Wrist-ankle acupuncture for the treatment of acute orthopedic pain after surgery: a meta-analysis

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Research Article

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Abstract

BackgroundWrist-ankle acupuncture (WAA) have been reported in treatment of acute pain in orthopedic surgery, however, the effects of WAA on acute pain were controversial in the current studies. Therefore, the purpose of this meta-analysis was to critically evaluate the effect of WAA on acute pain in orthopedic surgery.

Methods: Several digital databases were searched from the inception of databases to July 2021, including CNKI, VIP, Wanfang, CBM, Pubmed, Cochrane Central Register of Controlled Trials, Embase, Medline and Web of Science Core Collection. The risk of bias was evaluated using the cocharne collaboration criteria. The primary outcome indicators included pain score, the dosage of pain killer, analgesia satisfaction, and adverse reaction incidence. All analyses were performed with Review Manager 5.4.1.

Result: A total 10 studies with 725 patients with orthopedic surgery (intervention group: 361, control group: 364) were included in this meta-analysis. The results demonstrated that the pain score of intervention group were lower than the control group, and the difference was statistically significant [MD= -0.29 95%CI(-0.37,-0.21),P<0.0001]. Compared with the control group, the patient in intervention group used smaller amounts of pain killer [MD= -0.16 95%CI(-0.30,-0.02),P=0.02]. the satisfaction of patients on pain relief was also higher in intervention group, and the difference was statistically [OR= 0.25 95%CI(0.15,0.41) , P<0.0001].

Results: WAA has a certain effect on acute pain in orthopedic surgery, and the effect of WAA combined with other therapies is better than that not using WAA therapy.

Background

Over the past 20 years, the attention of professional societies to the importance of evaluation and treatment of acute pain has been a dramatic increased. [1]. With sensory, cognitive, emotional and social components, pain is an unpleasant experience. [2]. Many daily activities can be interfered with Pain, such as sleep, work, and social intercourse. [3]. NSAIDs (non-steroidal anti-inflammatory drugs) are one of the most useful methods to control acute orthopedic pain after surgery is mainly controlled by. However, toxic and side effects can also be caused by drugs therapy, like vomiting, constipation, urinary retention, dizziness, delirium, and other adverse reactions[4]. Additionally, patients may also develop drug tolerance over time due to the long-term drug analgesia which will aggravate the economic burden for patients [5]. Therefore, more and more attention has been attracted to the non-pharmacological therapies for acute orthopedic pain after surgery.

Invented by the Chinese, acupuncture is one of the complementary and alternative therapies. With a long history in China, acupuncture has been widely recognized and accepted[6]. Among them, In the 1970s, Zhang Xinshu, a professor of the second military medical university, invented a new kind of micro acupuncture therapy named wrist-ankle acupuncture (WAA).[7] Combined with modern neurology theory and traditional acupuncture theory, WAA is a new kind of electrical stimulation therapy [5]. Featured simple operation and high safety, WAA can treat the symptoms all over the body, though the acupuncture site of WAA is limited to the wrist and ankle. According to the current clinical studies, WAA has been proved that it has significant efficacy in some clinical pain, like orthopedic pain, dysmenorrhea, soft tissue pain, and toothache[8]. According to Zhou's research, WAA can achieve pain relief by increasing serotonin levels in the brain and raising the pain threshold[9]. What's more, according to Chen's study, the main mechanism of the analgesic effect of WAA may be associated with inhibiting the production of substance P and the promoting release of β-endorphins in plasma [4].

In recent years, studies comparison significantly increased between the effect of WAA on acute orthopedic pain and drug therapy. Some studies showed that WAA or WAA plus drug therapy was more effective while others had opposite results. Therefore, the purpose of this meta-analysis was to critically assess the effect of WAA on acute orthopedic pain after surgery to provide a scientific reference for the development of an intervention strategy for acute orthopedic pain after surgery.

Methods

According to Cochrane Handbook, the similar meta-analysis studied WAA[4] was used as reference for this review.

Searching strategies

This study systematically searched four digital databases which were China National knowledge Infratructure (CNKI), Wanfang, VIP, China biology Medicine (CBM). The keywords for searching are Wrist Ankle Acupuncture "OR "Wrist Acupuncture" OR "Ankle Acupuncture" OR "wrist-ankle acupuncture") pain OR ache OR soreness OR analgesia OR acesodyne, OR trauma OR sports injury OR postoperative. The searching strategies for the databases are shown as follow:

#1 Search ((("Wrist Ankle Acupuncture ") OR "Wrist Acupuncture") OR "Ankle Acupuncture") OR "wrist-ankle acupuncture"

#2 Search ((((pain) OR ache) OR soreness) OR analgesia,) OR acesodyne

#3 Search (((fracture) OR trauma) OR sports injury) OR postoperative

#4 #1 AND #2 AND #3

Inclusion criteria

Participants

The participants included in the studies are suffered from acute pain of postoperative, orthopedic pain, regardless of nation, region, or gender.

Interventions and controls

The intervention was wrist-ankle acupuncture alone, placebo acupuncture, or body acupuncture, The control group was intervened with drug therapy.
The outcome indicators were pain score, the dosage of analgesics, satisfaction of pain relief, and adverse reaction.

Types of studies

Only random control trials were eligible.

Exclusion criteria

The exclusion criteria were listed as follow: (1) Studies that are nonrandomized trials ; (2) studies did not use WAA as the major treatment; (3) studies that had repeated reporting with same results; (4) studies had incomplete data; (5) studies didn't set up pain measurement like pain scale or effective rate; (6) The procedure of wrist and ankle needle didn't meet the national technical standards; (7) the intervention periods were more than 30 days.

Data extraction

Two researchers extracted and cross-checked the data independently. In case of differences, they would judge a third party. The basic data were extracted, including the first author of the literature, age of participants, number of participants, year of publication, intervention and control measures, indicators of effect evaluation and incidence of adverse reaction. The author of the report would be contacted to obtain the information if the key information was missing.

Risk of bias assessment

According to the Cochrane assessment tool, the risks of bias was evaluated by two reviewers independently. The assessment consists of the following seven domains "adequate sequence generation, blinding of outcome assessment, allocation concealment, blinding of participants and personnel, selective reporting, incomplete outcome data, and other bias. Each question can be rated as follows: yes (+), low risk of bias; unclear (?), unclear risk of bias; no (-), high risk of bias.

Statistical analysis

Review manager 5.4.1 software was used for statistical analysis. Risk ratio (RR) was used for continuous data. Reporting and publication biases of the included studies were assessed by visually inspecting the asymmetry of the funnel plot. In each analysis, I^2 was used to measure the statistical heterogeneity among the trials. If $P > 0.05$ and $I^2 < 50\%$, due to the homogeneity of the trials, the fixed effects model was used for analysis;

Results

3.1 study selection.

An initial search of RCTs yielded 621 potential literature citations (Fig. 1). After screening, 611 articles were excluded and 10 articles were examined in detail to assess their relevance.

3.2 overall study characteristics

A total of 12 studies met the inclusion criteria and were included in our studies. Two of the relevant outcome indicators could not be combined for statistical analysis and could not be included in quantitative studies. All the studies were performed in china. The characteristics of the studies were showed in Table 1.

Table 1
Studies included in the systematic review

Author,year	surgery	sample(T/C)	The intervention for treatment group				Control group	Timing of pain measurement
			Intervention model	Select acupoints for wrist and ankle needles	Timing of WAA	Retaining needle time		
Jiansong Chen,2016	UKA	70(35/35)	WAA	same side down 4	10 min before CPM	2h	Routine analgesic nursing	1/3/7/14 days after surgery
Wenlong Li,2016	THA	68(35/33)	WAA + PCA	same side down 1、4、5	3d before surgery	8h	painkiller	12h/24h/36h/48h/1/3/7/14 day after surgery
Wenlong Li, 2017	THA	73(35/38)	WAA + low dosage of celecoxib	same side down 1、4、5	3d before surgery	8h	painkiller	4h/8h/12h/1/2/3/4 days after surgery
Jingjuan Zhu,2014	THA	68(34/34)、	WAA + Auricular point	same side down 1、4、5	1d before surgery	8h	Routine analgesic nursing	2h/6h/12h/24h/48h/72h//7/day after surgery
Jingjuan Tian,2018	THA	78(39/39)、	WAA + pain killer	same side down 4、5	After surgery	4-6h	painkiller	1h/6h/12h/24h/ after surgery、、6、12、24 h
Dongmiao Ma,2020	Limb fracture	72(36/36)、	WAA	According to the fracture side	after admission to hospital	30min	painkiller	5min before acupuncture, 10/15/30 min/1h/24h after acupuncture
Peiqian Lai,2019	Thoracolumbar internal fixation	60(30/30)	WAA + PCA	same side down 5、6	1day after surgery	30 min	Chinese and Western medicine pain nursing	12h/24h/36h/48h/3/4/5 days after surgery
Qiao Wang,2018	Calcaneus internal fixation	145(48/48/59)	WAA	same side down 1、2	1h after surgery, 6h after surgery	1-24h	Routine analgesic nursing	1h/6h/12h/24h after surgery
Min Zhang2020	THA	84(42/42)	WAA	same side down 1、4、5	After surgery	2h	Routine analgesic nursing	12h/24h/2/3/4/5 days after surgery
Hougang Xia,2021	spine surgery	60(30/30)	WAA	same side down 5、6	1day after surgery	30min	Routine analgesic nursing	12h/24h/36h after surgery
Huihua Zhou,2018	TKA	74(37/37)	WAA	same side down 2, 3, 4	1day after surgery, before CPM	4h	Routine analgesic nursing	after admission to hospital and 1/3/5/7/14 days after surgery
Su(2010)	Acute low back pain	60(30/30)	WAA	same side down 5、6	after admission to hospital	30min	Sham acupuncture	3 min before acupuncture, and 5/10/15 minutes during acupuncture, and 30 minutes after acupuncture.

3.3 Methodological quality and risk bias evaluation of the studies

The methodological quality and risk bias assessment results of the included quantitative research are moderate. Random number table method was used in all the studie. Three studies used closed envelopes for random allocation. Since the control group used conventional analgesic nursing interventions or drug interventions, and did not use fake acupuncture or body acupuncture treatment, the participants and Blindness of patients is not suitable for WAA intervention, so the risk of bias in all studies is high. Only one study reported blinded methods for evaluating results. The methodological quality evaluation of the included studies is shown in Fig. 2a, and the risk bias evaluation is shown in Fig. 2b.

3.4 Results of Meta analysis

3.4.1 Analgesic effect analysis base on VAS

3.4.1.1 pure WAA group

Based on the VAS analgesic effects, four studies [10–13]reported that the pain score is lower in ankle acupuncture group (Fig. 3a). The difference was statistically significant [MD= -0.29, 95%CI(-0.37,-0.21),P < 0.0001]. The funnel chart (Fig. 3b) shows that the distribution of the literature included in the study's pain score comparison is still symmetrical, indicating that the bias is at an acceptable level and the analgesic effect of the wrist-ankle acupuncture group is better than that of the non-wrist-ankle acupuncture group.

3.4.1.2 combined with other therapies

The analgesic effect was compared in four studies[14–17]. According to the results(Fig. 4a), the pain score in the WAA combined with other therapies group was lower than that of the non-WAA group, and the difference was statistically significant [MD= -0.16, 95%CI(-0.30,-0.02),P = 0.02]. The funnel chart (Fig. 4b) shows that the distribution of the literature included in the study's pain score comparison is still symmetrical, indicating that the bias is at an acceptable level, and the analgesic effect of the wrist-ankle acupuncture combined with other therapies is better than that of the non-wrist-ankle acupuncture group.

3.4.1.3 Comparison of analgesic dosages

Two studies[14, 16] compared the dosage of analgesic drugs, and 133 patients were included in the studies, including 65 in the experimental group and 68 in the control group. The results (Fig. 5a) showed that compared with non-WAA group, the application of WAA can reduce the used of analgesic drugs, and the difference is statistically significant [MD= -0.33, 95%CI(-0.57,-0.09),P = 0.008].

3.4.1.4 Analgesia satisfaction

Three studies[13, 18, 19] compared the .satisfaction of analgesia effect after using WAA and 222 patients were included, 111 in experimental group and 111 in the control group. The results (Fig. 5b)showed that the analgesic satisfaction of the WAA group was higher than that of the non-wrist-ankle acupuncture group, and the difference was statistically significant [OR = 4.23, 95%CI(1.35,13.24) ,P = 0.01].

3.1.1.5 Adverse Events Reporting

Seven studies [12–16, 18, 19]clearly reported adverse events. 485 patients were enrolled, including 242 in the experimental group and 243 in the control group. The adverse reaction rates were lower in the experimental group, and the difference was statistically significant (Fig. 5c) [OR = 0.25, 95%CI(0.15,0.41), P < 0.0001]. The main adverse reactions in the WAA group were subcutaneous hemorrhage and fainting needles. The adverse reactions in the conventional analgesic care group were nausea and vomiting, urinary retention, dizziness and drowsiness.

Discussion

This meta-analysis included 10 studies conducted on a total 725 participants (intervention group 361 patients, control group 364 patients). Random number table method was used in all studies. Three studies report allocation concealment, and only one study reported blinding of outcome assessment. Five studies were pure WAA therapy and other five studies were WAA combined with other therapies (combined treatment), such as combined with ear point pressure, the use of analgesic drugs, and the use of self-controlled analgesic pumps et al. The results showed that the analgesic effect in the WAA combined with other therapies group was better than that in non-WAA group, and it also have a better analgesic satisfaction. Besides, in terms of adverse reactions, the experimental group was significantly lower than that in the control group, and the adverse reactions of the control group were mainly nausea and vomiting, urinary retention, vertigo and drowsiness, which was mainly related to the use of analgesic drugs in the routine analgesic care of the control group. In WAA group, drug-related adverse reactions could be reduced by reducing the use of analgesics, and the main adverse reactions were subcutaneous bleeding and acupuncture fainting, which occurred in a small proportion. This study suggest that in the construction of painless ward in orthopedics department, it is beneficial to relieve the acute pain of patients by adopting WAA and combined with other traditional Chinese medicine therapies to control the symptom of the patients.

Despite our comprehensive review of the literature on the treatment of acute pain in orthopedic surgery with WAA, the present study still has some limitations. First, the quality of the studies included in this meta-analysis is mediocre, and the report of sequence generation and allocation concealment is incomplete. Most studies considered to have a high or unclear risk of bias. Second, all studies were written in Chinese. Third, In the control group, conventional analgesic

nursing, like sham acupuncture and body acupuncture was used, which made it difficult to achieve blindness for researchers and patients, thus affecting the accurate judgment of efficacy and easy to overestimate the efficacy.

Conclusion

Results from this meta-analysis provide evidence that WAA or WAA combined with other therapies helps relieve acute pain in orthopedic surgery. Besides, WAA is a cheap and safe treatment, which is worthy of clinical promotion. But this meta-analysis included relevant and rigorous RCTs are insufficient; hence, higher quality and more rigorously designed clinical trials with large enough sample sizes are needed to further confirm our findings. Last, we were unable to conduct subgroup analysis, and there is a certain bias in the WAA combined with other therapies. This study has some implications for the future research direction of the application of wrist and ankle acupuncture in orthopedic pain.

Declarations

a. Ethics approval and consent to participate

Not applicable

b. Consent for publication

Not applicable

c. Availability of data and materials

All data generated or analysed during this study are included in this published article [and its supplementary information files].

d. Competing interests

The authors declare that they have no competing interests

e. Funding

Not applicable

f. Authors' contributions

Yisheng Xu designed the experiments. Mengli Chen performed the experiments. Yiyin Xu wrote the main manuscript text. Xuewei Cao and Xiuzhen Fu analyzed the data. Jiewei Xie prepared figures. All authors reviewed the manuscript.

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Figures

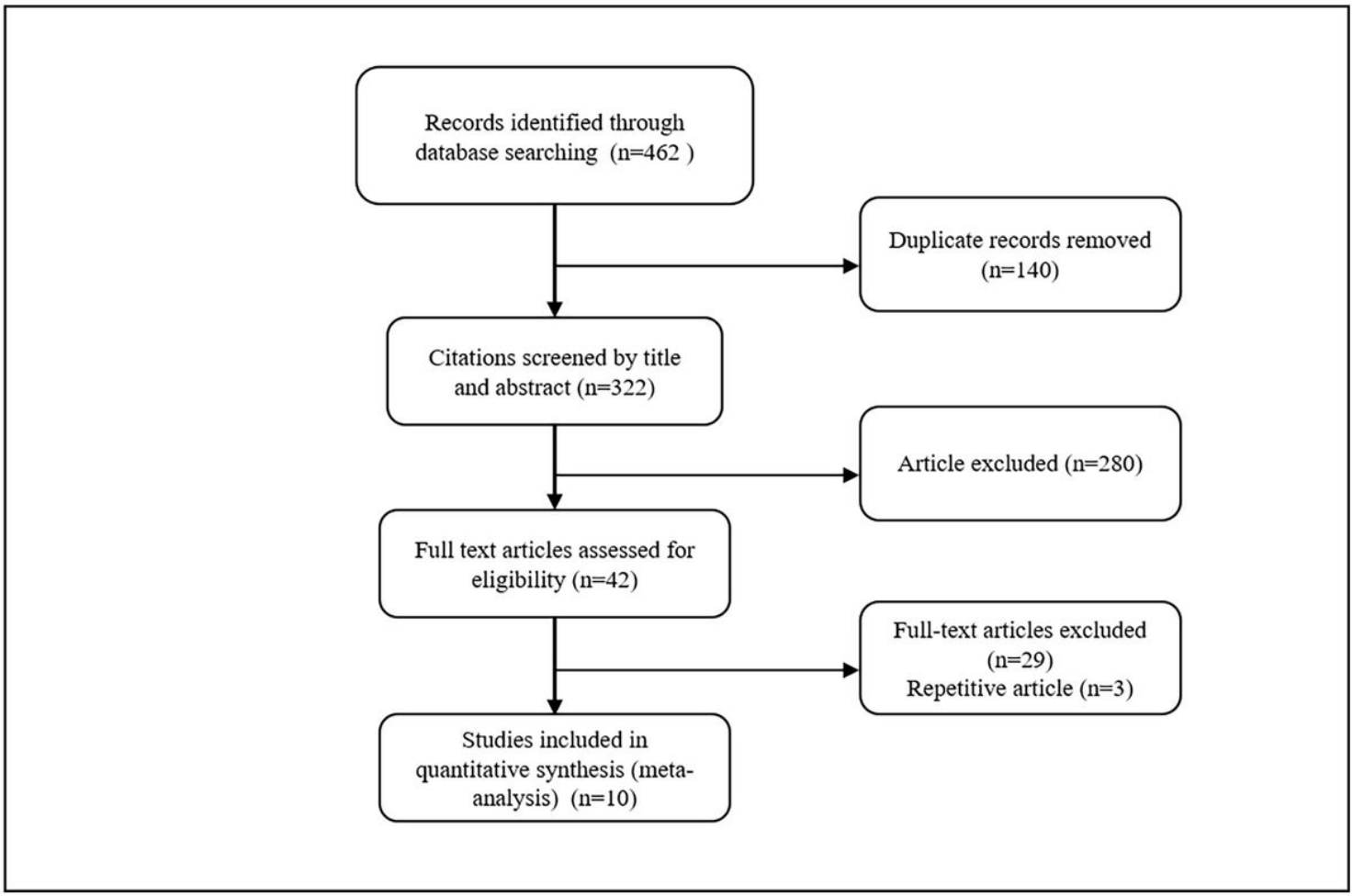


Figure 1

Flow chart diagram of trial identification and selection

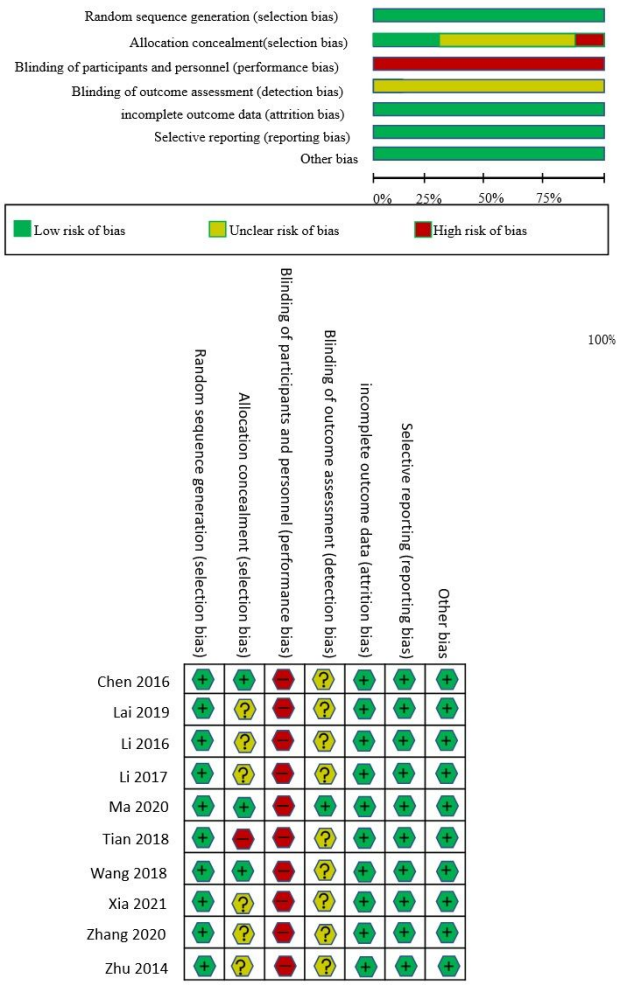


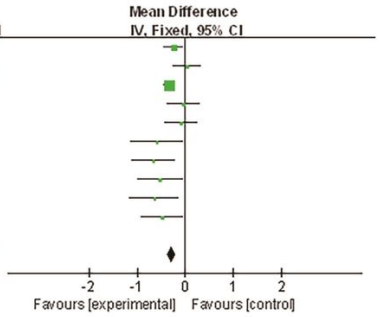
Figure 2

a, Methodological quality evaluation of included studies. b. Risk of bias assessment using the Cochrane tool

a

Study or Subgroup	Experimental Mean	Experimental SD	Experimental Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
Chen 2016	4.93	0.43	32	5.17	0.39	33	17.6%	-0.24 [-0.44, -0.04]
Wang2018	3.67	0.72	48	3.63	0.76	49	8.1%	0.04 [-0.25, 0.33]
Xia2021	3.84	0.22	30	4.17	0.26	30	47.2%	-0.33 [-0.45, -0.21]
Zhang 2020a	3.98	0.68	42	4.02	0.92	42	5.9%	-0.04 [-0.39, 0.31]
Zhang 2020b	3.93	0.92	42	4.02	0.64	42	6.1%	-0.09 [-0.43, 0.25]
Zhang 2020c	3.62	0.99	42	4.21	1.5	42	2.4%	-0.59 [-1.13, -0.05]
Zhang 2020d	3.6	0.96	42	4.26	1.17	42	3.3%	-0.66 [-1.12, -0.20]
Zhang 2020e	2.76	1.12	42	3.28	1.09	42	3.1%	-0.52 [-0.99, -0.05]
Zhang 2020f	2.6	1.19	42	3.24	1.21	42	2.7%	-0.64 [-1.15, -0.13]
Zhang 2020g	1.71	0.94	42	2.19	1.11	42	3.6%	-0.48 [-0.92, -0.04]
Total (95% CI)			**404**			**406**	**100.0%**	**-0.29 [-0.37, -0.21]**

Heterogeneity: Chi² = 15.91, df = 9 (P = 0.07); I² = 43%
Test for overall effect: Z = 6.77 (P < 0.00001)



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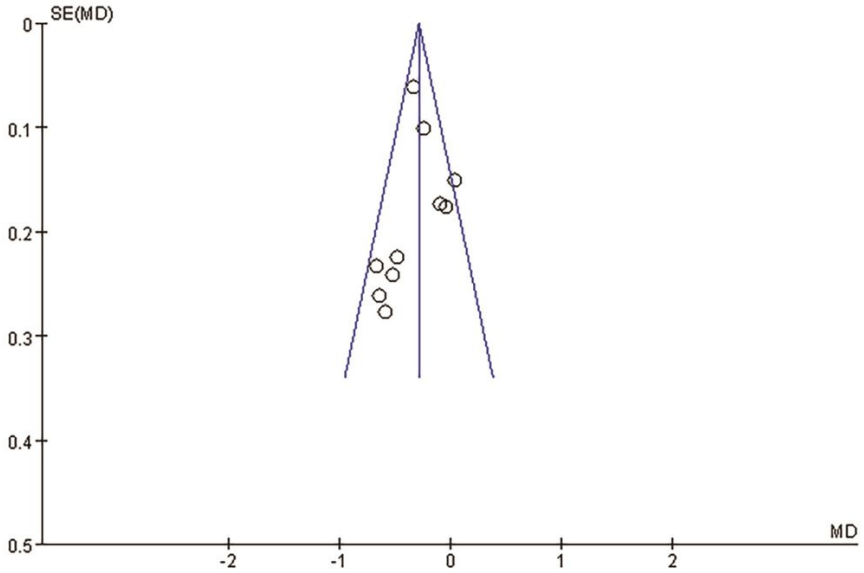


Figure 3

a. Forest plots of WAA versus non-WAA therapy: b. Funnel plots of pain relief rates: WAA versus non-WAA

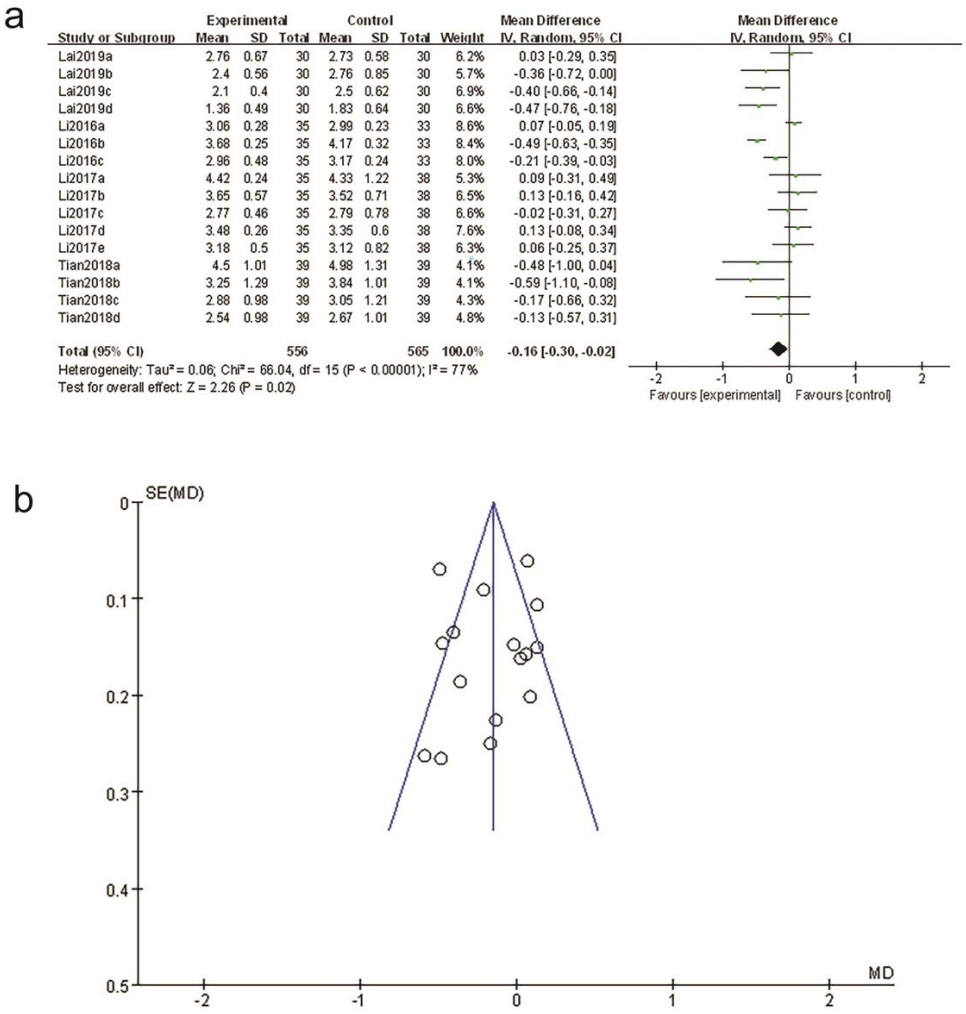
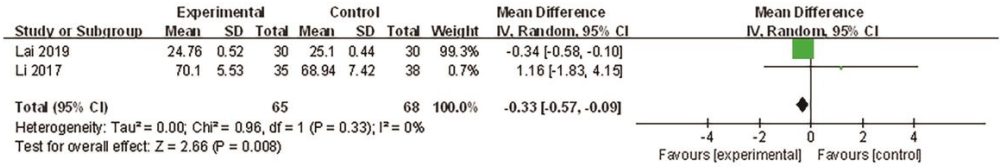


Figure 4

a. Forest plots of WAA plus other therapy versus non-WAA therapy. b. Funnel plots of pain relief rates: WAA plus other therapy versus non-WAA therapy.

a



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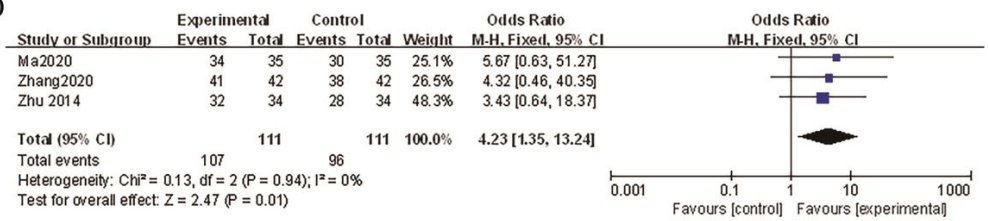

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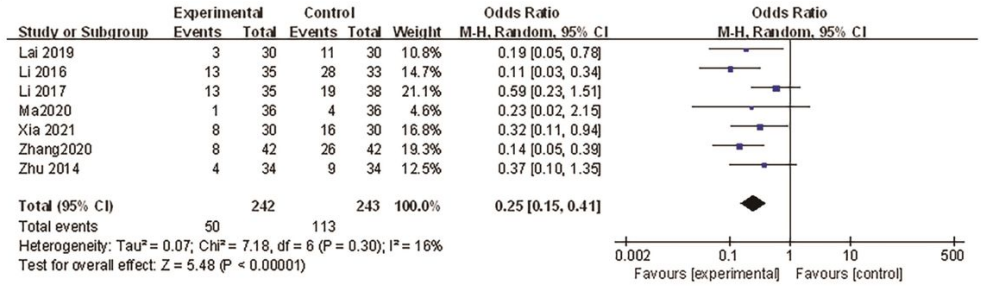

Figure 5

a. Forest plots of dosage of analgesic (WAA plus other therapy versus non-WAA therapy). b. Forest plots of adverse reaction. c. Forest plots of WAA analgesic satisfaction

Supplementary Files

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- supportingmaterials.xlsx