



External Application of Traditional Chinese Medicine for Fat Liquefaction in Abdominal Incision: A Systematic Review and Meta-Analysis

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ABSTRACT

Fat liquefaction in the abdominal incision (FLAI) is a common malignant complication with limitations of current treatments. Given the poor prognosis associated with an abdominal incision, many patients seek additional therapies that may improve the quality of life. Several external applications of traditional Chinese medicine (EA-TCM) have been evaluated in clinical trials, but fewer are known about them outside of China. The objective of this study is to evaluate the effectiveness of EA-TCM for prevention and treatment of fat liquefaction in abdominal incision. Fifty-four (54) of seven thousand three hundred and sixty-three (7363) randomized controlled trials (RCTs) in seven electronic databases met inclusion criteria. Two researchers independently selected articles, extracted data, assessed quality, and cross-checked the results. Revman 5.3.1 was used to analyze the results. The meta-analysis indicated that compared with conventional therapies alone or EA-TCM combined with conventional therapy. EA-TCM could elevate total effectiveness rate in treatment and preventing FLAI, reducing the incidence of FLAI; decreasing healing time of FLAI and average hospitalization time without serious adverse effects. Therefore, clinicians may consider EA-TCM as a viable complementary and alternative medicine for FLAI. However, a clinical recommendation is not warranted due to the low methodology quality. Multi-center and high-quality RCTs with large sample sizes are needed.

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Introduction

As a main cause of prolonged healing of aseptic post-surgical incision, fat liquefaction in abdominal incision (FLAI) is the necrosis of adipose tissue without infection with an incidence rate of 0.52-1.11% in all postoperative wounds.¹ Controlled clinical-trials had shown that vast majority of adverse events had higher postoperative incidence rates of fat liquefaction as well as pregnancy-induced hypertension syndrome, severe edema and twice cesarean section, including meconium-stained amniotic fluid stimulation, prenatal utero vaginal delivery, premature rupture of fetal membranes, vaginitis, pregnancy-induced anemia and hypoproteinemia.² If the incision fat liquefaction cannot hand out in a very short time, all the liquefied incisional dehiscence infection would lead to a secondary debridement suture. This negative consequence will not only increase the economic burden of the patients, but cause patients' dissatisfaction, even conflicts between doctors and patients.³ Hence, the three main objectives of FLAI treatment are to accelerate incision healing, to avoid fat liquefaction recurrence and to reduce the patients' burden.^{3,4} Route dressing change, debridement and drainage or compression bandaging are the standard first-line clinical treatments. Second-line treatments, which involve a range of interventions, are taken into account when first-line treatments failed. However, until recently, there have not been widely accepted second-line treatment standards.

In addition to surgery for the treatment of FLAI therapies collectively known as traditional Chinese medicine (TCM), showed a gradual and typically curative effect. As an integral part of TCM, EA-TCM has been perceived as less expensive, safer, and more effective than conventional western therapies.⁴⁻⁷ There are numerous clinical trials regarding the use of EA-TCM for treatment of FLAI with positive results. However, as far as we know, whether to justify their recommendation or their clinical role, the potential benefits of EA-TCM for patients with FLAI have not been accurately evaluated. Although, there is increasing use of EA-TCM, there are few meta-analyses in systemically reviewing the therapeutic effectiveness of EA-TCM on the prevention and treatment of FLAI. It is worth mentioning that plenty of studies could potentially be missed if research is restricted to English-only sources. Therefore, we supervised a systematic review to evaluate the clinical efficacy of EA-TCM in management of FLAI as a complementary and alternative therapy from mainly Chinese-sourced studies.

Materials and Methods

Data Sources and Searches

To identify the relevant randomized clinical trials (RCTs), two reviewers (Lian Liu and Song Wei Su) systematically searched the Medical Literature Analysis and Retrieval System Online (MEDLINE), Excerpta Medica Database (EMBASE), Cochrane Central Register, China National Knowledge Infrastructure database (CNKI), Chinese Scientific Journals Full Text Database (CQVIP), Wanfang Data Knowledge Service Platform, and the Chinese Biomedical Literature Service System (SinoMed) by using the search terms "fat liquefaction", "fat colliquation", "traditional

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Chinese medicine”, “TCM” “EA-TCM”, “traditional Chinese herb”, “herbal medicine”, “ointment”, “prevention and/or treatment”, “randomized controlled trial” and “RCTs”. In this study, we included papers dating from the earliest citation in the databases until August 2016. The references to all selected publications and reviews were manually searched for further relevant articles. We did not limit publication languages and types, including conference proceedings, abstract-only articles, and graduation dissertation, as long as they met our inclusion criteria.

Study Selection

RCTs were included. Quasi-RCTs, non-RCTs, or randomized trials with false randomization methods were excluded.

Participants

Patients diagnosed with fat liquefaction based on any set of explicit criteria were included, other severe infection or full-thickness dehiscence were excluded. There were no restrictive limitations on participant age, gender, or nationality. Surgical procedures. Retrieval results included 26 cesarean sections, 14 abdominal operations in Obstetrics and Gynaecology, 7 abdominal operations in general surgery department, two gynaecological operations, one abdominal operation, one appendicectomy and one radical resection of rectal carcinoma, one gynaecological malignant tumour surgery, one gynecological tumor surgery. The data collection form is shown in Figure 1.

Interventions

The focused experimental groups received either EA-TCM or EA-TCM combined with conventional therapy. We did not set limitations on formulations, dosages, routes of administration of TCM, or types of conventional therapy used. Applied with EA-TCM, the experimental groups, which included Rhubarb, combined with *Mirabilite* with different proportions,^{8,9,11-14,16,17,20-22,26,28,29,31-35,37,38,41,43,46-48,53-58} *Borneolum Syntheticum* combined with *Mirabilite*,¹⁰ Self-made Skin-growing Ointment,¹⁵ Anti-inflammatory Sarcogenic Ointment,^{18, 23} Moisture Exposed Burn Ointment,¹⁹ *Rhubarb Mirabilite* combined with Honeysuckle,²⁴ Yunnan Baiyao Powder,²⁵ mixture of Rhubarb, *Mirabilite*, *Alisma*, *Poria cocos*, Peach kernel,²⁷ *Rhubarb Borneolum* combined with *Mirabilite*,³⁰ *Borneolum Mirabilite* combined with *Polygonum cuspidatum*,³⁶ Raw Rhubarb compound of Glauber-salt and liquorice,^{39,45} *Mirabilite* alone,^{40,42} RuYiJinHuang Powder,^{44,51} Hematoma Formula,⁴⁹ Flesh-Engendering Powder,⁵⁰ *Rhubarb Mirabilite* combined with vinegar,⁵² RuYiJinHuang powder combined with *Mirabilite*,⁵⁹ Compound SH Chinese medicine (*Radix scutellariae*, *Cortex phellodendri*, *Rhizoma coptidis*),⁶⁰ and Compound SH Chinese medicine (*Rhizoma coptidis*, *Scutellaria baicalensis georgi*, *Cortex phellodendri*) combined with *Mirabilite*.⁶¹

Control Group Treatments

Control groups were defined as patients who received any type of conventional therapy for FLAI, without EA-TCM treatments. Our comparison of TCM and conventional therapy included antibiotics intravenous infusion, supportive therapy, nutritional support, Conventional dressing change including iodophor, normal saline solution, 75% alcohol, hydrogen peroxide, metronidazole; gentamicin sulphate, ethacridine lactate, chymotrypsin, 0.5% chlorhexidine gluconate, complex iodine, polyvinylpyrrolidone, sterile gauze,^{12,14,15,46-48,50} butterfly type tape fixed, etc. and debridement and drainage, Compression bandaging, infrared radiation of wound surface, microwave radiation treatment, pharmacological treatment, and secondary debridement suture.

Outcome Measurements

In order to provide more accurately effectiveness of the EA-TCM treatments, we evaluated primary outcomes as total effectiveness rate of EA-TCM versus conventional therapy groups based on the same intervention strategies or EA-TCM combined with conventional therapy versus conventional therapy alone, and total effectiveness rates and incidence rate of FLAI in preventing fat liquefaction applied with EA-TCM. The secondary outcomes included healing time of FLAI and average hospitalization time after operation. Trials were excluded if any of the following factors were identified: (1) insufficient information concerning evaluation rates, (2) lack of EA-TCM treatment, (3) mixed interventions in the experimental group (e.g., EA-TCM combined with internal TCM), (4) animal trials.

Data Extraction

Two reviewers (Lian Liu and Song Wei Su) extracted data independently using the predetermined inclusion criteria. Disagreements were resolved by discussion or consensus with a third reviewer (Hong Yan Sun). The data extracted included the first author, title, year of publication, study characteristics (i.e., year, duration of trial period, operative types); participant characteristics (i.e., mean age, sample size, number of participants and conventional therapy of experimental/control group), topical treatment of control group, EA-TCM of the experimental group, main outcomes. For studies with insufficient information, the reviewers contacted the primary authors, when possible, to acquire and verify the data. The use of modified JADAD scale evaluation mainly includes 4 aspects: (1) the generation of random sequence, (2) random hidden, (3) whether the use of blind method, (4) loss of access and withdrawal from the report. The highest score is 7 points, the lowest is divided into 0 points. At present, 1-3 is considered as a low quality, and 4-7 is considered as a high quality (Table 1). Data extraction and quality evaluation process, if there are different views, the use of collective discussion method solved it.

Risk of Bias Assessment

The risk of bias in each study assessed by two independent authors using the Cochrane Risk of Bias tool,⁶² disagreements were resolved either by consensus or by a third reviewer. Risk of bias in included trials and methodological quality of the included studies were described in Figure 2.

Data Synthesis and Analyses

The total effectiveness rates of dichotomous data were pooled using risk ratios (RRs). All statistical analyses were performed using Review Manager 5.3.1 software (Cochrane Community, London, United Kingdom). We compared the final results to assess the differences between experimental and control groups. Cochrane's χ^2 and I^2 tests were used to assess the degree of heterogeneity between studies. There was considerable heterogeneity for P values less than 0.10, or I^2 value above 50%, in the χ^2 and I^2 tests, respectively.⁶² In this case, a random-effects model was used in order to compute the global RR and MD. Otherwise, with P values greater than 0.10 or I^2 less than 50%, the between-study heterogeneity was not substantial, and the fixed-effect models were suitable. Clinical heterogeneity was assessed by reviewing the differences in the distribution of participants' characteristics among trials (i.e., age, gender, and duration of disorder and associated diseases).

Results and Discussion

Study Selection

From 4834 titles, the full texts of 79 potentially relevant studies were reviewed to confirm their eligibility. Among these 79 studies, 25 were excluded, including 16 non-RCT studies, two with incorrect interventions, three did not recognize control, two showed inappropriate clinical outcome assessment, and two no data for extraction. Finally, 54 trials met the inclusion criteria and included in the systematic review (Figure 1).

Study Characteristics

All the 54 trials included in this study were published in Chinese. A total of 7323 participants were included in these trials, with 3663 and 3660 in the experimental and control groups, respectively. The sample sizes of these trials ranged from 36 to 1200 (Table 1). The components and suppliers of the traditional Chinese Medicine used in each trial varied. The most common form of EA-TCM, used in 32 trials, was rhubarb combined with mirabilite in various proportion, other forms of EA-TCM used in clinical trials were in Table 2.

Risk of Bias Assessment

The methodological quality of all included trials was poor (Figure 2). Although all these trials reported randomization, only nine adequately described the randomization method,^{8, 9, 13, 19, 29, 30, 55, 37, 60} the other trials did not provide detailed information regarding random sequence generation. Moreover, none of the studies reported information such as allocation concealment or blinding of participants and study personnel. All the relevant trials adequately addressed incomplete outcome data, selective reporting could not be judged in all the studies because of the insufficient information provided. We found no other biases in these trials; however, considering their poor methodological quality, we determined that an unclear risk of bias should be given to all the included trials.

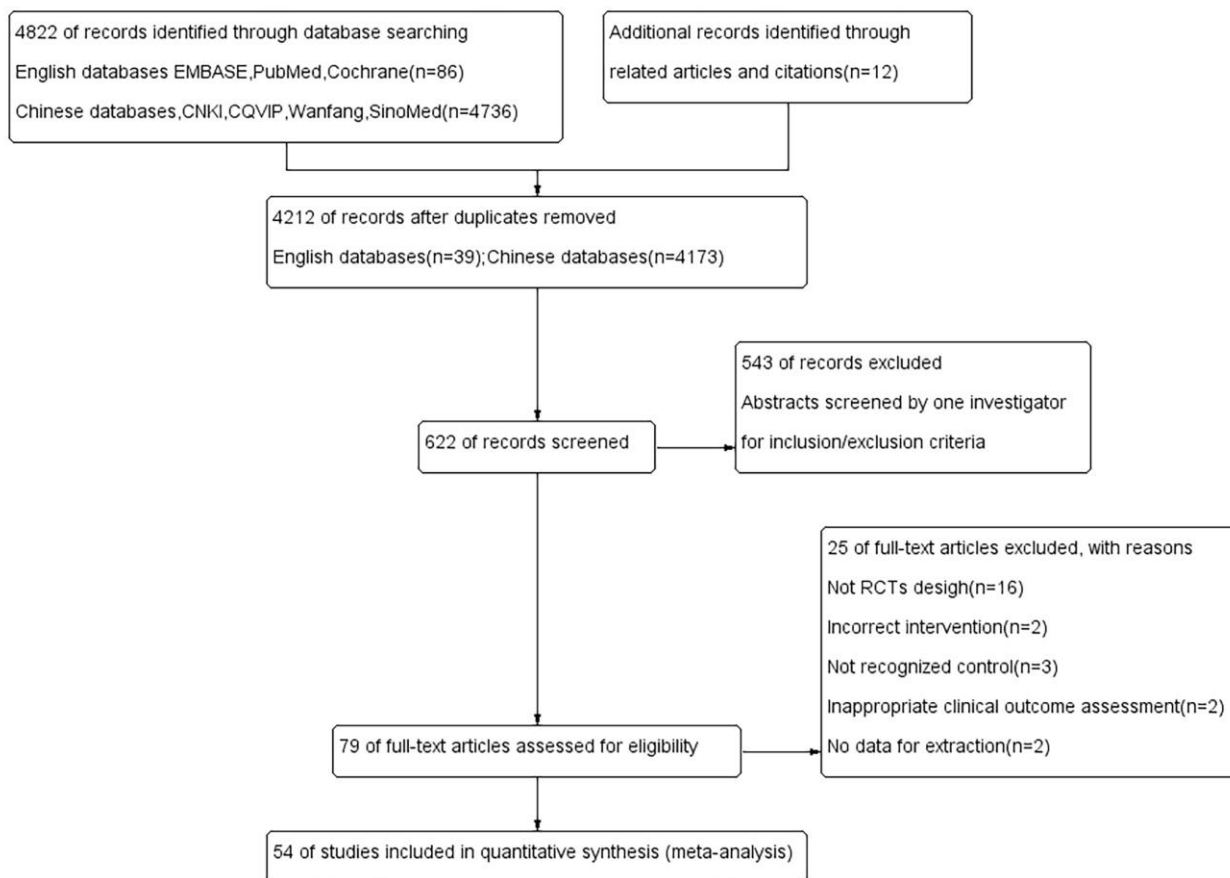


Figure 1: Summary of the literature identification and selection process. CNKI indicates the Chinese National Knowledge Infrastructure database, CQVIP, the Chinese Scientific Journals Full Text database, SinoMed.

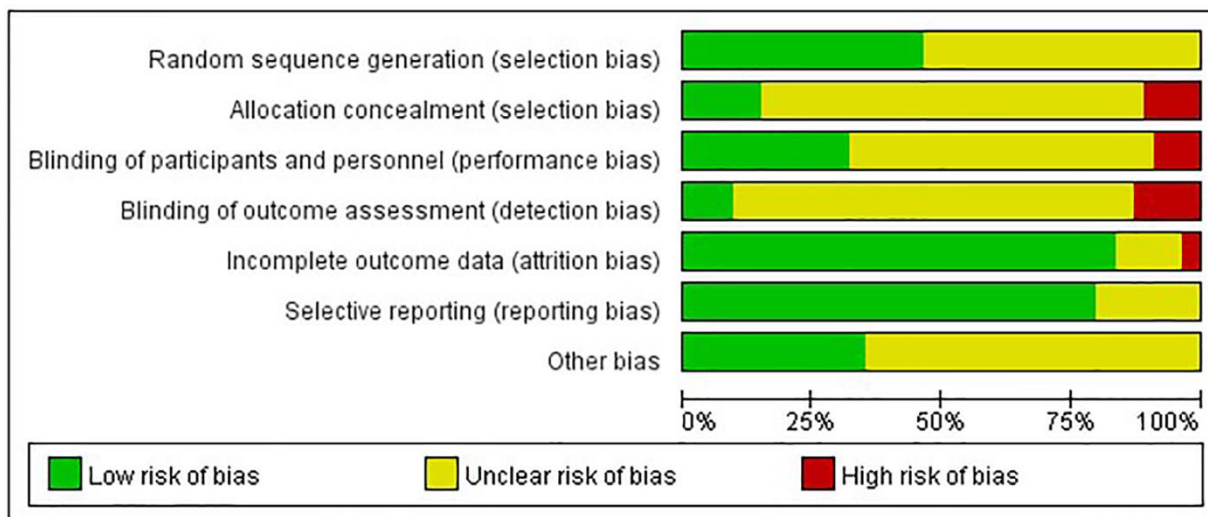


Figure 2: Risk of bias graph

Primary Outcomes

Total effectiveness rate of EA-TCM versus conventional therapy based on the same intervention strategies

Thirteen (13) RCTs contained 868 patients illustrated the results, the experimental and control groups received EA-TCM and conventional therapy, respectively. All subjects from the two groups received basic intervention strategies, including route dressing change debridement and drainage, compression bandaging as first-line clinical treatment and infrared radiation of wound surface, microwave radiation method, pharmacological treatment as the second-line treatment. Pooling of the results

from these trials showed a significant difference in the total effectiveness rate between the EA-TCM and conventional therapy groups (RR = 1.18, 95% confidence interval [CI] = 1.07, 1.30, and P = 0.0009) using the random-effects model (Figure 3).

Total effectiveness rate of EA-TCM combined with conventional therapy versus conventional therapy alone

Twenty-one (21) studies with 2000 subjects reported that the experimental groups received EA-TCM combined with conventional therapy and that the control groups received conventional therapy only. Results of meta-

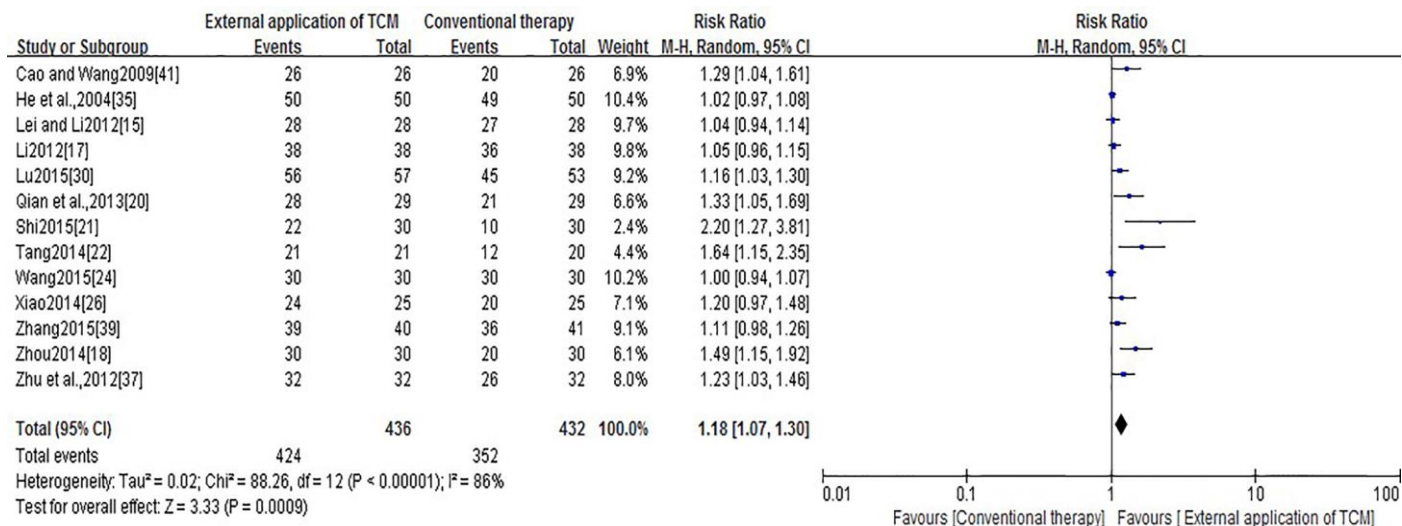


Figure 3: Meta-analysis of total effectiveness rate of EA-TCM versus conventional therapy based on the same intervention strategies.

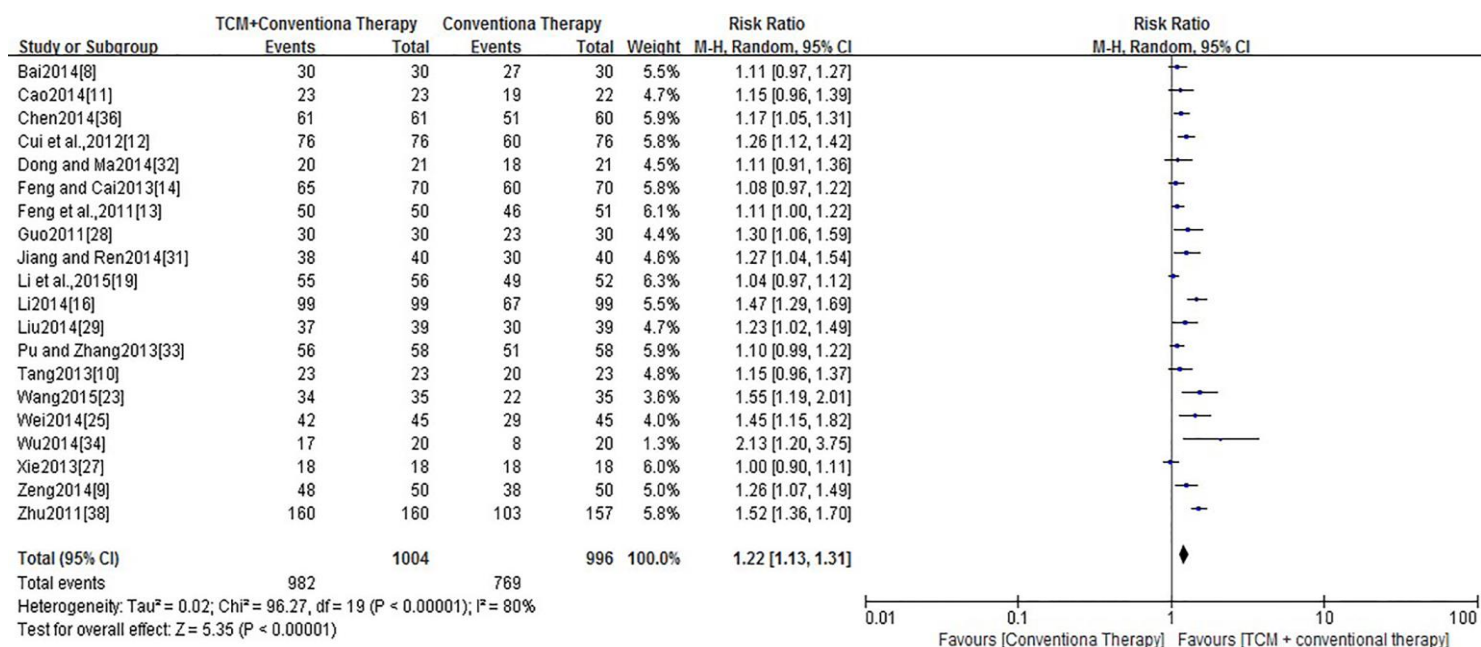


Figure 4: Meta-analysis of total effectiveness rate of combined EA-TCM with conventional therapy versus conventional therapy alone.

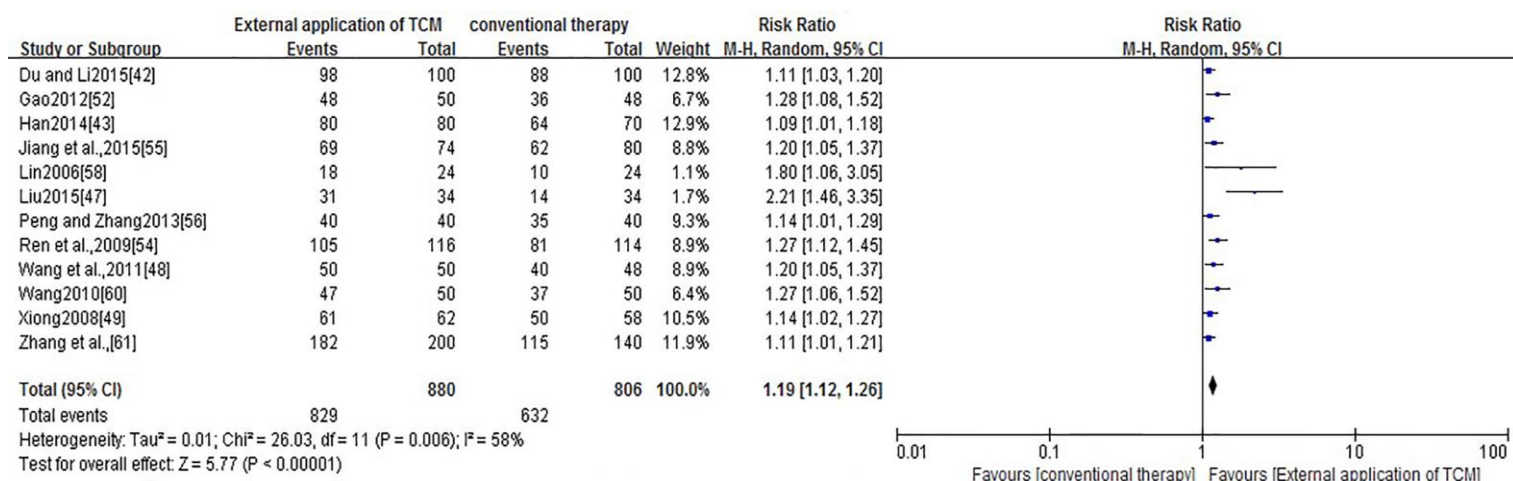


Figure 5: Meta-analysis of total effectiveness rate of (EA-TCM) versus conventional therapy based on the same intervention strategies in preventing FLAI.

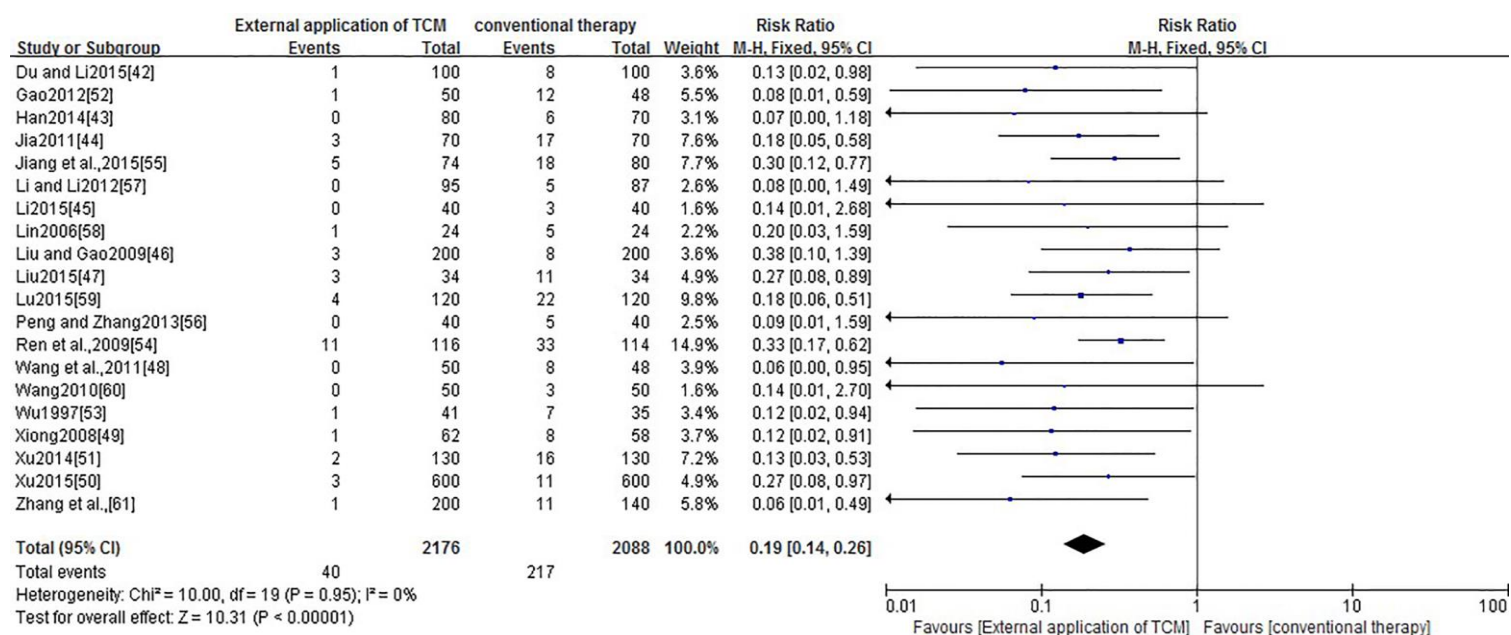


Figure 6: Meta-analysis of incidence rate of fat liquefaction (EA-TCM) versus conventional therapy based on the same intervention strategies in preventing fat liquefaction.

analysis using the random-effects model indicated a significantly higher total effectiveness rate for EA-TCM combined with conventional therapy compared to that of the control groups (RR=1.22, 95%CI=1.13, 1.31, and $P < 0.00001$). (Figure 4).

Total effectiveness rate of EA-TCM versus conventional therapy based on the same intervention strategies in preventing FLAI

Twelve (12) studies with 1686 subjects reported that the experimental groups received EA-TCM compared with conventional therapy. Results of meta-analysis using the random-effects model indicated statistically significant difference in total effectiveness rate of EA-TCM (RR = 1.19, 95% confidence interval [CI] =1.12, 1.26, and $P < 0.00001$). (Figure 5).

Incidence rate of fat liquefaction

Twenty (20) studies with 4264 subjects reported the incidence rate of fat liquefaction after EA-TCM. The results of meta-analysis using the fixed-effects model indicated significant difference in the experimental groups compared to the control groups (RR = 0.19, 95% confidence interval [CI] =0.14, 0.26, and $P < 0.00001$). (Figure 6).

Secondary Outcomes

Healing time of Abdominal incision

Twenty-five (25) studies with 2290 studies reported healing time of FLAI. With random-effects modeling, the pooled data for the two studies showed a statistically significant difference between the experimental and control groups (Mean Difference = -4.47, 95% confidence interval [CI] = -5.03, -3.91, and $P < 0.00001$) (Figure 6). The subgroup analysis was performed to compare EA-TCM with different control interventions. The aggregated results indicated that there were also significant differences in each subgroup: EA-TCM versus conventional therapy based on the same intervention strategies (Mean Difference = -4.84, 95% confidence interval [CI] = -6.22, -3.45, and $P < 0.00001$); EA-TCM and conventional therapy versus conventional therapy alone (Mean Difference = -4.25, 95% confidence interval [CI] = -4.90, -3.60, and $P < 0.00001$). (Figure 7).

Average hospitalization time after operation

Six (6) studies with 482 subjects reported average hospitalization time after operation. The aggregated results of meta-analysis using the random-effects model indicated statistically significant difference (Mean Difference = -6.43, 95% confidence interval [CI] = -9.79, -3.06, and $P = 0.0002$). (Figure 8).

Adverse Events

No study reported adverse events in the experimental groups or control groups with EA-TCM.

Sensitivity analysis

Sensitivity analysis using the leave-one-out approach indicated the finding was reliable and are not dependent on anyone study, the direction of the combined estimates did not vary markedly with the removal of each study, in turn, indicating that the meta-analysis was robust and the data was not overly influenced by any one study.

Assessment of Publication Bias

In this review, all literature cited were compared with the Chinese literature as the origination and application of traditional Chinese medicine are mainly in China and these topical applications on FLAI has not been introduced abroad at present, the funnel plots for total effectiveness rate of EA-TCM, EA-TCM combined with conventional therapy, total effectiveness rate of EA-TCM in preventing FLAI, incidence rate of fat liquefaction, healing time of FLAI, average hospitalization time performed including 13 RCTs, 21 RCTs, 12 RCTs, 20 RCTs, 25 RCTs and 6 RCTs, respectively. Regarding these studies of EA-TCM for FLAI, the publication bias was insignificant because the spots were substantially symmetric, and none of the studies lies outside the limits of the 95% CI. However, caution is advised in interpreting the results of publication bias of average hospitalization time after operation because of a small subset of studies. Consequently, the probability of publication bias may also exist in our study.

Summary of Evidence

This paper was the first systematic review and meta-analysis to assess the effects of EA-TCM for FLAI. This systematic review searched a wide variety of electronic databases for relevant articles. Consequently, the results of our systematic review were considered robust. As an adjunctive treatment method to FLAI, EA-TCM has been used in clinical practice for many years for the management of incision complication. Fifty-four (54) RCTs were identified, a detailed subgroup analysis based on different comparisons revealed the clinical outcome of FLAI. The trials included in this study assessed the efficacy of several types of external application on various medical conditions. Three thousand three hundred and sixty-three (3363) patients in treatment groups and 3360 in control groups were evaluated, and the duration of RCTs ranged from 7 days to above 20 days. Despite the fact that most of the trials had small sample sizes and poor methodological quality, analysis of the pooled data showed a consistently superior effect of EA-TCM in terms of increasing total effectiveness rate

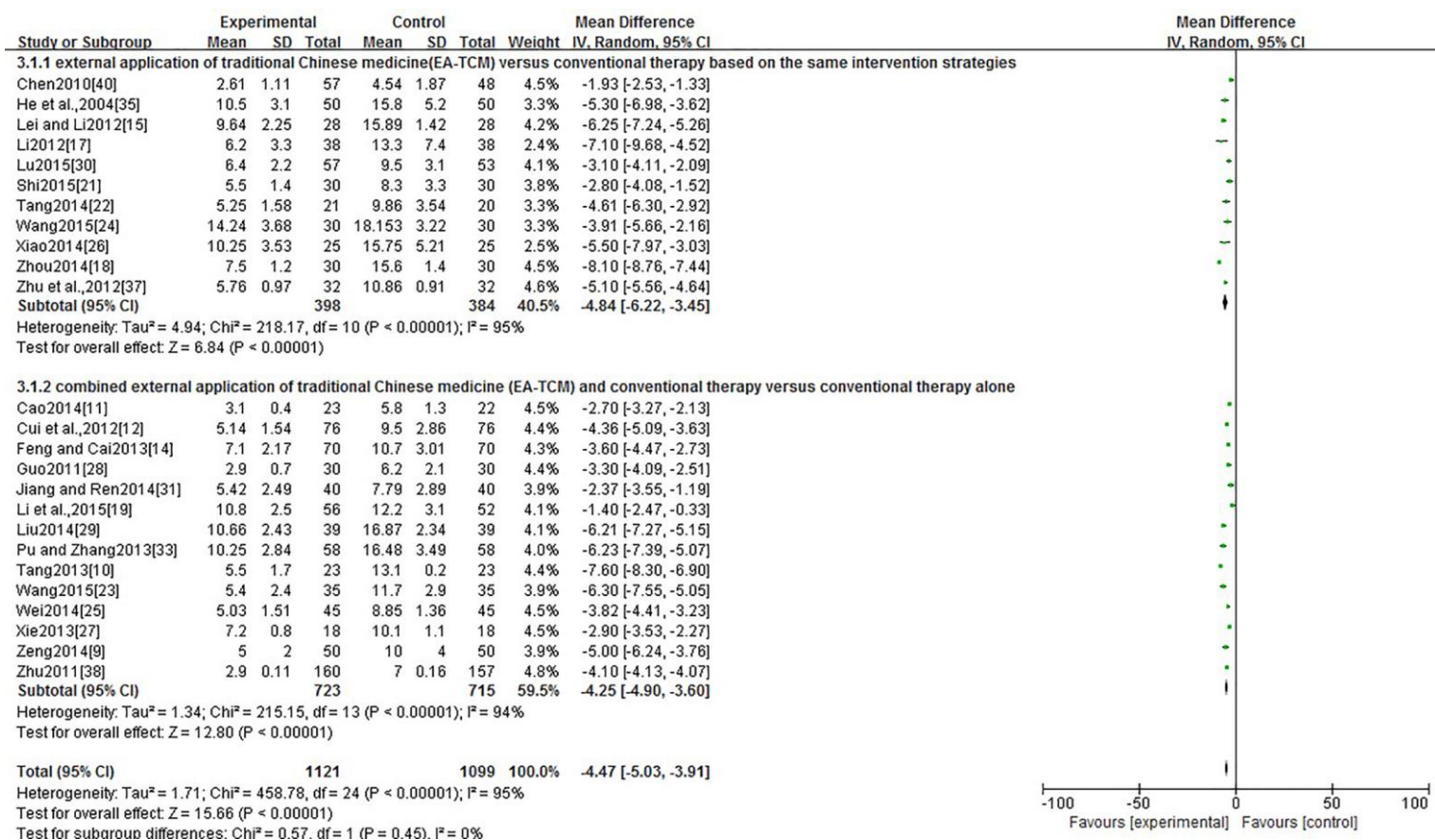


Figure 7: Meta-analysis of healing time of Abdominal incision(EA-TCM) versus conventional therapy based on the same intervention strategies or EA-TCM and conventional therapy versus conventional therapy alone

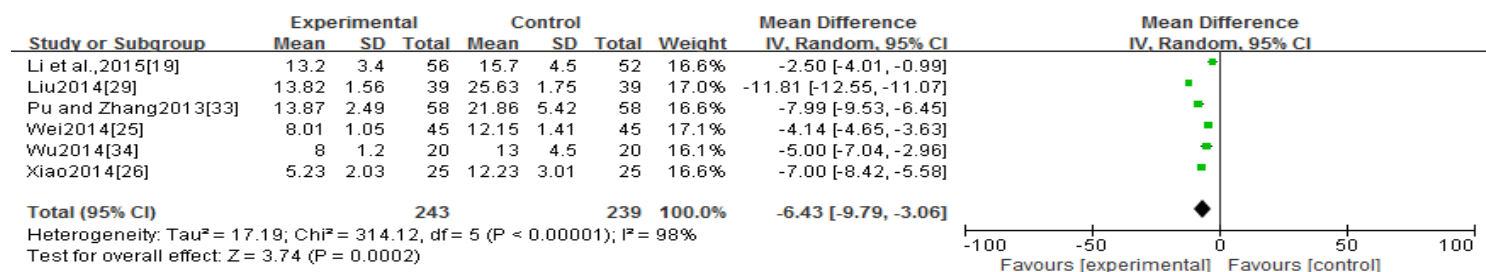


Figure 8: Meta-analysis of average hospitalization time after operation. (EA-TCM) versus conventional therapy based on the same intervention strategies or EA-TCM and conventional therapy versus conventional therapy alone.

and reducing the incidence rate of FLAI, EA-TCM could even lead to shorter postoperative recovery time by decreasing healing time of FLAI and average hospitalization time, when compared to the control groups. There were no patients dropped out of their trials due to adverse effects, suggesting that EA-TCM was safe for clinical use.

Possible rationales for EA-TCM for prevention and treatment of FLAI

The pathogenesis of FLAI is theoretically caused by “Re (heat) evil”, “Yu (qi-stagnancy, blood-stasis)”, and “Xu (qi blood and yin yang deficiency)” according to traditional Chinese medicine theory. We could find that although the components of EA-TCM used in each trial varied, the treatment principles were consistent, including clearing away heat and dampness, promoting blood circulation to dissipate blood stasis, and providing supplements for deficiencies.^{12,34,65} The most commonly single TCM used were Rhubarb, Mirabilite and Borneol. Additional pharmacological effects have been attributed to compounds isolated from these individual herbs, including anti-inflammatory activity, antifungal effect, antiviral effect, bacteriostatic action, hemostatic effect and antioxidant activity. Studies have shown that rhein, the main ingredient of

Rhubarb, could significantly inhibit biosynthesis of leukotriene B₄, leukotriene C₄ in macrophages; it also can inhibit the increase of Ca²⁺ stimulated by the bacterial endotoxin in macrophages and promote cyclic adenosine monophosphate (cAMP) level elevated simultaneously^{9,37} when treated with Mirabilite, the inflammatory-related factors including NF-κB and proinflammatory cytokines (e.g., TNF-α, IL-1β, IL-6, and RANTES) in the abdominal wound were significantly upregulated following FLAI and could be suppressed, and Mirabilite can significantly reduce the number of leukocytes and PGE₂.^{20,29} Furthermore, researchers found out that the expression of inflammation factor interleukin-1 beta (IL-1β), Tumor necrosis factor alpha (TNF-α) and cell adhesion molecule-1 were reduced by giving borneol injection on cerebral ischemia-reperfusion model in rats, and results show that in the absence of extracellular calcium, borneol can significantly inhibit elevated intracellular Ca²⁺ concentration in platelet-induced by 5-HT, thus it can inhibit increase of celiac capillary permeability and inhibit arterial thromboembolism.¹⁰ It was determined that these formulas could restore the balance of metabolism-immune pathways to promote the healing of FLAI using different groups of bioactive ingredients. Thus, Compatibility of Rhubarb, Mirabilite and

Table 1: Basic characteristics of the included studies.

Study	Location	Sample size E/C	Age E/C (Mean \pm SD)	Duration E/C (months)	Duration of treatment (days)	Operative types	Main outcomes	JADAD Score
Bai, 2014 ⁸	China	60(30/30)	21-46(M=31)	2012.1-2013.10	>14	Cesarean section	TER; CR; IR	3
Zeng, 2014 ⁹	China	100(50/50)	26-40	2011.6-2013.6	>7	Cesarean section	TER; CR; IR; HT	3
Tang, 2013 ¹⁰	China	46(23/23)	21-41(27.13 \pm 1.4)	2012.4-2014.12	>14	Cesarean section	TER; CR; IR; HT	3
Cao, 2014 ¹¹	China	45(23/22)	23-40(29.5 \pm 10.6)	2011.2-2013.2	>14	Abdominal operation in Obstetrics and Gynecology	TER; CR; IR; HT	3
Cui <i>et al.</i> , 2012 ¹²	China	152(76/76)	28-80(M=55)	2005.9-2010.9	>14	Abdominal operation in General Surgery Department	TER; CR; IR; HT	4
Feng <i>et al.</i> , 2011 ¹³	China	101(50/51)	26-75	2009.1-2010.10	>10	Abdominal operation	TER; IR	5
Feng and Cai, 2013 ¹⁴	China	140 (70/70)	E:23-41(30 \pm 6.3) C:22-42 (32 \pm 6.85)	2008.4-2011.4	>10	Cesarean section	TER; CR; IR; HT	4
Lei and Li, 2012 ¹⁵	China	56(28/28)	20-58	2008.1-2011.12	>16	Abdominal operation in General Surgery Department	TER; CR; IR; HT	4
Li, 2014 ¹⁶	China	188(99/99)	22-29(26.1 \pm 1.3)	2010.1-2013.10	>14	Cesarean section	TER; CR; IR	3
Li, 2012 ¹⁷	China	76(38/38)	20-53(m=35.4)	2010.0-2011.1	>7	Abdominal operation in General Surgery Department	TER; CR; IR; HT	3
Zhou, 2014 ¹⁸	China	60(30/30)	E:(28.4 \pm 4.1) C: 27.9 \pm 4.5	2010.8-2013.1	>16	cesarean section	TER; CR; IR; HT	3
Li <i>et al.</i> , 2015 ¹⁹	China	192(56/52)	E:21-69(44.3 \pm 7.5) C:20-70(43.3 \pm 6.5)	2012.1-2015.1	>16	Appendicectomy	TER; CR; IR; HT; AHT	5
Qian <i>et al.</i> , 2013 ²⁰	China	58(29/29)	23-81	2008.2-2011.2	>7	Gynecological operation	TER; CR; IR	3
Shi, 2015 ²¹	China	60(30/30)	22-68(M=35)	2012.1-2012.12	>10	Abdominal operation in Obstetrics and Gynecology	TER; CR; IR; HT	3
Tang, 2014 ²²	China	41(21/20)	E:27.94 \pm 2.5 C:27.84 \pm 2.87	2009.10-2013.8	>14	Cesarean section	TER; CR; IR; HT	3
Wang, 2015 ²³	China	70 (35/35)	24-31 (27.4 \pm 2.5)	2012.5-2014.11	>14	Cesarean section	TER; HT	4
Wang, 2015 ²⁴	China	60 (30/30)	M=52	2008.5-2012.5	>20	Cesarean section	TER; HT	3
Wei, 2014 ²⁵	China	90(45/45)	20-46(31.16 \pm 6.51)	2012.3-2014.4	>14	Abdominal operation in Obstetrics and Gynecology	TER; CR; IR; HT; AHT	3
Xiao, 2014 ²⁶	China	50(25/25)	E:20-56(30.22 \pm 2.12) C:20.35(30.44 \pm 2.74)	2012.12-2013.10	>20	Abdominal operation in General Surgery Department	TER; IR; HT; VHT; AHT	4
Xie, 2013 ²⁷	China	36(18/18)	36-65(M=49.7)	2010.6-2012.12	>14	Radical resection of rectal carcinoma	TER; CR; IR; HT	3
Guo, 2011 ²⁸	China	60(30/30)	17.45(27.5 \pm 4.5)	2008.6-2010.12	>7	Abdominal operation in Obstetrics and Gynecology	TER; CR; IR; HT	3
Liu, 2014 ²⁹	China	78(39/39)	E:22.41(28.5 \pm 9.7) C:21-40(27.9 \pm 10.2)	2013.6-2014.6	>30	abdominal operation in Obstetrics and Gynecology	TER; CR; IR; HT; AHT	4
Lu, 2015 ³⁰	China	110(57/53)	22-56(32.4 \pm 5.2)	2013-2014	>10	Abdominal operation in General Surgery Department	TER; CR; IR; HT	4
Jiang and Ren, 2014 ³¹	China	80(40/40)	E:24-40(30.81 \pm 2.79) C:24-41(30.45 \pm 2.85)	2012.2-2014-6	>10	Cesarean section	TER; CR; IR; HT	4
Dong and Ma, 2014 ³²	China	42(21/21)	32-46(38.5 \pm 1.5)	2011.5-2012.11	>7	Gynecological malignant tumor surgery	TER; CR; IR;	3
Pu and Zhang, 2013 ³³	China	116(58/58)	E:24-65(37.42 \pm 5.27) C:28-61(37.26 \pm 6.33)	2012.2-2013.2	>24	Abdominal operation in Obstetrics and Gynecology	TER; CR; IR; HT; AHT	5
Wu, 2014 ³⁴	China	40(20/20)	22-34(26 \pm 2.9)	2012.4-2013.11	>14	Cesarean section	TER; AHT	5
He <i>et al.</i> , 2004 ³⁵	China	100(50/50)	E:22.75-39.5 C:20.70-36.2	2000.1-2003.12	>20	Abdominal operation in Obstetrics and Gynecology	TER; HT	3

Chen, 2014 ³⁶	China	121(61/60)	E:22-49(35.5±3.5) C:21-48(34.5±2.5)	2012.6-2013.6	>7	Abdominal operation in Obstetrics and Gynecology	TER; CR; IR;	3
Zhu <i>et al.</i> , 2012 ³⁷	China	64(32/32)	19-56	2009.2-2012.6	>14	Abdominal operation in Obstetrics and Gynecology	TER; CR; IR; HT	3
Zhu, 2011 ³⁸	China	317(160/157)	E:26-65(47.2±5.3) C:23-63(46.1±6.3)	2009.1-2010.5	>14	Abdominal operation in Gynecology	TER; CR; IR; HT	4
Zhang, 2015 ³⁹	China	81(40/41)	E:21-38 C:21-38	2014.1-2014.6	>14	Cesarean section	TER; CR; IR;	4
Chen, 2010 ⁴⁰	China	105(57/48)	E:22-65 C:23-63	2005.8-2008.7	>7	Abdominal operation in Obstetrics and Gynecology	TER; CR; IR; HT	4
Cao and Wang, 2009 ⁴¹	China	52(26/26)	19-75(M=47)	2000.6-2006.10	>14	abdominal operation in Obstetrics and Gynecology	TER; CR; IR; HT	3
Du and Li, 2015 ⁴²	China	200(100/100)	E:21-40(29.6±4.6) C:20-40(30.1±4.9)	2010.1-2013.12	>14	Cesarean section	TER; IRFL	4
Han, 2014 ⁴³	China	150(80/70)	20-42	2010.10-2012.10	>14	Cesarean section	TER; IRFL	4
Jia, 2011 ⁴⁴	China	140(70/70)	21-60(40.23±12.34)	2008.12-2010.12	>14	Abdominal operation in Obstetrics and Gynecology	TER; IRFL	4
Li, 2015 ⁴⁵	China	80(40/40)	20-40	2014.1-2014.12	>14	Cesarean section	IRFL	3
Liu and Gao, 2009 ⁴⁶	China	400(200/200)	20-43(31.23±5.56)	2008.1-2008.12	>14	Cesarean section	IRFL	5
Liu, 2015 ⁴⁷	China	68(34/34)	22-40(30.8±2.2)	2013.5-2014.5	>14	Cesarean section	TER; IRFL	3
Wang <i>et al.</i> , 2011 ⁴⁸	China	100(50/48)	E:38-66 C:40-65	2008.3-2009.1	>14	Abdominal operation in Obstetrics and Gynecology	TER; IRFL	3
Xiong, 2008 ⁴⁹	China	120(62/58)	E:21-60(47.1±6.4) C:20-63(46.3±7.1)	2002.10-2007.10	>14	Abdominal operation in Obstetrics and Gynecology	TER; IRFL	4
Xu, 2015 ⁵⁰	China	1200(600/600)	22-45(31.23±7.67)	2011.1-2014.1	>7	Cesarean section	IRFL	5
Xu, 2014 ⁵¹	China	260(130/130)	22-38	2009.8-2013.6	>7	Cesarean section	IRFL	4
Gao, 2012 ⁵²	China	98(50/48)	24-35(M=28.5)	2008.7-2010.6	>7	Cesarean section	TER; IRFL	
Wu, 1997 ⁵³	China	76(41/35)	20-32	1994.2-1996.2	>7	Cesarean section	IRFL	32
Ren <i>et al.</i> , 2009 ⁵⁴	China	230(116/114)	35-67(45.6)	2005.9-2008.1	>7	Gynecological tumor surgery	IRFL	3
Jiang <i>et al.</i> , 2015 ⁵⁵	China	154(74/80)	E:20-40(27.82±4.84) C:20-41(27.85±4.61)	2011.1-2013.12	>7	Cesarean section	TER; IRFL	4
Peng and Zhang, 2013 ⁵⁶	China	80(40/40)	19-39	2010.6-2012.8	>7	Cesarean section	TER; IRFL	3
Li and Li, 2012 ⁵⁷	China	182(95/87)	E:18-42(M=30) C:19-43(M=31)	2009.1-2011.9	>14	Cesarean section	IRFL	4
Lin, 2006 ⁵⁸	China	48(24/24)	22-46(M=34.2)	2002.1-2005.6	>14	Abdominal operation in Obstetrics and Gynecology	TER; IRFL	3
Lu, 2015 ⁵⁹	China	240(120/120)	E:18-40(26.5±3.2) C:18-45(27.1±3.2)	2011.1-2012.12	>7	Cesarean section	IRFL	4
Wang, 2010 ⁶⁰	China	100(50/50)	E:29.8±5.83 C:32.1±5.85	2005.1-2010.1	>17	Abdominal operation in Obstetrics and Gynecology	TER; IRFL	5
Zhang <i>et al.</i> , 2011 ⁶¹	China	340(200/140)	E:21-40(M=27.4) C:21-39(M=26.8)	2004.1-2011.6	>7	Cesarean section	TER; IRFL	5

RCTs = Randomized Controlled Trials; E = Experimental group; C = Control group; NR = no report; TER = Total Effective Rate; CR = Curative Ratio; IR = Inefficiency Rate; HT = Healing Time of Abdominal Incision; AHT = Average Hospitalization Time after Operation; IRFL = Incidence Rate of Fat Liquefaction.

Table 2: Treatments used in the included studies

Study	Conventional therapy of experimental group/control group					Topical treatment of control group	External application of experimental group	Suppliers of the externally Applied TCM
	Route dressing change	Debridement and drainage; Compression bandage	Infrared radiation of wound surface	Microwave radiation treatment	Pharmacological treatment			
Bai, 2014 ⁸	Iodophor	NR	NR	NR	nutritional support	NR	Rhubarb: Mirabilite 1:4	TCM Hospital of Liuan city Anhui Province
Zeng, 2014 ⁹	Conventional dressing change; Butterfly type tape fixed	YES	YES	NR	NR	Compression and debridement	Rhubarb: Mirabilite 1:4	The Department of Obstetrics and Gynecology; The Affiliated Hospital of Zhejiang University School of Medicine of TCM
Tang, 2013 ¹⁰	Hydrogen peroxide; Normal saline solution ; Gentamycin	YES	NR	NR	NR	NR	Borneolum Syntheticum :Mirabilite 1 :2	The Department of Obstetrics and Gynecology, People's Hospital of Guilin Ziyuan County, Guangxi Province
Cao, 2014 ¹¹	0.5%Chlorhexidine Gluconate; Metronidazole	yes	NR	YES	NR	NR	Rhubarb: Mirabilite 1:4	The Department of Obstetrics and Gynecology, health centers of Pingshi town Lechang City , Guangdong Province
Cui <i>et al.</i> , 2012 ¹²	Iodophor; Sterile gauze	yes	NR	NR	NR	Metronidazole; Chymotrypsin; Gentamycin; Butterfly type tape fixed	Rhubarb: Mirabilite 1:4	The Second Affiliated Hospital of Lanzhou University.
Feng <i>et al.</i> , 2011 ¹³	Conventional dressing change; Butterfly type tape fixed	yes	Yes	NR	Secondary debridement suture	75% Alcohol	Rhubarb: Mirabilite 1:1	Department of TCM, The 301 th Hospital of Chinese People's Liberation Army
Feng and Cai, 2013 ¹⁴	Iodophor; Metronidazole; Sterile gauze; Butterfly type tape fixed	yes	NR	NR	NR	NR	Rhubarb: Mirabilite 1:4	The Department of Obstetrics and Gynecology; Maternal and Child Care Service Centre of Qianan City, Hebei Province
Lei and Li, 2012 ¹⁵	Iodophor; Normal saline solution; Sterile gauze; Butterfly type tape fixed	yes	Yes	NR	NR	Metronidazole	self-made Skin-growing Ointment	The Department of Obstetrics and Gynecology, TCM Hospital of Shanxi Province
Li, 2014 ¹⁶	Conventional dressing change; 75% Alcohol	yes	NR	NR	NR	NR	Rhubarb: Mirabilite 200 g:100 g	The Department of Obstetrics and Gynecology; People's Hospital of Linqing City Shandong Province
Li, 2012 ¹⁷	Conventional dressing change;75% Alcohol	yes	NR	NR	NR	Secondary debridement suture	Rhubarb: Mirabilite 100 g:50 g	The Department of Obstetrics and Gynecology people's hospital of

Zhou, 2014 ¹⁸	Conventional dressing change	YES	NR	NR	NR	Ethacridine Lactate	Anti-inflammatory Sarcogenic Ointment	heshuo county, Xinjiang Province The Department of Obstetrics and Gynecology, Health Centers of Jinghu town Dazhi City, Hubei Province
Li <i>et al.</i> , 2015 ¹⁹	Conventional dressing change; Iodophor; Normal saline solution	YES	NR	NR	NR	Hydrogen peroxide; Ozone	Moisture Exposed Burn Ointment	People's Hospital of Hengshui City, Hebei Province
Qian <i>et al.</i> , 2013 ²⁰	Polyninylpyrrolidone	yes	NR	NR	Antibiotics intravenous infusion	Secondary debridement suture	Rhubarb: Mirabilite 1:4	people's hospital of Wuhan University, Hubei Province
Shi, 2015 ²¹	Iiodophor; 75% Alcohol; Gentamicin sulphate; Ethacridine Lactate Normal saline solution;	yes	Yes	NR	NR	NR	Rhubarb: Mirabilite 1:3	The first People's Hospital of Wuhu City, Anhui Province
Tang, 2014 ²²	Hydrogen peroxide; Complex iodine	yes	NR	NR	NR	NR	Rhubarb: Mirabilite 1:3	Department of Obstetrics and Gynecology; People's Hospital of Longshan County, Hunan Province
Wang, 2015 ²³	Conventional dressing change	yes	NR	NR	NR	NR	Anti-inflammatory Sarcogenic Ointment	TCM Hospital of Nehe City, Heilongjiang Province
Wang, 2015 ²⁴	Conventional dressing change	yes	Yes	NR	Oral antibiotic	Normal saline solution; Ethacridine Lactate	Rhubarb: Mirabilite: Honeysuckle 10:2:1	TCM Hospital of Zhuanglang County, Gansu Province
Wei, 2014 ²⁵	Conventional dressing change	yes	NR	NR	NR	75% Alcohol	YunNanBaiYao Powder	The People's Hospital of the Yao Nationality Autonomous County of Du'an, Guangxi Province
Xiao, 2014 ²⁶	Conventional dressing change	yes	NR	NR	NR	Iodophor; Gentamicin sulphate; Chymotrypsin	Rhubarb: Mirabilite 1:4	Department of Obstetrics and Gynecology, Peoples Hospital of Linxi County, Hebei Province
Xie, 2013 ²⁷	Conventional dressing change	yes	Yes	NR	Oral antibiotic	Iodophor; Normal saline solution; Gentamicin sulphate	Rhubarb, Mirabilite, Alisma, Poria cocos, Peach kernel	Department of Proctology; The Third People's Hospital of Hangzhou City, Zhejiang Province
Guo, 2011 ²⁸	0.5% Chlorhexidine gluconate; metronidazole hydrogen peroxide 75% Alcohol;	yes	NR	yes	NR	NR	Rhubarb: mirabilite 1:4	Department of Obstetrics and Gynecology; TCM Hospital of Huaxi City, Guiyang Province
Liu, 2014 ²⁹	0.5% Chlorhexidine gluconate; Metronidazole; Hydrogen peroxide 75% Alcohol;	yes	NR	YES	NR	NR	Rhubarb: mirabilite 1:4	Department of Obstetrics and Gynecology; TCM Hospital of Zhengzhou City, Guiyang Helan Province
Lu, 2015 ³⁰	Normal saline solution	yes	NR	YES	NR	NR	Rhubarb: Borneol: Mirabilite 1:1:3	TCM Hospital of Shijiazhuang City, Hebei Province

Gentamicin sulphate; secondary debridement suture

Jiang and Ren, 2014 ³¹	Conventional dressing change	yes	NR	NR	antibiotic	NR	Rhubarb: Mirabilite 3 :5	Maternal and Infant's Hospital of Siping City, Jilin Province
Dong and Ma, 2014 ³²	Conventional dressing change; Iodophor	yes	NR	NR	NR	NR	Rhubarb: Mirabilite 1 :2	The people's hospital of Gaoxin District of Weifang City, shandong province
Pu and Zhang, 2013 ³³	0.5% Chlorhexidine; Gluconate; Hydrogen peroxide Normal saline solution	yes	NR	YES	NR	NR	Rhubarb: Mirabilite 1 :4	Maternal and Infant's Hospital of Suide county, Shandong Province
Wu, 2014 ³⁴	Metronidazole; Hydrogen peroxide; Gentamicin sulphate	yes	YES	NR	NR	NR	Rhubarb: Mirabilite 1 :4	Health Center of The Village of Jiangshan City, Zhejiang Province
He <i>et al.</i> , 2004 ³⁵	Conventional dressing change	yes	NR	NR	NR	normal saline solution	Rhubarb: Mirabilite 2:1	The First Hospital Branch of Qiqihaer City, Heilongjiang Province
Chen, 2014 ³⁶	Conventional dressing change; Iodophor	yes	NR	NR	NR	NR	Borneol: Mirabilite: Polygonum cuspidatum1:1:2	The People's Hospital of Yiyang County, Jiangxi Province
Zhu <i>et al.</i> , 2012 ³⁷	Conventional dressing change	yes	Yes	NR	Antibiotic intravenous infusion	iodophor	Rhubarb: Mirabilite1:3	The Affiliated hospital of Zhejiang university of TCM, Jiaxing City, Zhejiang Province
Zhu, 2011 ³⁸	Complex Iodine; 75% Alcohol	yes	NR	NR	NR	NR	Rhubarb: Mirabilite2:1	Hospital of TCM of Shuiping County, Helan Province
Zhang, 2015 ³⁹	Conventional dressing change	yes	NR	NR	NR	NR	Raw Rhubarb: compound of Glauber-salt and liquorice1:2	The Ruici Hospital of Nantong City, Jiangsu Province
Chen, 2010 ⁴⁰	Conventional dressing change	yes	Yes	NR	NR	Iodophor	Mirabilite 200 g-500 g	TCM Hospital of Zhuji City, Zhejiang Province
Cao and Wang, 2009 ⁴¹	Conventional dressing change; Iodophor	yes	NR	NR	NR	Metronidazole; Gentamicin sulphate; Chymotrypsin	Rhubarb: Mirabilite1:4	Department of Obstetrics and Gynecology, The third People's Hospital of Nantong City, Jiangsu Province
Du and Li, 2015 ⁴²	Conventional dressing change	yes	NR	NR	NR	Iodophor	Mirabilite 80g	The Second People's Hospital of Jinyun County, Zhejiang Province
Han, 2014 ⁴³	Conventional dressing change	yes	NR	YES	Antibiotics	Iodophor	Rhubarb: Mirabilite1:4	Shimen town center of hospital of Tongxiang City, Zhejiang

					intravenous infusion ; Supportive therapy			province
Jia, 2011 ⁴⁴	Conventional dressing change	yes	NR	NR	Iodophor	NR	RuYi Jin Huang Powder	The Fourth People's Hospital of Langfang city, Hebei Province
Li, 2015 ⁴⁵	Conventional dressing change	yes	NR	NR	Antibiotics; intravenous infusion ; Supportive therapy	Sterilized dressing	Rhubarb:compound of Glauber-salt and liquorice1:3	TCM Hospital of Jiangning City, Nanjing Province
Liu and Gao, 2009 ⁴⁶	Conventional dressing change	yes	NR	NR	Normal saline solution; Hydrogen peroxide	Sterilized dressing	Rhubarb: Mirabilite2:5	Department of Obstetrics and Gynecology, The 404th Hospital of Chinese People's Liberation Army
Liu, 2015 ⁴⁷	Conventional dressing change	yes	NR	NR	normal saline solution; Hydrogen peroxide	Sterilized dressing	Rhubarb:Mirabilite	Tongan Hospital of Nahe City, Heilongjiang Province
Wang <i>et al.</i> , 2011 ⁴⁸	Conventional dressing change	yes	YES	NR	Antibiotics intravenous infusion ; Supportive therapy	Sterilized dressing	Rhubarb: Mirabilite1:4	Friendship Hospital of Yangzhou City, Jiangsu Province
Xiong, 2008 ⁴⁹	Conventional dressing change	yes	NR	NR	Antibiotics intravenous infusion	NR	Hematoma Formula	Department of Obstetrics and Gynecology; The Second Affiliated Hospital of Nanchang University
Xu, 2015 ⁵⁰	Conventional dressing change sterile gauze	yes	NR	NR	NR	Iodophor	Flesh-Engendering Powder	TCM Hospital of Suyang County, Jiangsu Province
Xu, 2014 ⁵¹	Conventional dressing change	yes	NR	NR	NR	Normal saline solution; Iodophor	RuYi Jin Huang Powder	The fourth People's Hospital of Langfang, Bazhou City, Hebei province
Gao, 2012 ⁵²	Conventional dressing change	yes	YES	NR	NR	NR	Rhubarb:Mirabilite1:4; Vinegar	Department of Obstetrics and Gynecology, General Hospital of Xingtai Mining Group,Xingtai City, Hebei Province,
Wu, 1997 ⁵³	Conventional dressing change	yes	NR	NR	NR	75% Alcohol; Iodophor	Rhubarb: Mirabilite1:3	Maternal and Infant's Hospital of Xining City, Qinghai Province
Ren <i>et al.</i> , 2009 ⁵⁴	Conventional dressing change	yes	NR	NR	NR	5% Iodophor	Rhubarb: Mirabilite 300 g:100 g	The 546th Hospital of Chinese People's Liberation Army, Xinjiang Province
Jiang <i>et al.</i> , 2015 ⁵⁵	Conventional dressing change	yes	NR	NR	NR	Ethacridine Lactate	Rhubarb: Mirabilite 1:3	Maternal and Infant's Hospital of Kaihua County Zhejiang Province

Peng and Zhang, 2013 ⁵⁶	Conventional dressing change	yes	YES	NR	Antibiotics intravenous infusion	NR	Rhubarb:Mirabilite	Heshui Town Center of Hospital of Xinyi City, Guangdong Province
Li and Li, 2012 ⁵⁷	Conventional dressing change	yes	NR	NR	Antibiotics intravenous infusion	Iodophor	Rhubarb:Mirabilite:1:4	Department of Obstetrics and Gynecology Maternal and Infant's Hospital of Lishui City, Zhejiang Province
Lin, 2006 ⁵⁸	Conventional dressing change	yes	YES	YES	Antibiotics intravenous infusion	75% Alcohol	Rhubarb:Mirabilite 1:4	Department of Obstetrics and Gynecology, People's hospital of Zhangpu County, Fujian Province
Lu, 2015 ⁵⁹	Conventional dressing change	yes	NR	NR	NR	0.5% Iodophor	RuYi Jin Huang Powder: Mirabilite1:8	The Third People's Hospital of Dafeng City Jiangsu Province
Wang, 2010 ⁶⁰	Conventional dressing change	yes	NR	YES	Antibiotics intravenous infusion; Anti-infective therapy	NR	Compound SH Chinese Medicine (<i>Radix scutellariae</i> , <i>Cortex Phellodendri</i> , <i>Rhizoma coptidis</i>)	People's Hospital of Lingshi County, Shanxi Province
Zhang <i>et al.</i> , ⁶¹	Conventional dressing change	yes	NR	NR	NR	0.5% Iodophor	Compound SH Chinese medicine (<i>Rhizoma coptidis</i> , <i>Scutellaria baicalensis georgi</i> , <i>Cortex Phellodendri</i> : mirabilite	Maternal and Infant's Hospital of Zhao county, Hebei Province

NR = No Report; TCM = Traditional Chinese Medicine.

Borneol could increase local blood microcirculation and enhance the phagocytosis of reticular endothelial cells.^{40,42} Besides, the synergistic effects of the major bioactive ingredients in them may activate the reticuloendothelial system, strengthen reticular endothelial cells' proliferation to promote the blood coagulation.^{20,31,41} Furthermore, a substantial number of researchers investigated the chemical constituents of Compound SH Chinese Medicine (*Radix scutellariae*, *Cortex phellodendri*, *Rhizoma coptidis*).^{60,61} Study showed that coptisine in *Rhizoma coptidis* could inhibit the expression of monoamine oxidase and selectively inhibit the vascular smooth muscle cell in G0/G1 phase proliferation and differentiation. Both immunohistochemical and Western blot assays indicated that *Cortex phellodendri* could exert anti-inflammatory effects by reducing the expression of IL-1 β and TNF- α . It has an obvious inhibitory effect on 12-O-tetradecanoylphorbol 13-acetate (TPA) in mice through counteracting the upregulation of inflammatory cytokine, such as the tumor necrosis factor alpha (TNF- α), interleukin 1 beta (IL - 1 beta), interleukin - 6 (IL 6) and cyclo-oxygenase-2 (COX-2) inflammation factor mRNA. Baicalin can also reduce the release of the three kinds of cytokines (L-1 β , TNF- α , IL-6) and PGE₂ synthesis. Baicalin has antipyretic effect by reducing content of prostaglandin E2 (PGE2) and Cyclic Adenosine Monophosphate (cAMP) in rat hypothalamus caused by endotoxin. It was demonstrated that baicalin (a flavonoid) could attenuate proinflammatory cytokine production by inhibiting TLR4 signaling pathway expression. Experiment found that baicalin could inhibit PGE2 release from rat C6 glioma cells induced by Ca²⁺ ionophore A23187, which is protein kinase-cytosolic phospholipase A2 channels (MAPK-c PLA2) to reduce the release of arachidonic acid by inhibiting activation of mitogens protein kinase, it also plays a role in anti-inflammation by inhibiting the nuclear factor kappa-B light-chain-enhancer of activated B-cells (NF- κ B) activation.^{60,61} In clinical practice, this compound had shown a curative effect on preventing subcutaneous fat liquefaction and incision dehiscence simultaneously. Compound Chinese herbal medicine, Moisture Exposed Burn Ointment (MEBO), which mainly composed of *Coptis chinensis*, *Cortex phellodendri*, *Radix scutellariae*, *Lumbricus*, poppy shell.¹⁹ Research has shown that Local administration of MEBO for eight days markedly increased the levels of vascular endothelial growth factor (VEGF) and basic fibroblast growth factor (bFGF) by 77.5% and 90.8%, respectively (P < 0.01). Furthermore, qPCR (quantitative polymerase chain reaction) analysis indicated that MEBO treatment for eight days led to increases in the mRNA expression of VEGF and bFGF by 40.9% and 97.1%, respectively. And a study investigated the effect of MEBO topical application on activation and proliferation of epidermal stem cells through the immunohistochemical localization of cytokeratin 19 (CK19). The analgesic effect of MEBO is attributable to the presence of the layer of oily ointment that shields the burn wound from the external environment. During the first 2 weeks post-randomization. The cumulative MRSA infection rates at day 14 for Control group and MEBO group were 38.5 % and 37.4 %, respectively, these studies demonstrated that MEBO also has a remarkable bacteriostatic property. Modern pharmacological research showed that Ruyi Jinhuang Powder had an antibacterial effect on *Streptococcus hemolyticus*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Escherichia coli*. Likewise, experimental results confirmed that it also activated macrophages to increase their phagocytic ability, accelerate the capillaries dilation and reconstruction.^{44,51} Other compound TCM had also been recommended to improve the clinical curative effect and promote FLAI rehabilitation for their common pharmacological efficacy. For example, the Self-Made Skin-Growing Ointment, mainly composed of Frankincense, Myrrh, Calamine and Beeswax, can also restrain the growth of the local *Staphylococcus aureus* and also possess detoxification and hemostatic effects.¹⁵ Anti-inflammatory Sarcogenic Ointment, which was made of *Angelica Sinensis*, *Radix angelicae*, *Lithospermum*, Liquorice, Mercurous chloride, *Daemonorops draco*, could expel pathogenic factors from muscles for clearing heat to promote blood circulation for removing blood stasis, nourish blood and promote granulation eventually.^{18,23} Yunnan Baiyao powder may effectively ease the inflammatory pain and inhibit wound swelling by retarding bacterial growth, it can also be used to prevent further wound infection by inhibiting the release of inflammatory substances.²⁵ Flesh-Engendering Powder could improve the local blood circulation, reduce

inflammatory exudation by accelerating inflammatory liquid absorption. The Hematoma Formula, Main formula composition is Frankincense, Safflower, Agilawood etc, was used in patients with early postoperative incision originally, which was essential for the redness, swelling and induration characteristic of late-phase allergic response and may play a role in repairing/ remodeling processes.⁴⁹ Other TCM studies, such as ErMiaoSan, ZhuHuang Powder, ShengJiYuhong Plaster, ShengJi YuPi Ointment, XiangPi ShengJi Ointment,⁶³ HuaFu ShengJi Ointment, HongYao Ointment, Lithospermum Ointment, FuHuang Sarcogenic Ointment, ShangYu Ointment, YuChuang Powder, Dragon Gypsum Ointment, FuFangZhenzhuSan etc.⁶⁴ which were not included in this meta-analysis, were also very encouraging. But we did not assess their final pain measurements, the mean hospitalization time and the recurrence rates during follow-up in this meta-analysis for incomplete data, inappropriate clinical outcome assessment or no effective data for extraction. Particularly worth mentioning is that Rhubarb and Mirabilite are forbidden during lactation which could not be ingested internally, but the local application has little effect on breastfeeding it is recommended to stop breastfeeding during EA-TCM treatment.^{41,47} As an additional strategy, EA-TCM is not suitable for severe intraperitoneal infection or Full-thickness dehiscence of the incision, secondary suture is necessary under these circumstances.^{32,45}

Implications for research

As an important complementary therapy, although a substantial amount of research has investigated the chemical constituents of EA-TCM, which showed that the use of EA-TCM alone or combined with conventional therapy could offer an effective treatment method for FLAI. However, more trials with high methodological quality are needed to further identify the effectiveness and safety of EA-TCM treatments. Rigorous methods of design, measurement and evaluation (DME) following the Cochrane Handbook should apply to enhance the representativeness of the sample. Clinical trial registries should be encouraged to provide details of the protocols, specifically, placebo-controlled clinical trials are essential. Randomized controlled trials, for instance, should be strictly required in study design and reported according to the Consolidated Standards of Reporting Trials (CONSORT). Furthermore, careful consideration of the interventions for responding to different levels of FLAI severity is required to find optimal subgroups that provide greater benefits than harm. Outcome measures should include the evaluation of sub-items in the internationally recognized scales. Quality of life and long-term effect should be assessed as well.

Conclusion

While this systematic review demonstrated that EA-TCM may be an effective adjuvant treatment for FLAI, it is not conclusive due to the low methodological quality of the RCTs. Therefore, our findings need to be further confirmed by more sophisticated and well-designed RCTs. Moreover, the underlying mechanisms of EA-TCM in the treatment of FLAI need to be further investigated.

Conflict of Interest

The authors declare no conflict of interest.

Authors' declaration

The authors hereby declare that the work presented in this article are original and that any liability for claims relating to the content of this article will be borne by them.

Authors' Contributions

All authors had full access to all study data and take responsibility for its integrity and the accuracy of the analysis. Lian Liu and Song Wei Su were responsible for the study concept and design. Lian Liu and Fan Li were responsible for data acquisition, and Lian Liu and Siping Yu were responsible for data extraction. The assessment of bias risk was

performed by Lian Liu and Qiuxia Liu; data analysis and interpretation were performed by Lian Liu. The paper was drafted by Lian Liu, while Hong Yan Sun, provided critical paper review for important intellectual content. Statistical analyses were performed by Lian Liu and Hong-Yan Sun supervised the study.

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