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Meta-Analysis

Effectiveness and Safety of Acupuncture Combined with Bloodletting Cupping Therapy in the Treatment of Scapulohumeral Periarthritis: A Systematic Review and Meta-Analysis

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Abstract:

Background: Scapulohumeral periarthritis commonly afflicts individuals in their middle age. Its etiology is multifaceted, and treatment presents a challenge with a high risk of recurrence. The main symptoms include shoulder pain and limited joint mobility, seriously affect the quality of life of the patients. Recent research indicate that acupuncture combined with bloodletting cupping can significantly improve the function of activity of shoulder joint and the pain in individuals with scapulohumeral periarthritis. However, these studies have typically been limited in scope, therefore additional research to substantiate the efficacy and safety of these intervention. **Methods:** To evaluate the efficacy of acupuncture combined with bloodletting cupping for treating patients with scapulohumeral periarthritis. We conducted an online search of databases in both Chinese and English, including PubMed, the Cochrane Library, Embase, Web of Science, CNKI, Wangfang Data, China Science and Technology Journal Database (VIP) and Chinese BioMedical Literature Database (CBM), to collect randomized controlled trials (RCTs) concerning the use of acupuncture combined with bloodletting cupping in scapulohumeral periarthritis patients. We also examined the references within the identified literature. Search utilised subject headings and free-text terms in both languages, without racial restrictions, for records up to April 3, 2024. Two researchers independently screened the literature, extracted data, and evaluated their qualities. RevMan 5.3 software was used for meta-analysis of the included studies. The protocol of this review was recorded in the International Platform of Registered Systematic Review and Meta-analysis Protocols (PROSPERO). Its registration number is CRD42023454614. **Results:** This review incorporated 22 RCTs involving a total of 1,774 patients. The results of meta-analysis showed that the clinical effective rate (RR=1.25, 95%CI [1.20, 1.30], $P<0.00001$) of treating scapulohumeral periarthritis with acupuncture combined with bloodletting cupping was higher in the experimental group than in the control group. The all of Visual Analogue Scale (VAS) score (MD=-1.70, 95% CI [-2.17, -1.22], $P<0.00001$). Melle score (SMD=-2.45, 95% CI [-2.55, -2.34], $P=0.007$]) and recurrence rate (RR=0.23, 95% CI [0.07, 0.77], $P=0.02$) were lower in the experimental group than in the control group with statistical significance ($P<0.05$). **Conclusion:** The acupuncture combined with bloodletting cupping for the treatment of shoulder impingement syndrome demonstrates definite efficacy and safety, with superior clinical effectiveness, pain relief, improvement in shoulder joint mobility, and reduction in recurrence compared to acupuncture alone. Therefore, it is worthy of being promoted and applied clinically.

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1. Background

Scapulohumeral periarthritis (SP) refers to a condition characterized by chronic inflammation, adhesion of tendons, tendon sheaths, bursae, and joint capsules around the shoulder joint. This condition leads to limited shoulder movement, pain, and functional impairment [1]. The prevalence of SP ranges from 2% to 5%, predominantly affecting individuals aged 40 to 70, with a higher incidence observed in females [2]. In severe cases, scapulohumeral periarthritis can cause muscle atrophy in the shoulder region, which may result in dependence for daily activities. This condition is prevalent and recurrent in clinical settings. Studies suggest a rising incidence of SP, representing an escalating healthcare challenge. Without timely and effective treatment, SP can significantly deteriorate the quality of life of patients, imposing both financial and lifestyle burdens, thereby adversely affecting the physical and mental health [3].

Treatments for SP include conservative and surgical strategies. Conservative treatments generally consist of oral medication and rehabilitation exercises, while surgical options include joint distension, manipulation under anaesthesia, arthroscopic release, and open release surgeries [4]. Oral medications may cause varying degrees of liver and kidney damage, while surgical treatments may pose certain risks to the body and may resulting in suboptimal outcomes [5]. However, combination of acupuncture with bloodletting cupping has recently emerged as an effective treatment, achieving notable therapeutic success. This approach, by facilitating the flow of qi and clearing the meridians, effectively dispels internal dampness and cold. Owing to its minimal side effects, eco-friendly nature, superior efficacy, and cost-effectiveness, this treatment has gained widespread recognition and favourable evaluations in the management of SP [6].

Research comparing the clinical efficacy of acupuncture with bloodletting cupping therapy to the oral administration of diclofenac sodium sustained-release tablets in the treatment of acute SP found that the former exhibited a higher overall effective rate and improved Michael Reese Medical Centre shoulder scores. Additionally, there was a decrease in visual analogue scale (VAS) scores and shoulder joint mobility scores, with no adverse reactions reported [7].

The distinct mechanism of acupuncture coupled with bloodletting cupping therapy entails stimulating acupoints to balance yin and yang, harmonize qi and blood, and clear meridians, thereby nourishing the liver and kidneys, expelling wind and dampness, activating blood circulation to alleviate pain, and suppressing the human sympathetic nervous system, which aids in reducing tendon and ligament spasms or adhesions [8]. Bloodletting cupping therapy involves pricking small vessels in the affected shoulder to induce minor bleeding and applying cups to create a negative pressure on the skin. This not only aids in the removal of superficial skin cells and internal toxins but also generates heat that expands blood vessels, boosts blood flow, and promotes SP recovery [9]. Clinically, it has been observed that some patients do not efficiently expel residual toxins with acupuncture alone, impacting the treatment's effectiveness.

The integration of acupuncture with bloodletting cupping therapy offers a multifaceted approach by not only balancing yin and yang, harmonizing qi and blood, and clearing meridians to nourish the liver and kidneys, dispel wind and dampness, and activate blood circulation to mitigate pain but also by inhibiting the sympathetic nervous system, alleviating tendon and ligament spasms or adhesions, and reducing the synthesis of endogenous compounds like dopamine for anti-inflammatory and analgesic outcomes [10-11].

In recent years, the clinical adoption of acupuncture with bloodletting cupping therapy for SP has aimed to improve therapeutic results, capitalizing on the unique benefits of both modalities. There has been an increase in interventional studies exploring this combined treatment for shoulder periarthritis. However, a comprehensive literature search indicates a gap in reported meta-analyses on the efficacy of this integrative therapy. This study, therefore, seeks to incorporate RCTs that examine shoulder periarthritis treatment with acupuncture and bloodletting cupping, to perform a systematic and quantitative meta-analysis of data from various independent investigations. The objective is to evaluate the effectiveness and safety of this combined therapy systematically, thus offering evidence-based support for SP clinical management, guiding clinical decisions with the best evidence available, and improving the standard of healthcare provision.

2. Materials and Methods

2.1. Inclusion and Exclusion Criteria

The inclusion criteria of this study were formulated according to the PICOS principles as follows: (1) P: The subjects met the diagnostic criteria for SP, without restrictions on sex, occupation, education, nationality, etiology, or disease severity. (2) I: The experimental group underwent acupuncture (it includes electro acupuncture, acupuncture, warm acupuncture, autotomy) combined with bloodletting cupping therapy. C: The control group received bloodletting cupping therapy alone. (4) O:The outcomes were clinical efficacy rate, pain score, shoulder joint functional activity, and adverse reactions. Pain score was evaluated using the visual analogue scale (VAS). Shoulder joint functional activity was evaluated using the Melle Scores. (5) S: The study type was a randomized controlled trial (RCT). The exclusion criteria are as follows: (1) literature inaccessible or lacking original data; (2) duplicate publications; (3) literature quality rated as Grade C; (4) non-Chinese or non-English literature.

2.2. Literature Retrieval Strategy

We conducted a comprehensive digital search across different databases, including the China National Knowledge Infrastructure (CNKI), WanFang Data, VIP Chinese Journal Service Platform, Chinese Biomedical Literature Database (CBM), and English databases, such as PubMed, EMbase, The Cochrane Library, Web of Science, and CINAHL. Our aim was to collate RCTs concerning the acupuncture combined with bloodletting cupping therapy in the treatment of SP. The search extended from the inception of each database until November 2023. Additionally, we conducted manual searches of key orthopaedic journals to enhance and broaden the compilation of relevant literature. The search terms in English included: scapulohumeral periarthritis, bursitis in shoulder, periarthritis of shoulder , shoulder periarthritis frozen shoulder, shoulder pain；pricking-cupping,bloodletting and cupping, cupping therapy, bloodletting, pricking blood with cupping, blood-letting cupping, pricking-cupping bloodletting method, blood-letting therapy, cupping, blood-pricking therapy, blood-letting puncture, cupping treatment, Cupping Treatments; acupuncture and moxibustion, acupuncture therapy, acupuncture treatment, pharmaco acupuncture treatment, acupotomy, acupotomies; randomized controlled trial, randomized control, randomized, random, randomly, randomized controlled trial, RCT. See the supplementary material for details.

2.3. Literature Screening and Data Extraction

Two researchers independently conducted literature screening and data extraction based on predefined inclusion and exclusion criteria, followed by a meticulous cross-verification process. In cases of discrepancies, a third researcher was consulted for a decisive adjudication. The screening process commenced with an initial review of titles and abstracts to filter out patently irrelevant studies, followed by a detailed evaluation of

the full texts to determine their eligibility for inclusion. The extracted information primarily included: the lead author, publication date, sample size, age, intervention measures, duration of intervention, and outcome indicators.

2.4. Quality Assessment of Included Literature

Two researchers independently evaluated the quality of the included studies using the Cochrane Handbook for Systematic Reviews of Interventions, Version 5.1.0, as a guide [12]. In instances of disagreement, a third researcher was called upon to assist in reaching a consensus. The evaluation criteria encompassed aspects such as random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, completeness of outcome data, selective reporting, and other potential sources of bias. Each criterion was judged as 'low risk of bias', 'high risk of bias', or 'unclear risk of bias'. Studies meeting all criteria were designated as Grade A, indicating low bias; those meeting some criteria as Grade B, denoting moderate bias; and those not meeting any as Grade C, signifying high bias.

2.5. Statistical Analysis

Meta-analysis was conducted using RevMan 5.3 software [13]. We used binary outcomes using relative risk (RR) and 95% confidence intervals (CIs). For continuous outcomes, we used the weighted mean difference (WMD) and 95% CIs if the measurement tools were the same, or the standardized mean difference (SMD) and 95% CIs if they were not. Study heterogeneity was assessed using P-values and the I^2 test: heterogeneity was considered significant if $P \leq 0.1$ and $I^2 \geq 50\%$, prompting the use of a random-effects model for data analysis; otherwise, a fixed-effects model was applied. When the source of heterogeneity could not be determined, descriptive analysis was employed in lieu of meta-analysis. Subgroup analyses were conducted to explore sources of heterogeneity, with a significance level of $\alpha = 0.05$ and a threshold of $P \leq 0.05$ for statistical significance.

3. Results

3.1. Literature Screening Process and Outcomes

Following the pre-established search strategy and data collection methods, an initial search yielded 408 relevant publications. After deduplication, 284 articles were remained. The titles and abstracts were reviewed and 234 were excluded for did not align with the study's inclusion criteria regarding research type and intervention measures. This preliminary screening resulted in 50 articles included, and full texts were reviewed. Further scrutiny of these full texts, based on inclusion criteria, outcome measures, and data completeness, led to the final inclusion of 22 RCTs [14-35], encompassing a total of 1774 patients, 889 in the experimental group and 885 in the control group. The process and results of the literature screening are depicted in Figure 1.

3.2. Basic Characteristics and Bias Risk Assessment of Included Studies

Selection Bias due to Inadequate Generation of Random Sequences: Of the 22 studies included, ten [14,16,18,22-24,28-29,32-33] mentioned the use of random number tables, thus assessed as 'low risk'; one [28] did not specify the randomization method; and the remaining studies mentioned randomization without detail, assessed as 'unclear'. Selection bias due to inadequate concealment of allocation: two studies [18,22] mentioned using sealed envelope method for allocation concealment, thus assessed as 'low risk'; and the remaining studies without mention, assessed as 'unclear'. Performance Bias: None of the studies mentioned the implementation of blinding, thus being assessed as 'unclear'. Detection bias: one studies [23] talked about dropout, but only looked at those who were actually supposed to be in the study. The amount of missing data in the outcome measures wasn't high enough to have a clinically relevant effect on the estimate of the intervention

effect, so it was called "low risk." Complete data reporting: The rest of the studies had no incomplete data, hence being assessed as 'low risk'. Reporting Bias: None of the studies could provide the original study protocols, but the published reports included all expected outcomes, thus being assessed as 'low risk'. Other Sources of Bias: All studies were unable to ascertain the presence of other sources of bias affecting the outcomes, thus being assessed as 'unclear'. The basic characteristics of the included studies are presented in Table 1, and the risk of bias assessment results for the included RCT studies are shown in Table 2.

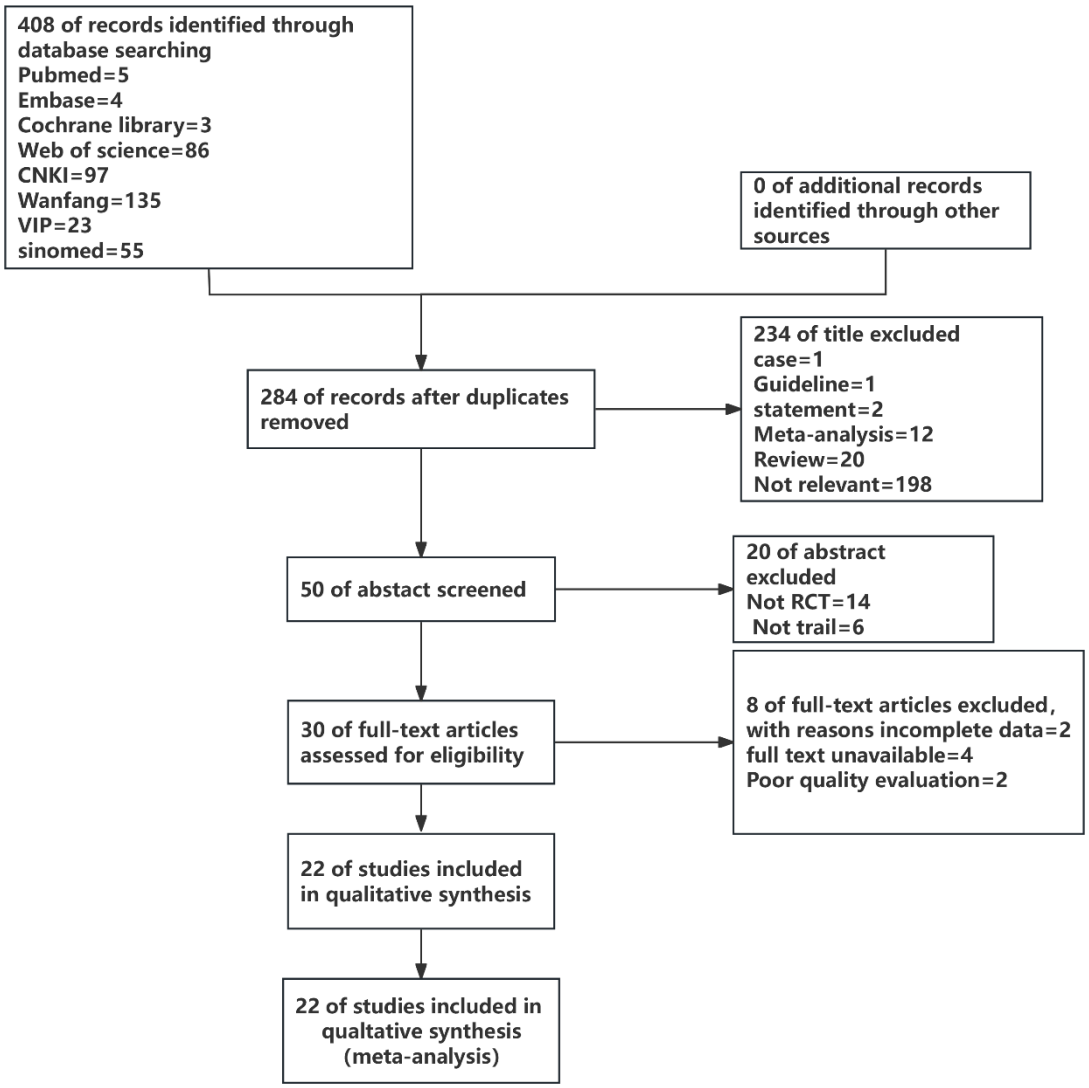

Figure 1. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow chart of study selection

The characteristics of the included studies are detailed in Table 1, and the risk of bias assessment for the included studies is as follows:

Table 1. Characteristics of the included studies

Included studies	Participants (Experimental group/Control group)	Intervention		Duation (days)	Age (year)	Outcome
		Experimental group	Control group			
Chen 2009[11]	30/28	Pricking cupping +A	A	60	T:52±1.56 C:53±1.25	①②
Zhang 2010[12]	60/60	Pricking cupping+B	B	20	T:— C:—	①
Li 2014[13]	60/60	Pricking cupping +A	A	28	43-61	①
Chen 2015[14]	38/38	Pricking cupping+B	B	28	T:51.28±7.23 C:53.13±6.35	①②
Zheng 2015[15]	30/30	Pricking cupping+B	B	28	T:54.50±5.01 C:54.23±5.84	①②
Jiang 2016[16]	60/60	Pricking cupping+B	B	20	T:— C:—	①
Huang 2017[17]	26/26	Pricking cupping+B	B	12	T:53.1±5.5 C:52.6±5.6	①
Wang 2018[18]	39/39	Pricking cupping+C	C	4	T:53.36±7.25 C:52.20±8.39	①④
Nie 2018[19]	30/30	Pricking cupping+D	D	14	T:48.20±4.397 C:48.30±4.170	①②③
Huang 2019[20]	39/37	Pricking cupping+B	B	20	T:52.81±7.84 C:53.16±8.23	①
Liu 2019[21]	42/42	Pricking cupping+C	C	20	T:52.46±4.17 C:53.18±3.96	①
Zhang 2020[22]	25/25	Pricking cupping+B	B	10	T:52.4±5.3 C:51.2±3.6	①④
Xu 2020[23]	30/30	Pricking cupping+B	B	28	T:55.37±5.29 C:54.60±5.24	①
Wang 2020[24]	32/32	Pricking cupping+B	B	28	T:44.25±0.17 C:45.28±0.25	①②③
Wang 2021[25]	50/50	Pricking cupping+B	B	28	T:61.8±2.7 C:62.4±2.6	①
Zhu 2021[26]	50/50	Pricking cupping+C	C	28	T:51.32±2.16 C:51.29±2.12	①②
Gou 2021[27]	40/40	Pricking cupping+C	C	20	T:52.20±2.71 C:52.18±2.75	②
Fang 2021[28]	50/50	Pricking cupping+C	C	30	T:53.16±1.34 C:53.34±1.31	①
Yang 2021[29]	42/42	Pricking cupping+C	C	22	T:53.95±3.92 C:53.89±3.87	①②
Huang 2022[30]	36/36	Pricking cupping+C	C	10	T:50.78±2.98 C:51.21±3.23	①③
Deng 2022[31]	30/30	Pricking cupping +A	A	9	T:60.63±6.73 C:59.3±7.97	①②
Su 2022[32]	50/50	Pricking cupping+C	C	20	T:53.13±3.40 C:52.12±3.46	①②

Note: T=Experimental group；C=Control group；① Total Clinical effective rate；②Pain；③ range of motion；④ Relapse rate; A: Electroacupuncture B: Acupuncture C: Warm acupuncture D: acupotomy

Table 2. Methodological Quality Assessment of the Included Literature（n=22）

Included studies	Random Sequence	Allocation Concealment	Blinding of Subjects/Researchers	Blinding of OutcomeAssessors	Complete Data Reporting	Selective Reporting	Other Bias Sources	Evidence Level (Grade)
Chen 2009[13]	Low risk	Unclear	Unclear	Low risk	Low risk	Low risk	Unclear	B
Zhang 2010[15]	Unclear	Unclear	Unclear	Low risk	Low risk	Low risk	Unclear	B
Li 2014[16]	Low risk	Unclear	Unclear	Low risk	Low risk	Low risk	Unclear	B
Chen 2015[17]	Unclear	Unclear	Unclear	Low risk	Low risk	Low risk	Unclear	B
Zheng 2015[18]	Low risk	Low risk	Unclear	Low risk	Low risk	Low risk	Unclear	B
Jiang 2016[19]	Unclear	Unclear	Unclear	Low risk	Low risk	Low risk	Unclear	B
Huang 2017[20]	Unclear	Unclear	Unclear	Low risk	Low risk	Low risk	Unclear	B
Wang 2018[21]	Low risk	Unclear	Unclear	Low risk	Low risk	Low risk	Unclear	B
Nie 2018[22]	Low risk	Low risk	Unclear	Low risk	Low risk	Low risk	Unclear	B
Huang 2019[23]	Low risk	Unclear	Unclear	Low risk	Low risk	Low risk	Unclear	B
Liu 2019[24]	Low risk	Unclear	Unclear	Low risk	Low risk	Low risk	Unclear	B
Zhang 2020[25]	Unclear	Unclear	Unclear	Low risk	Low risk	Low risk	Unclear	B
Xu 2020[26]	Unclear	Unclear	Unclear	Low risk	Low risk	Low risk	Unclear	B
Wang 2020[27]	Unclear	Unclear	Unclear	Low risk	Low risk	Low risk	Unclear	B
Wang 2021[28]	Unclear	Unclear	Unclear	Low risk	Low risk	Low risk	Unclear	B
Zhu 2021[29]	Low risk	Unclear	Unclear	Low risk	Low risk	Low risk	Unclear	B
Gou 2021[30]	Low risk	Unclear	Unclear	Low risk	Low risk	Low risk	Unclear	B
Fang 2021[31]	Unclear	Unclear	Unclear	Low risk	Low risk	Low risk	Unclear	B
Yang 2021[32]	Low risk	Unclear	Unclear	Low risk	Low risk	Low risk	Unclear	B
Huang 2022[33]	Low risk	Unclear	Unclear	Low risk	Low risk	Low risk	Unclear	B
Deng 2022[34]	Unclear	Unclear	Unclear	Low risk	Low risk	Low risk	Unclear	B
Su 2022[35]	Unclear	Unclear	Unclear	Low risk	Low risk	Low risk	Unclear	B

4. Meta-Analysis Results

4.1. Clinical Efficacy Rate

Five studies [14–29, 31-25] encompassing a total of 1694 participants explored the clinical efficacy rate of acupuncture combined with bloodletting cupping in treating SP. Homogeneity was observed among the studies (P=0.10, I^2=0%). Consequently, a fixed-effect model was employed for the pooled analysis. The results revealed a statistically significant higher overall clinical efficacy rate in the experimental group compared to the control group [Z=11.29, RR=1.25, 95% CI (1.20, 1.30), P<0.00001], as detailed in Figure 2.

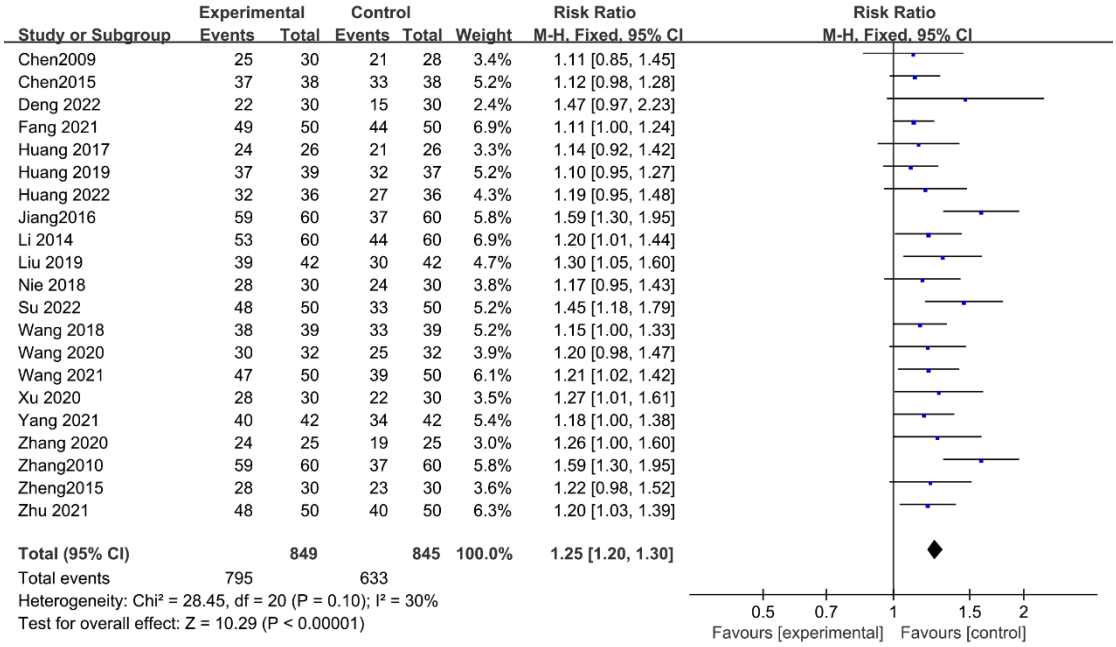

Figure 2. Forest plot of the clinical efficacy rates

4.2.Pain Scores

Ten studies [14,17-18,22,27,29-30,32,34–35] investigated the effect of acupuncture combined with bloodletting cupping on pain in patients with SP, involving a total of 806 participants. The pain scores were assessed using the VAS scales. Significant heterogeneity was observed across the studies (P<0.00001, I^2=90%), necessitating the use of a random effects model for the meta-analysis. The results indicated a statistically significant improvement in VAS scores in the experimental group compared to the control group [Z=7.01, MD=-1.70, 95% CI (-2.17, -1.22), P<0.00001], as elaborated in Figure 3. A sensitivity analysis, excluding the studies by Zheng 2015 [18], showed a significant reduction in heterogeneity (P<0.00001, I^2=88%), necessitating the use of a random effects model for the meta-analysis of the remaining studies. This analysis confirmed the significant superiority of the experimental group in VAS scores [Z=6.35, MD=-1.56, 95% CI (-2.05, -1.08), P<0.00001].

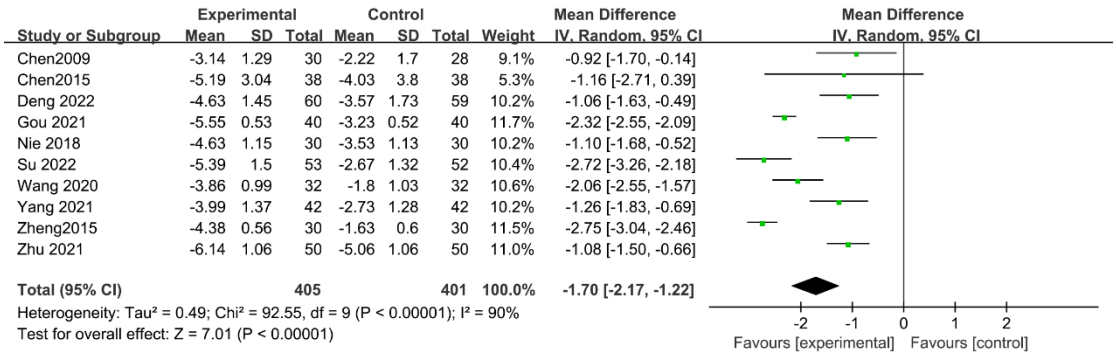

Figure 3. Forest plot of the pain scores

4.3. Shoulder Joint Functional Activity

Three studies [22, 27, 33] investigated the effect of acupuncture combined with bloodletting cupping in patients with SP, assessed using the Melle scores system. The research encompassed 196 participants. Homogeneity was observed among these studies (P<0.00001, I^2=48%), leading to the use of a fixed-effect model for the combined analysis. The results indicated that the Melle scores in the experimental group were significantly lower than those in the control group [Z=46.64, MD=-2.45, 95% CI (-2.55, -2.34), P<0.00001], as elaborated in Figure 4.

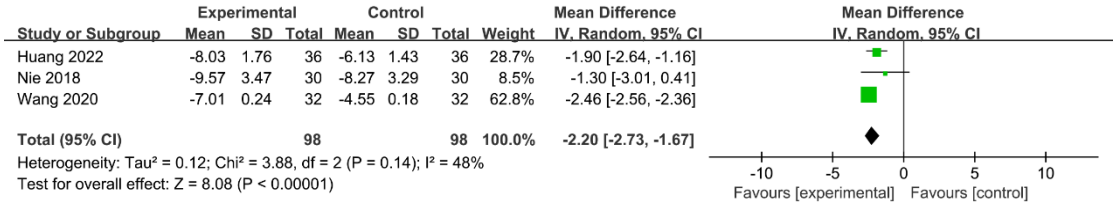

Figure 4. Forest plot of the shoulder joint functional activity

4.4. Adverse Reactions Rate

Two studies [21,25] investigated the adverse reactions rate of acupuncture combined with bloodletting cupping in patients with SP, involving a total of 128 participants. Homogeneity was observed among these studies (P=0.86, I^2=0%), leading to the use of a fixed-effect model for the combined analysis. The results indicated that the adverse reactions rate in the experimental group were significantly lower than those in the control group [Z=2.38, RR=0.23, 95% CI (0.07, 0.77), P=0.02], as elaborated in Figure 5.

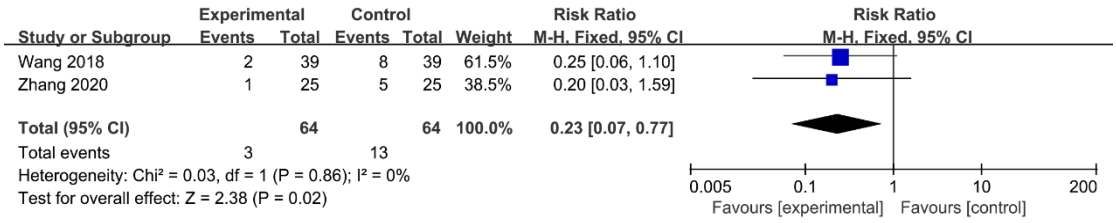

Figure 5. Forest plot of the adverse reactions rate

4.5. Adverse events

Among the included studies, one study [33] mentioned that there was one case of vomiting and one case of blister formation during the treatment process in the experimental group. While there were two cases of vomiting and one case of hematoma

during the treatment process in the control group. The comparison of the incidence of adverse reactions between the two groups showed no statistically significant difference ($P > 0.05$), indicating that the adverse reaction rate of ACBC therapy was low and the safety was good.

4.6. Publication Bias

Using clinical efficacy as an indicator, a funnel plot analysis was conducted to qualitatively analyse publication bias. The scatter distribution of each study was basically symmetrical, indicating a small possibility of publication bias. Robustness analysis was also employed to test for publication bias and the results showed that there was no reversal or significant change in clinical efficacy, VAS score, Melle score, and recurrence rate. The stability and reliability of the meta-analysis results are good, indicating that the research results are reliable. See Figure 6 for details.

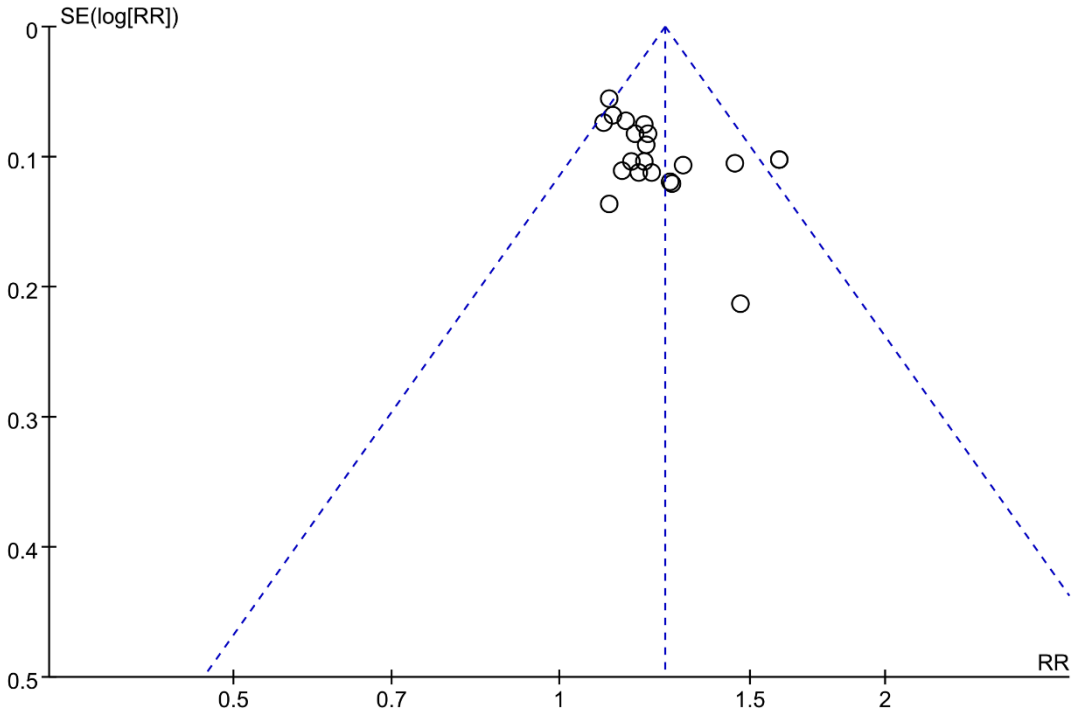

Figure 6. Funnel plot

5. Discussion

5.1. The results of meta-analysis

Acupuncture combined with bloodletting cupping (ACBC) therapies have demonstrated superior effectiveness over acupuncture alone in alleviating pain, improving shoulder joint mobility, and reducing recurrence rates in the treatment of SP. This reinforces the efficacy of this integrative treatment modality, offering evidence-based justification for its clinical use in mitigating joint pain and enhancing mobility. The theoretical foundation for this approach is anchored in Traditional Chinese Medicine (TCM), specifically the "Suwen Bitheory," which classifies SP within the painful obstruction syndrome category. This condition is primarily attributed to the invasion of wind, cold, and dampness, causing blockages in the meridians and vessels, and impairing the circulation of nutritive and defensive qi and blood. The pathogenesis of SP involves both internal and external factors that obstruct the local meridians of the shoulder, leading to the malnourishment of muscles and tendons, compression of vessels, and eventual

deterioration of tendons and ligaments. This process disrupts the circulation of qi and blood in the meridians, resulting in pain and limited mobility of the shoulder joint [21]. Acupuncture not only stimulates local nerves in the shoulder, clearing meridians, promoting blood circulation, relieving pain, and dispelling wind but also enhances the release of endorphins, enkephalins, and dynorphins, as well as the synthesis of serotonin. By stimulating specific points, it regulates neural activity and promotes nerve impulse transmission, improving metabolism, blood circulation, and achieving analgesic effects [36]. Secondly, it has been discovered that the technique of pricking blood and cupping, which involves bleeding small vessels in the targeted area followed by the application of cupping, utilizes tools to aid in disease treatment. The negative pressure generated by cupping encourages the removal of aged cells from the skin's surface, facilitates the expulsion of toxins and waste, produces localized warmth, expands blood vessels, improves blood flow, increases vascular permeability and the phagocytic capacity of cells, eliminates wind and cold, diminishes swelling, and enhances the circulation of qi and blood, effectively relieving pain. Additionally, by exerting regulatory effects on nerves, blood vessels, and body fluids, this method prevents the onset of pain and rejuvenates the body's natural pain self-regulation mechanisms, thereby offering pain relief [27]. Thirdly, research by Liu Jun and colleagues [24] has shown that in patients with periarthritis of the shoulder, levels of interleukin 6 (IL-6) and tumour necrosis factor-alpha (TNF-α) significantly decreased after treatment with ACBC. This indicates that the combined treatment can alleviate inflammation and pain mediators in SP, exhibiting a potent anti-inflammatory effect. Pain relief also encourages patients to move their shoulders more freely, reducing mobility restrictions and thereby enhancing shoulder joint function.

5.2. The meta-analysis results showed a certain degree of heterogeneity.

Heterogeneity was observed in the VAS scores, and upon the sequential exclusion of included studies, the heterogeneity index I^2 decreased from 90% to a minimum of 88%, without significant alteration, suggesting multiple potential causes: firstly, Variations in study design could lead to disparities in outcomes, including differences in the specific methodologies and technical execution of ACBC therapy, which might influence the results. Secondly, differences in patient demographics, the severity of conditions, and duration of disease could contribute to discrepancies in outcomes. Thirdly, Variations in treatment approaches, including the number of sessions, frequency, and duration of ACBC therapy, might affect the therapeutic efficacy. Given the heterogeneity in VAS scores, this paper could not identify the sources of heterogeneity, hence, it is recommended to conduct further large-scale, multi-center studies to validate these findings and explore the potential reasons for heterogeneity, exercising caution in the interpretation of results.

5.3. Limitations

This study offers a thorough assessment of the effectiveness of acupuncture combined with bloodletting cupping (ACBC) therapy in treating scapulohumeral periarthritis (SP), presenting wide-ranging application possibilities. It introduces new reference points for researchers and contributes to the evolution of ACBC therapy and SP treatment methodologies. Nonetheless, clinical practice should continue to focus on customized treatments and incorporate other therapeutic strategies to improve outcomes and reduce the risk of adverse effects. Future investigations are required to explore the mechanisms behind ACBC therapy, providing a more scientific and robust theoretical foundation for clinical applications.

While the literature included in this analysis satisfies the study's criteria, the methodological quality is variable. Consequently, future research should strive for more rigorous design, execution, and reporting, in line with the Consolidated Standards of Reporting Trials (CONSORT) [37]. Detailed descriptions or clear explanations of

randomization methods and allocation concealment measures are necessary. Despite the challenges in implementing blinding for ACBC, it is advised to blind outcome assessors to reduce assessment bias. It is recommended that research protocols be registered with authoritative platforms [38], such as the World Health Organization's International Clinical Trials Registry Platform or clinicaltrial.com, report sample size calculations, and employ intention-to-treat analysis to address missing data, thereby enhancing the reliability of RCT outcomes.

6. Conclusion

Based on the above results, the following conclusions can be drawn regarding the treatment of SP with ACBC therapy: ACBC therapy is superior to acupuncture alone in reducing pain, recurrence rate and adverse reaction rate and improving shoulder joint function activity. The safety of ACBC therapy was good.

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Author contributions

MHX and SJS was responsible for conceptualization and methodology. MHX and ZXY was responsible for formal analysis and writing-original draft preparation. WQY and LB was responsible for software, validation. ZJX also reviewed, edited and supervision. XZF and MB was responsible for resources and data curation. All authors have read and agreed to the published version of the manuscript.

Competing interests

The authors declare no conflicts of interest.

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