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Review Article

Effectiveness and safety of acupuncture for carpal tunnel syndrome: An overview of systematic reviews and meta-analyses

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ABSTRACT

Background: Several systematic reviews (SRs) and meta-analyses (MAs) have explored the effectiveness and safety of acupuncture for Carpal Tunnel Syndrome (CTS), but findings are inconsistent and vary in quality. Therefore, this overview aims to evaluate these SRs and MAs critically, synthesizing existing evidence on acupuncture in treating CTS.

Methods: We searched 7 databases from their inception to April 25, 2024, using the keywords "acupuncture", "carpal tunnel syndrome", and "systematic review". Methodology and reporting quality were assessed using AMSTAR 2 and PRISMA. The risk of bias was evaluated using ROBIS, and evidence certainty was appraised using GRADE.

Results: 9 related SRs/MAs were included, with 8 judged as critically low quality and 1 rated as low quality by AMSTAR 2. According to the PRISMA checklist, while 7 SR/MAs were found to adequately report over 70 %, none reported all items. The ROBIS assessment rated 4 SRs/MAs with a low risk of bias and 5 with a high risk. The quality of evidence evaluated by GRADE was low or very low. Descriptive analyses indicated that acupuncture could effectively reduce pain intensity, but evidence on responder rate, symptom severity, functional status, and electrophysiological parameters was inconsistent. No serious adverse events associated with acupuncture were found.

Conclusions: Acupuncture might be beneficial for CTS. However, given the existing evidence limitations, the efficacy of acupuncture for CTS requires confirmation through further high-quality research.

Protocol registration: PROSPERO (CRD42023409659).

1. Introduction

Carpal tunnel syndrome (CTS), the most prevalent peripheral nerve entrapment syndrome,[1] is caused by compression of the median nerve as it travels through the carpal tunnel.[2] This pathological compression typically results from a reduction in the dimensions of the carpal tunnel or an increase in the volume of its contents. The prevalence of CTS is 3.8 % in the general population, increasing to 10 % among individuals performing repetitive manual tasks.[3,4] CTS is characterized by pain and paresthesias in the hand(s).[5] Patients with moderate to severe CTS may experience atrophy of the thenar muscle and weakness in pinch grasp.[6] Therefore, CTS often leads to work disability,[3] making it a crucial healthcare concern that deserves wider attention.

Currently, both non-surgical and surgical treatments are available for CTS.[7] Non-surgical approaches for treating CTS encompass local steroid injections, oral medications, ultrasound, and splinting.[8] However, the evidence supporting the efficacy of these conservative treatments remains inadequate.[9] Surgical decompression stands as a firmly established treatment for CTS, but it involves potentially more complications, such as scar tenderness.[10,11] Hence, there is a compelling need to seek a secure and efficacious non-surgical intervention for individuals with CTS.

Acupuncture, an essential method in Traditional Chinese Medicine, has been utilized for centuries to treat neuro-musculoskeletal disorders. Numerous studies have confirmed its analgesic effects, and it is increasingly recommended as a potentially beneficial option for treating CTS.[12,13] Nowadays, a multitude of systematic reviews (SRs) and meta-analyses (MAs) have been carried out to investigate the effectiveness and safety of acupuncture in treating CTS. However, the evidence presented in these SRs/MAs is inconsistent and varies in quality, poten-

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tially leading to misinformation for patients, clinical practitioners, and policymakers. For instance, a SR of 10 trials suggests that acupuncture is superior to conventional medications in improving symptom severity.[14] However, the study by Dong et al. reports that acupuncture has no advantage over medication.[15] Thus, an overview of this matter is necessary.

Overview serves as a comprehensive approach to synthesize findings from SRs/MAs, critically evaluate their quality, and attempt to reconcile any divergent results.[16] By providing a thorough synthesis and evaluation, this approach can facilitate an understanding of the reliability of knowledge concerning a specific topic. This overview intends to assess the quality of SRs/MAs on acupuncture for CTS, summarizing evidence of its effectiveness and safety, thereby ascertaining the reliability of current evidence and guiding clinical practice.

2. Methods

2.1. Protocol and registration

This overview was prospectively registered in PROSPERO (CRD42023409659).

2.2. Search strategy

Four English databases (PubMed, Embase, Cochrane Library, and Web of Science) and three Chinese databases (Chinese National Knowledge Infrastructure [CNKI], Chinese Science and Technology Periodical Database [VIP], and Wan Fang database) were searched from their inception to April 25, 2024, using the keywords “acupuncture”, “carpal tunnel syndrome”, and “systematic review”. The detailed search strategies can be found in Supplement 1.

2.3. Inclusion and exclusion criteria

2.3.1. Inclusion criteria

(1) Study design: SRs or MAs of randomized controlled trials (RCTs).

(2) Participants: Patients diagnosed with primary CTS, based on any specific criteria, including electrodiagnostic parameters or relevant clinical diagnostic criteria. No restrictions were applied regarding age, gender, race, or severity of CTS.

(3) Intervention: Acupuncture alone or acupuncture combined with other treatments. No limitations were imposed on acupuncture modality (e.g., manual acupuncture, electroacupuncture, laser acupuncture, and moxibustion).

(4) Comparison: Relevant active treatments (e.g., corticosteroid nerve blocks, splints, and drugs), sham acupuncture, or no treatment.

(5) Outcomes: Results reported from each SR/MA should include at least one of the following outcome measures:

- Responder rate: responders (those whose conditions improved) versus non-responders (those whose conditions remained the same or worsened);
- Symptom severity: measured by Boston Carpal Tunnel Questionnaire Symptom Severity Scale (SSS) or Global Symptom Score (GSS);
- Functional status: measured by Boston Carpal Tunnel Questionnaire Functional Status Scale (FSS) or Disabilities of Arm, Shoulder and Hand Questionnaire (DASH);
- Pain intensity: measured by visual analogue scale (VAS);
- Electrophysiological parameters: including compound muscle action potential (CMAP), sensory nerve action potential (SNAP), distal motor latency (DML), distal sensory latency (DSL), and nerve conduction velocity (NCV).

2.3.2. Exclusion criteria

SRs/MAs were excluded for meeting any of the listed conditions: (1) participants were diagnosed with CTS accompanied by systemic diseases, such as diabetes and rheumatoid arthritis; (2) the full text was unavailable; (3) duplicate publications, or meeting abstracts.

2.4. Study selection

The results from each database were imported into EndNote software, X9. After removing duplicate records, two researchers (QZ and SHN) individually reviewed the titles and abstracts for the initial screening. Subsequently, the same researchers downloaded the full texts of the potentially eligible articles for further screening. Discrepancies in opinions were addressed by consulting a third researcher (QAZ).

2.5. Data collection

Two researchers (YLL and CW) individually extracted related data and completed a predefined data-collecting form. The extracted data included: first author, publication year, number of studies, number of patients, searched databases, intervention, control, outcomes, quality assessment tools, quality of primary studies, and conclusions. Authors would be contacted in case of missing information. Discrepancies were addressed by consulting a third researcher (QAZ). We used Corrected Covered Area (CCA) to evaluate the overlap of included studies. CCA calculations were conducted following Pieper et al.’s protocol according to $CCA = (N - r)/(rc - r)$, where “N” represents the total number of primary studies, “r” represents the number of non-duplicated primary studies, and “c” represents the count of reviews.[17,18] Overlap was interpreted using predefined thresholds (slight: 0–5 %, moderate: 6–10 %, high: 11–15 %, very high: >15 %).

2.6. Assessment method

Two researchers (YLL and QW) independently conducted assessments of the included SRs/MAs, evaluating methodological quality, reporting quality, risk of bias, and certainty of evidence. After completion, the results were cross-checked by the same researchers, with any disparities resolved by consulting a third researcher (QAZ).

(1) We employed the AMSTAR 2 to evaluate the methodological quality.[19] This checklist, encompassing 16 items (7 critical and 9 non-critical), covers the entire process of systematic review. Each item is judged as “yes”, “partial yes”, or “no”. The overall assessment is categorized into four levels (high, moderate, low, and critically low) depending on identified flaws.

(2) The Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) checklist was utilized to assess the reporting quality. It contains 27 items, each evaluated as “yes”, “partial yes”, or “no”, with the completion level quantified as a ratio.[20,21]

(3) The Risk of Bias in Systematic Reviews (ROBIS) tool was applied to evaluate the risk of bias.[22] This tool comprises 3 phases: Phase 1 (optional) judges the pertinence of the study question. Phase 2 contains 4 domains to identify concerns in the review process, while Phase 3 determines the overall risk of bias, rated as “low”, “high”, or “unclear”.

(4) The Grading of Recommendations Assessment, Development and Evaluation (GRADE) system was utilized to assess the evidence quality.[23] Evidence derived from RCTs is initially considered of high quality. However, there are five aspects that can influence the quality, including study limitations, inconsistency, indirectness, imprecision, and publication bias. Based on the results, the quality of evidence is rated as “High”, “Moderate”, “Low”, or “Very Low”.

2.7. Data synthesis

Considering the heterogeneity among SRs/MAs, a quantitative synthesis was not performed. Instead, we performed a descriptive analysis.

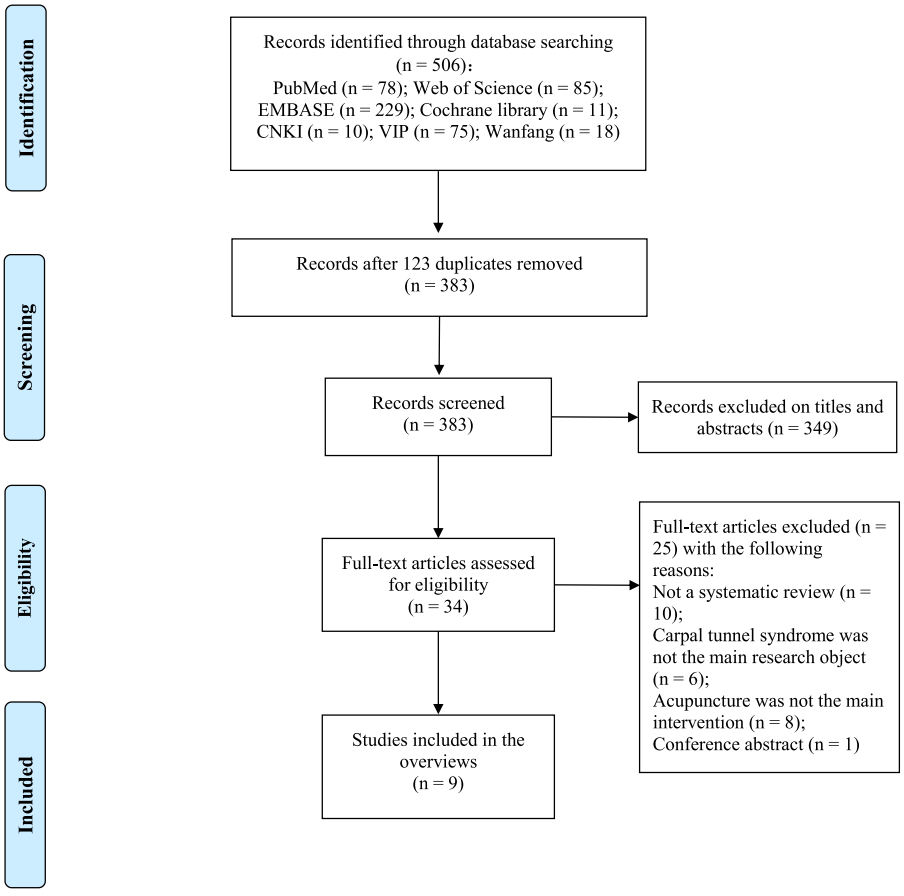

Fig. 1. Flowchart of the selection process of included SRs/MAs.

3. Results

3.1. Literature search

After conducting a database search, 506 studies were initially identified. Following the removal of duplicates, 383 records remained to screen. Upon reviewing the titles and abstracts, 349 studies were deemed ineligible, leaving 34 for further full-text appraisal. Ultimately, 9 studies met the inclusion criteria for this overview, while the remaining 25 were excluded (Fig. 1). Supplement 2 contains details on excluded studies and their exclusion reasons.

3.2. Characteristics of systematic reviews

Table 1 summarizes the characteristics of the SRs/MAs included. Additional details can be found in Supplement 3 and Supplement 4. They were all published between 2011 and 2023, with 3 specifically in 2019 and reported in Chinese.[24-26] Among the 9 reviews, 7 conducted meta-analyses,[15,24-29] while 2 performed narrative syntheses only.[14,30] The included SRs/MAs conducted searches across 5 to 18 databases and covered a range of 5 to 26 RCTs, involving participants from 160 to 1698. Primary interventions in the SRs/MAs included electroacupuncture, manual acupuncture, laser acupuncture, and acupuncture combined with other treatments like wrist splinting and steroid injection. Controls primarily involved sham acupuncture, night splints, medicines (vitamin B12, ibuprofen, corticosteroids), and no treatment. Outcome measures primarily focused on responder rate, symptom magnitude, functional status, pain level, and electrophysiological metrics. Additionally, one SR also evaluated the cure rate,[25] while another SR analyzed grip and pinch strength, recurrence rate, and complications.[29] As for the quality assessment of primary studies, all 9 SRs/MAs utilized the Cochrane criteria and 1 of them used ROB 2. Notably, most of the primary studies were of low quality.

3.3. Primary study overlap

In the 9 SRs/MAs, 100 primary studies were included, of which 57 were unique. There was a moderate degree of overlap among the primary studies, as indicated by a CCA of 9.4 % (Supplement 5).

3.4. Results of the methodological quality

The results of the AMSTAR 2 are shown in Supplement 6. Of the 9 SRs/MAs, 8 were judged as critically low quality, while 1 was rated as low quality. Many studies had deficiencies in items 2, 3, 10, 12, and 15. Only 4 SRs/MAs (44.44 %) established a prior study protocol, and only 1 of them specified deviations from the protocol (Item 2). Only 1 SR (11.11 %) provided information on the funding sources for the included RCTs (Item 10). Only 3 SRs/MAs (33.33 %) assessed publication bias (Item 15). None of the SRs explained their selection of the study designs (Item 3) and evaluated the potential influence of individual study RoB (Item 12).

3.5. Results of the reporting quality

The assessment results for reporting quality, based on PRISMA criteria, can be found in Supplement 7. Out of the 9 SRs/MAs, 7 demonstrated adequate reporting, covering over 70 % of the PRISMA items. However, none reported all PRISMA items. Among all the items, protocol and registration (44.44 %), and risk of bias across studies (33.33 %) were the major reporting deficiencies.

Table 1
Characteristics of meta-analyses or systematic reviews evaluating the efficacy and safety of acupuncture for carpal tunnel syndrome.

First author (year) [ref]	No. of study	No. of patient	No. of searched databases, searched dates	Intervention	Control	Outcomes	Conclusion (Quoted)
Sim (2011)[27]	6	422	11 DBs, December 2009	WA, EA, LA, needle acupuncture, acupressure	No treatment, sham acupuncture, relevant active treatments	Electrophysiological parameters; adverse events; symptom severity; pain intensity; responder rate	"…symptomatic treatment of CTS is encouraging but not convincing."
Choi (2018)[28]	12	869	9 DBs, November 2017 9 DBs, April 2018	LA, EA, needle acupuncture, acupuncture plus other treatments	Sham treatment, placebo, relevant active treatments	Adverse events; symptom severity; functional status; pain intensity; responder rate; grip and pinch strength	"There may be little or no evidence for any difference between acupuncture or laser acupuncture and placebo or sham for symptoms of CTS."
Wang (2019)[26]	5	160	7 DBs, October 2017	Acupuncture	Non-acupuncture	Electrophysiological parameters; symptom severity	"…is effective … low quality of the original research…"
Fan (2019)[24]	8	611	7 DBs, August 2018	Acupuncture, acupuncture plus other treatments	Non-acupuncture	Electrophysiological parameters; adverse events; symptom severity; functional status; pain intensity	"…a better therapeutic effect…"
Liao (2019)[25]	10	848	6 DBs, September 2018	Acupotomy, acupotomy plus other treatments	Non-acupotomy	Adverse events; symptom severity; functional status; pain intensity; responder rate; cure rate	"…Acupotomy therapy is effective … low quality with a small sample size."
Wu (2020)[14]	10	728	9 DBs, July 2019	MA, EA, TENS, Moxa	Sham acupuncture, physical therapies, conventional medicines	Adverse events; symptom severity; functional status; pain intensity	"…appear to be effective in improving symptoms, function, and pain … Associated adverse events are minimal … conclusion is limited…"
Huh (2021)[30]	7	338	5 DBs, June 2021	MA	N Non-MA	Electrophysiological parameters; adverse events; symptom severity; functional status; pain intensity	"…can be used for CTS treatment without serious adverse effects."
Li (2022)[29]	26	1698	8 DBs, May 2022	EA	Other treatments	Electrophysiological parameters; symptom severity; functional status; pain intensity; responder rate; grip and pinch strength; recurrence rate; complications	"…electroacupuncture is a safe and effective…"
Dong (2023)[15]	16	1025	7 DBs, October 2022	Acupuncture, acupuncture plus other treatments	No treatment, sham acupuncture, other treatments, sham acupuncture combined with other treatments	Electrophysiological parameters; adverse events; symptom severity; functional status; pain intensity; responder rate	"Acupuncture as an adjunctive treatment may be effective … evidence had a low or very low degree of certainty."

DB: database; EA: electroacupuncture; LA: laser acupuncture; MA: manual acupuncture; Moxa: moxibustion; TENS: transcutaneous electrical nerve stimulation; WA: warm acupuncture.

3.6. Results of ROBIS evaluation

The ROBIS evaluation results, depicted in Fig. 2, indicate that all included SRs/MAs were assessed as having a low risk of bias in Domain 1 of Phase 2. However, in Domain 2 and Domain 4, only 2 SRs/MAs had a low risk of bias. In Domain 3, 6 SRs/MAs were considered low risk, while 3 were high risk. As for Phase 3, 4 SRs/MAs were rated as having a low risk of bias and 5 as having a high risk.

3.7. Results of GRADE evaluation

In Table 2, we provide a summary of the confidence in the findings of 9 SRs/MAs. Additional details can be found in Supplement 8. Among all the outcomes, 6 were assessed as low quality, while 47 were assessed as very low according to the GRADE evaluation. The primary reasons for downgrading were the risk of bias and publication bias. Several primary RCTs included did not clearly report blinding and allocation concealment, which were important in assessing the risk of bias. Significant heterogeneity (I^2>50) led to downgrading for inconsistency, and imprecision was downgraded due to inadequate total sample size.

3.8. Effectiveness of acupuncture for CTS

Table 2 displays the summary effect sizes from the included SRs/MAs.

3.8.1. Responder rate

Three SRs/MAs showed a significant favorable effect of acupuncture therapy.[25,27,29] However, another SR showed no significant difference between the acupuncture and vitamin B12 groups.[28]

3.8.2. Symptom severity

One SR demonstrated that electroacupuncture improved symptom severity (SSS) more effectively than the control.[29] Another SR indicated that acupuncture plus medicine was more effective in improving symptom severity (SSS/GSS) compared to medicine alone.[15] Additionally, this review noted that patients receiving both acupuncture and night splints showed more improvement than those with medicine and night splints, although the advantage over using night splints alone was not significant. However, two other SRs/MAs indicated that acupuncture had no significant effect on symptom severity reduction.[24,26]

Table 2
Evidence certainty assessments of outcomes of included systematic reviews by GRADE.

Outcome	Study	Included RCTs (Sample size)	Intervention	Effect (95 % CI)	Quality of evidence
Responder rate	Sim 2011	2 (144)	Acupuncture vs Steroid nerve block	RR 1.28 (1.08, 1.52)	Very low
	Choi 2018	2 (100)	Acupuncture vs Vitamin B12	RR 1.16 (0.99, 1.36)	Very low
	Liao 2019	10 (848)	Acupotomy vs Non-acupotomy	RR 1.27 (1.19, 1.35)	Low
	Li 2022	16 (1043)	EA vs Non-EA	OR 4.94 (3.44, 7.08)	Low
Symptom severity	Wang 2019	3 (165)	Acupuncture vs Non-acupuncture	SMD 0.29 (0.13, 0.45)	Very low
	Fan 2019	3 (284)	Acupuncture vs Non-acupuncture	MD −0.32 (−0.87, 0.24)	Very low
	Li 2022	14 (970)	EA vs Non-EA	SMD −0.90 (−1.36, −0.44)	Very low
	Dong 2023	2 (99)	(Acupuncture + NS) vs (Meds + NS)	SMD −1.15 (−1.58, −0.72)	Very low
		2 (225)	(Acupuncture + NS) vs NS	SMD −0.13 (−0.59, 0.32)	Very low
		3 (226)	(Acupuncture + Meds) vs Meds	SMD −1.17 (−2.31, −0.03)	Very low
Functional status	Fan 2019	3 (284)	Acupuncture vs Non-acupuncture	MD −0.32(−0.75, 0.11)	Very low
	Li 2022	7 (611)	EA vs Non-EA	SMD −1.04 (−1.79, −0.29)	Very low
	Dong 2023	2 (225)	(Acupuncture + NS) vs NS	SMD −0.20 (−0.87, 0.46)	Very low
		2 (208)	(Acupuncture + NS) vs NS	SMD −0.40 (−0.68, −0.13)	Very low
		2 (166)	(Acupuncture + Meds) vs Meds	SMD −2.17 (−6.45, 2.10)	Very low
Pain intensity	Fan 2019	3 (155)	Acupuncture vs Non-acupuncture	MD −2.47 (−4.86, −0.07)	Very low
	Liao 2019	4 (290)	Acupotomy vs Non-acupotomy	MD −1.43 (−1.92, −0.95)	Very low
	Li 2022	8 (580)	EA vs Non-EA	MD −0.79 (−1.11, −0.47)	Very low
	Dong 2023	3 (252)	(Acupuncture + NS) vs NS	MD −1.65 (−3.05, −0.26)	Very low
The electrophysiological parameters					
DML	Wang 2019	4 (279)	Acupuncture vs Non-acupuncture	SMD −1.56 (−2.21, −0.91)	Very low
	Fan 2019	4 (290)	Acupuncture vs Non-acupuncture	MD −0.50 (−0.83, −0.17)	Very low
	Li 2022	11 (674)	EA vs Non-EA	MD −0.29 (−0.55, −0.03)	Very low
	Dong 2023	3 (NA)	Acupuncture vs Meds	MD −0.31 (−0.96, 0.34)	Very low
		3 (NA)	(Acupuncture + Meds) vs Meds	MD −0.47 (−0.66, −0.28)	Very low
		2 (NA)	(Acupuncture + NS) vs NS	MD 0.05 (−0.33, 0.43)	Very low
DSL	Wang 2019	4 (279)	Acupuncture vs Non-acupuncture	SMD −0.62 (−1.08, −0.16)	Very low
	Fan 2019	3 (204)	Acupuncture vs Non-acupuncture	MD −0.02 (−0.52, 0.49)	Very low
	Dong 2023	2 (NA)	Acupuncture vs Meds	MD −0.05 (−0.78, 0.69)	Very low
CMAP	Fan 2019	4 (285)	Acupuncture vs Non-acupuncture	MD 1.23 (−0.69, 3.15)	Very low
	Li 2022	9 (552)	EA vs Non-EA	MD 1.77 (0.86, 2.68)	Very low
	Dong 2023	3 (NA)	Acupuncture vs Meds	MD −1.02 (−2.02, −0.03)	Very low
		3 (NA)	(Acupuncture + Meds) vs Meds	MD 2.30 (0.84, 3.77)	Very low
		2 (NA)	(Acupuncture + NS) vs NS	MD 1.31 (−1.04, 3.66)	Very low
NCV	Wang 2019	3 (165)	Acupuncture vs Non-acupuncture	SMD 3.12 (1.52, 4.72)	Very low
	Fan 2019	3 (204)	Acupuncture vs Non-acupuncture	MD 1.87 (1.05, 2.69)	Very low
	Dong 2023	2 (NA)	(Acupuncture + NS) vs NS	MD 1.81 (−0.55, 4.18)	Very low
		2 (NA)	Acupuncture vs Meds	MD −3.57 (−13.79, 6.65)	Very low
		3 (NA)	Acupuncture vs Meds	MD −1.12 (−6.39, 4.14)	Very low
		3 (NA)	(Acupuncture + Meds) vs Meds	MD 4.02 (2.44, 5.59)	Very low
		2 (NA)	(Acupuncture + NS) vs NS	MD 0.24 (−2.20, 2.67)	Very low
	Li 2022	11 (732)	EA vs Non-EA	MD 4.78 (4.39, 5.18)	Low
		11 (732)	EA vs Non-EA	MD 3.77 (2.52, 5.02)	Very low
SNAP	Fan 2019	4 (285)	Acupuncture vs Non-acupuncture	MD 1.47 (−0.73, 3.68)	Very low
	Li 2022	6 (422)	EA vs Non-EA	MD 2.51 (2.12, 2.91)	Low
		6 (422)	EA vs Non-EA	MD 2.47 (2.07, 2.87)	Low
	Dong 2023	2 (NA)	Acupuncture vs Meds	MD −3.14 (−6.84, 0.56)	Very low
		3 (NA)	(Acupuncture + Meds) vs Meds	MD 2.53 (1.63, 3.44)	Very low
Cure rate	Liao 2019	10 (848)	Acupotomy vs Non-acupotomy	RR 1.53 (1.33, 1.76)	Low
BCTQ	Liao 2019	2 (222)	Acupotomy vs Non-acupotomy	MD −0.73 (−1.45, 0.00)	Very low
Grip	Li 2022	2 (66)	EA vs Non-EA	MD 2.81 (−0.09, 5.72)	Very low
Pinch	Li 2022	2 (66)	EA vs Non-EA	MD −0.17 (−0.89, 0.55)	Very low
Recurrence rate	Li 2022	2 (127)	EA vs Non-EA	OR 0.16 (0.07, 0.36)	Very low
Complications	Li 2022	3 (317)	EA vs Non-EA	OR 2.32 (0.34, 15.69)	Very low

EA: electroacupuncture; MD: mean difference; Meds: medicines; NA: not available; NS: night splints; OR: odds ratio; RR: risk ratio; SMD: standard mean difference.

3.8.3. Functional status

One SR demonstrated that electroacupuncture improved functional status (FSS) better than the control.[29] Another SR reported a greater improvement, measured by DASH, in the acupuncture combined with night splints group compared to the night splints group. However, this SR found no significant difference when assessed using the FSS.[15] Yet another SR reported that acupuncture did not show superiority over the control.[24]

3.8.4. Pain intensity

Four SRs/MAs found that acupuncture reduced pain intensity (VAS) more effectively than control.[15,24,25,29]

3.8.5. Electrophysiological parameters

Three SRs/MAs found that the acupuncture group had shorter DML and faster NCV than the control group.[24,26,29] Another SR indicated shorter DML and faster NCV in patients treated with both acupuncture and medicine, in contrast to medicine alone. However, this study observed no differences in other group comparisons.[15]

One MA demonstrated that DSL was shorter in the acupuncture group than the control group.[26] However, two SRs failed to demonstrate any advantage of acupuncture over the control group.[15,24]

One SR showed that the electroacupuncture group had higher CMAP and SNAP than the control group.[29] Conversely, one SR reported no difference in CMAP and SNAP between the acupuncture and control groups.[24] Additionally, another SR found that the combination of

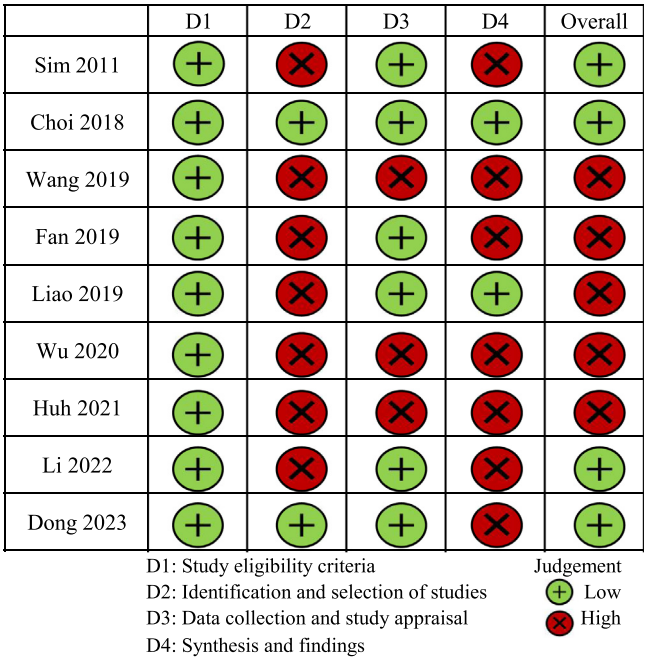

Fig. 2. Data on the risk of bias assessment (ROBIS).

acupuncture and medicine led to higher CMAP and SNAP compared to medication alone, but such advantages were not observed in other group comparisons.[15]

3.8.6. Other outcomes

One SR reported that the acupotomy group was superior to the control group in cure rate. However, it did not provide separate descriptions for symptom and function scores. Instead, it reported the total points of the Boston Carpal Tunnel Questionnaire, indicating no notable distinction between the two groups.[25]

One SR reported a lower recurrence rate in the electroacupuncture group than the control group. However, it identified no differences between the two groups concerning complications, grip and pinch clinical outcomes.[29]

3.9. Safety of acupuncture for CTS

Seven SRs/MAs reported acupuncture-related adverse events in CTS treatment.[14,15,24,25,27,28,30] Adverse events included local pain,[14,15,28,30] paresthesia,[14,15,30] skin bruising,[14,15,28] as well as local dermatitis.[14,15] None of these studies reported any serious adverse events related to acupuncture treatment. One SR found that oral corticosteroids led to more adverse events than acupuncture.[28] Another SR concluded that acupuncture had fewer side effects compared to conventional medicine.[30] Hence, acupuncture seems to be a safe therapy for CTS.

4. Discussion

4.1. Summary of main findings

This study comprehensively reviews 9 SRs/MAs, investigating the efficacy and safety of acupuncture for CTS. The AMSTAR 2 indicated that the methodological quality of 1 SR was low, and the other 8 SRs/MAs were critically low. The methodological limitations were attributed to the lack of a prior study protocol and an examination of publication bias. According to the PRISMA checklist, 7 out of the 9 SRs/MAs demonstrated adequate reporting, covering over 70 % of the PRISMA items. However, none of them reported all PRISMA items. Protocol and registration, and risk of bias across studies were the major reporting deficiencies. Utilizing the ROBIS tool, 5 out of the 9 SRs/MAs were at a high risk of bias. Significant issues were identified in Domain 2 and Domain 4, indicating deficiencies in study identification and selection, as well as synthesis and findings. No high-quality evidence assessed with GRADE was identified. Among all the outcome indicators, 6 were rated as low quality, and 47 were rated as very low. The primary reasons for downgrading were the risk of bias and publication bias.

As for the effect of acupuncture, most SRs/MAs suggested that acupuncture might be beneficial for CTS. However, caution is advised in recommending acupuncture for this population. The methodological quality of the included SRs/MAs was poor, diminishing the certainty of the evidence. Additionally, most RCTs included were of low quality. Moreover, except for pain intensity, some SRs/MAs reported conflicting results. Due to these reasons, the confidence in their conclusions is limited.

As for the safety of acupuncture for CTS, acupuncture may lead to minor adverse events, such as local pain and paresthesia, without causing significant harm to patients.

The selection and combinations of acupoints are regarded as the core of the acupuncture treatment system.[31] After reviewing, we found that the prescription of acupuncture points varied among studies, and the duration of treatment showed inconsistency as well, potentially impacting efficacy and contributing to disparate conclusions. Acupuncture, integral to traditional Chinese medicine, is widely employed for pain management. Beyond the observed effects on clinical outcomes, it is also important to understand the underlying mechanisms of acupuncture in pain management. Research indicates that acupuncture induces analgesic effects by stimulating the release of endorphins, and serotonin, as well as by modulating the areas of the brain associated with emotional and cognitive processing.[31,32] Conclusively, while the evidence supporting acupuncture as a treatment for CTS is currently insufficient but promising, there is a need to explore the optimal prescription of acupuncture treatment for CTS to further develop its therapeutic potential.

4.2. Implications for future study

After evaluation, we found that there were several common issues in the included SRs/MAs, such as failure to establish a prior study protocol, neglecting to examine publication bias, and incomplete retrieval. Addressing these shortcomings is crucial. Specifically, the protocol should be registered prior to the commencement of the SR, ensuring a transparent and accountable process. Grey literature should be taken into account to enhance the comprehensiveness of the search. Besides, authors are required to explore any possible bias across studies. In instances of significant heterogeneity, conducting subgroup analysis is advisable, and the examination of publication bias is recommended when enough RCTs are included.

Furthermore, it was observed that a majority of the included original RCTs lacked adequate reporting on the random sequence generation method and failed to provide clear information on blinding and allocation concealment. To offer more trustworthy evidence, future endeavors should focus on conducting multicenter trials with a more rigorous experimental design.

4.3. Strengths and weaknesses of the review

This is the first overview of SRs/MAs investigating the effectiveness and safety of acupuncture for CTS. We initiated this overview with a pre-established protocol, contributing to a reduction in bias. Besides, two researchers independently conducted the research tasks and cross-checked the results, ensuring the reliability of our findings.

However, our overview has several limitations. Firstly, due to the complexity of acupuncture therapy, describing acupuncture details be-

comes challenging. Secondly, the low quality of the primary studies directly constrains the certainty of evidence. Therefore, the results of this study should be interpreted cautiously.

4.4. Conclusion

Acupuncture might be beneficial for CTS. However, the efficacy of acupuncture for CTS requires confirmation through further high-quality research, given the existing evidence limitations.

Author contributions

Quanai Zhang and Yulin Liu designed the study. Qing Zhang and Songhao Ning performed the literature search. Yulin Liu, Chao Wang, and Qi Wang conducted data extraction and analysis. All authors contributed to the article drafting.

Declaration of competing interest

The authors declare that there are no conflicts of interest.

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Ethical statement

Not applicable.

Data availability

Not applicable.

Deviation from the protocol

Minor deviations from the protocol occurred. To gather more comprehensive evidence, we conducted additional database searches, which included adding the EMBASE database and extending the literature search timeframe to April 25, 2024. Furthermore, to thoroughly assess the quality of the included studies, we employed two additional assessment tools: PRISMA and ROBIS. Although our initial plan was to perform a quantitative synthesis of the data, the heterogeneity among RCTs prompted us to change our strategy, ultimately opting for descriptive analysis.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.imr.2024.101088.

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