Comparison Between Oblique Pulling Spinal Manipulation and Other Treatments for Lumbar Disc Herniation: A Systematic Review and Meta-Analysis

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Abstract

Objective: The purpose of this review was to compare oblique pulling spinal manipulation with other treatments for lumbar disc herniation.

Methods: Randomized controlled trials of oblique pulling manipulation versus other treatment for lumbar disc herniation were identified using the following databases: China National Knowledge Infrastructure, Wanfang Data, Chinese Science and Technology Periodical Database, PubMed, the Cochrane Library, Embase, Chinese Biological Medicine, and Web of Science. Data extraction was carried out based on inclusion and exclusion criteria, and meta-analysis were performed using RevMan 5.3 software.

Results: Nine relevant randomized controlled trials with a total of 887 patients were included. Meta-analysis revealed that oblique pulling manipulation was superior in effective rate to lumbar traction (risk ratio = 1.12; 95% confidence interval [CI]: 1.06-1.19; $P < .01$) and acupuncture (risk ratio = 1.22; 95% CI: 1.06-1.39; $P < .01$) and more effective in Visual Analog Scale score (mean difference = - 1.03, 95% CI: -1.32 to -0.74; $P < .01$) when compared to lumbar traction. It also demonstrated a favorable effect of modified oblique pulling manipulation in Japanese Orthopedic Association scores when compared with lumbar traction (mean difference = 1.66, 95% CI: 0.89 to 2.43; $P < .01$).

Conclusion: In the treatment of lumbar disc herniation, oblique pulling spinal manipulation presented with a higher effective rate than acupuncture and lumbar traction. Manipulation had a favorable effect in alleviating pain, and modified oblique pulling manipulation had significant superiority in improving lumbar function when compared with lumbar traction. However, considering the low methodological quality of included studies, more rigorously designed trials should be performed in the future. (J Manipulative Physiol Ther 2018;41:771-779)

Key Indexing Terms: *Intervertebral Disc Displacement; Musculoskeletal Manipulations; Massage*

Introduction

Lumbar disc herniation (LDH), which affects the life quality of patients and the social security system adversely, is one of the common spinal diseases; its treatment has been paid great attention to in the spine department.[1] The disease can be treated by surgical or conservative methods.[2,3] Most authors suggest that the efficacy of conservative treatment is satisfying, indicating that conservative treatment should be the first choice for LDH.[4]

Manual therapy in traditional Chinese medicine, which plays an important role in the nonoperative treatments for lumbar disc herniation, is effective and used commonly in China.[5-7] Oblique pulling manipulation is one of the typical manual therapies (Fig 1). In a clinical study of 62 patients with LDH treated using oblique pulling manipulation, Ren reported the effective rate of this manipulation was 90.3%.[8] In another clinical study, Zheng treated 69 patients with LDH using modified oblique pulling manipulation and reported that its effective rate was high—up to 93%.[9] Many other authors also reported the efficacy of oblique pulling manipulation in the treatment of LDH.[10,11]

Moreover, Yang published a meta-analysis[12] to evaluate the effectiveness of oblique pulling manipulation or oblique pulling manipulation accompanied with other treatment for LDH, demonstrating in his study that the interventions in the experimental group present with a higher effective rate than lumbar traction, extradural blocking, and conventional massage. Since the publication of the meta-analysis, more trials, which focus only on the effectiveness of oblique

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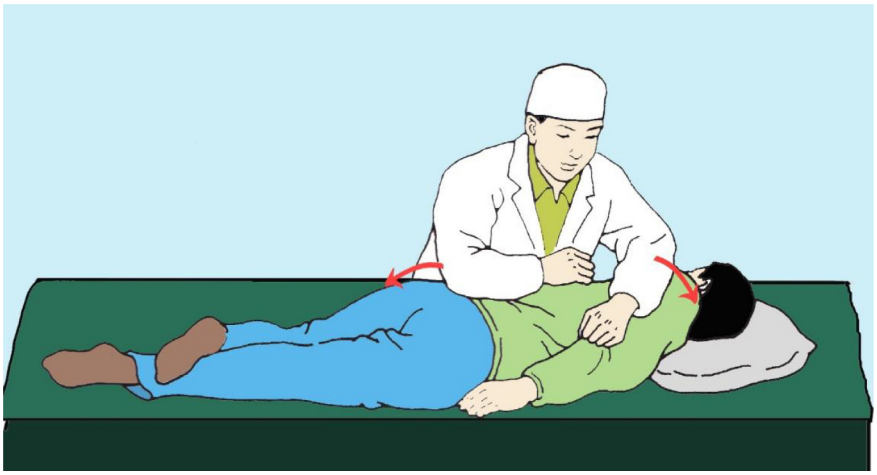

Fig 1. *Lumbar oblique pulling manipulation.*

pulling manipulation, have been carried out. However, until now, no meta-analysis has been published to evaluate the effectiveness of oblique pulling manipulation alone in the treatment of LDH.

Therefore, this study aimed to evaluate the current evidence of oblique pulling spinal manipulation compared with other treatments for LDH.

Materials and Methods

Data Sources

An electronic search was carried out in the following databases from their inception through October 20, 2017: PubMed, the Cochrane Library, Embase, Web of Science, Chinese Biological Medicine, the China National Knowledge Infrastructure, Chinese Science and Technology Periodical Database, and Wanfang Data. The language of these studies was restricted to Chinese and English. The searching was performed using medical subject headings and key words. The search strategy included the following group terms: English (herniated disc OR herniated disk OR disc prolapse OR disk prolapses OR disc prolapses OR disk prolapse OR intervertebral disc displacement OR intervertebral disc displacements OR intervertebral disk displacement OR intervertebral disk displacements OR slipped disc OR prolapsed disc OR prolapsed disk) AND (lumbar OR lumbar spine OR lumbar vertebra OR lumbar vertebrae) AND (manipulations OR musculoskeletal manipulations OR manual therapy OR manual therapies OR manipulation therapy OR manipulation therapies OR manipulative therapy OR manipulative therapies OR oblique pulling manipulation OR massage) AND (randomized controlled trials); Chinese (Tuina OR Shoufa OR ji rou gu ge shou fa OR zheng gu OR xie ban OR xie ban shou fa) AND (zhui jian pan tu chu OR zhui jian pan peng chu OR zhui jian pan yi wei OR zhui jian pan tuo chu) AND (sui ji) AND (yao zhui). The references in the located literatures also were searched manually for more relevant articles. Two physicians performed the search independently to ensure the consistency of the search. Two investigators independently reviewed the titles, subjects, and abstracts of articles and chose the potential ones, then they checked full texts of the chosen articles according to the inclusion and exclusion criteria, after which a third person checked the divergent articles.

Inclusion Criteria

Studies were included based on the following criteria: (1) randomized controlled trials (RCTs); (2) studies that compared oblique pulling manipulation or modified oblique pulling manipulation with Western medicine, lumbar traction, acupuncture, or other methods in the treatment of LDH; (3) studies in which oblique pulling manipulation or modified oblique pulling manipulation was employed as the sole management; (4) studies published in Chinese or English; and (5) studies in which LDH was diagnosed by symptoms, signs, and imaging examination.

Exclusion Criteria

The following studies were excluded: (1) non-RCT trials, (2) duplicate studies, (3) animal experiments, (4) literature review, (5) studies comparing different types of oblique pulling manipulations, (6) case reports or expert opinions, and (7) studies without integrated data.

Data Extraction

Two reviewers participated in the extraction of relevant data from the included studies. They collected following information independently: (1) basic characteristics, including author, study design, enrolled numbers, intervention measures, and evaluating indicators; (2) functional

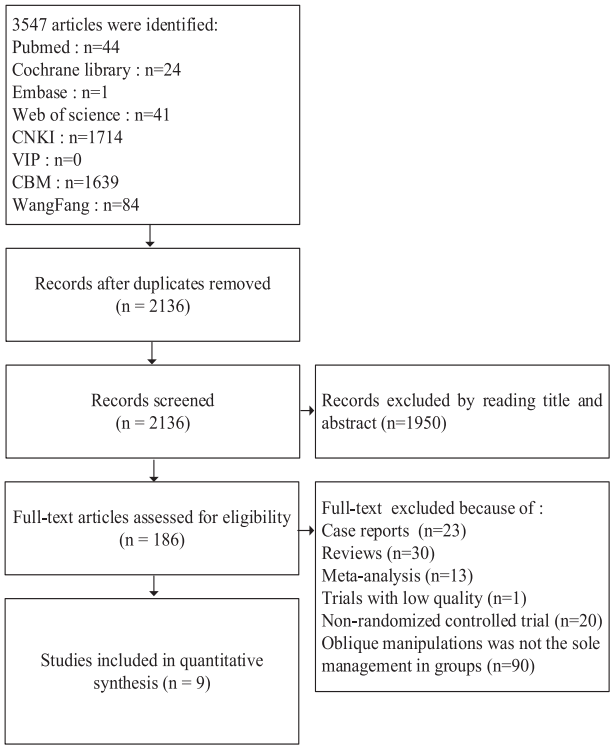

Fig 2. *Flow chart of study selection.* CBM, *Chinese Biological Medicine;* CNKI, *China National Knowledge Infrastructure;* VIP, *Chinese Science and Technology Periodical Database.*

outcomes, including effective rate, Japanese Orthopedic Association (JOA) scores, and Visual Analog Scale (VAS).

Quality Assessment and Baseline Characteristics

The Cochrane risk of bias tool was used for the quality assessment of the included studies, which was carried out independently by 2 reviewers. Disagreements were checked by the third person. Risk of bias included the following items: (1) random sequence generation, (2) allocation concealment, (3) blinding of participants and personnel, (4) blinding of outcome assessment, (5) incomplete outcome data, (6) selective reporting, and (7) other bias. The judgments on these items were categorized as low risk of bias, high risk of bias, or unclear risk of bias in the Cochrane assessment tool.

Statistical Analysis

A meta-analysis was carried out using Review Manager version 5.3 (The Nordic Cochrane Centre, Copenhagen, Denmark). Continuous variables (VAS, JOA) were analyzed using the mean differences (MDs) with 95% confidence interval (CI), and the dichotomous data (effective rate) using the risk ratio (RR) and its 95% CI. The heterogeneity studies were quantified by calculating the I^2, and $I^2 \geq 50\%$ indicated a substantial level of heterogeneity. A fixed-effects model was used when there was no significant heterogeneity between trials, otherwise a random-effects model was employed. $P < .05$ was regarded as a significant level.

Results

Identification of Relevant Studies

Three thousand five hundred forty-seven articles were identified totally. Of those, 1411 articles were excluded for duplications and 2136 were excluded by reading the titles and abstracts. The full texts of 186 articles were checked for eligibility, from which 23 were excluded because they were case reports, 30 were excluded for review articles, 13 were excluded for meta-analysis, 20 were excluded for nonrandomized controlled trials, and 90 were excluded for oblique-pulling manipulation not being the sole management in groups. In the rest of the 10 articles, 1 [13] was excluded for low quality, and finally 9 trials [11,14-21] were included in our analysis. Figure 2 shows the selection process for relevant studies.

Characteristics of the Included Trials

The included trials all were conducted in China and published in Chinese. The trials involved 887 patients, which included 537 men and 350 women, and the sample sizes ranged from 60 to 200 cases. For the diagnostic criteria of LDH, 6 trials [11,14,18-21] used the criteria of Traditional Chinese

Table 1. *Baseline Characteristics of the Included Trials*

Study	Number of Cases		Male/ Female	Age (y)	Course of Disease	Intervention Measure		Evaluating Indicator
	Experimental	Control				Experimental	Control	
Zhang Jun, et al, 2010[11]	32	31	29/34	25–54	0.5 y–10 y	Oblique pulling manipulation	Traction	Effective rate, VAS, JOA
Wang Lin Hua, et al, 2010[14]	32	30	37/25	25–55	1 wk–10 y	Oblique pulling manipulation	Traction	Effective rate, VAS, JOA
Li Yi Jing, et al, 2013[15]	50	50	48/52	22–65	—	Oblique pulling manipulation	Chinese medicine decoction	Effective rate
Tu Xin Sheng, et al, 2014[16]	60	40	70/30	22–55	>1 y	Oblique pulling manipulation	Yao tong ning capsule and compound DanShen tablet for oral	Effective rate
Wang Chang E, et al, 2016[17]	30	30	35/25	48.7–53.9	3.5±0.9 mo	Oblique pulling manipulation	Acupuncture	Effective rate
Ju Yao Dong, et al, 2014[18]	80	66	100/46	32–66	2 mo–6 y	Oblique pulling manipulation	Traction	Effective rate, VAS
Liu Wen, et al, 2012[20]	100	100	136/64	18–54	—	Oblique pulling manipulation	Traction, 25% mannitol 250 mL IV and osaminethacine 0.1 g for oral	Effective rate
Ding Yong, et al, 2014[21]	48	48	61/35	24–58	2.4±1.9 y	Oblique pulling manipulation	Acupuncture	Effective rate, JOA
Ning Guo Li, et al, 2015[19]	30	30	21/39	20–64	3 d–9 y	Oblique pulling manipulation	Traction	JOA, VAS

IV, intravenous injection; *JOA*, Japanese Orthopedic Association; *VAS*, Visual Analog Scale.

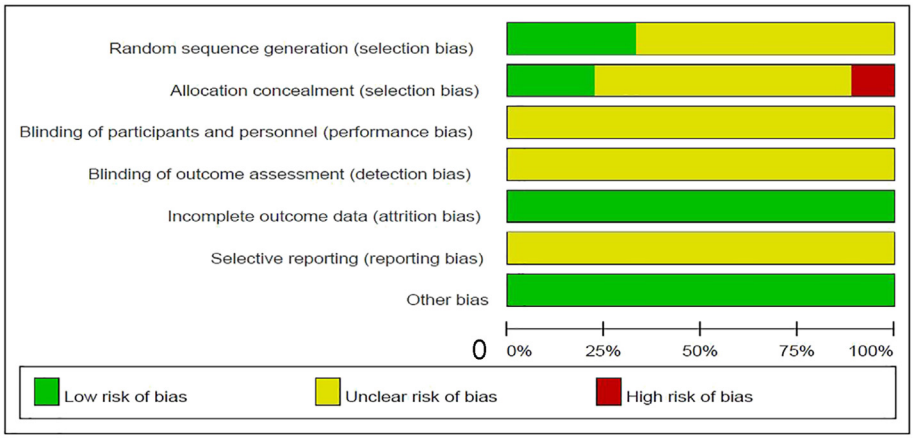

Fig 3. *Risk of bias.*

Medicine Disease Diagnosis and Efficacy,[22] 1 trial[16] did not provide the source of diagnostic criteria, and 2 trials[15,17] did not mention the diagnostic criteria. The major baseline characteristics of each included study are presented in Table 1.

In the treatment groups, all 9 trials employed oblique pulling manipulation as the sole treatment; the type of oblique pulling manipulation included traditional oblique pulling manipulation and modified oblique pulling manipulation. Seven trials[15-21] employed traditional oblique pulling manipulation and 2

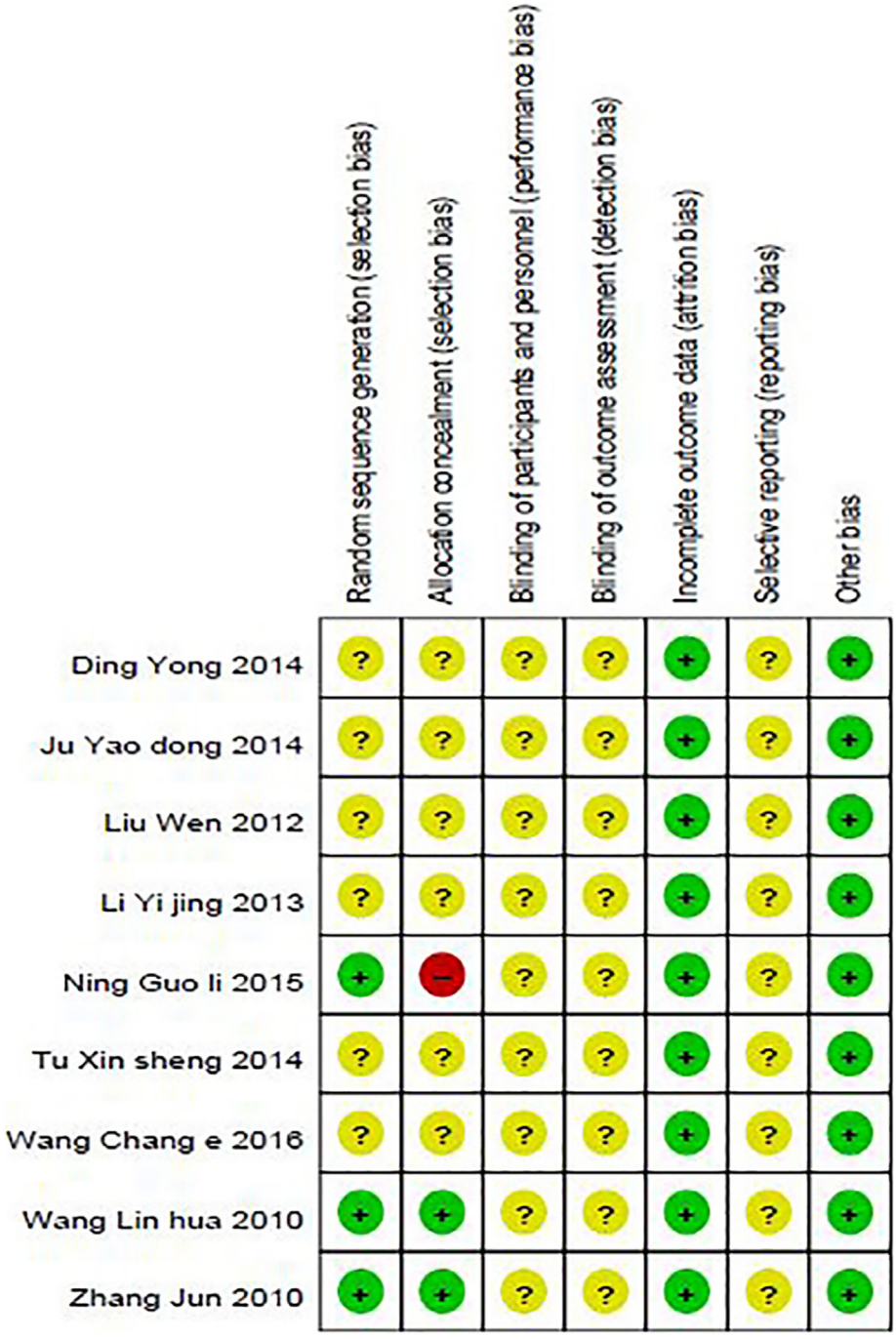

Fig 4. *Risk of bias summary.*

trials[11,14] used the modified one. Types of control groups consisted of Western medicine, Chinese medicine decoction, Chinese patent medicine, acupuncture, and lumbar traction, in which 5 trials[11,14,18-20] used lumbar traction, 2 trials[17,21] used acupuncture, 1 trial[15] used Chinese medicine decoction, and 1 trial[16] used Chinese patent medicine. In the 9 trials, effective rate was used as outcome measurement in 8 trials,[11,14-18,20,21] The JOA score was employed in 4 trials,[11,14,19,21] and VAS score was used in 4 trials.[11,14,18,19]

Quality Assessment

The risk of bias assessment, based on the Cochrane criterion, was summarized in Figures 3 and 4. The patients

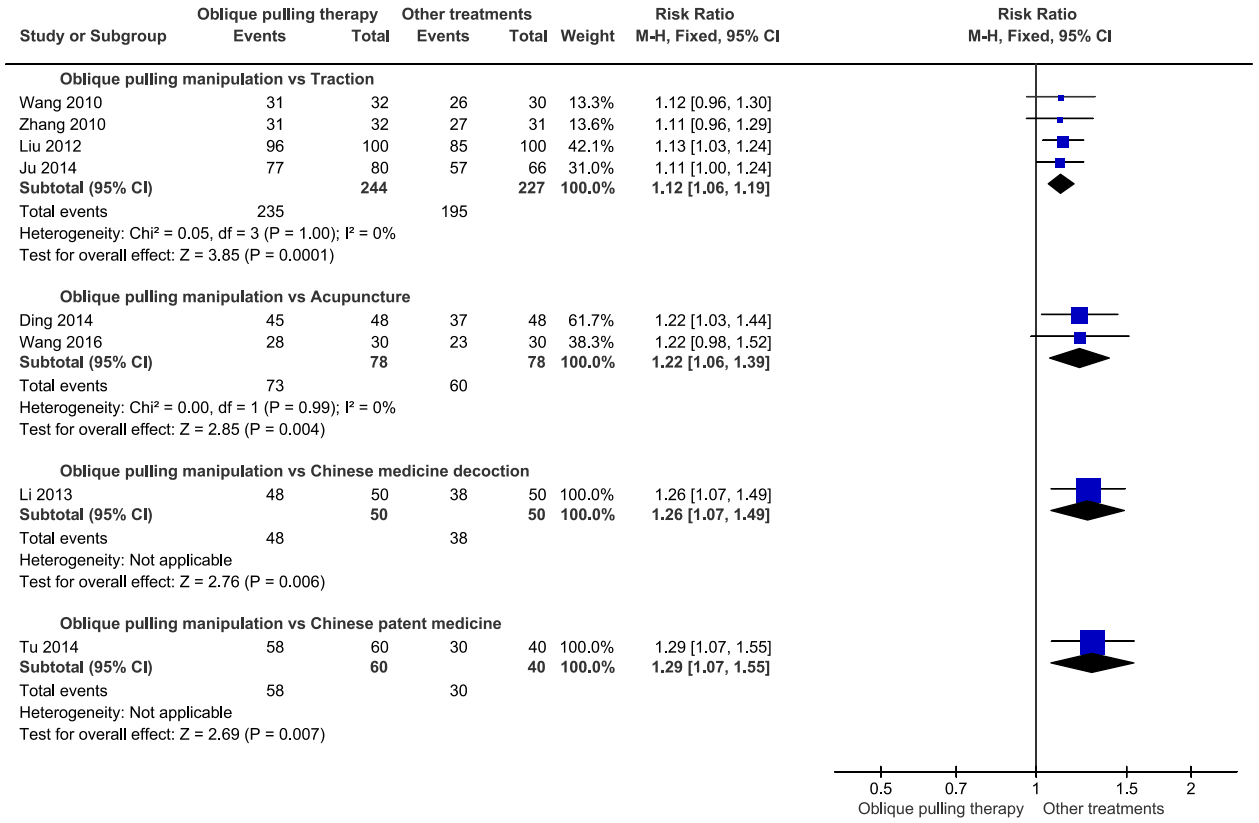

Fig 5. *Meta-analysis of the effective rate between oblique pulling manipulation and other treatments.* CI, *confidence interval;* M-H, *Mantel-Haenszel.*

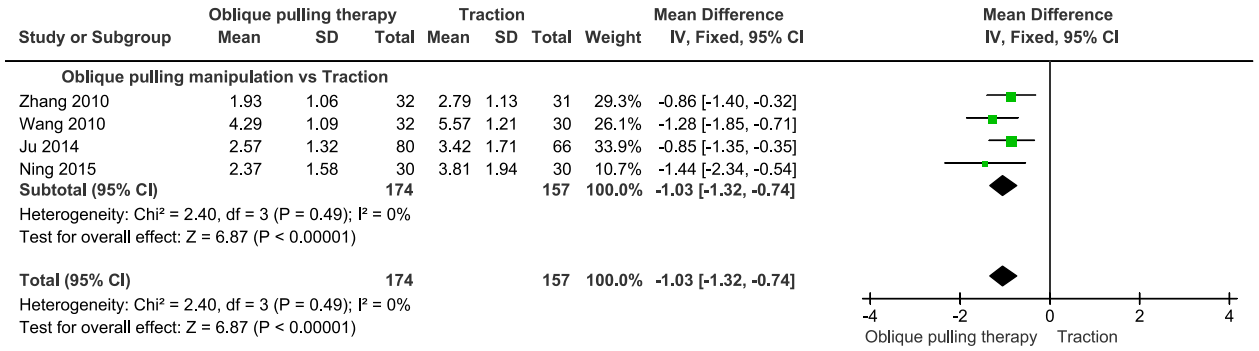

Fig 6. *Meta-analysis of Visual Analog Score between oblique pulling manipulation and traction.* CI, *confidence interval;* IV, *inverse variance.*

in 9 trials were randomly assigned to treatment or control groups, in which 1 trial[19] adopted a table of random numbers, 2 trials[11,14] used a network stochastic system, and 6 trials[15-18,20,21] did not mention the randomization method in detail. In addition, no trials mentioned the blinding method, allocation concealment, or follow-up in the included trials. Nine trials[11,14-21] reported entire outcome data, and 1 trial[11] reported missing or declining cases. No trials reported the adverse reaction.

Meta-analyses Results

Effective Rate. Eight trials[11,14-18,20,21] used effective rate as the primary outcome measurement. As Figure 5 shows, $I^2$is equal to 0%, indicating that the heterogeneity of 8 trials was low, so a fixed-effect model was used to analyze. The effective rate of oblique pulling manipulation versus lumbar traction showed a significant difference (RR = 1.12; 95% CI: 1.06-1.19; $P < .01$), demonstrating that the effective rate of oblique pulling manipulation was higher than lumbar

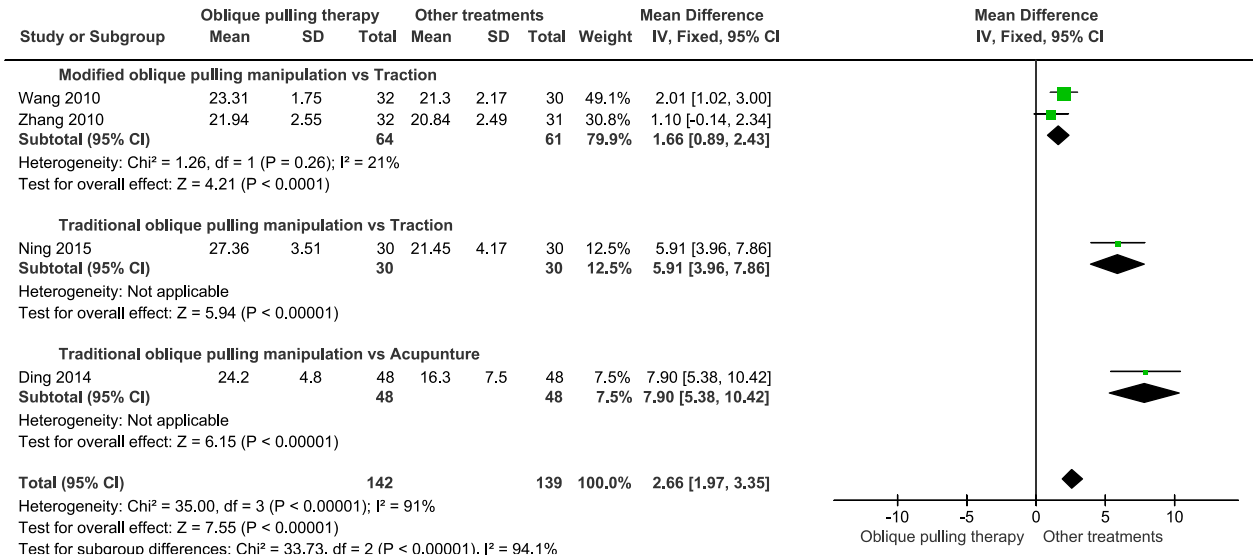

Fig 7. *Subgroup analysis of JOA score between oblique pulling manipulation and other treatments.* CI, *confidence interval;* IV, *inverse variance;* JOA, *Japanese Orthopedic Association;* SD, *standard deviation.*

traction. At the same time, when compared with acupuncture, oblique pulling manipulation also yielded a beneficial effect (RR = 1.22; 95% CI: 1.06-1.39; $P < .01$). In addition, 1 single trial comparing oblique pulling manipulation with Chinese medicine decoction, and 1 comparing oblique pulling manipulation with Chinese patent medicine, both showed a favorable effect of oblique pulling manipulation (Fig 5).

VAS Score and JOA Score. Four RCTs[11,14,18,19] that compared oblique pulling manipulation with lumbar traction reported VAS scores as outcome measurements. The comparison of VAS score is shown in Figure 6. Similarly, $I^2$was equal to 0%; the heterogeneity was low. The results (MD = - 1.03, 95% CI: -1.32 to -0.74; fixed-effect model; $P < .01$) showed that the VAS score in oblique pulling manipulation[11,14,18,19] was lower than that in lumbar traction (Fig 6).

Four RCTs[11,14,19,21] reported JOA as outcome measurements. A subgroup analysis was performed for the included 4 trials according to difference in intervention measures[11,14,19,21] because I^2 was high up to 91% when merging (Fig 7). In Figure 7, we found that the heterogeneity of 2 trials comparing modified oblique pulling manipulation with lumbar traction (I^2 = 21%) was low. The results showed that JOA scores in the modified oblique pulling manipulation group (MD = 1.66, 95% CI: 0.89-2.43; fixed-effect model; $P < .01$) were significantly higher than in the lumbar traction group. In addition, in the other 2 trials, 1 compared traditional oblique pulling manipulation with lumbar traction, 1 compared traditional oblique pulling manipulation with acupuncture, and both demonstrated a better effect of traditional oblique pulling manipulation.

Discussion

Result Analysis

In our meta-analysis, 9 published RCTs[11,14-21] on oblique pulling manipulation versus other treatments were analyzed, which demonstrated that oblique pulling manipulation presented with a higher effective rate than acupuncture and lumbar traction. Besides, oblique pulling manipulation had a better effect in alleviating pain, and modified oblique pulling manipulation had significant superiority in improving lumbar function compared to lumbar traction.

However, the methodological quality of some included trials was low, and the safety of oblique pulling manipulation for LDH is still unclear because no trials mentioned adverse events in detail, so the positive findings in the current study should be interpreted cautiously.

Mechanism of Oblique Pulling Spinal Manipulation

The mechanism of oblique pulling spinal manipulation in the treatment of LDH is attributed to the following 3 aspects: (1) Using the opposite pressure on the hip and shoulder from the same side, oblique pulling manipulation can improve the symptoms of lumbar disc herniation by decreasing lumbar disc internal pressure, increasing the volume of the nerve root canal, and relaxing adhesion between lumbar facet joints.[23] (2) During the manipulation, a displacement generated between nerve roots and the intervertebral disc can decrease the compression of nerve roots, which leads to pain relief.[24] (3) Oblique pulling manipulation can significantly improve the lumbar soft tissue tension in patients with LDH, facilitating relief of low back pain.[25]

In our meta-analysis, both oblique pulling manipulation and modified oblique pulling manipulation were included in trials. Different from traditional oblique pulling manipulation, in modified oblique pulling manipulation, the manipulation force can be concentrated at the herniated lumbar level, so modified oblique pulling manipulation presents with more accuracy, safety, and effectiveness than traditional oblique pulling manipulation.[9] In comparing JOA, the heterogeneity of trials was high up to 91%, but in subgroup analysis the heterogeneity decreased, indicating different types of oblique pulling manipulation may be the major factor of heterogeneity.

Strengths and Limitations

Different from the previous meta-analysis carried out by Yang,[12] in the current study we only included the trials in which oblique pulling manipulation or modified oblique pulling manipulation were employed as the sole management. In addition, our meta-analysis included more trials and evaluating indicators, and subsequently our meta-analysis can better demonstrate the effectiveness of oblique pulling manipulation for LDH.

However, there were some limitations in our study. First, the quality of included trials was low and they were not well-designed randomized controlled trials because of the randomized method and blinding for study. Second, effective rate was used as an outcome measurement in most included trials; however, it is not internationally recognized. Third, all the included trials did not report adverse reaction, so the safety of oblique pulling manipulation in the treatment of LDH is still uncertain. In addition, all the included trials were performed and published in China, so publication bias might exist as Chinese patients prefer to select manual treatment in the treatment of LDH and physicians in Asian countries are reported to be more likely to publish positive results.[26]

Implications for Future Trials

Considering the low quality of the trials in the current study, future RCTs should be performed rigorously according to the Consolidated Standards of Reporting Trials statement and Guideline for Reporting Interventions on Spinal Manipulative Therapy.[27] Meanwhile, allocation concealment and blinding of outcome evaluation should be employed, and the details of randomization methods should be described in articles. Besides, internationally recognized outcome measurements should be used in future trials correctly to facilitate better comparison of effectiveness in different groups. In addition, the information, including follow-up, dropout, withdrawal, and adverse reactions, should be recorded and reported in details to assess the safety of oblique pulling manipulation.

Conclusion

In the treatment of LDH, oblique pulling manipulation presented with a higher effective rate than acupuncture and lumbar traction, oblique pulling manipulation had a favorable effect in alleviating pain, and modified oblique pulling manipulation had a significant superiority in improving lumbar function when compared with lumbar traction. However, considering the low methodological quality of included studies, more rigorously designed trials should be performed in the future.

Funding Sources and Conflicts of Interest

This study was supported by Natural Science Foundation of Guangdong Province, China, NO.2016A030313076 and Science and Technology Plan Projects of Guangzhou, China, NO.201607010252. No conflicts of interest were reported for this study.

Contributorship Information

Concept development (provided idea for the research): T.S.
Design (planned the methods to generate the results): Z.M., T.S.
Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): T.S.
Data collection/processing (responsible for experiments, patient management, organization, or reporting data): Z.M., R.Z.
Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): Z.M.
Literature search (performed the literature search): Z.M., R.Z.
Writing (responsible for writing a substantive part of the manuscript): Z.M.
Critical review (revised manuscript for intellectual content, this does not relate to spelling and grammar checking): T.S.
Other (list other specific novel contributions): J.C., X.S.

Practical Applications

- Research supports that oblique pulling spinal manipulation is effective in improving physical function and reducing pain for lumbar disc herniation.
- This meta-analysis provides the recent RCTs to compare oblique pulling manipulation with other treatments for lumbar disc herniation.

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