Description of the condition

Elevated blood pressure (hypertension) is an important public-health problem (Kearney 2005), affecting an estimated 640 million people worldwide (Mensah 2002). People with resting sustained elevated blood pressure are at higher risk of myocardial infarction, stroke (cerebral infarction and hemorrhage), congestive heart failure, and renal failure (Chobanian 2003; Howell 2004). Lifestyle changes, such as reducing salt intake, weight loss, and exercise, may lower blood pressure, but it is difficult to achieve and even more difficult to maintain. Several classes of antihypertensive medication are commonly prescribed, but they can be unaffordable and cause unacceptable adverse effects leading to lack of patient adherence (Chobanian 2003). Numerous studies have suggested that blood pressure is not adequately controlled in a significant number of people with hypertension (Wolf-Maier 2004), and have emphasized that many people with elevated blood pressure resort to individualized therapy (Spence 2006). Since elevated blood pressure is a chronic condition, any treatment would need to have a sustained blood pressure lowering effect to be effective.

Description of the intervention

Acupuncture is an important part of Traditional Chinese Medicine (TCM) and it has been used to treat people with elevated blood pressure (BP) in China for centuries (Kaptchuk 2000). Presently, acupuncture is mainly used on people with elevated BP who want to avoid drug therapy or regard it as an alternative therapeutic option to reduce dosages of antihypertensive drugs (Napadow 2004; Turnbull 2007; Wan 2009). In the context of this review, acupuncture was defined as the needling of specific points of the body. Acupuncture is generally administered in a therapist's office.

How the intervention might work

The mechanism whereby acupuncture can lower BP is unclear. Acupuncture use is based on the TCM concept that diseases are due to disharmony in the body and there are channels (or 'meridians') of energy flow (called 'qi') within the body that can regulate the disharmony (Kalish 2004). When selected places (also called acupoints) on the meridians or collaterals are stimulated, diseases caused by dysregulation can be treated (Kaptchuk 2002). Mechanistic studies have demonstrated that acupuncture can normalize decreased parasympathetic nerve activity (Huang 2005), which is thought to result in increased excretion of sodium; reduced plasma renin, aldosterone, and angiotensin II activity; and changes in plasma norepinephrine, serotonin, and endorphin levels (Kalish 2004). For the management of chronic conditions, acupuncture can be practically administered monthly or at most weekly. Therefore, for it to be effective, it would need to reverse the elevated BP permanently or have a sustained effect for one week or more. A short-term effect on BP for hours or even one to three days would not be sufficient to make it a practical therapy.

Why it is important to do this review

Several clinical trials have investigated the efficacy of acupuncture in lowering BP, but there is still debate as to whether acupuncture is a practical approach for this (Kaplan 2006; Moffet 2006). Previous systematic reviews have not used up-to-date Cochrane methodology to assess risk of bias and interpret the evidence in view of the biases, and have not addressed the important issue of duration of any

BP lowering effect of the acupuncture (Dong 2012; Kim 2010; Kim 2012; Lee 2009). Consequently, we decided to conduct a systematic review based on the best currently available evidence and methodology to evaluate whether acupuncture lowers BP and whether the duration of the BP lowering effect is sufficiently long for the long-term management of elevated BP.

OBJECTIVES

To assess the effectiveness and safety of acupuncture for lowering blood pressure in adults with primary hypertension.

METHODS

Criteria for considering studies for this review

Types of studies

We included parallel randomized controlled trials (RCTs), and excluded cross-over trials and trials that used a clearly inappropriate method of randomization (e.g. open alternation).

Types of participants

The review included men and non-pregnant women over 18 years old who had been diagnosed with primary hypertension, with a systolic blood pressure (SBP) of 140 mmHg or greater or a diastolic blood pressure (DBP) of 90 mmHg or greater, or both or used antihypertensive drugs. We excluded participants with secondary hypertension, such as renal hypertension or hyperthyroidism; diabetes mellitus; atrial fibrillation; at least moderate valvular heart disease; and history of cerebrovascular events, endocrine disorders, and renal insufficiency.

Types of interventions

The interventions considered had to involve needle insertion at acupuncture points, pain points, or trigger points, and had to be described as acupuncture. We excluded other methods of stimulating acupuncture points without needle insertion (such as laser stimulation or transcutaneous electrical stimulation). Acupuncture could be used alone or as an add-on to anti-hypertensive drugs.

Control interventions accepted were:

- no treatment;
- sham acupuncture or minimal acupuncture (interventions mimicking 'true' acupuncture/true treatment, but deviating in at least one aspect considered important by acupuncture theory, such as skin penetration or non-acupoint location);
- antihypertensive drugs.

We excluded studies that only compared different forms or methods of acupuncture (e.g. transcutaneous electrical nerve stimulation) and compared acupuncture with any complementary and alternative therapies for which the efficacy is not yet established (e.g. Chinese herbs).

Types of outcome measures

We included studies that reported at least one clinical outcome related to hypertension, change in SBP or change in DBP. We documented the time after acupuncture that the BP measurement was taken if possible. We excluded studies reporting only physiological or laboratory parameters.

Primary outcomes

- Change in SBP from baseline.
- Change in DBP from baseline.

Secondary outcomes

- Withdrawal due to adverse effects.
- Adverse effect.

Search methods for identification of studies

Electronic searches

The Cochrane Hypertension Information Specialist searched the following databases without language, publication year or publication status restrictions:

- the Cochrane Hypertension Specialised Register via the Cochrane Register of Studies (CRS-Web) (searched 9 February 2017);
- the Cochrane Central Register of Controlled Trials (CENTRAL) via the Cochrane Register of Studies (CRS-Web) (searched 9 February 2017);
- MEDLINE Ovid (from 1946 onwards), MEDLINE Ovid Epub Ahead of Print, and MEDLINE Ovid In-Process & Other Non-Indexed Citations (searched 9 February 2017);
- Embase Ovid (from 1974 onwards) (searched 9 February 2017);
- ClinicalTrials.gov (www.clinicaltrials.gov) (9 February 2017);
- World Health Organization International Clinical Trials Registry Platform (www.who.int/trialsearch) (searched 9 February 2017).

We also searched the China National Knowledge Infrastructure (CNKI) (1917 to January 2015), and the VIP Database (1989 to January 2015).

We searched the Database of Abstracts of Reviews of Effectiveness (DARE) and the Cochrane Database of Systematic Reviews (CDSR) for related reviews.

The MEDLINE Ovid search strategy ([Appendix 2](#)) was translated into the Cochrane Hypertension Specialised Register ([Appendix 3](#)), CENTRAL ([Appendix 4](#)), Embase ([Appendix 5](#)), AMED ([Appendix 6](#)), CNKI ([Appendix 7](#)), and VIP ([Appendix 8](#)) using appropriate controlled vocabulary. Where appropriate, they were combined with subject strategy adaptations of the highly sensitive search strategy designed by Cochrane for identifying randomised controlled (as described in the Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0, Box 6.4.c. (Handbook 2011)).

Searching other resources

- The Cochrane Hypertension Information Specialist searched the Hypertension Specialised Register segment (which includes searches of MEDLINE, Embase, and Epistemonikos for systematic reviews) to retrieve existing reviews relevant to this systematic review, so that we could scan their reference lists for additional trials. The Specialised Register also includes searches for controlled trials in the Allied and Complementary Medicine Database (AMED), CAB Abstracts & Global Health, CINAHL, ProQuest Dissertations & Theses and Web of Science.
- We checked the bibliographies of included studies and any relevant systematic reviews identified for further references to relevant trials.

- Where necessary, we contacted authors of key papers and abstracts to request additional information about their trials.
- We also searched Current Controlled Trials (www.controlled-trials.com) and the Chinese Clinical Trial Register (www.chic-tr.org.cn).

Data collection and analysis

Selection of studies

Two review authors (JC, YR) independently screened all abstracts identified from the literature search, they excluded those that were clearly irrelevant (e.g. studies focusing on other conditions, reviews, etc.). We obtained full texts of all remaining references and the same two review authors screened and excluded clearly irrelevant papers according to the selection criteria. We resolved disagreements by discussion or with a third review author.

Data extraction and management

Two review authors (JC, YR) independently used a specially designed form to extract information on participants, methods, interventions, outcomes, and results. In particular, we extracted first author's name, year of publication; age; sex; duration of disease; sample size; number and type of centers, treated and analyzed; number of reasons for dropouts; duration of baseline, treatment, and follow-up; details of acupuncture treatments (such as selection of points; number, frequency, and duration of sessions); achievement of *De-Qi* (an irradiating feeling considered to indicate effective needling); number, training, and experience of acupuncturists; and details of control interventions (sham technique, type, and dosage of drugs). We extracted the net changes in SBP and DBP before and after acupuncture treatment as main outcome measures. We contacted the first or corresponding authors via email and asked them to provide additional information if necessary.

Assessment of risk of bias in included studies

At least two review authors (JY, JC, and MY) independently assessed risk of bias for each study as low, high, or unclear, using the 'Risk of bias' tool for Cochrane Reviews ([Higgins 2011](#)). We resolved disagreements by discussion or with a third review author. We used the following six criteria:

- adequate sequence generation;
- allocation concealment;
- blinding (performance bias and detection bias);
- incomplete outcome data;
- selective reporting;
- other bias.

We assessed risk of bias using the following recommendations of the *Cochrane Handbook for Systematic Reviews of Interventions* ([Higgins 2011](#)).

1. Random sequence generation (checking for possible selection bias)

We described for each included study the method used to generate the allocation sequence in sufficient detail to allow an assessment of whether it should produce comparable groups.

We assessed the method as:

- low risk (any truly random process, e.g. random number table, computer random number generator);
- high risk (judged unlikely to be randomized);
- unclear risk (method not reported).

2. Allocation concealment (checking for possible selection bias)

We described for each included study the method used to conceal the allocation sequence in sufficient detail and determine whether intervention allocation could have been foreseen in advance of, or during, recruitment, or changed after assignment.

We assessed the methods as:

- low risk (e.g. telephone or central randomization, consecutively numbered sealed opaque envelopes);
- high risk (unsealed or non-opaque envelopes);
- unclear risk.

3. Blinding (checking for possible performance bias and detection bias)

We described for each included study the methods used, if any, to blind study participants and personnel from knowledge of which intervention a participant received. We judged studies at low risk of bias if they were blinded, or if we judged that the lack of blinding could not have affected the results. We assessed blinding separately for different outcomes or classes of outcomes. A problem specific to acupuncture trials is that it is difficult to achieve blinding.

We assessed the methods as:

- low risk, high risk, or unclear risk for participants;
- low risk, high risk, or unclear risk for personnel;
- low risk, high risk, or unclear risk for outcome assessors.

4. Incomplete outcome data (checking for possible attrition bias through withdrawals, dropouts, protocol deviations)

We described for each included study, and for each outcome or class of outcomes, the completeness of data including attrition and exclusions from the analysis. We stated whether attrition and exclusions were reported; the numbers included in the analysis at each stage (compared with the total randomized participants); reasons for attrition or exclusion where reported; and whether missing data were balanced across groups or were related to outcomes. Where sufficient information was reported, or was supplied by the trial authors, we reincluded missing data in the analyses that we undertook. We assessed the methods as:

- low risk: trials where few dropout/losses to follow-up were noted and an intention-to-treat (ITT) analysis was possible;
- high risk: rate of exclusion was at least 20%, or wide differences in exclusions between groups whatever the ITT was used;
- unclear risk.

5. Selective reporting bias (checking for possible reporting bias)

We described for each included study how we investigated the possibility of selective outcome reporting bias and what we found.

We assessed the methods as:

- low risk (where it was clear that all the study's prespecified outcomes and all expected outcomes of interest to the review were reported);
- high risk (where not all the study's prespecified outcomes were reported; one or more reported primary outcomes were not prespecified; outcomes of interest were reported incompletely and so could not be used; study failed to include results of a key outcome that would have been expected to have been reported);
- unclear risk.

6. Other bias

We described for each included study any important concerns we had about other possible sources of bias.

We assessed whether each study was free of other problems that could put it at risk of bias as:

- low risk;
- high risk;
- unclear risk.

Quality of the evidence

We used the GRADE system for grading the overall quality of the evidence (Atkins 2004). In GRADE, RCTs without important limitations and some observational studies are considered as high-quality evidence. Five limitations can downgrade the quality of the evidence (Gordon 2008):

- study limitations;
- inconsistent results;
- indirectness of evidence;
- imprecision;
- publication bias.

Three factors can upgrade the quality of evidence:

- large magnitude of effect;
- plausible confounding, which would reduce a demonstrated effect;
- dose-response gradient.

The quality of evidence and definitions were (Gordon 2008a):

- high quality: further research is very unlikely to change our confidence in the estimate of effect;
- moderate quality: further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate;
- low quality: further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate;
- very low quality: any estimate of effect is very uncertain.

Measures of treatment effect

Dichotomous data

For dichotomous data, we recorded the number of participants and incidence of events in each group; we expressed results as summary risk ratio (RR) with 95% confidence intervals (CI).

Continuous data

For continuous data, we used the mean difference (MD) if outcomes were measured in the same way between studies, and the standardized mean difference (SMD) to combine studies that measured the same outcome, but used different methods.

For the purposes of summarizing results, we categorized the included trials according to control groups: comparisons with sham acupuncture; comparisons with angiotensin-converting enzyme inhibitor (ACEI); comparisons with calcium antagonists; comparisons with beta-blockers; acupuncture plus ACEI compared with ACEI alone; acupuncture plus calcium antagonists compared with calcium antagonists alone.

Unit of analysis issues

Different units of analysis were planned to be subjected to a sensitivity analysis.

Dealing with missing data

We contacted the authors in China via telephone, and authors from elsewhere via email to obtain missing data, if necessary. For all outcomes, we carried out analyses, both per-protocol (PP) analysis and ITT analysis would be accepted. Attrition rates, for example dropouts, losses to follow-up, and withdrawals, were investigated.

Dealing with duplicate publications

In the case of duplicate publications and companion papers of a primary study, we tried to maximize yield of information by simultaneous evaluation of all available data. In cases of doubt, the original publication (usually the oldest version) was given priority.

Assessment of heterogeneity

We used the χ^2 and I^2 test were used to assess for heterogeneity among the studies. I^2 values were used to assess the degree of statistical heterogeneity. Less than 50% heterogeneity was accepted as homogeneous. When significant heterogeneity was present, we attempted to explain it by subgroup analyses.

Assessment of reporting biases

We did not perform funnel plots to assess the reporting bias due to the lack of sufficient studies (fewer than 10).

Data synthesis

We used Review Manager 5 software to carry out statistical analysis (RevMan 2014). We used MD for continuous data. There were no dichotomous data in this review (Higgins 2011). In the case of homogeneous data, we used the fixed-effect model. In case of heterogeneity, we also used the random-effects model. In this study, we identified five studies that included three arms (Li 2012a; Macklin 2006; Wang 2012a; Xie 2004; Zhang 2012a). Li 2012a compared warm acupuncture versus standard acupuncture versus captopril; Macklin 2006 compared traditional acupuncture versus standardized acupuncture versus sham acupuncture; Xie 2004 compared chronological acupuncture versus traditional acupuncture versus nitrendipine; Zhang 2012a compared acupuncture plus psychological counselling versus acupuncture versus captopril. In these four studies, the effect of groups that conveyed acupuncture treatment

were combined to form a new group, because they compared different acupuncture methods and thus could be combined. Wang 2012a compared acupuncture versus nicardipine versus acupuncture plus nicardipine. In this case, we only extracted the data of acupuncture group and nicardipine group for analysis.

Subgroup analysis and investigation of heterogeneity

If one of the primary outcome parameters demonstrated statistically significant differences between intervention groups, we planned to use subgroup analyses. Planned subgroup analyses were:

- different levels of hypertension;
- different interventions;
- sex.

Sensitivity analysis

We planned to test the robustness of the studies by contrasting the results of different measures, such as fixed-effect model to random-effects model, the robustness of the studies should not be reversed by changing of the models.

However, we did not perform sensitivity analyses due to an insufficient number trials.

RESULTS

Description of studies

See: [Characteristics of included studies](#); [Characteristics of excluded studies](#); and [Characteristics of ongoing studies](#) tables.

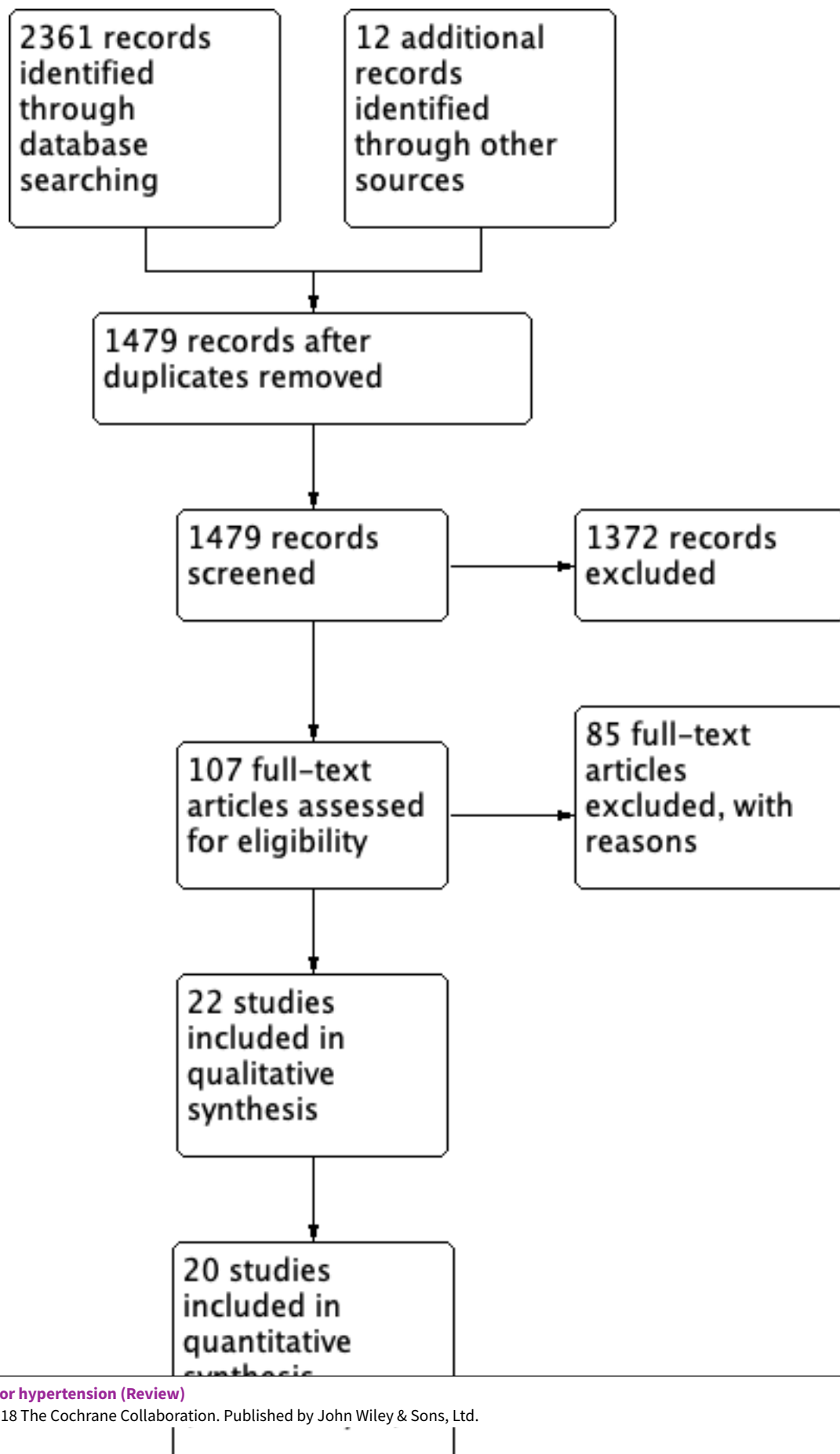
Results of the search

We retrieved the following: 173 records from the Cochrane Hypertension Specialised Register, 460 from Cochrane Central Register of Controlled Trials, 270 from Ovid MEDLINE, 405 from Embase, 40 from AMED, 7 from ClinicalTrials.gov, 307 from CNKI, 518 from WangFang database, and 198 from VIP, 5 from Chinese Clinical Trial Register, giving a total of 1479 records after removal of duplicates.

We selected records that related to our question by scanning the title and reading the abstract of trials. The most frequent reasons for exclusion at this level were: studies were reviews or commentaries, studies of non-primary hypertension, clearly non-randomized design, and investigation of an intervention that was not true acupuncture involving skin penetration.

Two review authors assessed 107 full-text papers for eligibility; 85 reports (including duplicates) did not meet the selection criteria. Common reasons for exclusion included: trial had mixed hypertension participants or not primary hypertension (21 trials); interventions did not meet our definition of acupuncture (eight trials); different forms or methods of acupuncture and compared acupuncture with any complementary and alternative therapies (25 trials); and incorrect randomization method (nine trials); design of trial was cross-over (three trials); study with irrelevant outcome, such as only physiological or laboratory parameters (14 trials); trial with duplicate publications (five trials). Finally, we included 27 citations to 22 trials, 23 were published in journals (including published protocols), and four were published as part of Master's theses (Figure 1).

Figure 1. Study flow diagram.



Searches in the clinical trial registers identify one ongoing trial (Liang; see [Characteristics of ongoing studies](#) table).

Included studies

Participants

In total, 1744 people (972 in the acupuncture group, 772 in the control group) participated in the included studies, and the mean number of participants in each trial was 79 (ranging from 28 to 188 participants per trial). The participants were men and non-pregnant women over 18 years old, with primary hypertension documented by at least three resting BP readings above (SBP/DBP) 140/90 mmHg or a history of hypertension with current use of antihypertensive medication. All the participants had primary hypertension. The number of participants ranged from 14 to 124 in the acupuncture groups and 14 to 68 in the controlled groups. Age ranged from 28 to 71 years. The participants receiving antihypertensive medicine accounted for 19.34% in the acupuncture group and 75.00% in the control group (drug control and sham acupuncture control), separately. All studies included both men and women. All studies were performed in a single center. Eighteen RCTs (1358 participants) originated in China, one (188 participants) came from the US (Macklin 2006), one (140 participants) came from Germany (Flachskampf 2007), and two (58 participants) came from Korea (Kim 2012; Yin 2007).

Interventions

All trials used a parallel group design, 17 trials had two arms (one acupuncture group and one control group) and five trials had three arms (Li 2012a; Macklin 2006; Wang 2012a; Xie 2004; Zhang 2012a).

The acupuncture interventions tested in the included trials varied. In 15 trials, acupuncture treatments were standardized (all participants were treated at the same points); in three trials, treatments were semi-standardized (either all participants were treated with some basic points and additional individualized points depending on symptom patterns) (Chen 2010a; Dan 1998; Liu 2011); in two trials, the selection of acupuncture points was individualized (all participants were treated at individualized points depending on symptom patterns) (Flachskampf 2007; Yin 2007); and in two trials participants were randomized to two acupuncture groups: in one group the needles were placed at correct, individualized points after the full process of Chinese diagnosis, in the other group needles were placed at standardized points without the 'Chinese ritual' (to investigate whether the different interaction and process affected outcomes) (Macklin 2006; Xie 2004).

Four trials compared acupuncture with sham acupuncture interventions and 18 trials compared acupuncture and antihypertensive medicine treatment. The sham techniques varied considerably in the four sham controlled trials (Flachskampf 2007; Kim 2012; Macklin 2006; Yin 2007). Yin 2007 used the Park's sham needle device, in which the needles did not penetrate the skin, and the points were placed at the same predefined points as in the true treatment

group. The other three sham controlled trials used non-acupuncture points considered at variable distance from true points. Kim 2012 used needles superficially; Macklin 2006 inserted needles perpendicular to the skin without stimulation; and Flachskampf 2007 used acupuncture with the same technique as for active treatment, but used needling points without relevance for BP lowering according to TCM concepts.

In total, 18 trials compared acupuncture to antihypertensive medicine treatment using: nifedipine (Chen 2000; Dan 1998; Shen 2010a), nifedipine (Ma 2011; Wang 2012a), nitrendipine (Xie 2004), metoprolol (Chen 2006a), valsartan (Chen 2010a), metoprolol tartrate (Wu 2011), captopril (Hao 2006; Li 2012a; Liu 2011; Wu 2003; Yang 2010a; Zhang 2012a), enalapril maleate capsules (Guo 2009), levamlodipine besylate tablets/levamlodipine besylate tablets (Tian 2007), or captopril plus aspirin (Liao 2006).

Few trials provided detailed information about the acupuncturists' experience or expertise, treatment rationale, and reproducible description of the intervention.

Outcomes

The main outcome reported was change in BP and most trials (13) measured BP within minutes of an acupuncture session. Exceptions to that included six trials that measured BP by 24-hour monitoring (Chen 2010a; Dan 1998; Flachskampf 2007; Hao 2006; Kim 2012; Yang 2010a). In those trials, the effect reflected the mean effect over the 24 hours after the session. Three trials measured BP one day (Wang 2012a), three days (Chen 2000), or within five days (Wu 2003) after the last acupuncture session. Thus, none of the RCTs assessed whether there was a sustained effect of acupuncture on BP. Further considerations of the impact of time of measurement are addressed in the [Discussion](#). For the safety of acupuncture for hypertension, only eight trials recorded any adverse events.

Excluded studies

Eighty-five studies did not meet the selection criteria (see [Characteristics of excluded studies](#) table). Common reasons for exclusion included: mixed hypertension participants or not primary hypertension (21 trials); interventions did not meet our definition of acupuncture (eight trials); different forms or methods of acupuncture and compared acupuncture with any complementary and alternative therapies (25 trials); and incorrect randomization method (nine trials); design of trial was cross-over (three trials); no relevant outcomes reported, such as only physiological or laboratory parameters (14 trials); and trial with duplicate publications (five trials). We telephoned or emailed the original authors for detail of the studies, if necessary.

Risk of bias in included studies

We used the Cochrane 'Risk of bias' tool to assess the methodological quality of the trials ([Figure 2](#); [Figure 3](#)).

Figure 2. Risk of bias graph: review authors' judgments about each risk of bias item presented as percentages across all included studies.

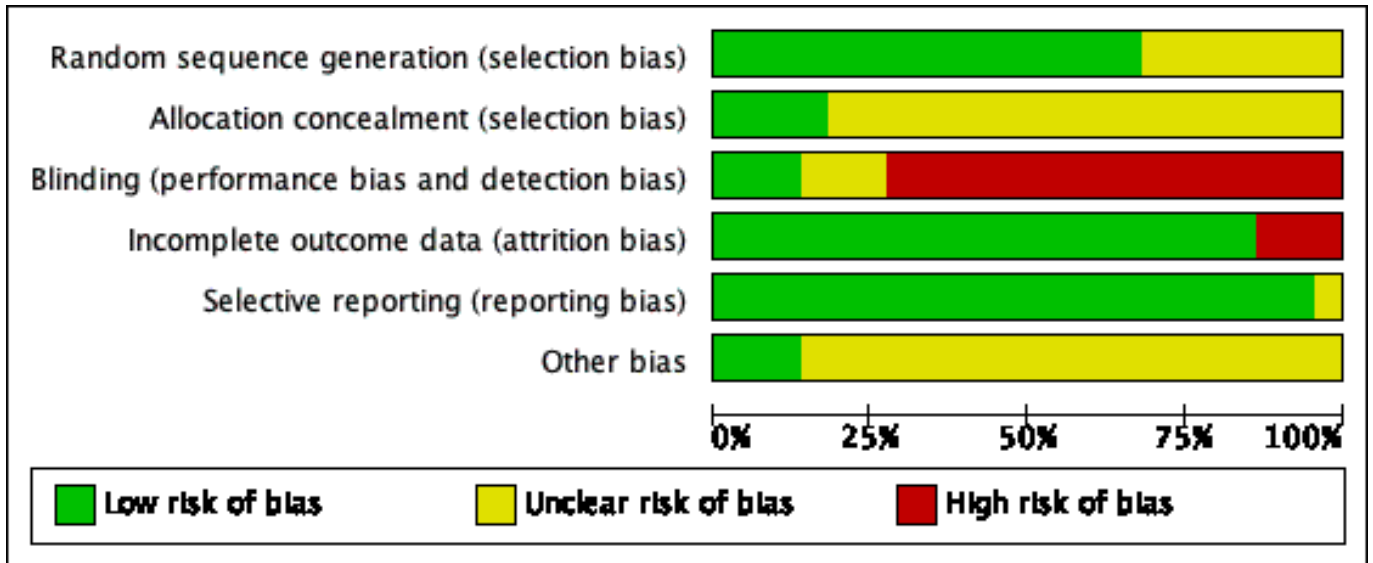


Figure 3. Risk of bias summary: review authors' judgments about each risk of bias item for each included study.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding (performance bias and detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Chen 2000	?	?	-	+	+	?
Chen 2006a	+	?	-	+	+	?
Chen 2010a	+	?	-	+	+	?
Dan 1998	?	?	?	+	+	?
Flachskampf 2007	?	+	+	+	+	+
Guo 2009	+	?	-	+	+	?
Hao 2006	?	?	?	+	?	?
Kim 2012	?	+	+	-	+	+
Li 2012a	?	?	-	+	+	?

Figure 3. (Continued)

Li 2012a						
Liao 2006						
Liu 2011						
Ma 2011						
Macklin 2006						
Shen 2010a						
Tian 2007						
Wang 2012a						
Wu 2003						
Wu 2011						
Xie 2004						
Yang 2010a						
Yin 2007						
Zhang 2012a						

Allocation

Eight studies described the method of generation of allocation sequence, which was by 'random number table' (Chen 2006a; Chen 2010a; Guo 2009; Ma 2011; Shen 2010a; Wu 2011; Xie 2004; Zhang 2012a); one study allocated the participants by 'random digits' (Wu 2003); one study reported the generation of randomization sequence by 'draw lots random' (Liao 2006); five studies allocated the participants by 'randomization software' used, such as NERI's software, SAS software, and excel software (Macklin 2006; Tian 2007; Wang 2012a; Yang 2010a; Yin 2007). However, seven studies mentioned randomly allocate participants, but gave no description of the randomization method in detail (Chen 2000; Dan 1998; Flachskampf 2007; Hao 2006; Kim 2012; Li 2012a; Liu 2011).

Four studies had low risk of allocation concealment, these guided a critical and feasible concealment for allocation of participants, such as opaque, sealed envelopes (Flachskampf 2007; Kim 2012; Macklin 2006; Wang 2012a), and one study had opened the envelopes after the participants had been included in the study, but the physician was not involved further (Kim 2012).

Blinding

Only five trials mentioned blinding, two of them had low risk of bias: Macklin 2006 masked the acupuncturist to random assignments, and did not inform participants that the control points were not traditional acupuncture points; in Yin 2007, the double-blinding was likely successful as no-one dropped out due to finding out the sham nature of their acupuncture sessions; the other three had unclear risk: Flachskampf 2007 described the test as single blinded, the Chinese physician who included participants was blinded, but with very short description only, unclear how participants were informed about the sham acupuncture; Kim 2012 described the test as double-blinded, with very short description about participants and observers, and no information about how participants were informed about the sham acupuncture; Wang 2012a masked surveyor and statistics to random assignments, but did not mention whether acupuncturists and participants were blinded. The other trials did not mention blinding, and were at high risk of performance bias and detection bias.

Incomplete outcome data

Seventeen trials were at low risk of attrition bias, which reported no participants dropped out or were excluded from the primary analysis, and two trials had low risk for reporting the number of dropouts and related reasons, and using ITT analyses (Flachskampf 2007; Macklin 2006). Three trials were at high risk, two had participants who dropped out early or could not be analyzed, but there were no reasons given and no ITT analysis (Kim 2012; Wang 2012a). One trial had participants who dropped out, but they only used a PP analysis, and related reasons were explained (Yin 2007).

Selective reporting

Twenty-one studies reported relevant outcomes in detail, which had low risk of reporting bias. Only one trial had unclear risk as they reported relevant outcomes during the treatment period, but no outcome reported in follow-up (Hao 2006).

Other potential sources of bias

Similarity of comparison groups at baseline

Age, gender, race, clinical characteristics, and history were regarded as significant elements, which possibly affect the outcome measurements. All studies reported that the demographic, clinical status, and history of the two groups did not differ significantly, except the racial profile of one study that had more minority group participants in the control group by chance (Macklin 2006).

Conflicts of interest

Nine studies reported the source of financial support and declared no competing financial interests. The others neither stated the funding source nor mentioned whether the research was approved by an ethics committee.

Effects of interventions

See: [Summary of findings for the main comparison Acupuncture compared to sham acupuncture for hypertension](#); [Summary of findings 2 Safety of acupuncture for primary hypertension](#)

Primary outcomes

Change in blood pressure

Sustained blood pressure lowering effect (greater than seven days)

Only one RCT investigated whether acupuncture had a sustained effect on BP (Flachskampf 2007). There was no BP lowering effect at three and six months after the last acupuncture session.

Short-term blood pressure lowering effect (less than seven days, mostly within one to 24 hours)

Acupuncture versus sham acupuncture

This was the most important comparison in this review as it represented the best attempt to assess the short-term BP lowering effect of acupuncture and reduce bias due to loss of blinding. Four trials compared acupuncture with sham acupuncture (Flachskampf 2007; Kim 2012; Macklin 2006; Yin 2007). Acupuncture reduced SBP compared to sham acupuncture (MD -3.43, 95% CI -5.92 to -0.85; [Analysis 1.1](#)), and reduced DBP (MD -1.95, 95% CI -3.95 to -0.32; [Analysis 1.2](#)). However, heterogeneity was high for SBP ($I^2 = 76%$).

Acupuncture versus renin-angiotensin system (RAS) inhibitors

Eight trials compared acupuncture with RAS inhibitors (Chen 2010a; Guo 2009; Hao 2006; Li 2012a; Liao 2006; Wu 2003; Yang 2010a; Zhang 2012a). One of the trials was a three-arm trial comparing acupuncture, warm needling, and ACEI (Li 2012a). The pooled result suggested that acupuncture reduced BP more than RAS inhibitors (SBP: MD -3.48, 95% CI -5.22 to -1.74; [Analysis 2.1](#); DBP: MD -1.64, 95% CI -2.81 to -0.48; [Analysis 2.2](#)). However, these trials were not blinded and there was significant heterogeneity for SBP ($I^2 = 66%$).

Acupuncture versus calcium antagonists

Seven trials compared acupuncture with calcium antagonists (Chen 2000; Dan 1998; Ma 2011; Shen 2010a; Tian 2007; Wang 2012a; Xie 2004). One was a three-arm trial comparing standard acupuncture, midnight-noon ebb-flow acupuncture, and calcium antagonists (Xie 2004). Another was a three-arm trial comparing acupuncture, acupuncture plus calcium, and calcium antagonists (Wang 2012a). The pooled results suggested that acupuncture lowered BP

more than calcium antagonists (SBP: MD -2.98, 95% CI -5.03 to -0.92; [Analysis 3.1](#); DBP: MD -1.41, 95% CI -2.73 to -0.09; [Analysis 3.2](#)). However, these trials were not blinded and there was significant heterogeneity for both SBP ($I^2 = 92%$) and DBP ($I^2 = 97%$).

Acupuncture versus beta-blocker

Two trials compared acupuncture with beta-blocker ([Chen 2006a](#); [Wu 2011](#)). The pooled results showed no difference between treatments (SBP: MD 0.41, 95% CI -1.72 to 2.55; [Analysis 4.1](#); DBP: MD -0.62, 95% CI -2.88 to 1.64; [Analysis 4.2](#)). However, these trials were not blinded and they showed significant heterogeneity for SBP ($I^2 = 82%$).

Acupuncture plus angiotensin-converting enzyme inhibitor versus angiotensin-converting enzyme inhibitor alone

One trial compared acupuncture plus ACEI with ACEI alone ([Liu 2011](#)). Acupuncture plus ACEI reduced SBP more than ACEI alone (MD -10.79, 95% CI -16.80 to -4.78), but not DBP (MD -0.24, 95% CI -3.94 to 3.46).

Acupuncture plus calcium antagonists versus calcium antagonists alone

One trial compared acupuncture plus calcium antagonists with calcium antagonists alone ([Wang 2012a](#)). Acupuncture plus calcium antagonists lowered SBP more than calcium antagonists alone (MD -6.25, 95% CI -11.65 to -0.85) but not DBP (MD -1.42, 95% CI -4.66 to 1.82).

Secondary outcomes

Adverse events

Eight trials recorded adverse events. Major adverse events occurring in the acupuncture group were headache (one participant in [Chen 2010a](#)), pain (two participants in [Flachskampf 2007](#); [Kim 2012](#)), spot-bleeding (eight participants in [Yin 2007](#); [Kim 2012](#)), time-related reason ([Flachskampf 2007](#)). Serious adverse events were reported in [Macklin 2006](#): hypertensive urgencies (two participants) and congestive heart failure (one participant). Adverse events in the control group were headache (six participants in [Chen 2010a](#) (Drug: Diovan); two participants in [Tian 2007](#) (Drug: levamlodipine maleate tablets)), dizziness (seven participants in [Chen 2010a](#) (Drug: Diovan)), cough (one participant in [Chen 2010a](#) (Drug: Diovan)), nausea and heart palpitations (two participants in [Tian 2007](#) (Drug: levamlodipine maleate tablets)), foot edema/flush/rash/flushed (six participants in [Wang 2012a](#) (Drug: Nicardipine)). Two trials reported no serious adverse events ([Hao 2006](#); [Kim 2012](#)).

Subgroup analyses

We performed no subgroup analyses due to an insufficient number of trials.

DISCUSSION

Summary of main results

In recent years, there have been many publications and studies on the BP lowering effect of acupuncture. However, interpretation of this evidence from these studies is difficult. Thus, at present, it is not known whether acupuncture is an effective therapy for chronic hypertension. In this review, we attempted to clarify this by identifying what type of evidence is required for acupuncture to be a useful therapy in the community. Since elevated blood pressure is

a chronic condition, in order to be effective any treatment would need to have a blood pressure lowering effect sustained for at least seven days and preferably for one month. We found only one trial that tested whether there was a sustained BP lowering effect of acupuncture compared to sham acupuncture after a six-week course of active acupuncture ([Flachskampf 2007](#)). In that trial, there was no change in BP at three and six months after the last acupuncture treatment. None of the other trials reported the effect on BP more than five days after the last session. Therefore, we can report that, at present, there is no evidence for the use of acupuncture to treat chronic hypertension in the community.

The results of this review only relate to the short-term effects of acupuncture, in most cases within one hour or one day of the last acupuncture session. There are only four RCTs with a rigorous design in which acupuncture was compared to a form of sham acupuncture ([Flachskampf 2007](#); [Kim 2012](#); [Macklin 2006](#); [Yin 2007](#)). The pooled effect of these trials suggested that acupuncture causes a short-term non-clinically significant reduction of BP by 3/2 mmHg when compared with sham acupuncture; however, this was very low quality evidence (see [Summary of findings for the main comparison](#)).

In the other trials, the participants were not blinded to the acupuncture intervention and BP was measured within hours to one day after the last acupuncture session. Eight trials compared acupuncture with RAS inhibitors administered daily and suggested that acupuncture lowered BP by 3/2 mmHg more than RAS inhibitors ([Chen 2010a](#); [Guo 2009](#); [Hao 2006](#); [Li 2012a](#); [Liao 2006](#); [Wu 2003](#); [Yang 2010a](#); [Zhang 2012a](#)). If this were true and it was sustained, it would be clinically important as ACEI have been shown in one Cochrane Review to lower BP by 8/5 mmHg ([Heran 2008](#)). However, this suggests a BP lowering effect of 11/7 mmHg, which is not consistent with the findings compared to sham acupuncture. Because of this, and the high risk of loss of blinding bias and publication bias, we have not reported these data in a 'Summary of findings' table.

Nine trials suggested that acupuncture reduced BP by 3/1 mmHg more than daily calcium antagonists ([Chen 2000](#); [Chen 2006a](#); [Dan 1998](#); [Ma 2011](#); [Shen 2010a](#); [Tian 2007](#); [Wang 2012a](#); [Wu 2011](#); [Xie 2004](#)). If this were sustained and true it would be clinically important as calcium antagonists lower BP by about 10/6 mmHg on average based on one Cochrane Review in preparation ([Wong 2002](#)). This suggests a large effect of 13/7 mmHg, which is not consistent with the sham blinded trials. In the forest plot, the obvious outlier, [Shen 2010a](#), contributed to the high heterogeneity. The large BP lowering effect of acupuncture in this trial could be explained by the mean baseline BP being over 200/120 mmHg, which is much higher than the other included studies. This may result in overestimation of acupuncture effect and underestimation of drug effect. Therefore, this finding has inconsistency problems and the same risk of bias as with the ACEIs; for this reason, we have not reported these data in a 'Summary of findings' table.

Two trials suggested that acupuncture lowered BP the same as daily metoprolol beta-blocker therapy ([Chen 2006a](#); [Wu 2011](#)). One Cochrane Review showed that metoprolol lowered BP by 6/5 mmHg ([Wong 2016](#)). One trial ([Liu 2011](#)) investigated the addition of acupuncture to ACEI and did not add any additional evidence. If future trials of acupuncture are conducted, they need to be designed to measure a sustained BP lowering effect at least seven days and preferably one month after the acupuncture.

This review provided very little information as to the safety of acupuncture.

Overall completeness and applicability of evidence

Acupuncture treatment approaches vary in different countries and settings. The trials included in our review came from a variety of countries. In the German trial, acupuncture was mainly provided by Chinese physicians, who were professionally trained in China for acupuncture (Flachskampf 2007). All Chinese physicians had at least five years of training in TCM, combined with five years of training in Western medicine, with additional practice of acupuncture of several years. In the US trial, TCM diagnosing and acupuncture treatment were performed independently by diagnosing acupuncturist with a minimum three years' postgraduate experience and treating acupuncturist with a minimum 1 year' postgraduate experience. In practice, the participating diagnosing acupuncturists had 13 to 22 years' experience, and all had received acupuncture training in colleges in China. All participating acupuncturists delivering acupuncture treatment had two to eight years' experience, and were licensed to practice in Massachusetts. (Training and certification for acupuncturists consisted of studying detailed training manuals and videotapes and attending an eight-hour practical training session with a competency/certification exam (Macklin 2006). In a trial from Korea, physicians were trained in the context of traditional Korean medicine (Kim 2012). The acupuncture treatment forms differed due to practitioners with different qualifications in different countries may confound the results. Sessions of acupuncture treatment may vary in different countries, which may lead to differences. For instance, in most trials from China, acupuncture was performed once a day for a consecutive course, while in the US or Germany, acupuncture was mostly conducted two or three times a week. None of the trials reflected a course of treatment that would be practical in real practice. Moreover, most clinical trials were performed in a restricted experimental condition, by which the inclusion of the participants was highly selective. This is likely quite different from real-world conditions where hypertension is commonly accompanied with other conditions. As explained, the results only relate to a short-term effect of acupuncture, which does not answer whether it would be effective in managing chronic hypertension.

Quality of the evidence

The methodological quality of included trials was variable. Even in the sham controlled trials, we downgraded the evidence to very low using GRADEPro (<https://gradepr.org/>). We appreciate that designing and performing clinical trials of acupuncture is a challenge, particularly with respect to blinding and selection of control interventions. Many old and small trials from China decrease the validity of the results. Since journals are more likely to report positive results, there is a high risk of publication bias. The wide clinical heterogeneity of included trials was also a limitation. Differences in controls, duration of treatment, frequency of sessions, the selected acupoints used, the number of acupoints, and the use of different antihypertensive medicines all added to the heterogeneity.

Potential biases in the review process

First, bias could be generated by the omission of completed studies. Although we conducted extensive searches to identify relevant trials, we cannot rule out the possibility that there are additional trials that are unpublished or published in sources inaccessible to our search. Second, we could not include the data from ongoing clinical trials.

Though we approached the responsible investigators, we were not provided with the data.

Agreements and disagreements with other studies or reviews

Our review agrees with other studies in the aspect that acupuncture as a complement to conventional drugs reduces BP, though with uncertainty. One systematic review reported that acupuncture significantly improved both SBP and DBP in people receiving antihypertensive medication (Li 2014). They did not address the issue of duration of effect. It was similar to our findings with non-sham acupuncture controlled trials, but we disregarded the findings from those trials due to the high risk of bias. In their review, only minor adverse events were identified and this agrees with our results. One review assessed acupuncture either as an adjunct or an alternative in lowering BP, and reported that it was inconclusive whether acupuncture lowers high BP (Lee 2009). The difference with our review was that it used a slightly wider inclusion criterion on mild arterial hypertension, mild or moderate arterial hypertension, or BP within or higher than the prehypertension category, without predescribing a limit to primary hypertension. Another review assessed the efficacy of acupuncture for essential hypertension, particularly that of individualized acupuncture treatment based on TCM diagnosis (Kim 2010). They showed reduction in BP between acupuncture and control, but did not include trials published after 2008. More well designed, rigorous, and large trials in the field are needed. Moreover, our conclusions on the certainty of evidence agrees with a study published in 2013, which emphasized that the methodological quality of the included trials was evaluated as generally low (Wang 2013).

AUTHORS' CONCLUSIONS

Implications for practice

At present, there is no evidence for the sustained blood pressure lowering effect of acupuncture that is required for the management of hypertension. Acupuncture may be associated with a short-term (one to 24 hour) reduction in blood pressure; however, in sham acupuncture trials, the effect at best is small (reduction in systolic/diastolic blood pressure of 3/2 mmHg) and likely clinically irrelevant. The larger effect shown in non-sham acupuncture controlled trials most likely reflects bias and not a true effect.

Implications for research

As hypertension is a chronic condition, it is essential that for acupuncture to be useful it must cause a sustained blood pressure lowering effect. Future randomized controlled trials (RCTs) are needed to determine whether acupuncture lowers blood pressure for at least seven days and preferably longer. The control group in these RCTs must be sham acupuncture. RCTs with improper controls and measuring short term effects on blood pressure are not needed.

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CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by study ID]

Chen 2000

Methods	<p>Groups: A: acupuncture, B: medicine control.</p> <p>Blinding: no information.</p> <p>Dropouts/withdrawals: 0.</p> <p>Duration of intervention: no information of baseline; 2 weeks' treatment; no follow-up.</p>
Participants	<p>Number of participants screened/included/analyzed: not reported/70/70.</p> <p>Number of participants in each group: 35:35.</p> <p>Demographics: mean age 63.57 years in A, mean age 65.20 years in B; number of women 16:16.</p> <p>Number of participants who used antihypertensive: no information.</p> <p>Course of disease: no information.</p> <p>Setting: inpatients and outpatients from The First People's Hospital of Chengdu.</p>
Interventions	<p>Acupuncture points: Quchi, Fenglong.</p> <p>Information on acupuncturists: none.</p> <p>Deqi achieved?: yes.</p> <p>Frequency and duration of treatments: BP measured every 4 hours, when BP at stable normal level, BP measured every morning and before retiring.</p> <p>Control group intervention: nifedipine (Chengdu Pharmaceutical factory), 10-20 mg, TID, at 8 a.m., for 2 weeks.</p>
Outcomes	<p>Primary outcome:</p> <ul style="list-style-type: none"> change in SBP/DBP before and after treatment (BP measured at 3rd day after acupuncture session). <p>Secondary outcomes:</p> <ul style="list-style-type: none"> change in BP; change in endothelin and angiotensin II levels at diagnosis and 2 weeks.
Study detail	<p>Position for measuring BP: decubitus position.</p> <p>BP measurements: no information.</p> <p>Time of each session: needles retained for 15-30 min, stimulated every 5 min.</p>

Chen 2000 (Continued)

Number of treatment sessions: 14 (continuously for 14 days).
Frequency of treatment sessions: no information, 2 weeks was a course.
Time of recruiting: 1997-1999.
Adverse events: no information.

Publication detail
Language of publication: Chinese.
Commercial funding: no.
Non-commercial funding: no.
Publication status: peer review journal.

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"Randomly allocate participants" mentioned, but no detailed description of the randomization method.
Allocation concealment (selection bias)	Unclear risk	No description.
Blinding (performance bias and detection bias) All outcomes	High risk	Participants and investigators not blinded to acupuncture or pills.
Incomplete outcome data (attrition bias) All outcomes	Low risk	"70 participants included" mentioned in results, numbers of participants were matched with information.
Selective reporting (reporting bias)	Low risk	Relevant outcomes reported.
Other bias	Unclear risk	No description.

Chen 2006a

Methods
Groups: A: acupuncture, B: medicine control.
Blinding: no information.
Dropouts/withdrawals: 0.
Duration of intervention: no information of baseline; 4 weeks' treatment; no follow-up.

Participants
Number of participants screenings/included/analyzed: not reported/60/60.
Number of participants in each group: 30:30
Demographics: aged 36-65 years, mean age 54.75 years in A, aged 33-61 years, mean age 51.72 years in B; number of women 10:9.
Number of participants who used antihypertensive: no information.

Chen 2006a (Continued)

Course of disease: from 1 month to 10 years, mean 5.65 years in A; from 6.5 months to 10.42 years, mean 5.39 years in B

Setting: inpatients from Department of Acupuncture and Moxibustion in the first hospital in Wuhan.

Interventions

Acupuncture points: Fengchi (bilateral).

Information on acupuncturists: none.

Deqi achieved?: yes.

Control group intervention: metoprolol (25 mg pills, Batch number Su Wei medicine approved by 1985, 326201), 100 mg, once daily, at 8 a.m., for 4 weeks.

Outcomes

Primary outcome:

- change in SBP/DBP before and after treatment (measured on last 3 days of acupuncture sessions).

Secondary outcome:

- change in BP.

Study detail

Position for measuring BP: no information.

BP measurements: no information.

Time of each session: needles retained for 30 min, stimulated every 10 min.

Number of treatment sessions: 28 (continuously for 4 weeks).

Frequency of treatment sessions: no information, 2 weeks was a course.

Time of recruiting: March 2004 to December 2004.

Adverse events: no information.

Publication detail

Language of publication: Chinese.

Commercial funding: no.

Non-commercial funding: yes (State administration of TCM).

Publication status: peer review journal.

Notes

Baseline BP: mean BP on 3 different days before treatment.

Last BP: mean BP in last 3 days before ceasing treatment.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random number table.
Allocation concealment (selection bias)	Unclear risk	No description.
Blinding (performance bias and detection bias) All outcomes	High risk	Participants and investigators not blinded to acupuncture or pills.

Chen 2006a (Continued)

Incomplete outcome data (attrition bias) All outcomes	Low risk	No dropouts or exclusions from analysis.
Selective reporting (reporting bias)	Low risk	Relevant outcomes reported.
Other bias	Unclear risk	No description.

Chen 2010a

Methods	<p>Groups: A: acupuncture, B: medicine control.</p> <p>Blinding: no information.</p> <p>Dropouts/withdrawals: 0.</p> <p>Duration of intervention: no information of baseline; 34 days' treatment; no follow-up.</p>
Participants	<p>Number of participants screened/included/analyzed: not reported/80/80.</p> <p>Number of participants in each group: 40:40.</p> <p>Demographics: mean age 61.3 years in A, mean age 62 years in B; number of women 19:20.</p> <p>Number of participants who used antihypertensives: no information.</p> <p>Course of disease: mean 16 years in A; mean 17.3 years in B.</p> <p>Setting: outpatients and inpatients from German Otto Boylen Hospital.</p>
Interventions	<p>Acupuncture points: main points: Fengchi (GB20), Quchi (LI11), Taichong (LR3), Sanyinjiao; assistant points: Xingjian (LR2), Xiashi (GB43); Yin deficiency and yang excess: Ganshu (BL18) and Fuli (KI7); Phlegm wet indicates sheng: Fenglong and Yinlingquan; Yin-yang deficiency: Guanyuan (CV4) and Shenshu (BL23).</p> <p>Information on acupuncturists: none.</p> <p>Deqi achieved?: yes.</p> <p>Control group intervention: valsartan (Novartis), 80 mg, once daily for 30 days.</p>
Outcomes	<p>Primary outcome:</p> <ul style="list-style-type: none"> change in SBP/DBP before and after treatment (BP measured 15 min after acupuncture session). <p>Secondary outcomes:</p> <ul style="list-style-type: none"> change in BP; change in TCM symptom pattern.
Study detail	<p>Position for measuring BP: sitting position and ambulatory BP monitoring.</p> <p>BP measurements: ambulatory BP monitoring by MOBIL-O-GRAPHÓ, made in Germany.</p> <p>Time of each session: needles retained for 30 min, stimulated every 10 min.</p> <p>Number of treatment sessions: 28 (continuously for 4 courses).</p> <p>Frequency of treatment sessions: once daily, 7 days was a course, 2-day interval between 2 courses.</p>

Chen 2010a (Continued)

Time of recruiting: December 2004 to December 2008.

Adverse events: 1/40 had headache in A; 6/40 had headache, 7/40 had dizziness, 1/40 had cough in B.

Publication detail

Language of publication: Chinese

Commercial funding: no

Non-commercial funding: no

Publication status: peer review journal.

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random number table.
Allocation concealment (selection bias)	Unclear risk	No description.
Blinding (performance bias and detection bias) All outcomes	High risk	Participants and investigators not blinded to acupuncture or pills.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No dropouts or exclusions from analysis.
Selective reporting (reporting bias)	Low risk	Relevant outcomes reported.
Other bias	Unclear risk	No description.

Dan 1998

Methods

Groups: A: acupuncture, B: medicine control.

Blinding: no information.

Dropouts/withdrawals: 0.

Duration of intervention: no information of baseline; 3 weeks' treatment; no follow-up.

Participants

Number of participants screenings/included/analyzed: not reported/52/52.

Number of participants in each group: 26:26.

Demographics: mean age 57.8 years in A, 48.35 years in B; number of women 7:8.

Number of participants who used antihypertensives: no information.

Course of disease: 5-25 years, mean 9.4 years in A; 4-26 years, mean 8.8 years in B.

Setting: inpatients from Beijing Chaoyang Second Hospital.

Dan 1998 (Continued)

Interventions	<p>Acupuncture points: main points: Quchi, Hegu, Taichong, Fengchi, Geshu; assistant points: Yin deficiency and yang excess: Fuliu, Neiguan; The phlegm wet resistance: Fenglong, Gongsun; Yin-yang deficiency: Zusanli, Sanyinjiao.</p> <p>Information on acupuncturists: none.</p> <p>Deqi achieved?: yes.</p> <p>Control group intervention: nifedipine, 10 mg, TID, for 3 weeks.</p>	
Outcomes	<p>Primary outcome:</p> <ul style="list-style-type: none"> change in 24-hour BP before and after treatment (measured immediately after acupuncture session). <p>Secondary outcomes:</p> <ul style="list-style-type: none"> change in BP; change in heart rate, myocardial oxygen consumption; response of symptom. 	
Study detail	<p>Position for measuring BP: activity not restricted for ambulatory BP monitoring.</p> <p>BP measurements: Accutracker II (Suntech MedicalIns, Raleigh, NC USA), non-invasive portable ambulatory BP monitoring.</p> <p>Time of each session: needles retained for 20-30 min, stimulated after 10 min of inserting needle.</p> <p>Number of treatment sessions: 15 (lasting 3 weeks).</p> <p>Frequency of treatment sessions: once daily, 5 times a week.</p> <p>Time of recruiting: no information.</p> <p>Adverse events: no information.</p>	
Publication detail	<p>Language of publication: Chinese.</p> <p>Commercial funding: no.</p> <p>Non-commercial funding: no.</p> <p>Publication status: peer review journal.</p>	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Only described randomization used, but no description of the method and detail of randomization.
Allocation concealment (selection bias)	Unclear risk	No description.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Participants and investigators not blinded to acupuncture or pills. Detection bias reduced as BP was measured with automatic 24-hour monitor.
Incomplete outcome data (attrition bias)	Low risk	No dropouts or exclusions from analysis.

Dan 1998 (Continued)

All outcomes

Selective reporting (reporting bias)	Low risk	Relevant outcomes reported.
Other bias	Unclear risk	No description.

Flachskampf 2007

Methods	<p>Groups: A: active acupuncture, B: sham acupuncture (80% of participants with antihypertensive).</p> <p>Blinding: participants, Chinese physician who included participants.</p> <p>Dropouts/withdrawals: in 2 weeks between randomization and initiation of treatment: 7/83 in A, 4/77 in B; during the treatment course: 4/76 in A, 5/73 in B; first follow-up visit: 0/72 in A, 0/68 in B; second follow-up visit: 4/72 in A, 1/68 in B; third visit: 1/68 in A, 1/67 in B.</p> <p>Duration of intervention: no information of baseline; 6 weeks' treatment; 3 follow-up visits: first (immediate) post-treatment follow-up visit within 3 working days after finishing treatment; second 3 months after finishing treatment; third 6 months after finishing treatment.</p>
Participants	<p>Number of participants screenings/included/analyzed: 342/160/140.</p> <p>Number of participants in each group: 72:68.</p> <p>Demographics: mean age 58.8 years in A, 58.0 years in B; number of women 46:60.</p> <p>Number of participants who used antihypertensives: 53:52.</p> <p>Course of disease: no information.</p> <p>Setting: outpatients at Med Klinik, Klinikum Ottobeuren.</p>
Interventions	<p>Acupuncture points: needling points chosen according to Chinese type of hypertension, and angle, depth, and type of manipulation of needling conformed to typical prescriptions (3 acupuncture points were needled bilaterally except single points such as Taiyang): Taiyang, KG12, KG6, KG4, Di11, Di4, Ks6, Ma36, Ma40, Mp9, Mp6, Ni3, Le3, Le2, LG20, Gb20, BI18, BI23.</p> <p>Information on acupuncturists: 7; Chinese physicians included participants, Chinese physicians trained and accredited at the Nanjing School of Traditional Chinese Medicine (Nanjing, People's Republic of China) administered acupuncture. All Chinese physicians had ≥ 5 years of training in Traditional Chinese Medicine, combined with 5 years of training in Western medicine, with additional practice of acupuncture of several years.</p> <p>Deqi achieved?: yes.</p> <p>Control group intervention: needling performed with same technique as for active treatment, but needling points were without relevance for BP lowering according to Traditional Chinese Medicine concepts. Pl1, dorsolateral forearm between traditional acupuncture points SI 7 and 8 on the small intestine meridian; Pl2, lateral thigh between acupuncture points Gb32 and Gb31 on the gall bladder meridian; and Pl3, lateral lower limb between acupuncture points Gb 34 and Gb35 on the gall bladder meridian.</p>
Outcomes	<p>Primary outcome:</p> <ul style="list-style-type: none"> mean SBP and DBP levels on 24-hour ambulatory BP monitoring (started 5 min after acupuncture session). <p>Secondary outcome:</p>

Flachskampf 2007 (Continued)

- mean daytime and night-time SBP and DBP and reduction in BP at peak stress during bicycle stress testing.

Study detail	<p>Position for measuring BP: sitting position for auscultatory cuff BP measurements.</p> <p>BP measurements: ambulatory BP measurements were performed with an oscillometric device (Tracker NIBP, Reynolds Medical, Feucht, Germany); auscultatory cuff BP measurements with calibrated instruments.</p> <p>Time of each session: needles retained for 30 min.</p> <p>Number of treatment sessions: 22.</p> <p>Frequency of treatment sessions: during first 2 weeks: 5 sessions once a week, and in the following 4 weeks: 3 sessions weekly.</p> <p>Time of recruiting: January 2001 to May 2004.</p> <p>Adverse events: no local complications noted. Most frequent complaint about acupuncture therapy concerned the time demand for the treatment sessions. 2 participants terminated study early, complaining that acupuncture was too painful to continue.</p>	
Publication detail	<p>Language of publication: English.</p> <p>Commercial funding: no.</p> <p>Non-commercial funding: yes (the Schöller-Stiftung, Nürnberg, Germany).</p> <p>Publication status: peer review journal.</p>	
Notes	<p>None of the physicians spoke German.</p> <p>1 participant developed atrial fibrillation during treatment and was excluded because of necessity of anticoagulation.</p> <p>Other participants discontinuing study stated difficulty in keeping to time schedule, advised by family practitioner, or no reason for discontinuation.</p> <p>Participants taking antihypertensives continued their treatment without change in dosage or type of medication.</p>	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Only described the block randomization used, but no description of method and detail of randomization.
Allocation concealment (selection bias)	Low risk	Closed envelope, without indicating assignment to participants.
Blinding (performance bias and detection bias) All outcomes	Low risk	Study described as single blind, Chinese physicians who included participants blinded. Very short description only, unclear how participants were informed about sham acupuncture. Low risk of detection bias as BP was by automatic 24-hour monitoring.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Mentioned intention-to-treat analyses and reported number of dropouts and related reasons.

Flachskampf 2007 (Continued)

Selective reporting (reporting bias)	Low risk	Relevant outcomes reported.
Other bias	Low risk	There is no conflict of interest.

Guo 2009

Methods	<p>Groups: A: acupuncture (electroacupuncture), B: medicine control.</p> <p>Blinding: no information.</p> <p>Dropouts/withdrawals: 0.</p> <p>Duration of intervention: 3 weeks of baseline; 4 weeks' treatment; no follow-up visit.</p>
Participants	<p>Number of participants screenings/included/analyzed: not reported/60/60.</p> <p>Number of participants in each group: 30:30.</p> <p>Demographics: aged 32-64 years in A; aged 29-65 years in B; number of women 14:13.</p> <p>Number of participants who used antihypertensives: no detailed information.</p> <p>Course of disease: 0.5-10 years in A; 1-9 years in B.</p> <p>Setting: no information.</p>
Interventions	<p>Acupuncture points: Baihui, Fengchi, Fenglong, Taichong, Taixi, Zusanli, Sanyinjiao.</p> <p>Information on acupuncturists: no information.</p> <p>Deqi achieved?: yes.</p> <p>Control group intervention: enalapril maleate capsules (Yangzijiang Pharmaceutical Group, Jiangsu), 10 mg once daily, for 4 weeks.</p>
Outcomes	<p>Primary outcome:</p> <ul style="list-style-type: none"> change in SBP and DBP before and after treatment (measured in the last week of acupuncture sessions). <p>Secondary outcome:</p> <ul style="list-style-type: none"> change in blood sugar, insulin, insulin sensitivity index, total cholesterol, triglycerides, low density lipoprotein cholesterol, and high density lipoprotein cholesterol.
Study detail	<p>Position for measuring BP: supine.</p> <p>BP measurements: no information.</p> <p>Time of each session: needles retained for 30 min, stimulating every 10 min.</p> <p>Number of treatment sessions: 28.</p> <p>Frequency of treatment sessions: once daily (for 4 weeks).</p> <p>Time of recruiting: June 2008 to June 2010.</p> <p>Adverse events: no information.</p>
Publication detail	<p>Language of publication: Chinese.</p>

Acupuncture for hypertension (Review)

Guo 2009 (Continued)

Commercial funding: no.
Non-commercial funding: no.
Publication status: peer review journal.

Notes Antihypertensive withdrawal 2 weeks before treatment, BP in 3 different days as baseline BP in the third week before treatment, BP at 3 different days before ceasing treatment as last BP.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random number table.
Allocation concealment (selection bias)	Unclear risk	No description.
Blinding (performance bias and detection bias) All outcomes	High risk	Participants and investigators not blinded to acupuncture or pills.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No mention of dropout and withdrawals.
Selective reporting (reporting bias)	Low risk	Relevant outcomes reported.
Other bias	Unclear risk	No description.

Hao 2006

Methods **Groups:** A: acupuncture, B: medicine control.
Blinding: no information.
Dropouts/withdrawals: 0.
Duration of intervention: no information of baseline; 7 days' treatment; follow-up visits: at 1 month after ceasing treatment.

Participants **Number of participants screenings/included/analyzed:** not reported/60/60.
Number of participants in each group: 30:30.
Demographics: mean age 64.57 years in A, mean age 64.77 years in B; number of women 15:15.
Number of participants who used antihypertensives: no information.
Course of disease: no information.
Setting: inpatients and outpatients from Affiliated hospital of Guangzhou University of TCM.

Interventions **Acupuncture points:** Taichong (bilateral).
Information on acupuncturists: no information.

Hao 2006 (Continued)

Deqi achieved?: yes.

Control group intervention: captopril, 12.5 mg, BID, for 7 days.

Outcomes

Primary outcome:

- change in 24-hour SBP and DBP before and after treatment (not mentioned, but likely right after the last session).

Secondary outcomes:

- change in BP;
- change in symptom score;
- change in differential pressure, symptom score, and heart rate.

Study detail

Position for measuring BP: no information.

BP measurements: no information.

Time of each session: needles retained for 20 min, stimulated every 5-10 min.

Number of treatment sessions: 7.

Frequency of treatment sessions: once daily, 7 days was a course.

Time of recruiting: 2004 to December 2005.

Adverse events: no reported liver and kidney function damage, pulmonary infection, or arrhythmia by acupuncture.

Publication detail

Language of publication: Chinese.

Commercial funding: no.

NON-Commercial funding: no.

Publication status: Masters thesis.

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Only described simple randomization used, but no description of the method and detail of randomization.
Allocation concealment (selection bias)	Unclear risk	No description.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Participants and investigators not blinded to acupuncture or pills. Detection bias reduced as BP was measured with automatic 24-hour monitor.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No dropouts and withdrawals mentioned.
Selective reporting (reporting bias)	Unclear risk	Relevant outcomes reported, but no outcome reported in follow-up period.

Hao 2006 (Continued)

Other bias	Unclear risk	No description.
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Kim 2012

Methods	<p>Groups: A: active acupuncture, B: sham acupuncture.</p> <p>Blinding: participants and observers.</p> <p>Dropouts/withdrawals: in the 2 weeks between randomization and initiation of treatment: 7/83 in A, 4/77 in B; during treatment course: 4/76 in A, 5/73 in B; first post-treatment follow-up visit: 0/72 in A, 0/68 in B; second follow-up visit: 4/72 in A, 1/68 in B; third visit: 1/68 in A, 1/67 in B.</p> <p>Duration of intervention: no information of baseline; 8 weeks' treatment; 8 weeks' follow-up visits: 1 participant was eliminated (drank alcohol several hours before follow-up 24-hour ambulatory BP measurement); 4 participants dropped out for personal reasons (distance, personal work, etc.).</p>
Participants	<p>Number of participants screening/included/analyzed: 72/33/28.</p> <p>Number of participants in each group: 17:16.</p> <p>Demographics: mean age 52.08 years in A, 52.38 years in B; number of women 4:8.</p> <p>Number of participants who used antihypertensives: no previous use of antihypertensive medication.</p> <p>Course of disease: no information.</p> <p>Setting: outpatients at the Kyung Hee University Hospital at Gangdong, Korea.</p>
Interventions	<p>Acupuncture points: ST36, PC6 (bilateral).</p> <p>Information on acupuncturists: 1 physician trained in traditional Korean medicine.</p> <p>Deqi achieved?: yes.</p> <p>Control group intervention: non-acupuncture points (which were 1 cm lateral from ST36 and PC6) were needed superficially and bilaterally; Deqi was avoided.</p>
Outcomes	<p>Primary outcome:</p> <ul style="list-style-type: none"> mean nocturnal BP dipping levels of SBP and DBP according to 24-hour ambulatory BP monitoring (started immediately after acupuncture session). <p>Secondary outcome:</p> <ul style="list-style-type: none"> nocturnal BP dipping patterns, mean SBP and DBP levels, and mean daytime and night-time SBP and DBP levels.
Study detail	<p>Position for measuring BP: no information.</p> <p>BP measurements: oscillometric device (Tonoport V, GE Medical System Information, Germany).</p> <p>Time of each session: needles retained for 20 min.</p> <p>Number of treatment sessions: 16 (for 8 weeks).</p> <p>Frequency of treatment sessions: twice a week.</p> <p>Time of recruiting: July 2009 to June 2010.</p>

Kim 2012 (Continued)

Adverse events: no serious adverse events reported. Observed adverse effects were related to insertion of needles, such as: transient slight injection-site pain and small bleeding.

Publication detail

Language of publication: English.

Commercial funding: no.

Non-commercial funding: yes (Korea Research Foundation Grant funded by the Korean Government (MOEHRD, Basic Research Promotion Fund)).

Publication status: peer review journal.

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Only described block randomization used (block size 4), but no description of method and detail of randomization.
Allocation concealment (selection bias)	Low risk	Inadequate method, although used consecutively numbered, opaque envelopes, but were opened to physician after participants were included in study; however, physician was not involved further.
Blinding (performance bias and detection bias) All outcomes	Low risk	Study described as double blind, participants and observers, but very short description, unclear how participants were informed about sham acupuncture. No detection bias as BP was by automatic 24-hour monitoring.
Incomplete outcome data (attrition bias) All outcomes	High risk	28/33 participants (5 in A, 0 in B) dropped out early or could not be analyzed. Detailed description, no intention-to-treat analysis.
Selective reporting (reporting bias)	Low risk	Relevant outcomes reported.
Other bias	Low risk	There is no conflict of interest.

Li 2012a

Methods

Groups: A: warm needling, B: acupuncture, C: medicine.

Blinding: no information.

Dropouts/withdrawals: 0.

Duration of intervention: no information of baseline; 2 weeks' treatment (total 14 treatments, with no elapsed days between consecutive treatment sessions), no follow-up.

Participants

Number of participants screening/included/analyzed: not reported/60/60.

Number of participants in each group: 20:20:20.

Demographics: mean age 63.1 years in A, 61.7 years in B, 62.0 years in C; number of women 7:6:7.

Number of participants who used antihypertensives: 3:5:4.

Course of disease: 2.08-8.33 years, mean 5.11 years in A; 1.67-7.75 years, mean 4.35 years in B; 1.33-8.67 years, mean 4.89 years in C.

Li 2012a (Continued)

Setting: outpatients from Community Health Station, Beipei, Chongqin and the First Affiliated Hospital to TCM of Guangzhou.

Interventions

Acupuncture points: in A: Siguan points (Hegu LI4 and Taichong LR3); in B: Siguan points (Hegu LI4 and Taichong LR3).

Information on acupuncturists: no information.

Deqi achieved?: yes.

Control group intervention: captopril 12.5 mg, BID, 14 days.

Outcomes

Primary outcome:

- change in SBP and DBP (measured right after acupuncture session).

Secondary outcomes:

- change in BP;
- change in heart rate, symptom score, and lipid profiles.

Study detail

Position for measuring BP: sitting or decubitus.

BP measurements: mercurial sphygmomanometer.

Time of each session: A: until moxa stick moxibustion (length 2 cm) burning out; B: needles retained for 30 min and stimulated every 10 min.

Number of treatment sessions: 14 (for 2 courses).

Frequency of treatment sessions: every day, 7 days was a course.

Time of recruiting: May 2011 and January 2012.

Adverse events: no information.

Publication detail

Language of publication: Chinese.

Commercial funding: no.

Non-commercial funding: no.

Publication status: Masters thesis.

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No description.
Allocation concealment (selection bias)	Unclear risk	No description.
Blinding (performance bias and detection bias) All outcomes	High risk	Participants and investigators not blinded to acupuncture or pills.
Incomplete outcome data (attrition bias)	Low risk	No attrition.

Li 2012a (Continued)

All outcomes

Selective reporting (reporting bias)	Low risk	Relevant outcome reported.
Other bias	Unclear risk	No description.

Liao 2006

Methods	<p>Groups: A: acupuncture, B: medicine control.</p> <p>Blinding: no information.</p> <p>Dropouts/withdrawals: 0.</p> <p>Duration of intervention: no information of baseline; 14 days' treatment; no follow-up visits.</p>
Participants	<p>Number of participants screening/included/analyzed: not reported/90/90.</p> <p>Number of participants in each group: 59:31.</p> <p>Demographics: mean age 56.5 years in A, mean age 55.6 years in B; number of women 28:14.</p> <p>Number of participants who used antihypertensives: no information.</p> <p>Course of disease: mean 9.20 years in A; mean 8.56 years in B.</p> <p>Setting: inpatients in integrative traditional Chinese and western medicine in the Fourth Central Hospital of Tianjin.</p>
Interventions	<p>Acupuncture points: use "reducing south and reinforcing north" needling method, the points of "reducing south" were Taichong and Xingjian, Daling and Neiguan; the points of "reinforcing north" were Ququan, Taixi, Kunlun and Fuli; assistant points were: Quchi, Fenglong.</p> <p>Information on acupuncturists: no information.</p> <p>Deqi achieved?: yes.</p> <p>Control group intervention: captopril 12.5 mg TID + aspirin 75 mg once daily for 14 days.</p>
Outcomes	<p>Primary outcome:</p> <ul style="list-style-type: none"> change in SBP/DBP before and after treatment (measured during the last 3 days of acupuncture sessions). <p>Secondary outcome:</p> <ul style="list-style-type: none"> change in BP; change in TCM symptom pattern.
Study detail	<p>Position for measuring BP: decubitus.</p> <p>BP measurements: no information.</p> <p>Time of each session: needles retained for 30 min, stimulated 3 times (immediately after inserting needle, middle of treatment, before withdrawing the needle), lasting 5 min every time.</p> <p>Number of treatment sessions: 28 (continuously for 2 weeks).</p> <p>Frequency of treatment sessions: twice a day, 7 days was a course.</p>

Liao 2006 (Continued)

Time of recruiting: 2003-2004.

Adverse events: no information.

Publication detail

Language of publication: Chinese.

Commercial funding: no.

Non-commercial funding: no.

Publication status: peer review journal.

Notes

Average BP during 3 days before treatment and during 3 days after treatment.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomly drawn lots.
Allocation concealment (selection bias)	Unclear risk	No description.
Blinding (performance bias and detection bias) All outcomes	High risk	Participants and investigators not blinded to acupuncture or pills.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No dropouts or exclusions from analysis.
Selective reporting (reporting bias)	Low risk	Relevant outcome reported.
Other bias	Unclear risk	No description.

Liu 2011

Methods

Groups: A: acupuncture + medicine, B: medicine control.

Blinding: no information.

Dropouts/withdrawals: 0.

Duration of intervention: no information of baseline; 30 days' treatment; no follow-up visits.

Participants

Number of participants screening/included/analyzed: not reported/106/106.

Number of participants in each group: 53:53.

Demographics: mean age 46.5 years in A, mean age 45.2 years in B; number of women 23:25.

Number of participants who used antihypertensives: no information.

Course of disease: mean 10.68 years in A; mean 11.16 years in B.

Setting: People's Hospital in Tianzhu.

Liu 2011 (Continued)

Interventions	<p>Acupuncture points: main points: Fengchi, Quchi, Zusanli, Sanyinjiao; supplementary points: deficiency of liver-yin and kidney-yin: Taixi, Taichong; the phlegm wet resistance: Fenglong.</p> <p>Information on acupuncturists: no information.</p> <p>Deqi achieved?: yes.</p> <p>Control group intervention: captopril, 12.5 mg TID for 30 days.</p>	
Outcomes	<p>Primary outcome:</p> <ul style="list-style-type: none"> change in SBP/DBP before and after treatment (time of measurement not reported but likely on last day after acupuncture session). <p>Secondary outcome:</p> <ul style="list-style-type: none"> change in BP. 	
Study detail	<p>Position for measuring BP: no information.</p> <p>BP measurements: no information.</p> <p>Time of each session: needles retained for 20 min.</p> <p>Number of treatment sessions: 30 (lasting 2 courses).</p> <p>Frequency of treatment sessions: once daily, 15 days was a course.</p> <p>Time of recruiting: January 2002 to December 2009.</p> <p>Adverse events: no information.</p>	
Publication detail	<p>Language of publication: Chinese.</p> <p>Commercial funding: no.</p> <p>Non-commercial funding: no.</p> <p>Publication status: peer review journal: yes.</p>	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Only described the randomization used, but no description of the method and detail of randomization.
Allocation concealment (selection bias)	Unclear risk	No description.
Blinding (performance bias and detection bias) All outcomes	High risk	Participants and investigators were not blinded to acupuncture or pills.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No attrition.

Liu 2011 (Continued)

Selective reporting (reporting bias)	Low risk	Relevant outcome reported.
Other bias	Unclear risk	No description.

Ma 2011

Methods	<p>Groups: A: acupuncture (electroacupuncture), B: medicine control.</p> <p>Blinding: no information.</p> <p>Dropouts/withdrawals: 0.</p> <p>Duration of intervention: no information of baseline; 15-day treatment; no follow-up.</p>
Participants	<p>Number of participants screening/included/analyzed: not reported/80/80.</p> <p>Number of participants in each group: 40:40.</p> <p>Demographics: mean age 66.39 years in A, mean age 64.58 years in B; number of women 15:18.</p> <p>Number of participants who used antihypertensives: no information.</p> <p>Course of disease: mean 14.94 years in A; mean 15.4 years in B.</p> <p>Setting: outpatients and inpatients from rehabilitation department in Central hospital in Wuhan.</p>
Interventions	<p>Acupuncture points: Quchi (LI11) bilateral (f:20 Hz, stimulation intensity:10-20 mA).</p> <p>Information on acupuncturists: no information.</p> <p>Deqi achieved?: yes.</p> <p>Control group intervention: nicardipine (Beijing Double-crane Pharmaceutical), 20mg, TID, for 15 days.</p>
Outcomes	<p>Primary outcome:</p> <ul style="list-style-type: none"> change in SBP and DBP before and after treatment (measured immediately after acupuncture session). <p>Secondary outcomes:</p> <ul style="list-style-type: none"> change in BP; change in concentration of the plasma NPY, NT.
Study detail	<p>Position for measuring BP: no information.</p> <p>BP measurements: no information.</p> <p>Time of each session: needles retained for 10 min.</p> <p>Number of treatment sessions: 15.</p> <p>Frequency of treatment sessions: once a day (for 15 days).</p> <p>Time of recruiting: June 2008 to June 2010.</p> <p>Adverse events: no information.</p>
Publication detail	<p>LANGUAGE OF PUBLICATION: Chinese.</p>

Acupuncture for hypertension (Review)

Ma 2011 (Continued)

Commercial funding: no.

Non-commercial funding: yes (Health Bureau, in Wuhan).

Publication status: peer review journal.

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random number table.
Allocation concealment (selection bias)	Unclear risk	No description.
Blinding (performance bias and detection bias) All outcomes	High risk	Participants and investigators not blinded to acupuncture or pills.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No attrition.
Selective reporting (reporting bias)	Low risk	Relevant outcome reported.
Other bias	Unclear risk	No description.

Macklin 2006

Methods	<p>Groups: A: individualized acupuncture, B: standardized acupuncture , C: sham/control acupuncture .</p> <p>Blinding: participant (participants not informed that the control points were not traditional acupuncture points used to treat hypertension), a diagnosing acupuncturist masked to random assignments, treating acupuncturists masked to diagnosing.</p> <p>Dropouts/withdrawals: in treatment period (the first 6 weeks): 5/64 in A, 2/64 in B, 4/64 in C; in the follow-up period, 1. with no follow-up: 4/64 in A, 0/64 in B, 0/64 in C; 2. weeks 2-10: 1/64 in A, 2/64 in B, 6/64 in C; 3. at week 10: 5/64 in A, 5/64 in B, 7/64 in C.</p> <p>Duration of intervention: 6 months' baseline; 6 weeks' treatment (total 12 treatments, with 3 or 4 elapsed days between consecutive treatment sessions, treatment period could extend to 8 weeks to complete), follow-up every 2 weeks to week 10, then at months 4, 6, 9, and 12.</p>
Participants	<p>Number of participants screening/included/analyzed: 424/192/188.</p> <p>Number of participants in each group: 64:64:64.</p> <p>Demographics: mean age 56.8 years in A, 55.9 years in B, 53.2 years C; 46% women; more minority ethnic participants in C by chance.</p> <p>Number of participants who used antihypertensives: 44:44:47.</p> <p>Course of disease: no information.</p>

Macklin 2006 (Continued)

Setting: outpatient clinics, at Massachusetts General Hospital in Boston, US.

Interventions

Acupuncture points: in A: if flare-up of liver fire: GB20, GB21, GB34, GB43, GV20, LI04, LI1, LR02, LR03, ST36, ST44, Tai Yang; liver yang rising with kidney yin deficiency: BL18, BL 23, GB20, GV20, HT07, KI03, LI04, LI11, LR03, SP06, Yin Tang; obstruction of phlegm and dampness: BL20, BL64, CV12, GB20, GV20, LI04, LI11, LR03a, PC06, SP06, ST08, ST 36, ST 40; Yin and yang deficiency: BL23, CV04, CV06, GB20, GV04, GV20, KI03, LI04, LI11, LR03, SP06, ST36; Qi and blood deficiency leading to liver yang rising: BL18, BL20, BL23, CV04, CV06, GB20, GV20, HT 07, KI03, LI04, LI11, LR03, SP06, ST36. the total number of a prescription points could not exceed 12, which might have consisted of 5 bilateral points and 1 point on the midline. Auricular points: liver, heart, Shen Men, Jiang Ya Gou, autonomic/sympathetic (at each treatment session). Corporeal acupuncture at 10-12 points (median: 12, counting bilateral points twice) selected and stimulated as individually prescribed. Auricular acupuncture at the 2 most active points identified with a point detector at the start of each treatment session. In B: standardized acupuncture, corporeal acupuncture at 5 bilateral points with neutral stimulation: GB20, LI11, LR03, SP06, and ST36. Auricular acupuncture at Heart and Jiang Ya Gou. Points selected a priori by an expert panel.

In C: sham/control acupuncture, corporeal acupuncture at 5 bilateral points that did not fall along any TCM meridian with no stimulation. Auricular acupuncture in Darwin's tubercle and the posterior ear lobe. All corporal and auricular acupuncture points in areas considered inactive according to TCM.

Information on acupuncturists: number not reported; diagnosing acupuncturist had minimum 3 years' postgraduate experience and treating acupuncturist had minimum 1 year' postgraduate experience. In practice, participating diagnosing acupuncturists had 13-22 years' experience, and all had received acupuncture training at colleges in the Peoples' Republic of China. Participating treating acupuncturists had 2-8 years' experience. All study acupuncturists were licensed to practice in Massachusetts. (Training and certification for acupuncturists consisted of studying detailed training manuals and videotapes and attending an 8-hour practical training session with a competency/certification exam.)

Deqi achieved?: in B: used a neutral method of stimulation (obtaining 'De Qi' without any further stimulation). At 10, 20, and 30 min, acupuncturist touched each corporeal needle but did not stimulate the needles.

Control group intervention: 5 control corporeal locations needled bilaterally (total of 10 points), in all corporeal locations, needles were inserted perpendicular to the skin without stimulation, and 2 auricular locations needled unilaterally at each visit, inserted perpendicular to the skin without stimulation.

Outcomes
Primary outcome:

- change in SBP from baseline to 10 weeks (measured at 5 min after acupuncture session).

Secondary outcomes:

- change in DBP from baseline to 10 weeks;
- blood chemistries, lipid profiles, complete blood cell counts, and urinalysis performed at baseline, 10 weeks, 6 months, and 12 months. Quality of life data were collected using self-administered Medical Outcomes Study Short Form questionnaires 41 at baseline, 10 weeks, and 12 months;
- adverse events recorded when participants presented with complaints at any time and based on asking participants if they had been well at each visit. Serious adverse events were recorded.

Study detail

Position for measuring BP: no information.

BP measurements: manual mercury sphygmomanometers by trained staff.

Time of each session: in A: if prescription included only anterior corporeal points, participant was needed in supine position. Needles were retained for 30 min and stimulated according to the prescription at the time of initial insertion, and again at 10 and 20 min. If both anterior and posterior points were prescribed, anterior points were needled first (supine position) and retained for 20 min with the prescribed needle stimulation at the time of initial insertion and at 10 min. Needles were then removed and participant placed in prone position. Posterior points were then needled and retained for 10 min, with the prescribed needle stimulation at the time of insertion. In B: needled in the supine position. In C: supine corporeal points were touched by the acupuncturist at 10 min and withdrawn at 20 min, then

Macklin 2006 (Continued)

turned over to lie prone and the remainder of the corporeal needles inserted. After an additional 10 min (30 min total time), the needles were touched and removed without stimulation. Auricular acupuncture needles were inserted prior to corporeal needling, without stimulation and were retained without stimulation during the 30-min treatment period.

Number of treatment sessions: 12.

Frequency of treatment sessions: twice a week.

Time of recruiting: March 2001 and July 2002.

Adverse events: 3 study related serious adverse events occurred over 165 participant-years of follow-up: 2 participants experienced hypertensive urgencies, in B and 1 participant experienced congestive heart failure in C. No deaths occurred.

Publication detail	<p>Language of publication: English.</p> <p>Commercial funding: no.</p> <p>Non-commercial funding: yes.</p> <p>Publication status: peer review journal.</p>
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Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Use the NERI's randomization software (used centralized computer).
Allocation concealment (selection bias)	Low risk	Sealed envelopes, inclusion, diagnosing, and treating by different acupuncturist.
Blinding (performance bias and detection bias) All outcomes	Low risk	Acupuncturist masked to random assignments; participants not informed that the control points were not traditional acupuncture points.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Mentioned intention-to-treat analyses and reported the number of dropouts and related reasons.
Selective reporting (reporting bias)	Low risk	Relevant outcomes described in publication and additional data provided on request.
Other bias	Low risk	There is no conflict of interest.

Shen 2010a

Methods	<p>Groups: A: acupuncture, B: medicine control.</p> <p>Blinding: no information.</p> <p>Dropouts/withdrawals: 0.</p> <p>Duration of intervention: no information of baseline; 1 day' treatment; no follow-up visits.</p>
Participants	<p>Number of participants screening/included/analyzed: not reported/60/60.</p>

Acupuncture for hypertension (Review)

Shen 2010a (Continued)

Number of participants in each group: 30:30.

Demographics: mean age 50.6 years in A, mean age 51.13 years in B; number of women 13:14.

Number of participants who used antihypertensives: no information.

Course of disease: mean 4.73 years in A; mean 4.67 years in B.

Setting: inpatients from Department of Acupuncture and Moxibustion and emergency department in The First Affiliated Hospital of Tianjin Medical University.

Interventions

Acupuncture points: Renyin, Hegu, Taichong, Quchi, Zusanli.

Information on acupuncturists: no information.

Deqi achieved?: yes.

Control group intervention: nifedipine, 10 mg daily, immediately after patient hospitalization.

Outcomes

Primary outcome:

- change in SBP/DBP before and after treatment (BP measured 3 min after acupuncture session).

Study detail

Position for measuring BP: no information.

BP measurements: no information.

Time of each session: needles retained for 30 min.

Number of treatment sessions: 1 (once).

Frequency of treatment sessions: once a day.

Time of recruiting: April to June 2009.

Adverse events: no information.

Publication detail

LANGUAGE OF PUBLICATION: Chinese.

Commercial funding: no.

Non-commercial funding: no.

Publication status: peer review journal..

Notes

Only 1 treatment.

BP measured at 3, 15, 30, 60 min, and 2, 4, and 6 hours.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random number table.
Allocation concealment (selection bias)	Unclear risk	No description.
Blinding (performance bias and detection bias) All outcomes	High risk	Participants and investigators not blinded to acupuncture or pills.

Shen 2010a (Continued)

Incomplete outcome data (attrition bias) All outcomes	Low risk	No participant dropout and withdraw.
Selective reporting (reporting bias)	Low risk	Relevant outcomes presented.
Other bias	Unclear risk	No description.

Tian 2007

Methods	<p>Groups: A: acupuncture, B: medicine control.</p> <p>Blinding: no information.</p> <p>Dropouts/withdrawals: 0.</p> <p>Duration of intervention: no information of baseline; 30 days' treatment; no follow-up.</p>
Participants	<p>Number of participants screening/included/analyzed: not reported/60/60.</p> <p>Number of participants in each group: 30:30.</p> <p>Demographics: mean age 59.17 years in A, mean age 59 years in B; number of women 13:14.</p> <p>Number of participants who used antihypertensives: no information.</p> <p>Course of disease: mean 7.67 years in A; mean 8.03 years in B.</p> <p>Setting: inpatients from internal medicine in the People's Hospital Zhuzhou.</p>
Interventions	<p>Acupuncture points: Quchi, Taichong, Fengchi (bilateral).</p> <p>Information on acupuncturists: no information.</p> <p>Deqi achieved?: yes.</p> <p>Control group intervention: levamlodipine besylate pills, 2.5 mg, once daily, at 7 a.m. for 30 days.</p>
Outcomes	<p>Primary outcome:</p> <ul style="list-style-type: none"> change in SBP and DBP before and after treatment (measured at 15 min after acupuncture session). <p>Secondary outcomes:</p> <ul style="list-style-type: none"> change in BP; change in symptom score; change in blood sugar, lipids.
Study detail	<p>Position for measuring BP: no information.</p> <p>BP measurements: no information.</p> <p>Time of each session: needles retained for 30 min, stimulated every 10 min.</p> <p>Number of treatment sessions: 30.</p> <p>Frequency of treatment sessions: once daily, 30 days was a course (at 9 a.m.).</p> <p>Time of recruiting: January 2006 to January 2007.</p>

Tian 2007 (Continued)

Adverse events: 2/30 headache, nausea and 2/30 heart palpitations in B.

Publication detail	<p>Language of publication: Chinese.</p> <p>Commercial funding: no.</p> <p>Non-commercial funding: no.</p> <p>Publication status: Masters thesis.</p>
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Notes	BP measured at 7 a.m. and 5 p.m. by nurse.
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Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer program (DPS8.01 Chinese Statistical software).
Allocation concealment (selection bias)	Unclear risk	No description.
Blinding (performance bias and detection bias) All outcomes	High risk	Participants and investigators not blinded to acupuncture or pills.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No participant dropout and withdraw.
Selective reporting (reporting bias)	Low risk	Relevant outcomes presented.
Other bias	Unclear risk	No description.

Wang 2012a

Methods	<p>Groups: A: acupuncture (electroacupuncture), B: medicine control, C: acupuncture + medicine control.</p> <p>Blinding: assessor and statistician.</p> <p>Dropouts/withdrawals: in treatment: 2/47 unfinished treatment, 3/45 incomplete data, 2/42 non-compliant participants; B: 4/45 adverse drug reaction, 1/41 non-compliant participant; C: 2/50 adverse drug reaction.</p> <p>Duration of intervention: no information of baseline; 28 days' treatment: A: 2/47 unfinished treatment, 3/45 incomplete data, 2/42 non-compliant participants; B: 4/45 adverse drug reaction, 1/41 non-compliant participant; C: 2/50 adverse drug reaction; no follow-up.</p>
Participants	<p>Number of participants screening/included/analyzed: 142/128/128.</p> <p>Number of participants in each group: 47:45:50 (at end of treatment: 40:40:48).</p> <p>Demographics: mean age 66.39 years in A, mean age 64.58 years in B, mean age 64.29 years in C; number of women 15:18:20.</p> <p>Number of participants who used antihypertensives: no information.</p> <p>Course of disease: mean 14.94 years in A; mean 15.39 years in B; mean 15.03 years.</p>

Wang 2012a (Continued)

Setting: outpatients and inpatients from rehabilitation department in Hubei University of Chinese Medicine.

Interventions

Acupuncture points: Quchi (bilateral); and non-acupoint: ligature between Quchi and Yangxi, 5 Cun below Quchi (f:20 Hz).

Information on acupuncturists: no information.

Deqi achieved?: yes.

Control group intervention: B and C: nifedipine (Beijing ShuangHe Pharmaceutical Co. Ltd.), 20 mg, TID, for 28 days.

Outcomes

Primary outcome:

- changes of SBP/DBP before and after treatment (measured at 1 day after acupuncture session).

Secondary outcome:

- changes of NPY concentration, NT concentration, NPY/NT concentration before and after treatment.

Study detail

Position for measuring BP: supine.

BP measurements: mercurial sphygmomanometer (XJ11D).

Time of each session: needles retained for 10 min.

Number of treatment sessions: 28 (continuously for 4 courses).

Frequency of treatment sessions: once daily, 7 days was a course.

Time of recruiting: March 2010 to February 2012.

Adverse events: B: 4/40: foot edema, flush, rash, flustered, headache; C: 2/40: foot edema, flush, rash.

Publication detail

Language of publication: Chinese.

Commercial funding: no.

Non-commercial funding: no.

Publication status: Masters thesis.

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomization by Excel software.
Allocation concealment (selection bias)	Low risk	Opaque envelop.
Blinding (performance bias and detection bias) All outcomes	High risk	Assessor and statistician masked to random assignments, but acupuncturists and participants were not masked.
Incomplete outcome data (attrition bias) All outcomes	High risk	14/142 participants dropped out early or could not be analyzed during treatment. No related reason description, no intention-to-treat analysis.

Wang 2012a (Continued)

Selective reporting (reporting bias)	Low risk	Relevant outcomes presented.
Other bias	Unclear risk	No description.

Wu 2003

Methods	<p>Groups: A: acupuncture, B: medicine control.</p> <p>Blinding: no information.</p> <p>Dropouts/withdrawals: 0.</p> <p>Duration of intervention: no information of baseline; 30 days' treatment; no follow-up.</p>
Participants	<p>Number of participants screening/included/analyzed: not reported/80/80.</p> <p>Number of participants in each group: 40:40.</p> <p>Demographics: mean age 48.55 years in A, 47.85 years in B; number of women 17:19.</p> <p>Number of participants who used antihypertensives: no information.</p> <p>Course of disease: 6 months to 10 years, mean 5.15 years in A; 6 months to 10 years; mean 4.95 years in C.</p> <p>Setting: no information.</p>
Interventions	<p>Acupuncture points: acupuncture at Hegu (LI4), Taichong (LR3) and warming acupuncture-moxibustion at Baihui (GV20).</p> <p>Information on acupuncturists: no information.</p> <p>Deqi achieved?: yes.</p> <p>Control group intervention: captopril (Bristol-Myers Squibb, Shanghai), 25 mg TID, for 30 days.</p>
Outcomes	<p>Primary outcome:</p> <ul style="list-style-type: none"> change in SBP and DBP before and after treatment (measured within 5 days after last session). <p>Secondary outcome:</p> <ul style="list-style-type: none"> change in plasma angiotensin II before and after treatment.
Study detail	<p>Position for measuring BP: no information.</p> <p>BP measurements: no information.</p> <p>Time of each session: needles retained for 20 min, stimulated every 5 min and lasting 30 seconds.</p> <p>Number of treatment sessions: 30 (for 30 days).</p> <p>Frequency of treatment sessions: once daily.</p> <p>Time of recruiting: January 2000 to December 2002.</p> <p>Adverse events: no information.</p>
Publication detail	<p>Language or publication: Chinese.</p>

Wu 2003 (Continued)

Commercial funding: no

Non-commercial funding: yes (Hunan Technology Gallery).

Publication status: peer review journal.

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Use of random digits.
Allocation concealment (selection bias)	Unclear risk	Not described.
Blinding (performance bias and detection bias) All outcomes	High risk	Participants and investigators not blinded to acupuncture or pills.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No dropouts or withdrawals from analysis.
Selective reporting (reporting bias)	Low risk	Relevant outcomes presented.
Other bias	Unclear risk	No description.

Wu 2011

Methods

Groups: A: acupuncture, B: medicine control.

Blinding: no information.

Dropouts/withdrawals: 0.

Duration of intervention: no information of baseline; 22 days' treatment; no follow-up.

Participants

Number of participants screening/included/analyzed: not reported/120/120.

Number of participants in each group: 60:60.

Demographics: mean age 54.75 years in A, mean age 51.72 years in B; number of women 26:24.

Number of participants who used antihypertensives: no information.

Course of disease: mean 6.78 years in A; mean 7.01 years in B.

Setting: outpatients from The Second Affiliated Hospital of Zhengzhou University.

Interventions

Acupuncture points: Zhigou, Yanglingquan, Taiyang, Taichong (bilateral).

Information on acupuncturists: no information.

Deqi achieved?: yes.

Wu 2011 (Continued)

Control group intervention: metoprolol, 100 mg, QD, for 20 days.

Outcomes	Primary outcome: <ul style="list-style-type: none"> change in SBP/DBP before and after treatment (measured at 30 min after acupuncture session). Secondary outcomes: <ul style="list-style-type: none"> change in BP; change in TCM symptom pattern. 	
Study detail	Position for measuring BP: sitting position and ambulatory BP monitoring. BP measurements: mercury column sphygmomanometer sleeve belt. Time of each session: needles retained for 30 min, stimulated every 10 min, lasting 1 min. Number of treatment sessions: 20 (continuously for 2 courses). Frequency of treatment sessions: once daily, 10 days was a course, 2-day interval between 2 courses. Time of recruiting: no information. Adverse events: no information.	
Publication detail	Language or publication: Chinese. Commercial funding: no. Non-commercial funding: no. Publication status: peer review journal.	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random number table.
Allocation concealment (selection bias)	Unclear risk	No description.
Blinding (performance bias and detection bias) All outcomes	High risk	Participants and investigators not blinded to acupuncture or pills.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No dropouts or withdrawals from analysis.
Selective reporting (reporting bias)	Low risk	Relevant outcomes presented.
Other bias	Unclear risk	No description.

Xie 2004

Methods	<p>Groups: A: Lingguibafa acupuncture, B: point selection by pattern identification, C: medicine.</p> <p>Blinding: no information.</p> <p>Dropouts/withdrawals: 0.</p> <p>Duration of intervention: no information of baseline; 3 months' treatment; no follow-up.</p>
Participants	<p>Number of participants screening/included/analyzed: not reported/90/90.</p> <p>Number of participants in each group: 30:30:30.</p> <p>Demographics: aged 38-71 years, mean age 56.77 years; number of women 47/90.</p> <p>Number of participants who used antihypertensives: no information.</p> <p>Course of disease: no information.</p> <p>Setting: inpatients from First Affiliated Hospital to Guangxi University of TCM.</p>
Interventions	<p>Acupuncture points: Quchi, Zusanli; Fengchi, Taichong; headache: Yintang, Taiyang; insomnia: Anmian, Shenmen; palpitation: Ximen, Neiguan (bilateral).</p> <p>Information on acupuncturists: no information.</p> <p>Deqi achieved?: yes.</p> <p>Control group intervention: nitrendipine, 10 mg, BID.</p>
Outcomes	<p>Primary outcome:</p> <ul style="list-style-type: none"> change in BP before and after treatment (measured at 30 min after acupuncture treatment). <p>Secondary outcome:</p> <ul style="list-style-type: none"> response after treatment.
Study detail	<p>Position for measuring BP: no information.</p> <p>BP measurements: desktop water silver column sphygmomanometer.</p> <p>Time of each session: needles retained for 30 min, with needle manipulation once during treatment.</p> <p>Number of treatment sessions: 1.</p> <p>Frequency of treatment sessions: no information.</p> <p>Time of recruiting: no information.</p> <p>Adverse events: no information.</p>
Publication detail	<p>Language or publication: Chinese.</p> <p>Commercial funding: no.</p> <p>Non-commercial funding: no.</p> <p>Publication status: peer review journal.</p>
Notes	<p>Risk of bias</p>

Xie 2004 (Continued)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random number table.
Allocation concealment (selection bias)	Unclear risk	No description.
Blinding (performance bias and detection bias) All outcomes	High risk	Participants and investigators not blinded to acupuncture or pills.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No dropouts or withdrawals.
Selective reporting (reporting bias)	Low risk	Relevant outcomes presented.
Other bias	Unclear risk	No description.

Yang 2010a

Methods	<p>Groups: A: acupuncture (electroacupuncture), B: medicine control.</p> <p>Blinding: no information.</p> <p>Dropouts/withdrawals: 0.</p> <p>Duration of intervention: no information of baseline; 14 days' treatment; no follow-up.</p>
Participants	<p>Number of participants screening/included/analyzed: not reported/60/60.</p> <p>Number of participants in each group: 30:30.</p> <p>Demographics: aged 28-44 years, mean age 40.4 years in A; 30-45 years, mean age 41.7 years in B; number of women 13:10.</p> <p>Number of participants who used antihypertensives: no information.</p> <p>Course of disease: 0.6-9.3 years, mean 5.2 years in A; 0.5-8.6, mean 4.2 years in B.</p> <p>Setting: outpatients from affiliated hospital of Shandong University of TCM.</p>
Interventions	<p>Acupuncture points: Quchi (LI11) and Taichong (LR3) (f:2 Hz/100 Hz, stimulation intensity: 10-20 mA).</p> <p>Information on acupuncturists: no information.</p> <p>Deqi achieved?: yes.</p> <p>Control group intervention: captopril (Bristol-Myers Squibb, Shanghai), 12.5 mg/day, TID, for 14 days.</p>
Outcomes	<p>Primary outcome:</p> <ul style="list-style-type: none"> change in 24-hour SBP and DBP before and after treatment (measured immediately after last acupuncture session). <p>Secondary outcome:</p>

Yang 2010a (Continued)

- BPV (24-hour systolic standard deviation, 24-hour diastolic standard deviation, daytime systolic standard deviation, night-time systolic standard deviation, and night-time diastolic standard deviation).

Study detail	<p>Position for measuring BP: no information (dynamic monitoring BP).</p> <p>BP measurements: non-invasive diagnosis of portable dynamic monitoring BP (type of ambulatory BP monitoring, US).</p> <p>Time of each session: needles retained for 30 min.</p> <p>Number of treatment sessions: 14.</p> <p>Frequency of treatment sessions: once daily (for 14 days).</p> <p>Time of recruiting: January 2007 to December 2008.</p> <p>Adverse events: no information.</p>
Publication detail	<p>Language or publication: Chinese.</p> <p>Commercial funding: no.</p> <p>Non-commercial funding: yes (Development of Science and Technology Plan project of TCM 20052006, in Shandong province).</p> <p>Publication status: peer review journal.</p>
Notes	BP also measured once before 3 days' and after 3 days' acupuncture treatment.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	SAS software Proc plan to randomization.
Allocation concealment (selection bias)	Unclear risk	Not mentioned.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Participants and investigators not blinded to acupuncture or pills. Detection bias was reduced as BP was measured with automatic 24-hour monitor.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No dropouts or exclusions from analysis.
Selective reporting (reporting bias)	Low risk	Relevant outcomes presented.
Other bias	Unclear risk	No description.

Yin 2007

Methods	<p>Groups: A: active acupuncture, B: sham acupuncture (all participants were antihypertensive).</p> <p>Blinding: assessor and participants (a single assessor made the measurements including BP, psychological factors, and lifestyle).</p>
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Yin 2007 (Continued)

Dropouts/withdrawals: in treatment: after 4 weeks: 3/21 in A, 1/20 in B had dropped for job-related reasons; 1/19 in A, 1/19 in B for distance to hospital; 0/18 to A, 1/18 to B for severe gonalgia; 1/18 in A, 1/17 in B for uncertainty about effectiveness of treatment; 0/17 in A, 1/16 in B for personal reasons; after 8 weeks: 1/17 in A, 1/15 in B dropped out for job-related reasons.

Duration of intervention: 8 weeks. After 4 weeks: 3/21 in A, 1/20 in B dropped for job-related reasons; 1/19 in A, 1/19 in B discontinued for far distance to hospital; 0/18 in A, 1/18 in B for severe gonalgia; 1/18 in A, 1/17 in B for uncertainty about effectiveness of treatment, 0/17 in A, 1/16 in B for personal reasons; after 8 weeks: 1/17 in A, 1/15 in B dropped out for job-related reasons; no follow-up.

Participants

Number of participants screening/included/analyzed: not reported/41/30.

Number of participants in each group: 21:20.

Demographics: mean age 52 years in A, mean age 54 years in B; number of women 11:10.

Number of participants who used antihypertensives: all.

Course of disease: 3.4 years in A, 4.2 years in B.

Setting: institutional review board at Kyung Hee University Hospital of Oriental Medicine, Seoul, Korea.

Interventions

Acupuncture points: acupuncture formula based on and modified from the Saam acupuncture theory of Korean acupuncture. The 4 formulas were: 1. ST36, LI11 and BL25 for toning the large intestine (L1) meridian energy; 2. SP3, LU9, and BL13 for the lung (LU); 3. K17, K12, and CV4 for the kidney (K1); 4. LI1, GV14, and GB20 for the bladder (BL). L1, LU, KI, or BL energy is typically considered deficient when a body is in a state of dampness, dryness, cold or hot, respectively. Optionally, PC6 and HT7 were added when a psychologic factor was considered of importance.

Information on acupuncturists: no information.

Deqi achieved?: yes.

Control group intervention: using Park's sham needle (a new non-penetrating sham acupuncture device), needle did not penetrate skin, but was twisted slowly to imitate real acupuncture. After the Deqi sensation detected, the needle was withdrawn immediately.

All participants were encouraged to follow the instructions for 10 min' deep, slow breathing exercise and to walk for 30 min a day at an easy pace during the 8-week period.

Outcomes

Primary outcome:

- change in SBP/DBP at baseline, 4 weeks, and 8 weeks (measured at 5 min after acupuncture treatment).

Secondary outcome:

- change in scales of overall health, pain, and anticipation.

Study detail

Position for measuring BP: supine.

BP measurements: automated sphygmomanometer (model T4, Omron, Japan).

Time of each session: needles retained for 30 min, stimulated every 5 min.

Number of treatment sessions: 17.

Frequency of treatment sessions: once daily, 3- to 4-day interval between sessions for 8 weeks.

Time of recruiting: 1 January to 31 May 2004.

Adverse events: spot-bleeding (8 in A).

Publication detail

Language or publication: English.

Yin 2007 (Continued)

Commercial funding: no.

Non-commercial funding: yes (supported by the SRC program of KOSEF, Korea).

Publication status: peer review journal.

Notes BP measured on right upper arm, mean of 3 readings with a 5-min interval. BP was taken 6 times for the baseline measurement and 3 times for the outcome measurement.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computerized random allocation.
Allocation concealment (selection bias)	Unclear risk	No detail mentioned.
Blinding (performance bias and detection bias) All outcomes	High risk	Blinding unlikely to have been achieved as sham procedure did not involve needle penetration.
Incomplete outcome data (attrition bias) All outcomes	High risk	Reported number of dropouts and related reasons, but no intention-to-treat.
Selective reporting (reporting bias)	Low risk	Relevant outcome reported.
Other bias	Unclear risk	No description.

Zhang 2012a

Methods **Groups:** A: acupuncture + psychotherapy, B: acupuncture, C: medicine.
Blinding: participants, Chinese physician who included participants.
Dropouts/withdrawals: not reported.
Duration of intervention: no information of baseline; 8 weeks' treatment; no follow-up.

Participants **Number of participants screening/included/analyzed:** not reported/42/42.
Number of participants in each group: 14:14:14.
Demographics: aged 42-60 years for all participants; number of women 19.
Number of participants who used antihypertensives: no information.
Course of disease: no information.
Setting: no information.

Interventions **Acupuncture points:** B: Quchi, Taichong, Zusanli, Sanyinjiao.
Information on acupuncturists: no information.
Deqi achieved?: no information.

Zhang 2012a (Continued)

Control group intervention: A: acupuncture + psychotherapy: 1. supportive psychotherapy, 30-min sessions, twice a week, 8 weeks was a course; 2. cognitive therapy, 30-min sessions, twice a week, 8 weeks was a course; 3. relaxation therapy, 30 min sessions, twice or three times a week, 8 weeks was a course; C: captopril (Bristol-Myers Squibb, Shanghai), 25 mg, TID.

Outcomes	<p>Primary outcome:</p> <ul style="list-style-type: none"> change in SBP and DBP before and after treatment (not mentioned, but likely right after last session). <p>Secondary outcome:</p> <ul style="list-style-type: none"> change in grade Zung self-rating anxiety scale (SAS) and Zung self-rating depression scale (SDS) before and after treatment.
Study detail	<p>Position for measuring BP: sitting.</p> <p>BP measurements: auscultatory cuff BP measurements.</p> <p>Time of each session: needles retained for 30 min, stimulated every 15 min.</p> <p>Number of treatment sessions: 24 (for 8 weeks).</p> <p>Frequency of treatment sessions: 3 times a week.</p> <p>Time of recruiting: no information.</p> <p>Adverse events: no information.</p>
Publication detail	<p>Language or publication: Chinese.</p> <p>Commercial funding: no.</p> <p>Non-commercial funding: no.</p> <p>Publication status: peer review journal.</p>
Notes	No detailed information of demographics.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random number table.
Allocation concealment (selection bias)	Unclear risk	No description.
Blinding (performance bias and detection bias) All outcomes	High risk	Participants and investigators not blinded to acupuncture or pills.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No dropouts or withdrawals.
Selective reporting (reporting bias)	Low risk	Relevant outcomes reported.
Other bias	Unclear risk	No description.

BID: twice a day; BP: blood pressure; DBP: diastolic blood pressure; min: minute; NPY: neuropeptide Y; NT: neurotensin; QD: once a day; SAS: Zung self-rating anxiety scale; SBP: systolic blood pressure; SDS: Zung self-rating depression scale; TCM: Traditional Chinese Medicine; TID: three times a day.

Characteristics of excluded studies [ordered by study ID]

Study	Reason for exclusion
An 2001	Methods: incorrect randomization method.
Cao 2007	Participants: only included cervical hypertension, but no description of primary hypertension.
Chen 1990	Participants: no detail description of participant criteria, not only included primary hypertension.
Chen 1995	Method: not randomized.
Chen 2006b	Intervention: abdominal acupuncture therapy.
Chen 2009	Participants: no detail description of participant criteria, not only included primary hypertension.
Chen 2010b	Outcome with no indication of blood pressure change.
Chen 2011	Outcome with no indication of blood pressure change.
Dong 2012	Outcomes: no relevant outcomes reported.
Fang 1998	Case observation.
Fang 2012	Intervention: acupuncture vs acupuncture.
Feng 2003	Outcome with no indication of blood pressure change.
Gao 2009	Included the comparison of a complementary and alternative intervention, which is lifestyle training. Thus, study was excluded.
Hao 2009	Participants: no detail description of participant criteria, not only included primary hypertension.
He 2002	Participants: no detail description of participant criteria, not only included primary hypertension.
He 2012	Participants: included elderly participants with systolic hypertension.
Hong 2009	Cross-over trial.
Hu 2010	Outcome with no indication of blood pressure change.
Huang 1991	Intervention: auricular acupuncture at Erxin.
Huang 2007a	Outcome with no indication of blood pressure change.
Huang 2007b	Participants: no detail description of participant criteria, not only included primary hypertension.
Jiang 2003	Intervention: magnetic needle acupuncture + captopril.
Jin 2010	Participants: no detail description of participant criteria, not only included primary hypertension.
Jung 2010	Cross-over study.

Study	Reason for exclusion
Li 2008a	Outcome with no indication of blood pressure change.
Li 2008b	Participants: only included cervical hypertension, but no description of primary hypertension.
Li 2012b	Outcome with no indication of blood pressure change.
Liu 2012	Intervention: acupuncture vs acupuncture.
Luo 2011	Intervention: acupuncture + bloodletting on ear-tip.
Mou 1991	Intervention: acupuncture vs acupuncture.
Mu 2009	Method: not randomized
Ning 2012	Participants: only included cervical hypertension, but no description of primary hypertension.
Qian 1996	Participants: only included cervical hypertension, but no description of primary hypertension.
Qu 2009	Intervention: auricular acupuncture and wrist-ankle acupuncture analgesia.
Shen 2010b	Intervention: acupuncture vs acupuncture.
Song 2003	Intervention: acupuncture + Chinese herb + western medicine vs Chinese herb.
Song 2006	Intervention: acupuncture vs acupuncture.
Sui 2012	Intervention: acupuncture vs acupuncture.
Sun 2009	Participants: only included cervical hypertension, but no description of primary hypertension.
Tang 2003	Method: incorrect randomization method.
Tian 2012	Cross-over trial.
Wang 1994	Intervention: acupuncture vs acupuncture.
Wang 2003	Outcome with no indication of blood pressure change.
Wang 2006	Intervention: acupuncture + Chinese herb vs western medicine.
Wang 2012b	Intervention: acupuncture + Chinese herb vs western medicine.
Wei 2010	Outcome with no indication of blood pressure change.
Wei 2012	Intervention: acupuncture vs acupuncture.
Wu 2004a	Outcomes: only laboratory parameters.
Wu 2004b	Wrong randomization method.
Wu 2005	Participants: no detail description of participant criteria, not only included primary hypertension.
Xia 2006	Change in diastolic blood pressure.
Xia 2012	Intervention: acupuncture vs acupuncture.

Study	Reason for exclusion
Xie 2000	Methods: not a randomized trial.
Xie 2014	Included the comparison of a complementary and alternative intervention, which is lifestyle training. Thus, this study was excluded.
Xing 2005	Intervention: acupuncture vs acupuncture.
Xing 2011	Intervention: acupuncture vs acupuncture.
Yang 2002a	Methods: not randomized trial.
Yang 2002b	Methods: not randomized trial.
Yang 2010b	Intervention: bloodletting at the Erjian-point.
Yao 1994	Participants: no detail description of participant criteria, not only included primary hypertension.
Yi 1988	Methods: not randomized trial.
Yin 1994	Participants: no detail description of participant criteria, not only included primary hypertension.
Yin 2002	Participants: no detail description of participant criteria, not only included primary hypertension.
Yu 2007	Outcome with no indication of blood pressure change.
Zhang 1999	Participants: no detail description of participant criteria, not only included primary hypertension.
Zhang 2001	Participants: no detail description of participant criteria, not only included primary hypertension.
Zhang 2002	inappropriate control design (compound medicine made of ≥ 2 ingredients).
Zhang 2004	inappropriate control design (compound medicine made of ≥ 2 ingredients).
Zhang 2005	Methods: incorrect randomization method.
Zhang 2008	Intervention: laser acupoint treatment.
Zhang 2009	Intervention: acupuncture vs acupuncture.
Zhang 2011	Intervention: catgut embedding in acupoint.
Zhang 2012b	Intervention: acupuncture + Chinese herb vs western medicine.
Zhao 2003	Included the comparison of a complementary and alternative intervention, which is lifestyle training. Thus, this study was excluded.
Zhao 2011	Case observation.
Zhao 2012	Intervention: acupuncture vs acupuncture.
Zheng 2012	Participants: no detail description of participant criteria, not only included primary hypertension.
Zhou 1997	Intervention: acupuncture vs acupuncture.
Zhou 2012	Participants: no detail description of participant criteria, not only included primary hypertension.

Study	Reason for exclusion
Zhu 2006	Participants: no detail description of participant criteria, not only included primary hypertension.

Characteristics of ongoing studies [ordered by study ID]

Liang






Trial name or title	Effect of Acupuncture on Patients with Mild Hypertension (EAPMH).
Methods	Large scale, open label, multicenter, randomized controlled clinical trial.
Participants	Adults with mild essential hypertension; estimated enrolment: 428.
Interventions	2 acupuncture arms, 1 sham acupuncture arm, and 1 waiting list arm.
Outcomes	Primary outcome: mean systolic and average diastolic blood pressure by 24-hour ambulatory blood pressure monitoring. Secondary outcomes: mean systolic and diastolic blood pressure during the daytime and night-time; changes in health-related quality of life; expectation of treatment; adverse events.
Starting date	July 2012.
Contact information	Liang FR, Chengdu University of Traditional Chinese Medicine.
Notes	

DATA AND ANALYSES

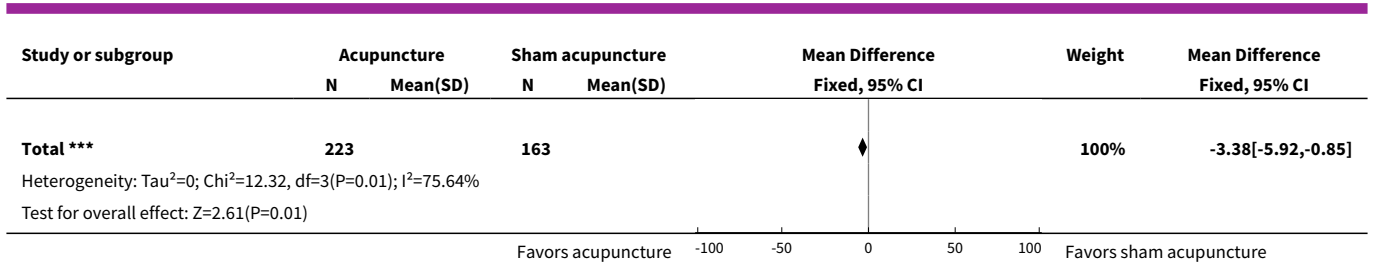
Comparison 1. Acupuncture versus sham acupuncture

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Change in systolic blood pressure	4	386	Mean Difference (IV, Fixed, 95% CI)	-3.38 [-5.92, -0.85]
2 Change in diastolic blood pressure	4	386	Mean Difference (IV, Fixed, 95% CI)	-1.95 [-3.59, -0.32]

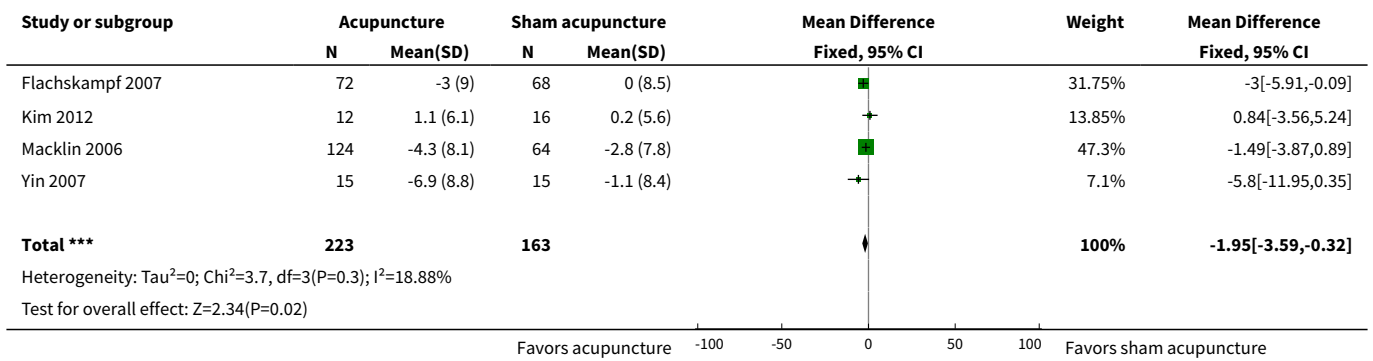
Analysis 1.1. Comparison 1 Acupuncture versus sham acupuncture, Outcome 1 Change in systolic blood pressure.

Study or subgroup	Acupuncture		Sham acupuncture		Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
	N	Mean(SD)	N	Mean(SD)			
Yin 2007	15	-14.1 (11.7)	15	-4 (13.3)		8%	-10.1[-19.07,-1.13]
Kim 2012	12	3 (9.8)	16	-0.3 (6.6)		15.5%	3.3[-3.15,9.75]
Macklin 2006	124	-3.6 (15)	64	-3.8 (15.1)		31.14%	0.28[-4.27,4.83]
Flachskampf 2007	72	-6 (12.5)	68	1 (10.2)		45.36%	-7[-10.77,-3.23]
							

Favors acupuncture -100 -50 0 50 100 Favors sham acupuncture



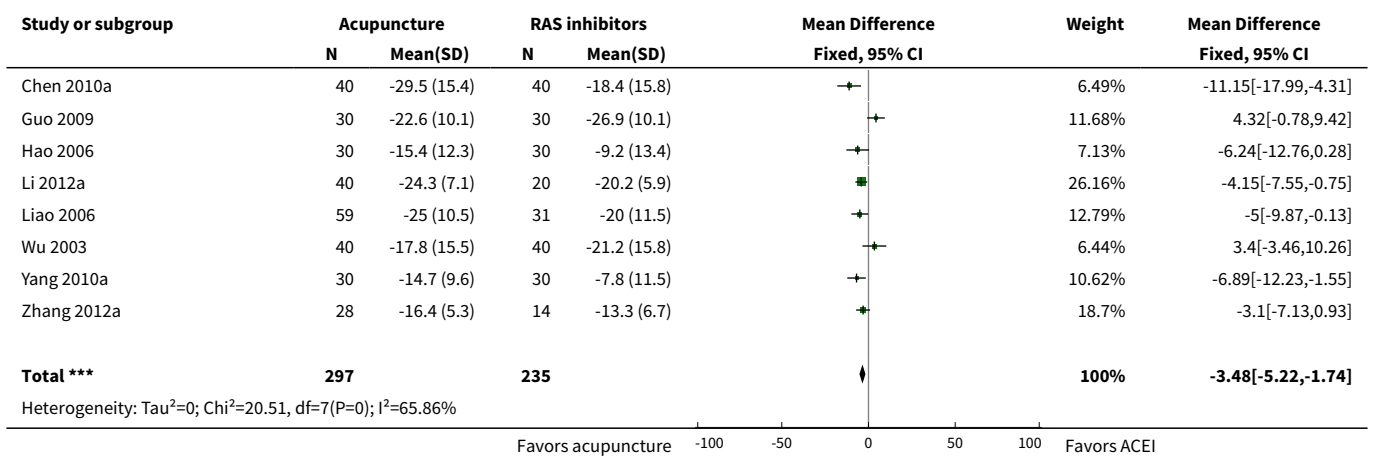
Analysis 1.2. Comparison 1 Acupuncture versus sham acupuncture, Outcome 2 Change in diastolic blood pressure.

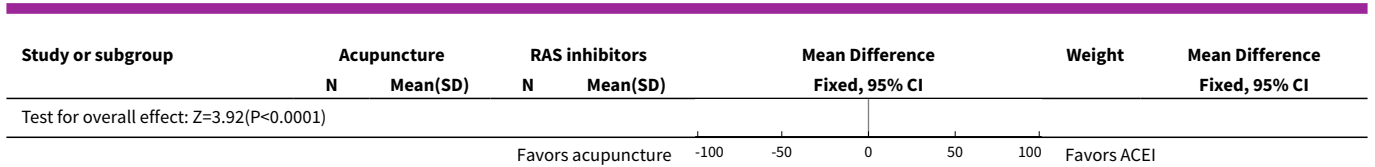


Comparison 2. Acupuncture versus RAS inhibitors

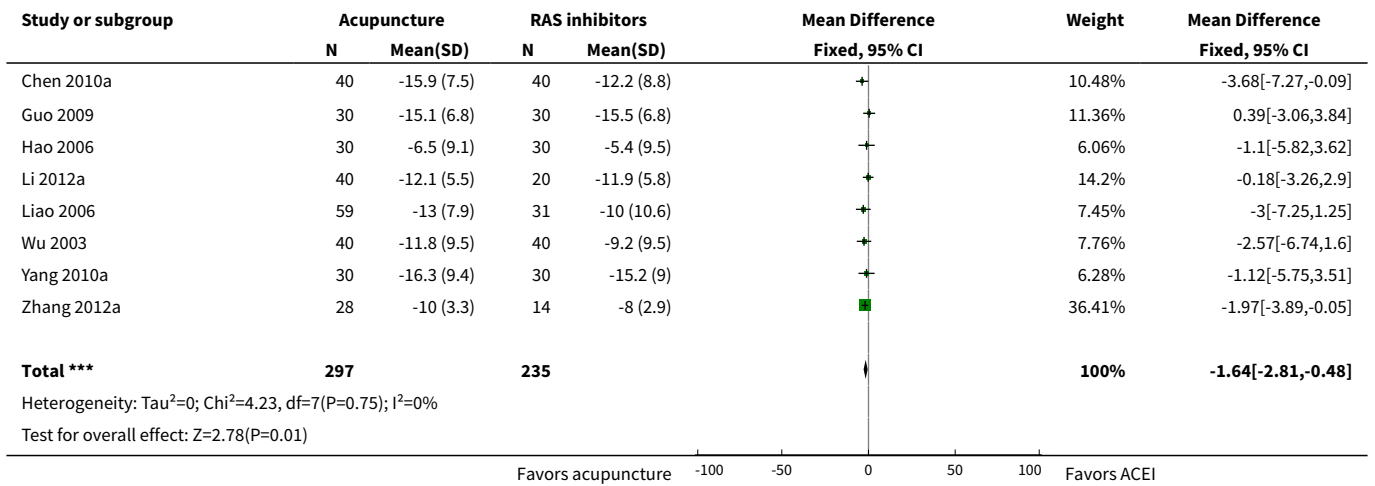
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Change in systolic blood pressure	8	532	Mean Difference (IV, Fixed, 95% CI)	-3.48 [-5.22, -1.74]
2 Change in diastolic blood pressure	8	532	Mean Difference (IV, Fixed, 95% CI)	-1.64 [-2.81, -0.48]

Analysis 2.1. Comparison 2 Acupuncture versus RAS inhibitors, Outcome 1 Change in systolic blood pressure.





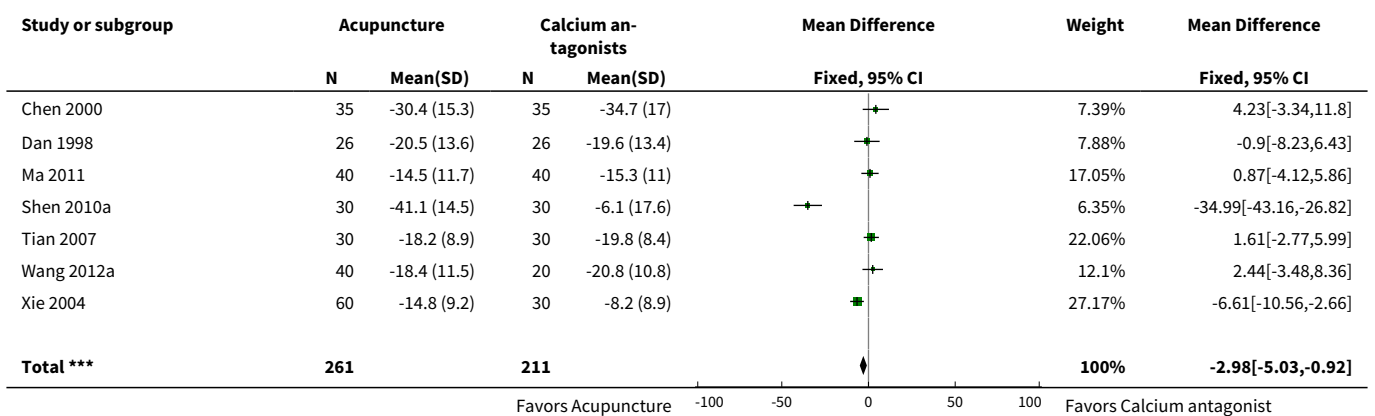
Analysis 2.2. Comparison 2 Acupuncture versus RAS inhibitors, Outcome 2 Change in diastolic blood pressure.

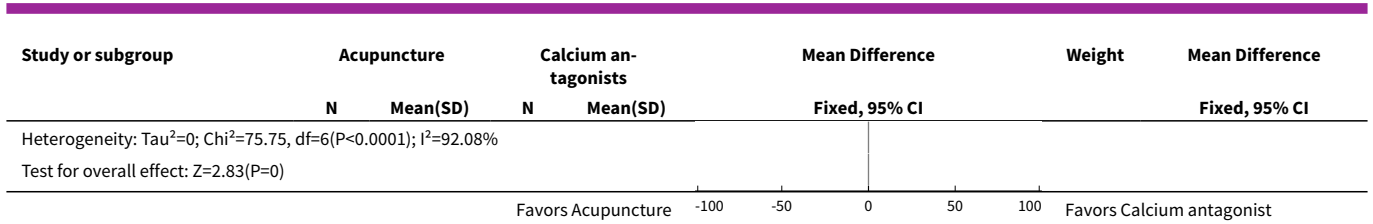


Comparison 3. Acupuncture versus calcium antagonists

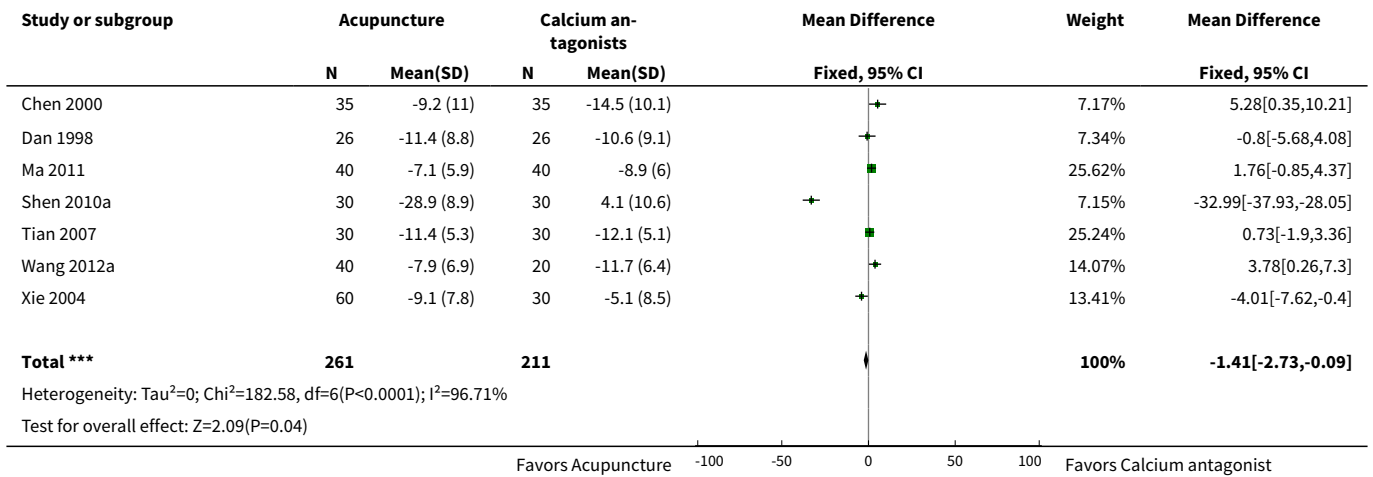
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Change in systolic blood pressure	7	472	Mean Difference (IV, Fixed, 95% CI)	-2.98 [-5.03, -0.92]
2 Change in diastolic blood pressure	7	472	Mean Difference (IV, Fixed, 95% CI)	-1.41 [-2.73, -0.09]

Analysis 3.1. Comparison 3 Acupuncture versus calcium antagonists, Outcome 1 Change in systolic blood pressure.





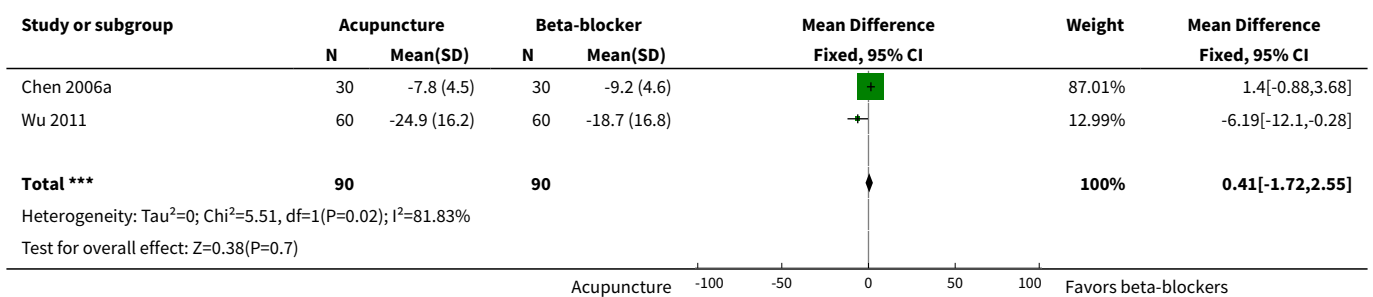
Analysis 3.2. Comparison 3 Acupuncture versus calcium antagonists, Outcome 2 Change in diastolic blood pressure.



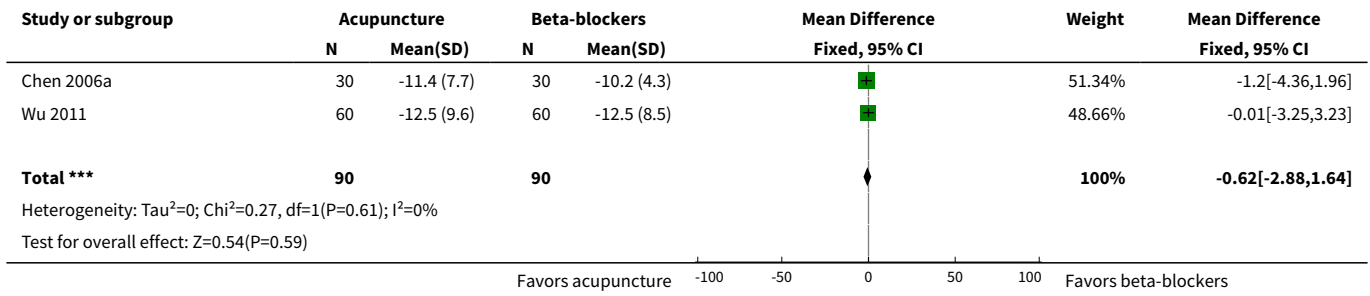
Comparison 4. Acupuncture versus beta-blocker

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Change in systolic blood pressure	2	180	Mean Difference (IV, Fixed, 95% CI)	0.41 [-1.72, 2.55]
2 Change in diastolic blood pressure	2	180	Mean Difference (IV, Fixed, 95% CI)	-0.62 [-2.88, 1.64]

Analysis 4.1. Comparison 4 Acupuncture versus beta-blocker, Outcome 1 Change in systolic blood pressure.



Analysis 4.2. Comparison 4 Acupuncture versus beta-blocker, Outcome 2 Change in diastolic blood pressure.



APPENDICES

Appendix 1. Data extraction forms

(Continued)

General information	Notes
Title	
First author	
Author affiliation	
Author degree	
Institution	
Source of this article	
Verification of study eligibility	Correct population? Correct intervention? Correct outcome? Correct study design?
Methods	
Posture of measuring blood pressure	Standing, sitting, supine, other
Blood pressure measurements	Hand movement, electronic, 24-hour ambulatory blood pressure monitoring, other
Study design	RCT, other
Unit of allocation	Patient, hospital, school

(Continued)

Unit of analysis

Power calculation

Method of randomisation

Allocation concealment

Blindedness

Population

Recruitment of patients

Place Hospital / City / Country

Enrollment dates

Inclusion criteria

Exclusion criteria

Age

Sex

Ethnicity

Work status

Diagnosis of disease How did the authors define the disease?

Outcome measures For example, duration of illness, severity of symptoms, etc.

Total number of patients recruited

Number of patients who met inclusion criteria

Total number of patients randomised

Total number of patients followed up

Interventions:

Intervention

Control group(s)

Outcomes

(Continued)

Who carried out the measurement?

What was measured at baseline? How was it measured? Is the tool validated (as stated in the article)?

What was measured immediately after the intervention? How was it measured? Is the tool validated (as stated in the article)?

When was the first follow-up?

What was measured at the first follow-up? How was it measured? Is the tool validated (as stated in the article)?

Analysis:

Statistical technique used:

Which tests? Alpha? Power? Sample size calculation? Software used.

Intention-to-treat analysis?

Patients were analysed according to the group they were randomised.

Does the technique adjust for confounding?

Number (or %) of followed up from each group

Results:

Quantitative results (e.g. estimates of effect size, between group P values)

If between-group comparisons are given, please use the next page.

If no between-group comparisons are given, then report here the general results.

Qualitative results

Cost of intervention

Cost-effectiveness

Adverse effects or complications

Appendix 2. MEDLINE search strategy

Database: Ovid MEDLINE(R) 1946 to Present with Daily Update

Search Date: 9 February 2017

1 exp acupuncture therapy/ 2 (acupunctur\$ or electroacupunctur\$ or electro-acupunctur\$ or acupoint\$ or acu-point\$ or acupress\$).mp. 3 ((meridian\$ or non-meridian or trigger) adj10 point\$).tw. 4 (zhenjiu or zhen jiu or zhenci or zhen ci or cizhen or dianzhen or dian zhen or zhen ya or er zhen or ti zhen or she zhen or tou pi zhen or zue wei).tw. 5 ((ching adj2 lo) or (jing adj2 luo) or jinglo).tw. 6 or/1-5 7 hypertension/ 8 hypertens\$.tw. 9 exp blood pressure/ 10 (blood pressure or bloodpressure).tw. 11 or/7-10 12 randomized controlled trial.pt. 13 controlled clinical trial.pt. 14 randomized.ab. 15 placebo.ab. 16 drug therapy.fs. 17 randomly.ab. 18 trial.ab. 19 groups.ab. 20 or/12-19 21 animals/ not (humans/ and animals/) 22 20 not 21 23 6 and 11 and 22 24 remove duplicates from 23

Appendix 3. Cochrane Hypertension Specialised Register search strategy

Database: Cochrane Hypertension Specialised Register

Search Date: 9 February 2017

#1 ((acupunctur* or electroacupunctur* or electro-acupunctur* or acupoint* or acu-point* or acupress* or meridian* or non-meridian* or trigger point*)) AND INSEGMENT #2 (meridian* or non-meridian or trigger) AND INSEGMENT #3 (zhenjiu or zhen jiu or zhenci or zhen ci or cizhen or dianzhen or dian zhen or zhen ya or er zhen or ti zhen or she zhen or tou pi zhen or zue wei) AND INSEGMENT #4 (ching lo or jing luo or jinglo) AND INSEGMENT #5 #1 OR #2 OR #3 OR #4 AND INSEGMENT #6 (antihypertens* OR hypertens*) AND INSEGMENT #7 (blood pressure OR bloodpressure) AND INSEGMENT #8 #6 OR #7 AND INSEGMENT #9 #5 AND #8 AND INSEGMENT #10 RCT:DE AND INSEGMENT #11 (Review OR Meta-Analysis):MISC2 AND INSEGMENT #12 #9 AND (#10 OR #11)

Appendix 4. CENTRAL search strategy

Database: Cochrane Central Register of Controlled Trials (2017 Issue 2) via Cochrane Register of Studies Online

Search Date: 9 February 2017

#1 (acupunctur* or electroacupunctur* or electro-acupunctur* or acupoint* or acu-point* or acupress*) #2 (meridian* or non-meridian or trigger) #3 (zhenjiu or zhen jiu or zhenci or zhen ci or cizhen or dianzhen or dian zhen or zhen ya or er zhen or ti zhen or she zhen or tou pi zhen or zue wei) #4 (ching lo or jing luo or jinglo) #5 #1 or #2 or #3 or #4 or #6 antihypertens* or hypertens* #7 (blood pressure or bloodpressure) #8 #6 OR #7 #9 #5 AND #8

Appendix 5. EMBASE search strategy

Database: Embase <1974 to 9 February 2017>

Search Date: 9 February 2017

1 exp acupuncture/ 2 (acupunctur\$ or electroacupunctur\$ or electro-acupunctur\$ or acupoint\$ or acu-point\$ or acupress\$).mp. 3 ((meridian\$ or non-meridian or trigger) adj10 point\$).tw. 4 (zhenjiu or zhen jiu or zhenci or zhen ci or cizhen or dianzhen or dian zhen or zhen ya or er zhen or ti zhen or she zhen or tou pi zhen or zue wei).tw. 5 ((ching adj2 lo) or (jing adj2 luo) or jinglo).tw. 6 or/1-5 7 exp hypertension/ 8 hypertens\$.tw. 9 (blood pressure or bloodpressure).mp. 10 or/7-9 11 randomized controlled trial/ 12 crossover procedure/ 13 double-blind procedure/ 14 (randomi?ed or randomly).tw. 15 (crossover\$ or cross-over\$).tw. 16 placebo.ab. 17 (doubl\$ adj blind\$).tw. 18 assign\$.ab. 19 allocat\$.ab. 20 or/11-19 21 10 and 20 22 (exp animal/ or animal.hw. or nonhuman/) not (exp human/ or human cell/ or (human or human-s).ti.) 23 21 not 22 24 6 and 10 and 23 25 remove duplicates from 24

Appendix 6. AMED search strategy

Database: AMED (Allied and Complementary Medicine) <1985 to January 2014>

Search Date: 9 February 2017

1 exp acupuncture therapy/ 2 (acupuncture\$ or electroacupuncture\$ or electro-acupuncture\$ or acupoint\$ or acupoint\$ or acupress\$).mp. 3 ((meridian\$ or non-meridian or trigger) adj10 point\$).tw. 4 (zhenjiu or zhen jiu or zhenci or zhen ci or cizhen or dianzhen or dian zhen or zhen ya or er zhen or ti zhen or she zhen or tou pi zhen or zue wei).tw. 5 ((ching adj2 lo) or (jing adj2 luo) or jinglo).tw. 6 or/1-5 7 hypertension/ 8 antihypertensive agents/ 9 hypertens\$.tw. 10 blood pressure/ 11 ((blood or arterial or diastolic or systolic) adj2 pressure).tw.

Acupuncture for hypertension (Review)

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12 bloodpressure.tw. 13 or/7-12 14 randomised controlled trials/ 15 randomised controlled trial.pt. 16 double blind method/ 17 random allocation/ 18 (randomised or randomised).tw. 19 (crossover or cross-over).tw. 20 placebo\$.tw. 21 (single\$ blind\$ or double\$ blind\$).tw. 22 assign\$.ab. 23 allocate\$.ab. 24 group\$.ab. 25 trial.tw. 26 or/14-25 27 76 and 13 and 26

Appendix 7. CKNI search strategy

Database: China National Knowledge Infrastructure

Search Date: 9 February 2017

(((全文=中英文扩展(针刺) 并且 全文=中英文扩展(高血压))) 或者 (题名=中英文扩展(针刺) 并且 题名=中英文扩展(高血压))) 或者 (主题=中英文扩展(针刺) 并且 主题=中英文扩展(高血压))) 或者 (关键词=中英文扩展(针刺) 并且 关键词=中英文扩展(高血压)))

Appendix 8. VIP search strategy

Database: Chongqing VIP

Search Date: 9 February 2017

(((((文摘=针刺)*1989-2013)*(文摘=高血压) + ((题名=针刺) * 1989-2013) * (题名=高血压)) + ((关键词=针刺) * 1989-2013) * (关键词=高血压)) + (题名或关键词=针刺*年=1989-2013) * (题名或关键词=高血压))

CONTRIBUTIONS OF AUTHORS

JY, JC and MY: contributed equally to this review.

FL and JY: conceived the review.

FL, JY, JC and MY: drafted the review.

FL, JY, JC, MY and JW: contributed to the interpretation of the data in the review.

MY and JW: revised the manuscript.

YR, SY and JC: searched the references and helped assess eligibility.

GJL and LY: analyzed the data.

JY and FL are responsible for updating the systematic review.

DECLARATIONS OF INTEREST

JY: nothing to declare.

JC: nothing to declare.

MY: nothing to declare.

SY: nothing to declare.

LY: nothing to declare.

GJL: nothing to declare.

YR: nothing to declare.

JW: nothing to declare.

FL: nothing to declare.

SOURCES OF SUPPORT

Internal sources

- Chengdu University of Traditional Chinese Medicine, China.
infrastructure support

External sources

- National Basic Research Program, China.
973 program, No. 2012CB518501
- National Natural Science Foundation of China, China.
No.81303060, 81273854

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

We made the following changes from the protocol.

- Used GRADEPro in the 'Summary the findings' tables to grade the quality of evidence.
- Removed the item 'change in heart rate,' from the primary outcomes of the protocol due to its lack of clinical significance.
- Discarded a secondary outcome, 'relative risk of number of patients withdrawn due to adverse events' from the protocol as most trials did not report this parameter.
- Removed one item 'the control group (lifestyle change, relaxation, etc.)' from the inclusion criteria as the effect of these interventions on blood pressure is not well established.
- Excluded studies that only compared different forms or methods of acupuncture (e.g. transcutaneous electrical nerve stimulation) or compared acupuncture with any complementary and alternative therapies for which the efficacy is not yet established (e.g. Chinese herbs).

INDEX TERMS

Medical Subject Headings (MeSH)

*Acupuncture Therapy; Angiotensin-Converting Enzyme Inhibitors [therapeutic use]; Antihypertensive Agents [therapeutic use]; Calcium Channel Blockers [therapeutic use]; Hypertension [drug therapy] [*therapy]; Publication Bias; Randomized Controlled Trials as Topic

MeSH check words

Humans