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Clinical Efficacy of Tuina Therapy for Acute Lumbar Sprain: A Bayesian Network Meta-Analysis Based on Randomized Controlled Trials

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Purpose: Traditional Chinese medicine possesses distinct advantages in the treatment of acute lumbar sprains, and Tuina (Chinese massage) is a commonly employed therapeutic method. This study employed a Bayesian meta-analysis to assess the efficacy and safety of Tuina therapy for acute lumbar sprain with the aim of providing more evidence-based medical substantiation for clinical practice.

Patients and Methods: Randomized controlled trials of Tuina therapy for acute lumbar sprains published in CNKI, CSPD, CCD, CBM, PubMed, Embase, Cochrane Library, and Web of Science were searched up to August 7, 2024. The included studies were assessed for the risk of bias using Cochrane's randomized controlled trial bias risk assessment tool.

Results: Eleven studies involving 810 patients were included in this meta-analysis. Two types of interventions were included: Tuina alone and Tuina combined with conventional treatment. The included studies had a low risk of bias. Three outcome indicators were analyzed. The results of the network meta-analysis showed that, compared with conventional treatment, Tuina alone or in combination with other interventions had a significant advantage in terms of efficacy ($P < 0.05$). The order of the surface under the cumulative ranking curve (SUCRA) was: Tuina (0.79) and Tuina combined with conventional treatment (0.70). Regarding the visual analog scale score, Tuina combined with the other interventions showed significant advantages ($P < 0.05$). The order of SUCRA was: Tuina combined with conventional treatment (0.80), followed by Tuina alone (0.64). Regarding the modified Japanese Orthopaedic Association scores, Tuina combined with conventional treatment had a significant advantage ($P < 0.05$). The order of SUCRA was Tuina combined with conventional treatment (0.98), followed by Tuina alone (0.26).

Conclusion: The results suggest that Tuina has significant advantages over conventional treatment.

Keywords: acute lumbar sprain, Tuina, efficacy, systematic review, Bayesian network meta-analysis

Introduction

Acute lumbar sprain (ALS), a prevalent clinical condition that frequently affects young and middle-aged individuals, particularly those engaged in heavy manual labor, involves the acute tearing of soft tissues, including muscles, fascia, and ligaments, caused by sudden excessive external forces that commonly occur during the forceful contraction of the lumbar muscles during exercise or heavy lifting.[1] The primary clinical manifestations of this condition include severe back pain, localized pain, and limited spinal mobility.[2] ALS is a prevalent clinical condition that frequently affects young and middle-aged individuals, particularly those engaged in heavy manual labor. The incidence rate is higher in males than in females.[3] According to survey results, approximately 60–80% of young individuals and manual laborers experience ALS.

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This common health issue significantly affects quality of life and work capacity.[4] Failure to promptly and effectively treat the disease in its acute phase can lead to chronicity, imposing a greater burden on patients.

Currently, Western medicine advocates the use of analgesics and anti-inflammatory medications, pain-point blockades, and muscle relaxants for the symptomatic treatment of ALS. Nonsteroidal anti-inflammatory drugs (NSAIDs), such as ibuprofen and acetaminophen, are considered the primary pharmacological agents in Western medicine for the management of ALS.[5] NSAIDs effectively alleviate pain by inhibiting cyclooxygenase activity and suppressing prostaglandin synthesis. Muscle relaxants are also commonly employed in ALS treatment to relieve symptoms by impeding nerve impulse conduction in skeletal muscles and inducing muscle relaxation.[6] Oral and local injectable therapies have distinct adverse effects.

Traditional Chinese medicine (TCM) has unique advantages in the treatment of this disease. Tuina can effectively modulate the tension of muscles, fascia, and other soft tissues. This modulation helps alleviate the mechanical compression resulting from sprains, improves pain management and blood circulation, and facilitates the recovery of lumbar function.[7] Tuina therapy for ALS offers several benefits, including remarkable clinical efficacy, minimal side effects, affordability, and high safety standards.[8] However, employing Tuina alone may yield slightly suboptimal outcomes; hence, combining Tuina with intervention methods such as acupuncture or Western medicine could potentially enhance therapeutic efficacy.

Several clinical trials have evaluated the efficacy and safety of Tuina combined with traditional Chinese medicine, which has unique advantages in the treatment of this disease. Tuina can effectively adjust muscle tension, fascial tension, and other soft tissue conditions to reduce mechanical compression caused by sprains, improve pain levels and blood circulation, and promote lumbar function recovery.[7] Tuina therapy for ALS offers good clinical efficacy, minimal side effects, affordability, and safety.[8] However, Tuina alone may be insufficient, and combining it with other interventions, such as acupuncture or Western medicine, may yield better therapeutic outcomes. However, the efficacy and safety of these procedures remain unclear. To provide further evidence for the clinical application of Tuina in the treatment of ALS, the relevant clinical literature was reviewed and its clinical efficacy and safety was evaluated using a network meta-analysis.

Materials and Methods

Study Registration

This study has been registered with PROSPERO (ID: CRD42024576289).The address is: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42024576289

Eligibility Criteria

Inclusion Criteria

Population ("P"): Patients with a definite diagnosis of ALS. Race, nationality, sex, age, and the course of illness were not limited.

Intervention ("I"): Use of Tuina or other treatment methods (including Western medicine and acupuncture).

Comparison ("C"): Other treatment methods (including Western medicine and acupuncture).

Outcome ("O"): (1) Main outcome indicators: Efficacy (effective number/total number × 100%) and visual analog scale (VAS) score;[9] (2) secondary outcome index: Modified Japanese Orthopaedic Association scores (M-JOA). The activities and working abilities before and after treatment were compared between the two groups. The higher the score, the milder the symptoms.[10] The reporting of outcome indicators were also included.

Study design ("S"): Randomized controlled trial.

Exclusion Criteria

P: None.

I/Exposure: None.

C: None.

O: None.

S: Abstracts of meetings published without peer review. Different studies from the same randomized controlled trial included the study with the largest sample size, most complete follow-up time, and most outcome measures.

Data Sources and Search Strategy

Randomized controlled trials investigating the efficacy of Tuina therapy for ALS were retrieved from various databases, including CNKI, CSPD, CCD, CBM, PubMed, Embase, Cochrane Library, and Web of Science, up until August 7, 2024. A combination of subject-specific and unrestricted keywords were used in the search. The detailed search strategies are provided in the Appendix 1 (Search strategy).

Study Selection

Two researchers independently conducted the literature search following an established search strategy, and the retrieved articles were imported into EndNoteX9 software (Clarivate, Philadelphia, PA, USA) to remove duplicates. Subsequently, the remaining studies were assessed based on the predetermined inclusion and exclusion criteria through a thorough examination of titles, abstracts, and full texts. In the case of any discrepancies, discussions with a third researcher were held to reach a consensus on the final selection of the included studies.

Data Extraction

Two researchers independently extracted tables based on the information design data required for the study. The extracted content included: (1) basic information, including title, author, year, study type, diagnostic criteria, intervention measures, treatment duration, and outcome indicators; (2) demographic characteristics, including sample size, age distribution, and sex ratio; (3) methodological details, including randomization method, allocation concealment scheme, and blinding procedures. In case of any inconsistencies in the extracted information between the two researchers' findings, they first engaged in discussions to resolve them collaboratively. If a consensus was not reached through discussion alone, further deliberation was conducted to reach a final decision.

Risk of Bias in Studies

Two investigators used the Cochrane randomized controlled trial bias Risk Assessment tool[10] to evaluate the risk of bias. The assessment tool encompassed seven components: generation of random sequences, concealment of allocation, blinding of participants and intervention providers, blinding of outcome assessors, handling of incomplete outcome data, selective reporting of outcomes, and identification of other potential sources of bias. Each component was assessed as having low, high, or unclear risk.

Synthesis Methods

A Bayesian random-effects model was employed to compare the effects of the different interventions and assess their efficacy. The Markov chain Monte Carlo method was utilized to model the four chains running simultaneously. The annealing times were set to 20,000 iterations, and the modeling process was completed after 50,000 simulation iterations. The model fit and global consistency were evaluated using the Deviation Information Standard, whereas a local consistency analysis was conducted using node splitting in closed-loop networks. Additionally, the interventions were ranked based on the surface under the cumulative ranking curve (SUCRA) and league tables were generated to compare the variations in effects across the interventions. Analyses were performed using Stata 15.0 (StataCorp, College Station, TX, USA) and R 4.2.0 (R Development Core Team, Vienna, Austria). Statistical significance was defined as $P < 0.05$.

Results

Study Selection

A preliminary search yielded 1792 relevant literature sources, of which 813 were excluded. After reviewing the titles and abstracts, 24 additional articles were excluded. Following full-text screening, 27 additional sources were excluded due to incomplete data (three studies), not meeting outcome indicators (seven studies), or unsuitable interventions (17 studies). Ultimately, 11 studies were included in the analysis. Figure 1 illustrates a flowchart of the screening process.

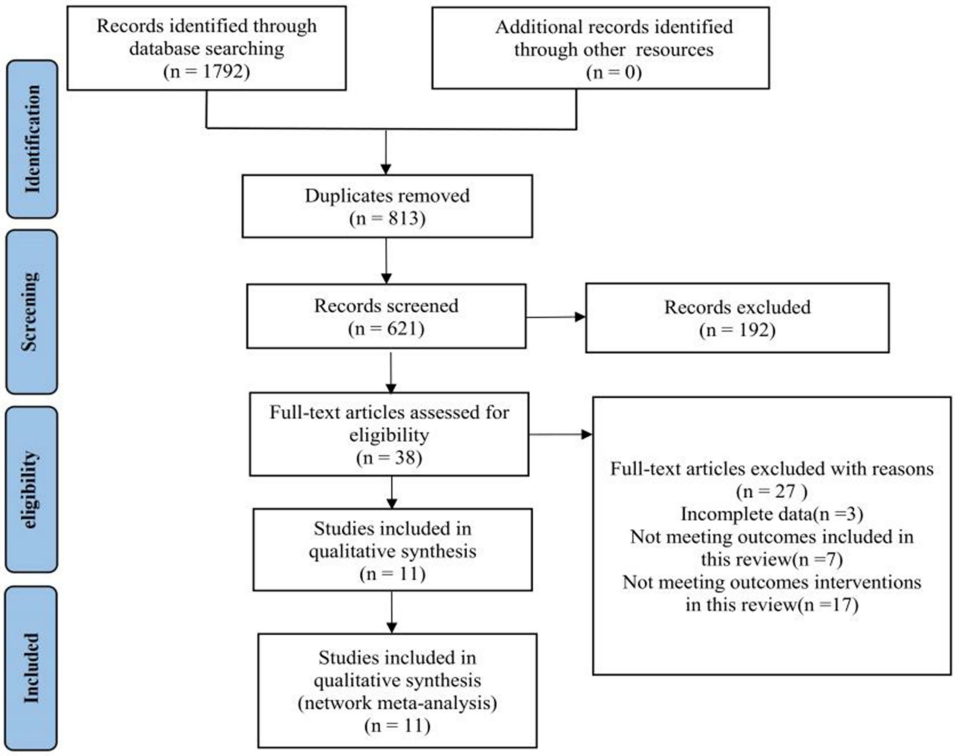

Figure 1 Literature screening process.

Study Characteristics

This analysis comprised 11 studies,[11–21] encompassing a total of 810 patients. The corresponding author is affiliated with China. The number of publications ranged from 2002 to 2024. The interventions consisted of Tuina alone and Tuina combined with conventional treatments. Table 1 summarizes the characteristics of the included studies.

Risk of Bias in Studies

In terms of randomization methods, computer-generated random sequences were used in six studies,[12,15,18–20,22] while admission sequence numbers were used in one study.[14] Regarding allocation and concealment, implementing blinding methods was challenging due to the unique nature of Tuina; however, its impact on the results was minimal. Data from all studies were complete and no withdrawal of participants was reported. Selective reporting and other sources of publication bias were not found in all studies. Figures 2 and 3 illustrate the risk of bias in the results of the included studies. The results of bias risk showed that ten studies were "low risk"[11–13,15–21] and one study was "high risk".[14]

Meta-Analysis

Efficacy

Correlation Between Interventions

Efficacy was reported in nine studies encompassing two interventions (I^2 = 0%). Each study compared Tuina and conventional treatments without any within-group comparisons. Among these, the most extensively investigated direct comparison was between the Tuina and conventional treatments, with no evidence of publication bias (Figure 4).

Synthesized Results

The results of the network meta-analysis demonstrated a significant effect when Tuina was combined with various treatments compared with conventional treatment ($P < 0.05$) (Figure 5 and Appendix 2 (league table)). The top three SUCRA rankings were Tuina alone (0.79) and Tuina combined with conventional treatment (0.70) (Table 2).

Table 1 Basic Features of Included Studies

First Author	Author Country	Years of Publication	Intervention	Control	Number of Cases	Gender (Male/Female)	Age	Course of Treatment	Outcome Indicators
Lien Jinqiang Gun[11]	China	2024	Tuina + Western medicine	C (Western medicine)	38, 38	21/17, 20/18	43.0±1.3, 42.5 1.8 mm	7 d	Efficacy, VAS, M-JOA
Shen Miaofen[12]	China	2019	Tuina	C (Rehabilitation)	45	28/17/16	49.19±2.73, 49.23 2.71 mm	7 d	VAS, M-JOA
Hu Guixing[13]	China	2008	Tuina	C (Western medicine)	35, 32	21/14/11	42.7, 38.2	5 d	Efficacy
Li Xiaomin[14]	China	2016	Tuina	C (Western medicine)	40, 40	27/13 p / 12	39.5, 38.9	7 d	Efficacy
Hua Li[15]	China	2023	Tuina + Rehabilitation	C (Rehabilitation)	33 Behavior	15/18/17	50.41±0.92, 45.59 2.81 mm	7 d	Efficacy, VAS, M-JOA
Wang Qiongfang[16]	China	2019	Tuina + Rehabilitation	C (Rehabilitation)	47, 47	27/20, 29/18	41.3±12.6, 42.5±13.1	5 d	Efficacy, VAS, M-JOA
Liu Xiaojun[17]	China	2017	Tuina + Rehabilitation	C (Rehabilitation)	45	32/13/12	42.30 ±9.50, 41.20±8.90	No description	Efficacy, VAS, M- JOA
Zhao Lingyu[18]	China	2019	Tuina + Rehabilitation	C (Rehabilitation)	15, 15	8/7, 9/6	44.09±0.91, 44.13 1.37 mm	No description	VAS
Zhang Qinming[19]	China	2005	Tuina	C (Western medicine)	47	54, 38	44	7 d	Efficacy
Liu Jianqun[20]	China	2002	Tuina	C (Western medicine)	35, 30	23/12.21/9	41.3, 39.2	5 d	Efficacy
Zhang Jingjing[21]	China	2021	Tuina	C (Western medicine)	30, 30	18/12, 18/12	47.56±3.44, 47.62±3.41	28 d	Efficacy, VAS

Abbreviations: C, Conventional treatment; VAS, visual analog scale; M-JOA, Modified Japanese Orthopaedic Association.

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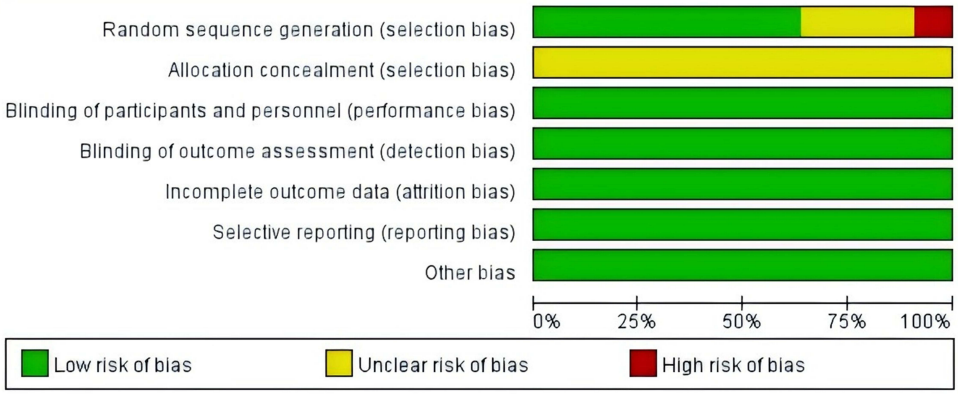

Figure 2 Risk of bias graph.
Abbreviation: C, Conventional treatment.

Figure 3 Risk of bias summary.
Abbreviation: C, Conventional treatment.

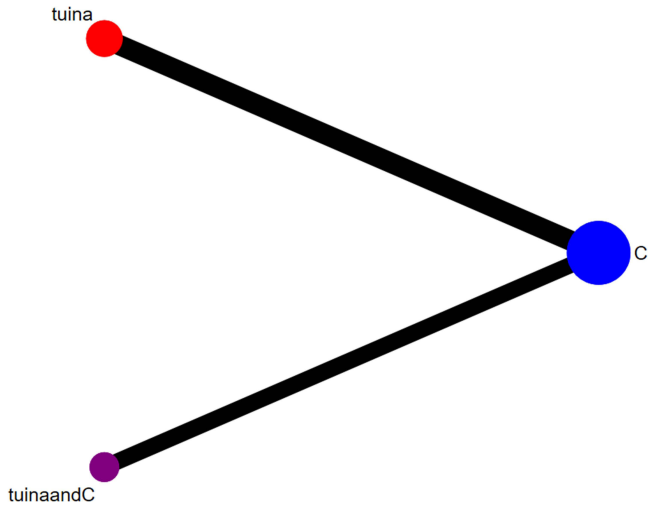

Figure 4 Network diagram of efficacy.
Abbreviation: C, Conventional treatment.

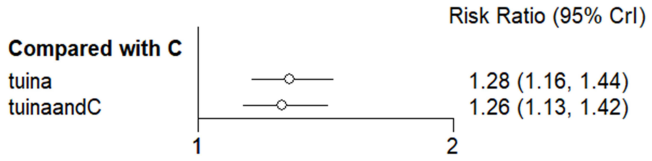

Figure 5 Forest map of efficacy.
Abbreviation: C, Conventional treatment.

VAS

Associations Between Interventions

VAS scores were reported in five studies, encompassing two interventions (I^2 = 12%). Each study compared Tuina with conventional treatment alone, without conducting pairwise comparisons between the different Tuina techniques. Notably, the most extensively studied comparison involved Tuina treatment combined with conventional treatment versus conventional treatment alone, and the results showed no closed loops (Figure 6).

Synthesized Results

Tuina alone and Tuina combined with conventional treatment had a significant effect (P < 0.05) compared to conventional treatment alone (Figure 7 and Appendix 2 (league table)). The top three SUCRA rankings were Tuina combined with conventional treatment (0.80) and Tuina alone (0.64) (Table 2).

Table 2 SUCRA Sort

	Efficacy	No	VAS	No	M-JOA	No
	SUCRA		SUCRA		SUCRA	
Tuina	0.79	1	0.64	2	0.26	2
Tuina + Conventional treatment	0.70	2	0.80	1	0.98	1
Conventional treatment	0.001	3	0.05	3	0.24	3

Abbreviations: SUCRA, surface under the cumulative ranking curve; VAS, visual analog scale; M-JOA, Modified Japanese Orthopaedic Association score.

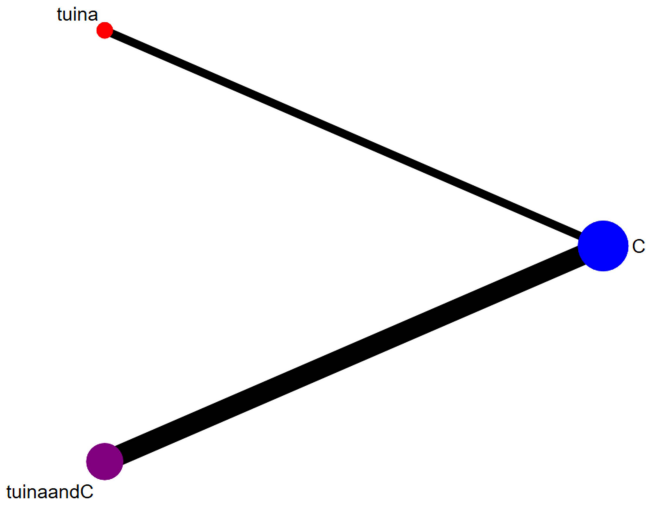

Figure 6 Network diagram of VAS.
Abbreviation: C, Conventional treatment.

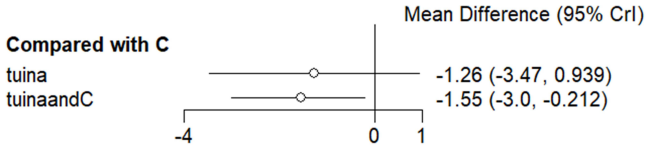

Figure 7 Forest map of VAS.
Abbreviation: C, Conventional treatment.

M-JOA

Associations Between Interventions

The M-JOA score was reported in five studies containing four interventions (I^2 = 11%). Each study reported only a comparison of Tuina with conventional treatment and no pairwise comparison between Tuina techniques. Among these, the direct comparison of Tuina combined with conventional treatment and conventional treatment alone was the most studied, and the graph showed no closed loops (Figure 8).

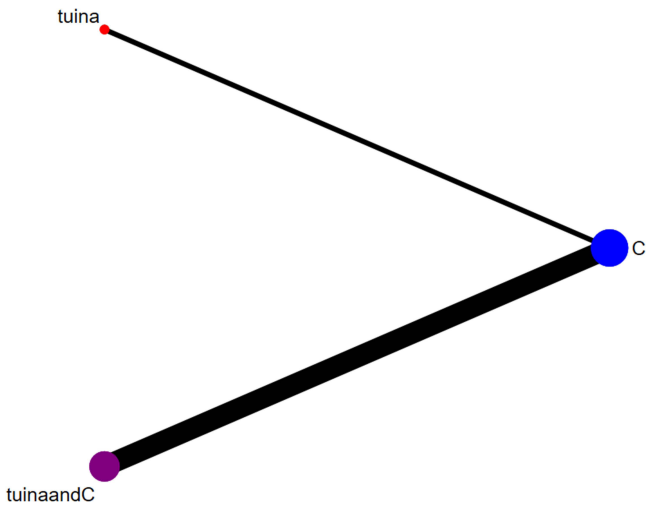

Figure 8 Network diagram of M-JOA.
Abbreviation: C, Conventional treatment.

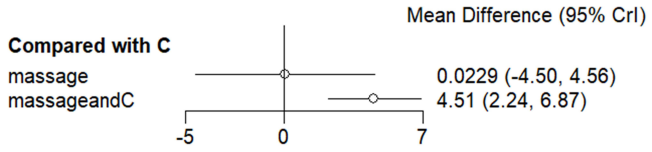

Figure 9 Forest map of M-JOA.
Abbreviation: C, Conventional treatment.

Synthesized Results

Compared to conventional treatment alone, Tuina combined with conventional treatment had a significant effect ($P < 0.05$) (Figure 9 and Appendix 2 (league table)). The top two SUCRA rankings were for Tuina combined with the conventional treatment (0.98) and Tuina alone (0.26) (Table 2).

Sensitivity Analysis

Sensitivity analysis of the outcome indicators showed that the results were stable (Table 3 and Appendix 3 (Sensitivity analysis)).

Discussion

This review included 11 studies with two types of interventions: (i) Tuina alone and (ii) Tuina combined with conventional treatment. We assessed three outcome measures.

Compared to conventional treatment alone, Tuina combined with different treatment methods had significant advantages in terms of the efficacy index. In terms of the VAS index, compared with conventional treatment alone, Tuina alone and Tuina combined with conventional treatment had significant advantages. In terms of the M-JOA index, Tuina combined with conventional treatments had significant advantages. No safety issues were reported in any of the studies included. Sensitivity analysis indicated that the results were stable, and that the effect of Tuina combined with other interventions was superior to that of Tuina alone.

Modern studies have demonstrated that Tuina therapy can enhance local circulation, elevate pain thresholds, alleviate muscle tension and spasms, facilitate tissue repair and absorption of edema and hematoma, correct joint disorders, mitigate aseptic inflammation, and contribute to menstrual relaxation and blood circulation promotion, while removing blood stasis and clearing collaterals.[23] It operates via various mechanisms.[24] Liu et al[22] demonstrated that, following centrifugal training, the Tuina group exhibited a slower decline in muscle strength than the control group and displayed significant muscle work recovery, indicating that Tuina therapy has a favorable reparative effect on damaged muscle tissue. Furthermore, the mechanism by which Tuina alleviates muscle spasms involves increasing local tissue pain thresholds through appropriate manual stimulation and enhancing local circulation to improve tissue hypoxia and reduce spastic pain.[25] Zhu et al[26] conducted a randomized division of 62 patients with calf muscle spasms into two groups: the experimental group received Tuina treatment, whereas the control group received infusion treatment. Their results demonstrated that the efficacy of Tuina was superior (81.8% vs 44.8%). Tuina alleviated pain by regulating the endogenous opioid peptides. Gong et al[27] utilized the radioreceptor competitive binding method to measure changes in serum endorphin levels before and after Tuina administration in 10 patients with neck, shoulder, back, and leg pain. They discovered that the post-Tuina serum endorphin levels were higher than the pre-Tuina levels, with a significant difference

Table 3 Sensitivity Analysis Results

Outcome Indicators	Sensitivity Analysis
Efficacy	0.78 (0.72, 0.84)
VAS	1.54 (0.98, 2.11)
M-JOA	1.62 (2.53, 0.71)

Abbreviations: VAS, visual analog scale; M-JOA, Modified Japanese Orthopaedic Association score.

between the Tuina and control groups ($P < 0.05$). This suggests that the analgesic effect of Tuina may be attributed to an increase in endorphins.

A published meta-analysis[28] demonstrated that the efficacy of Tuina in combination with other treatments surpassed that of conventional treatments (odds ratio = 5.47, 95% confidence interval [CI]: 3.27, 9.16, $P < 0.05$). Additionally, the VAS score indicated that Tuina combined with other treatments exhibited superior efficacy compared with conventional treatment (mean difference = –2.24, 95% CI [–2.36, –2.21], $P < 0.05$), which aligns with the outcomes observed in this study.

This study is the first to perform a comprehensive meta-analysis of Tuina therapy for ALS by incorporating rigorous inclusion and exclusion criteria. Nevertheless, this study has some limitations. The number of included studies was limited and variations were observed in terms of efficacy assessment criteria, patient characteristics, sample size, and outcome measures. Some studies lacked adequate randomization methods and assignment concealment, potentially affecting the strength of the evidence. Additionally, a few outcome indicators relied on a small amount of original literature, which may have influenced the results. Furthermore, a publication bias may have affected our findings. Therefore, future research should focus on conducting large-scale multicenter randomized controlled trials using high-quality methodologies to provide robust evidence.

Conclusion

The findings presented in this study indicate that Tuina therapy provides significant advantages as a therapeutic approach for acute lumbar sprains over conventional treatments. Given the limited number of studies included in this meta-analysis, further high-quality randomized controlled trials will be needed to comprehensively validate the efficacy and safety of Tuina.

Data Sharing Statement

Data are available from the corresponding author (Jiangshan Li) upon request.

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Disclosure

The authors report no conflicts of interest in this work.

References

1. Ye JG. A controlled study on treatment of acute lumbar sprain by acupuncture at Yaotongdian (EX-UE7) plus Tuina manipulation. *J Acupunct Tuina Sci*. 2015;13(3):194–198. doi:10.1007/s11726-015-0849-3
2. Wu YC, Zhang JF, Li SS, et al. Clinical effect and infrared thermogram on electroacupuncture for acute lumbar sprain. *J Acupunct Tuina Sci*. 2010;8(6):380. doi:10.1007/s11726-010-0455-3
3. Zhou H. *Observation on the Clinical Effect of Abdominal Tuina Combined with Acupuncture in the Treatment of Acute Lumbar Sprain* [Dissertation]. Fujian University of Traditional Chinese Medicine; 2019.
4. Vas J, Aranda JM, Modesto M, et al. Acupuncture in patients with acute low back pain: a multicentre randomized controlled clinical trial. *Pain*. 2012;153(9):1883–1889. doi:10.1016/j.pain.2012.05.033
5. Zhao K, Lin XZ. Clinical observation of wrist and ankle acupuncture combined with TCM characteristic nursing in the treatment of acute low back pain. *Chin Foreign Med Res*. 2018;16(01):178–179.

6. Jiang LH. *Clinical Study of Local Shallow Acupuncture Combined with Active Exercise in the Treatment of Acute Lumbar Sprain* [Dissertation]. Nanjing University of Traditional Chinese Medicine; 2018.
7. Gong WZ, Dai J, Shi WQ, et al. Clinical study of low back pain moxibustion combined with bone-setting Tuina in the treatment of acute lumbar sprain. *Liaoning J Tradit Chin Med*. 2022;49(9):188–191.
8. Wang B. Observation on the curative effect of Traditional Chinese Medicine Tuina on acute lumbar sprain. *Gansu Sci Technol*. 2015;31(4):137–138.
9. Faiz KW. VAS–visuell analog skala [VAS--visual analog scale]. *Tidsskr nor Laegeforen*. 2014;134(3):323. doi:10.4045/tidsskr.13.1145
10. Dong Z, Zhou Y, Huang Y. Case-control study on the treatment of single-segment lumbar spinal stenosis with modified interlaminar approach and traditional approach. *China J Orthop Traumatol*. 2021;34(4):37–40.
11. Lian JQ, Ye MW, Chen JX. Non-steroidal painkillers joint Tuina for the treatment of acute lumbar sprain. *Shenzhen Combine Tradit Chin West Med J*. 2024;2:59–61.
12. Shen MF. Effect observation of Tuina therapy in rehabilitation nursing of acute lumbar sprain. *Primary Med Forum*. 2019;23(15):2178–2179.
13. Hu GX, Xia Z, Liu ZG, et al. Clinical effect of three-step Tuina therapy on acute lumbar sprain. *Tuina Guid*. 2008;2:12–13.
14. Li XM. Effect of four-step Tuina therapy on patients with acute lumbar sprain. *Med Equip*. 2016;29(18):64.
15. Li H. Effect of Tuina therapy on rehabilitation nursing of patients with acute lumbar sprain. *Chin Sci Technol J Database*. 2023;5:0414.
16. Wang QF. Application of Tuina therapy in rehabilitation nursing of patients with acute lumbar sprain. *Clin Res Trad Chinese Med*. 2019;11(3):91–93.
17. Liu XJ, Zhuo LX, Lin TT, Yanli L. Application of Tuina therapy in rehabilitation nursing of patients with acute lumbar sprain. *Nurs Pract Res*. 2017;14(3):137–139.
18. Zhao LY. Application effect analysis of Tuina therapy in rehabilitation nursing of patients with acute lumbar sprain. *Maternal Child World*. 2019;15:258.
19. Zhang QM, Fang M, Lu YM, et al. Clinical efficacy evaluation of three-step Tuina therapy for acute lumbar sprain. *Shanghai J Tradit Chin Med*. 2005;39(6):37–38.
20. Liu JQ, Sun B, Wu YD. Study on the clinical effect of Tuina manipulation on acute lumbar sprain. *Liaoning J Tradit Chin Med*. 2002;29(9):558.
21. Zhang JJ. Clinical effect of traditional Chinese Medicine Tuina on acute lumbar sprain. *Chin Contemp Med*. 2021;28(29):157–159.
22. Liu B, Zhang SM, Ma J, et al. Effect of external treatment of traditional Chinese Medicine on work and torque of elbow flexor muscle continuous centrifugal training. *Chin J Sports Med*. 2002;2:141–145.
23. Liu P, Zhang Y, Yan B. Study on the treatment of acute lumbar sprain with balanced-abdominal Tuina. *J Changchun Uni Chin Med*. 2012;28(4):658.
24. Liu JY. Mechanism of Tuina therapy for soft tissue injury. *Chin J Pract Med*. 2007;14:72–73.
25. CG L, Liu MJ. Practical Chinese Medicine Tuina. *Chengdu*. 2004:28–29.
26. Zhu LF, Pan XH, Zhou C, et al. Effect of acupressure on lower limb muscle spasm in hemodialysis patients. *Mod J Integr Chin West Med*. 2006;17:2347–2348.
27. Gong JD, Xi GF, Pan XP, et al. Relationship between Tuina analgesia and endorphins. *Shanghai J Tradit Chin Med*. 1982;4:22–23.
28. Rao ZL, Liao AT, Song NC. Systematic evaluation of Tuina therapy for acute lumbar sprain. *Tradit Chin Med Bonesetting*. 2019;31(12):29–33.