DOI: 10.53469/jcmp.2025.07(04).13

A Meta-analysis of the Efficacy of Acupuncture Therapy Combined with Percutaneous Vertebroplasty in the Treatment of Osteoporotic Fractures

Yue Li[1], A'ni Ma[2,*]

[1]Department of Orthopedics, Xi'an Honghui Hospital, Xi'an Jiaotong University, Xi'an 710000, Shaanxi, China
[2]Affiliated Hospital of Shaanxi University of Chinese Medicine, Xianyang 712000, Shaanxi, China
**Correspondence Author*

Abstract: ***Objective:*** ***To explore the safety and effectiveness of acupuncture combined with percutaneous vertebroplasty in the treatment of osteoporotic fractures by Meta-analysis.*** ***Methods:*** ***The domestic and foreign medical databases including VIP, Chinese Clinical trial Registry, CNKI, Wanfang, CBM and foreign databases including PubMed, Embase, Cochrane Library, Cilnical trial were searched by computer. The retrieval content was randomized controlled trials of acupuncture and moxibustion combined with percutaneous vertebroplasty in the treatment of osteoporotic fractures. The selected outcome indicators were total effective rate, incidence of adverse reactions, VAS score, dysfunction index and cobb Angle. For the type of statistical index, the total effective rate and the incidence of adverse reactions were dichotomous variables, and VAS score, dysfunction index, and cobb Angle index were continuous variables. Two researchers independently included and excluded the literature. Strict quality evaluation was used to evaluate the quality of the literature that met the criteria, and the data were strictly extracted. The tools for assessing the risk of bias in the Cochrane Handbook for Systematic Reviews and the jadad quality assessment scale were used. After data extraction, Revman5.4 software was used for Meta-analysis.*** ***Results:*** ***A total of 2587 articles were included. The treatment methods included acupuncture + surgery, traditional Chinese medicine + surgery, simple surgery, etc. The Jadad score showed that the quality of the included literature was average. The Cochrane review showed that the risk of bias of the included studies was moderately high. Meta-analysis results showed that: Acupuncture and moxibustion combined with vertebroplasty had better clinical efficacy than vertebroplasty alone in the treatment of osteoporotic compression fractures, which could significantly improve the total effective rate [OR=5.55, 95% CI (2.22, 13.88), P=0.0002], VAS score [MD=-0.90, P=0.000], and the difference was statistically significant (P < 0.05). 95% CI (1.14, 0.66), P < 0.00001], ODI score [MD = 4.88, 95% CI (7.03, 2.74), P < 0.00001], cobb Angle [MD = 6.77, 95% CI (7.14, 6.41), P < 0.00001] were statistically significant (P < 0.05). There was no significant difference in the incidence of adverse reactions between the two groups before and after treatment [OR=0.39, 95% CI (0.07, 2.05), P=0.27] (P > 0.05), which suggested that the two treatment schemes were similar in safety and were reliable treatment methods.*** ***Conclusion:*** ***Compared with the simple operation, acupuncture therapy combined with operation in the treatment of osteoporotic fracture has better effect, can reduce VAS score, improve ODI index, improve the quality of life of patients, correct cobb Angle, and has better safety, can improve postoperative pain and movement disorders and other complications, has good application value.***

Keywords: Acupuncture, Percutaneous vertebroplasty, Osteoporotic fracture, Meta-analysis, Randomized controlled**.**

1. Introduction

Osteoporosis (OP) is a common orthopedic disease, and most of the patients are menopausal women, which is related to the decrease of estrogen secretion after menopause [1]. Studies have shown that the incidence of OP in China has been increasing year by year in recent years. The main factors may be the progress of aging society and the increase of life expectancy caused by the increase of medical level. The pathogenesis of osteoporosis is that aging or other factors lead to metabolic disorders resulting in calcium loss. The number of bone trabeculae is low, bone density is decreased, and bone strength and toughness are reduced. OVCF) [2]. OVCF is characterized by low back pain and discomfort accompanied by spinal kyphosis and activity limitation, sometimes muscle pain and spasm, which often reduces the quality of life of patients and causes physical and mental damage. Patients with severe disease can be induced to fracture under the guidance of slight external force, such as forced defecation, sneezing and coughing [3]. Conservative treatment of OVCF requires bed rest and requires a long time, even if drugs are taken, it will inevitably cause bone loss, which may further worsen the condition, and accompanied by a series of dangerous complications caused by long-term bed rest such as thrombosis, and in severe cases, it will endanger the patient's life [4]. The first choice of treatment is surgery, which not only has a short rest time, but also has a good correction effect on the deformity. It can get off the ground earlier and effectively avoid the occurrence of complications. Among them, percutaneous vertebroplasty is the most commonly used surgical treatment method in clinical practice [5], which has been widely recognized. In terms of classification, it can be divided into traditional percutaneous vertebroplasty (PVP) and percutaneous kyphoplasty (PKP). After surgery, the pain and discomfort of patients can be significantly improved, and the quality of life of patients can be improved. However, there are still postoperative complications such as low back pain, adjacent segment degeneration, and partial limitation of movement [6]. The use of conventional western medicine, such as calcium and vitamin D, can achieve a certain effect, but sometimes the effect is not ideal after long-term use. Therefore, how to reduce postoperative complications and improve the quality of life of patients after surgery is the problem that needs to be studied clinically.

Osteoporosis belongs to the categories of "bone obstruction" and "bone weakness" in traditional Chinese medicine. The lesion is in the bone, and its origin is in the kidney. Therefore,

in the treatment of osteoporosis, the treatment principles of tonifying the liver and tonifying the kidney, removing blood stasis and relieving pain are often used. In recent years, clinical studies have confirmed the effectiveness of acupuncture therapy combined with percutaneous vertebroplasty for osteoporotic fractures [7], but there is still a lack of relevant systematic reviews to provide evidence-based evidence. In this paper, Meta-analysis was used to systematically evaluate the clinical efficacy of acupuncture and moxibustion combined with percutaneous vertebroplasty in the treatment of osteoporotic fractures, so as to provide evidence-based reference for clinical decision-making in the treatment of knee osteoarthritis.

2. Materials and Methods

2.1 Data Sources

The data sources of systematic reviews and meta-analyses were retrieved from domestic and foreign medical databases, including CNKI, Wanfang, VIP, CBM, Chinese Clinical trial Registry, and foreign databases including PubMed, WOS, Embase, Cochrane Library, Cilnical trial. In Chinese, the key words are "acupuncture", "acupuncture", "electroacupuncture", "vertebroplasty", "PKP", "PVP", "osteoporosis" and "compression fracture". "Fractures, Compression," "Osteoporosis," "Fractures," The key words of "Bone", "Vertebroplasty", "Electroacupuncture", "Acupuncture" and "Kyphoplasty" were searched by joint search of subject words and free words. The search of English subject words followed the retrieval principle of mesh to ensure accuracy. The search time limit was from the establishment of the database to December 2022. Unpublished studies and protocols in Chinese clinical Trial registries and clinical trials were also searched to ensure the inclusion of the latest study results.

2.2 Literature Inclusion and Exclusion Criteria

2.2.1 Inclusion criteria of literature

① Study type: acupuncture and moxibustion combined with percutaneous vertebroplasty for osteoporotic fractures; ② Subjects: diagnostic criteria met osteoporotic compression fracture; ③RCT: the clinical randomized controlled trial with the method of randomization clearly stated and the original data published; ④ Intervention measures: the experimental group was treated with acupuncture and moxibustion combined with percutaneous vertebroplasty, and the control group was treated with single treatment such as simple surgical treatment. ⑤ Outcome indicators: total effective rate, visual analogue scale (VAS) score, The Oswestry Disability Index (ODI) score, cobb Angle and other outcome indicators. ⑥ Safety indicators: the incidence of adverse reactions ⑦ have clear X-ray, CT and other imaging diagnosis

2.2.2 Exclusion criteria of literature

① Inaccurate diagnostic criteria, unclear efficacy indicators and vague descriptions; ② literature with defects in the design of trial process, trial content, or statistical method design, and with records of baseline but questionable content; ③ literature with high risk of bias or low quality evaluation, which has no reference value; ④ clinical research literature that is not randomized controlled trial; ⑤ Repeated publications, reviews, animal experiments, personal experience, conference proceedings, case reports; ⑥ the outcome indicators were not used in the literature such as VAS score and ODI score; ⑦ literature with obvious errors in data; ⑧ literature with missing data or complete original text could not be obtained; ⑨ literature failed to provide imaging diagnosis evidence

2.3 Data Extraction

The inclusion and exclusion of the literature were screened independently by two researchers, strictly following the retrieval mode of the literature flow chart, and the initial screening literature was obtained after checking by two people. For the management of the literature screening results, EndNote 20 software was used to extract the data and import it into Excel to make a data table. The decision was made jointly after discussion. If there were missing data in the literature, the data were obtained and supplemented by email or telephone with the authors of the article. The extracted data included basic information of the study (title, author, year, type) and subject information (number, age, baseline).

Study information (interventions, outcome indicators and outcome measurement data, implementation process, follow-up) bias information (randomization, allocation concealment, blinding, drop out, etc.)

2.4 Literature Quality Evaluation

The risk of bias of the included studies was assessed using the principles for assessing the risk of bias of RCTS outlined in the Cochrane Handbook for Systematic Reviews [8], version 5.1.0, which included: Random sequence generation, allocation concealment, blinding of participants and persons, intention-to-treat analyses, completeness of outcome data, selective reporting, and other source biases, indicating low risk when the data source is accurate. high risk was defined when the source of the data was unclear, and unclear was defined when the content of the data was not specified. The quality of the literature was evaluated by Jadad scale [9], which was independently evaluated by two researchers. The Jadad scoring criteria were as follows: ① Random method: the random method was not described (0), only the use of random method was described (1), and there was an appropriate random allocation method in the literature (2). The highest score (2); ② Blinding: the use of blinding was not described (0), only the use of blinding (1), the availability of appropriate double-blind or triple-blind trials (2), the highest score (2); ③ Allocation hiding: no allocation hiding (0) was described, only hiding (1) was described, with appropriate allocation hiding (2) and the highest score (2); ④ Withdrawal and loss to follow-up: the withdrawal and loss to follow-up were not explained (0), but the withdrawal and loss to follow-up were explained (1). The reasons for withdrawal and loss to follow-up in the trial were described (2), and the highest score was (2). A comprehensive score of 0-2 was considered as low quality literature, 3-5 as medium quality literature, and 6-8 as high quality literature.

2.5 Statistical Analysis

RevMan5.4 software provided by Cochrane Collaboration Network [10] was used for statistical analysis. Relative risk (RR) OR relative odds ratio (OR) was used to combine the data of dichotomous variables and calculate the 95% confidence interval (95%CI). Continuous variables were measured by Mean (Mean) and standard deviation (SD), combined statistics and 95%CI were calculated. Chi-square and I2 were used to test the heterogeneity of the experimental results, when P & gt; 0.05, I2< When P≤0.05 and I2≥50%, the fixed effect model can be used to analyze the heterogeneity of the study. When P≤0.05 and I2≥50%, the heterogeneity between the studies is obvious or large. A random effect model was used to analyze the results. Sensitivity analysis or subgroup analysis based on random effects model was used to explore the sources of heterogeneity. Funnel plot was used to analyze the potential publication bias of the included studies.

3. Results

3.1 Results of Literature Search and Data Characteristics of Included Studies

According to the above retrieval methods, 2587 articles were retrieved initially, including 679 articles in CNKI, 523 articles in Wanfang, 422 articles in VIP, 757 articles in CBM, 69 articles in PubMed, 58 articles in EMbaseand 79 articles in Cochrane Library. After importing the literature data into EndNote 20, we checked the duplicate. A total of 1845 literatures were excluded, and 742 literatures were read in abstracts. After excluding literatures that did not meet the inclusion criteria, such as conference abstracts and animal experiments, 108 literatures were obtained. After full text reading, excluding literatures that did not meet the criteria, 10 literatures were finally obtained that met the inclusion criteria of this study. The total sample size of the included literature was 732 cases, and the sample size ranged from 20 to 63 cases. The average age of the participants was 42 to 83 years old, and the follow-up time ranged from 1 month to 2 years. The outcome indicators included in the literature mainly included the total effective rate of treatment, bone mineral density after treatment, ODI, cobb Angle, VAS, incidence of adverse reactions, and the degree of anterior vertebral Angle compression. The course of treatment ranged from 6 days to 6 months. The flow chart of literature search is shown in Figure 1, and the data characteristics of the included studies are shown in Table 1.

Table 1: Basic characteristics of the included literature

Literature	sample size,			Intervention methods		Outcome measures	Course of treatment
	Treatment group	Control group	Total number of persons	Treatment group	Control group		
Shan-shan Chen 2019[11]	36	36	72	Acupuncture and moxibustion combined with PKP and conventional medication were used	PKP+ conventional drug treatment	①②④⑥	The treatment was given once daily for 2 weeks
Chen Xu 2021[12]	35	35	70	Acupuncture and moxibustion combined with PKP and conventional medication were used	PKP+ conventional drug treatment	②④⑤	The treatment was given once every other day for 2 months
Zheng Xinlei 2020[13]	41	41	82	Acupuncture combined with PKP+ traditional Chinese medicine	PKP+ TCM treatment	①③	The treatment was given once a week for 6 months
Huang Mi 2016[14]	20	20	40	Acupuncture combined with PKP	PKP	②④⑤⑥	The treatment was given once a day for 6 consecutive days
Zhu Ruifei 2017[15]	30	29	60	Acupuncture and moxibustion combined with PKP and conventional medication were used	PVP+ conventional drug treatment	④⑥	The treatment was given 5 times a week for 4 weeks
Chen Zhengsheng 2018[16]	32	31	63	Acupuncture and moxibustion combined with PKP and conventional medication were used	PVP+ conventional drug treatment	②③④	The treatment was given twice a week for 6 months
Chen Ping 2021[17]	63	64	127	Acupuncture and moxibustion combined with PKP and conventional medication were used	PVP+ conventional drug treatment	①②⑥	Five sessions per week for 4 weeks
Liu Kun 2017[18]	36	36	72	Acupuncture combined with PKP	PKP	②④⑤	The treatment lasted for 12 weeks
Liu Zhigang 2020[19]	43	43	86	Acupuncture combined with PKP	PKP	②③④⑤⑥	The treatment was given once every other day, 5 times a week for 12 weeks
Zhang Lianqiang 2020[20]	30	30	60	Acupuncture and moxibustion combined with PKP and conventional medication were used	PVP+ conventional drug treatment	①②⑥	The treatment lasted for 2 weeks

Note: PKP: percutaneous kyphoplasty; PVP: percutaneous vertebroplasty: ① effective rate; ② Visual analogue scale (VAS) score after treatment; ③ bone mineral density after treatment; ④ODI; ⑤cobb Angle; ⑥ Other indicators

Continued Table 1

The literature	Mean age		Sex				Adverse events	Follow-up
	Treatment group	Control group	Treatment group Male	Treatment group female	Treatment group Male	Treatment group female		
Shan-shan Chen 2019	58.3±6.7	57.6±7.2	16	20	17	19	Not mentioned	The patients were followed up one month later
Chen Xu 2021	59.1±5.6	59.7±5.0	18	17	16	19	Not mentioned	Not mentioned
Zheng Xinlei 2020	68.61±8.42	68.82±8.35	18	23	19	22	Have a record	Not mentioned
Huang Mi2016	77.7±8.5	77.7±8.5	3	17	3	17	Not mentioned	The patients were followed up at 1, 6, 1 and 2 years

Zhu Ruifei 2017	74.5±6.26	75.96±6.69	14	16	13	16	Have a record	All patients were followed up for 6 months
Chen Zhengsheng 2018	76.55±6.78	77.02±5.21	0	32	0	31	Not mentioned	Not mentioned
Chen Ping 2021	57.6±13.2	59.3±12.7	37	25	36	28	Have a record	The patients were followed up for 3 and 6 months
Liu Kun 2017	75.08±4.48	75.03±4.41	11	25	9	27	Not mentioned	The patients were followed up at 1, 6 and 12 months
Liu Zhigang 2020	67.83±7.04	67.03±6.93	30	13	27	16	Not mentioned	Not mentioned
Zhang Lianqiang 2020	72.03±7.03	73.30±6.08	9	21	6	24	Have a record	Not mentioned

3.2 Methodological Quality Assessment of Included Studies

All the 10 studies included in this study mentioned randomization, among which 6 studies [11,12,15,16,17,19] used random number table method,1 study [20] used computer randomization method, and the remaining 3 studies [13,14,18] only mentioned randomization method without explanation of the randomization method. The included studies did not mention the method of concealment of allocation or the blinded design. One study [15] mentioned the number of lost follow-up without specific instructions, and two studies [16.20] had specific instructions for lost follow-up and withdrawal. Adverse events were recorded in four [13,16,17,20] studies and baseline data were comparable in all included studies. The Jadad score was used to assess the quality of the included literature, as shown in Table 2. The results showed that the overall quality of the included literature was moderate to low. The risk bias assessment items of the Cochrane Collaboration network were used for assessment and the risk of bias assessment chart was made, as shown in Figs. 2-3. The results showed that the overall risk of bias of the included studies was moderately high, which was consistent with the conclusion obtained by Jadad score, suggesting that the quality of the studies was fair.

Table 2: Quality assessment results of the included literature

Name of included literature	Random sequence generation	Concealment of randomization	Blinding of methods	Loss to follow-up or withdrawal	Baseline	Jadad score
Shan-shan Chen 2019	Random number table method	Not mentioned	Not mentioned	Not mentioned	comparable	2
Chen Xu 2021	Random number table method	Not mentioned	Not mentioned	Not mentioned	comparable	2
Zheng Xinlei 2020	Just mention random	Not mentioned	Not mentioned	Not mentioned	comparable	1
Huang Mi 2016	Just mention random	Not mentioned	Not mentioned	Not mentioned	comparable	1
Zhu Ruifei 2017	Random number table method	Not mentioned	Not mentioned	To mention only	comparable	3
Chen Zhengsheng 2018	Random number table method	Not mentioned	Not mentioned	Have a record	comparable	4
Chen Ping 2021	Random number table method	Not mentioned	Not mentioned	Not mentioned	comparable	2
Liu Kun 2017	Just mention random	Not mentioned	Not mentioned	Not mentioned	comparable	1
Liu Zhigang 2020	Random number table method	Not mentioned	Not mentioned	Not mentioned	comparable	2
Zhang Lianqiang 2020	Randomization was performed by computer software	Not mentioned	Not mentioned	Have a record	comparable	4

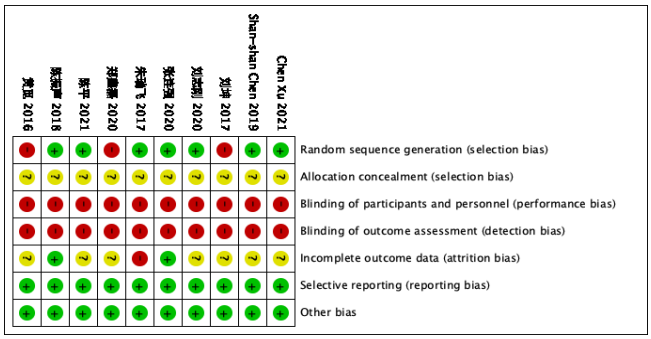

Figure 2: Plot of the risk of bias of the included studies

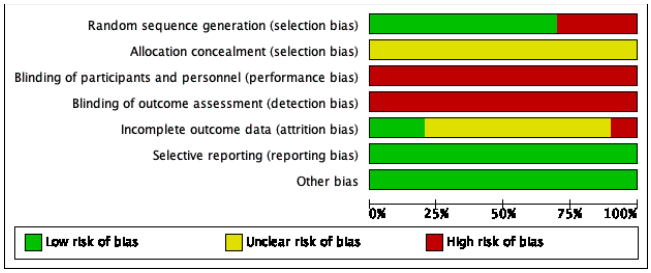

Figure 3: Risk of bias plot of included studies

3.3 Results of Meta-analysis

3.3.1 Total effective rate of treatment

Among the 10 included articles, 4 articles [11,13,19,20] reported the total effective rate of treatment, with a total of 300 patients, including 150 patients in the acupuncture combined with surgery treatment group and 150 patients in the surgery control group. The analysis results showed that there was no heterogeneity between the studies ($P > 0.05$, $I2=0$), which could be analyzed by the fixed effect model. The results showed that the total clinical effective rate of the treatment group was significantly different from that of the control group [$Z=3.67$, $P=0.0002$], and the treatment effective rate of the treatment group was higher than that of the control group [OR=5.55, 95% CI (2.22, 13.88), $P=0.0002$]. This suggests that acupuncture combined with surgery is more effective than surgery alone. See Figure 4.

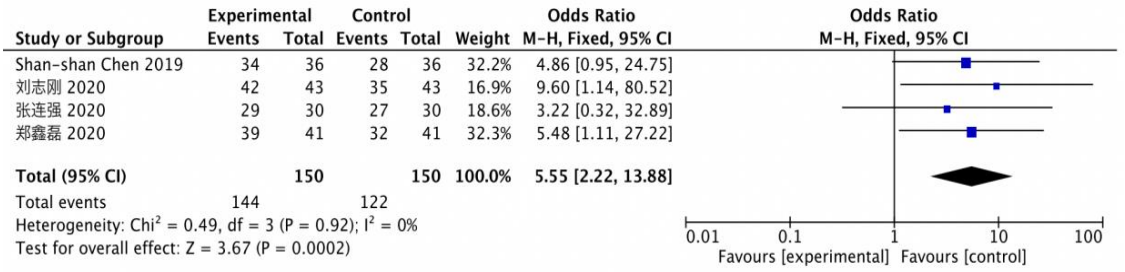

Figure 4: Effective rate of osteoporotic fracture treatment in the 2 groups

3.3.2 VAS score

Are included in the research of the communist party of China has 9,12,13,14,16,17,18,19,20 [11] research involving visual analog pain score (VAS), a total of 672 cases of patients, including acupuncture treatment group, 336 cases of combined surgery, surgery in the control group 336 examples, analysis results show that the heterogeneity between (P < 0.00001, I2=88%) using a random-effects model. It is speculated that the source of heterogeneity may be related to the use of different conventional drugs and different medication time, the length of medication will affect the level of VAS, and the method of PVP/PKP surgery and the method of bone cement injection will also affect the accuracy of VAS score. The results of Meta-analysis showed that the differences in VAS scores between the treatment group and the control group after treatment were statistically significant, and the combined test analysis results [Z=7.30, P < 0.0001] showed that the VAS score of the treatment group was lower than that of the control group [MD=-0.90, 95% CI (-1.14,-0.66), P < 0.00001]. This suggests that compared with surgery alone, surgery combined with acupuncture can better improve the postoperative symptoms and relieve the pain of patients. See Figure 5.

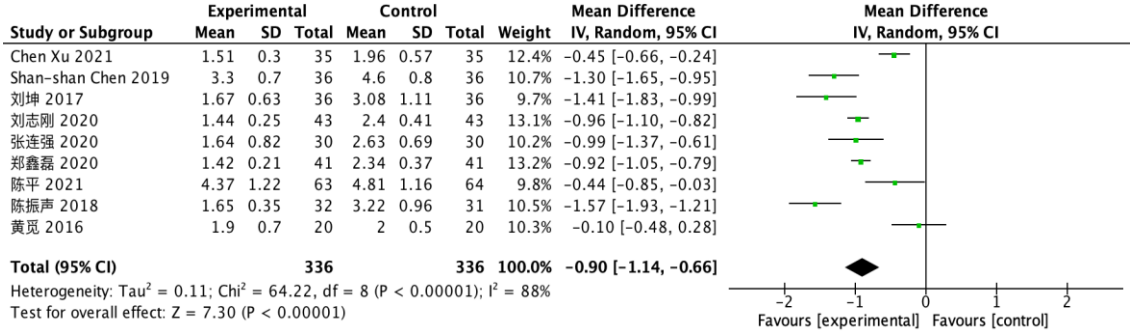

Figure 5: VAS scores after treatment of osteoporotic fractures in both groups

3.3.3 cobb Angle

A total of 5 included studies [12,13,14,18,19] involved the cobb Angle after treatment, with a total of 350 patients, including 175 cases in the acupuncture combined with surgery treatment group and 175 cases in the surgery control group. The results showed that the heterogeneity was low (P=0.20, I2=33%), and the fixed effect model was used. The results of Meta-analysis showed that the differences in cobb angles between the treatment group and the control group were statistically significant. The combined test analysis results [Z=36.60, P < 0.00001] showed that the cobb Angle of the treatment group was lower than that of the control group [MD=-6.77, 95% CI (-7.14,-6.41), P < 0.001]. P < 0.00001]. This suggests that compared with surgery alone, surgery combined with acupuncture can better improve the postoperative symptoms and relieve the pain of patients. See Figure 6.

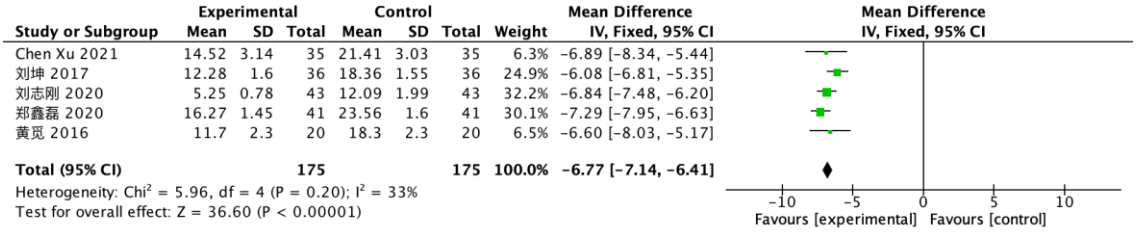

Figure 6: cobb Angle after treatment of osteoporotic fractures in patients of both groups

3.3.4 ODI score

A total of 8 included studies (11,12,13,14,15,17,18,19) involved the treatment of ODI score, with a total of 544 patients, including 273 patients in the acupuncture combined with surgery treatment group and 271 patients in the surgery control group. The results showed a high heterogeneity (P < 0.00001, I2=94%), and the random effect model was used. It is speculated that the source of heterogeneity may be related to the different locations of the injured vertebrae. The different locations of the injured vertebrae in the thoracic vertebrae, lumbar vertebrae, and thoracolumbar vertebrae also have different recovery degrees after treatment, so it will produce measurement bias. Patients with a longer time may have a poorer recovery after treatment, which may affect the effectiveness of treatment. In addition, due to the difference in the injured site of patients, the selection of acupoints during acupuncture and moxibustion treatment will also have

differences, so it may cause greater heterogeneity. The results of Meta-analysis showed that there were statistically significant differences in ODI scores between the treatment group and the control group after treatment, and the combined test analysis results [Z=4.46, P < 0.0001] showed that the ODI score of the treatment group was lower than that of the control group [MD=-4.88, 95%CI(-7.03,-2.74), P < 0.00001]. This suggests that compared with surgery alone, surgery combined with acupuncture and moxibustion can better improve the postoperative functional disorders such as activity limitation, which is conducive to the recovery of the quality of life of patients. See Figure 7.

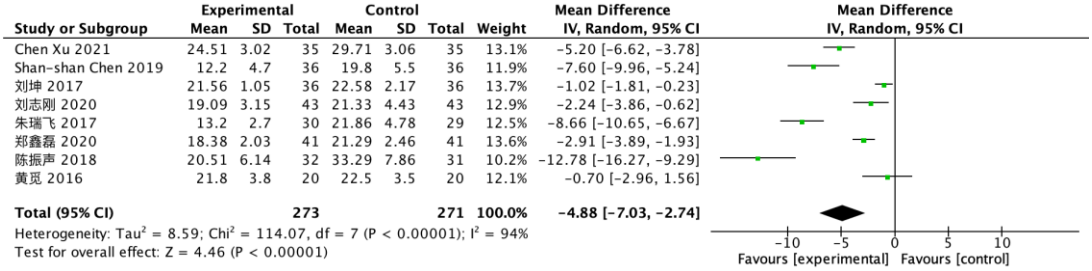

Figure 7: ODI scores after treatment of osteoporotic fractures in both groups

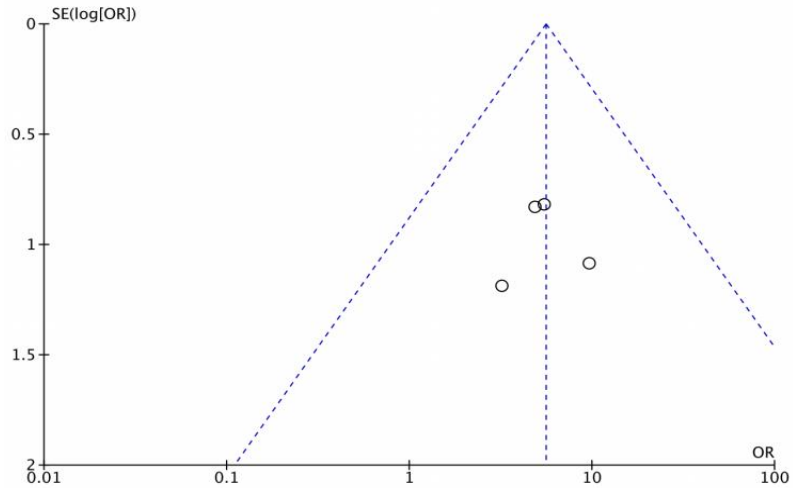

Figure 8: Funnel plot of publication bias based on treatment response rate

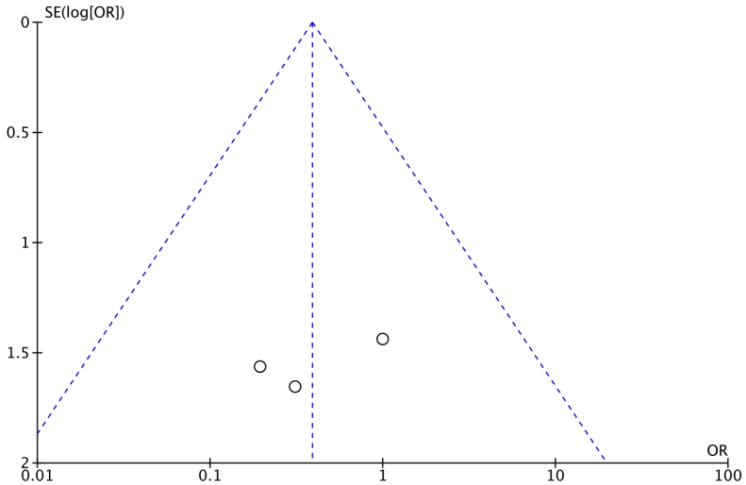

Figure 9: Funnel plot of publication bias based on incidence of adverse effects

3.3.5 Analysis of publication bias

Due to the lack of large sample data and the low publication rate of negative results, the results of Meta-analysis often have publication bias. The funnel plot was used to evaluate the publication bias of the results of this study. RevMan 5.4 software was used to make the funnel plot of the total clinical effective rate and the incidence of adverse reactions. The results showed that the symmetry of the incidence of adverse reactions was poor, which may be related to the small number of included studies and there may be publication bias. See Figures 8-9.

3.4 Safety Evaluation

A total of 4 included studies [13,15,17,20] involved the incidence of adverse reactions, with a total of 328 patients, including 164 cases in the acupuncture combined with surgery treatment group and 164 cases in the surgery control group. The results showed that the heterogeneity was low (P=0.73, I2=0%), which could be analyzed by the fixed effect model. The results of Meta-analysis showed that there was no

significant difference in the incidence of adverse reactions between the treatment group and the control group. The results of combined test analysis [Z=1.11, P=0.27] showed that there was no significant difference in the incidence of adverse reactions between the treatment group and the control group [OR=0.39, 95% CI (0.07,2.05), P=0.27]. P=0.27). This suggests that both treatment methods have good safety, the incidence of adverse reactions is at a low level, and both are safe treatment methods. However, it should be noted that there is a risk of intraoperative bone cement leakage in the operation itself, which did not appear in the included literature. Bone cement leakage is one of the possible intraoperative risks in PKP or PVP, which can cause a series of adverse consequences. If the leakage is adjacent to the muscles or adjacent to the vertebral body, it can cause compression of the spinal cord and local cauterization injury. If the leakage spreads through the blood vessels, it can reach the lungs through the blood vessels and cause pulmonary embolism. Too low injection may not ensure structural stability, too high injection needs to face the risk of leakage, and the uneven distribution of cement may lead to re-fracture caused by mechanical imbalance. We should pay attention to imaging examination and review, and pay attention to patients who may have complications or have had complications.

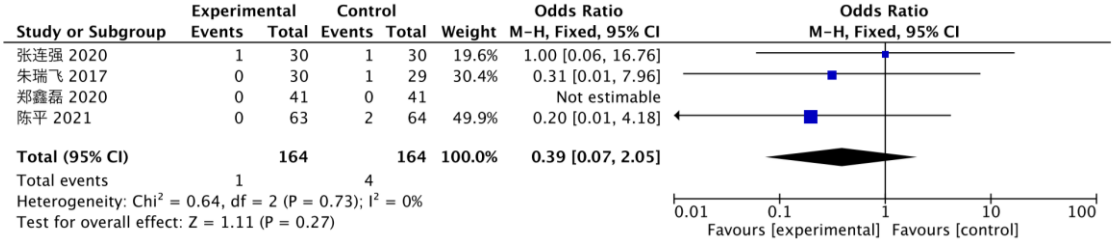

Figure 10: Incidence of adverse effects in the two groups of patients

3.5 Sensitivity Analysis

Sensitivity analysis was performed by excluding the included studies one by one to discuss the sources of heterogeneity, and it was found that the conclusions of the study had not changed, suggesting that the results of the Meta-analysis of this study were relatively stable.

4. Discussion

Osteoporosis is a metabolic disease, which often occurs with the increase of age. Endocrine hormones are the main influencing factors. With the increase of age, hormone deficiency decreases the activity of osteoblasts, the rate of bone resorption in the body exceeds the rate of bone formation, calcitonin secretion decreases, bone loss increases, and bone strength decreases, resulting in osteoporosis [21]. Because the rate of decline of androgen is slower than that of estrogen, it is more common in postmenopausal women, and other factors can also be seen in genetic factors and nutritional factors. Traditional Chinese medicine believes that the strength of bone is related to the rise and fall of kidney qi. When kidney qi is strong, muscles and bones are enriched. When spleen and stomach are fully processed, qi and blood biochemistry are continuously flowing, which give sufficient nutrients to the bone marrow. When the kidney qi is deficient and the spleen and stomach are weak, the bone will be blighted, and the operation will damage qi and blood. After the operation, due to bleeding, the blood from the meridians will be blocked outside the meridians, causing qi and blood block and pain. Therefore, on the basis of liver, spleen and kidney deficiency, the postoperative patients also have blood stasis factors, with kidney deficiency as the root and blood stasis as the standard.

Conservative treatment of OVCF is due to its time-consuming and poor recovery performance. Generally, it is not a recommended scheme. Due to the change of mechanical structure after fracture, the adjacent stages are also accompanied by the risk of vertebral fracture [23]. Percutaneous vertebroplasty can establish a channel to inject an appropriate amount of bone cement into the damaged vertebral body after fluoroscopic positioning. It has short operation time and good repair effect, can restore the strength of the vertebral body, and greatly shorten the time of bed rest of patients, can quickly return to daily life, and improve the quality of life of patients, which is the most mainstream treatment method at present [24].

The significant effect of acupuncture and moxibustion for analgesia has been recognized. For patients with osteoporotic fractures after surgery, the acupuncture sites are mainly back-shu points and ashi points, and the bladder meridian, gallbladder meridian, Qihai, Xuehai, Sanyinjiao and other commonly used acupoints are also used. When patients have lower back pain, they may have bleeding or swelling at the Yin fracture site, which may cause inflammatory response, and acupuncture pain is localized. It can change the local microstructure and promote the absorption of inflammatory substances. Moreover, due to the mechanical instability after fracture, the balance of spine is affected, which leads to the compensatory stretch of muscles. Long-term traction can cause muscle soreness and discomfort, and even produce inflammatory stimulation. Although surgery can rebuild the mechanical stability of the spine, acupuncture is still needed to relieve the accumulation of inflammatory substances in the perivertebral muscles of the spine [25]. Studies have shown that in addition to acupuncture and moxibustion, acupotomy therapy, preoperative manual reduction, oral administration of Chinese medicine, and external application of Chinese medicine can also be used to treat OVCF patients, which can achieve good results. Zhang Fen et al. [26] used acupotomology as the treatment group in a randomized controlled trial of patients after PKP. After comparison, it was found that acupotomology could significantly reduce the VAS score and ODI score of patients, and the effect was stable after follow-up, suggesting that the clinical effect of acupotomology was better than that of the surgery group. Hu Xiangling et al. [27] used Shujin Jiegu pill combined with acupuncture to treat patients after PKP in a randomized controlled trial, which could relieve residual low back pain and reduce VAS score, suggesting that traditional Chinese medicine combined with acupuncture has a good effect on

patients with osteoporotic fracture after operation. Zhang Xingguo et al. [28] performed traditional Chinese medicine hot compress combined with PKP on 45 patients and found that patients with traditional Chinese medicine hot compress had higher treatment efficiency, better improvement of residual low back pain, and lower VAS score, indicating that traditional Chinese medicine external application had significant effect. Niu Qiangwei [29] performed manual reduction on 46 patients with OVCF and found that manual reduction combined with PVP could better restore the kyphosis and functional recovery of patients than simple surgery. After manual reduction, the structure of the patients was more stable under X-ray, which was helpful for the development of surgery and reduced the risk of surgery. Combined with TCM dialectics, good results could be achieved.

This study evaluated and analyzed the effective rate of acupuncture and moxibustion combined with vertebroplasty in the treatment of osteoporotic fractures through multiple observation indicators. visual analog scale (VAS) [30] is currently widely used in the assessment of pain, with a wide range of data sources and simple evaluation steps. There are few items, measurement bias is relatively low, and it has high credibility. ODI [31], first proposed in 1976, is a common measurement and evaluation index for evaluating the dysfunction of patients with low back pain in spinal surgery and other fields, which has been widely recognized [32]. The results of Meta-analysis showed that acupuncture combined with acupuncture was superior to surgery alone in terms of treatment effectiveness (P=0.0002). The funnel plot showed that the literature was evenly distributed, suggesting that the risk of publication bias was low. Among them, acupuncture combined with surgery had a better improvement in VAS score than the simple surgery group ($P < 0.00001$), which may be due to the unique advantages of acupuncture for the treatment of local muscle pain. After surgery, the combination of the two will have a better therapeutic effect. The ODI score of the treatment group was lower than that of the control group ($P < 0.00001$), suggesting that acupuncture treatment can achieve a certain effect, improve motor function, reduce movement disorders, and facilitate the recovery of patients. The treatment group also had a better improvement in cobb Angle than the control group ($P < 0.00001$). In order to ensure the safety of acupuncture treatment, adverse events were also analyzed. The meta-analysis showed that there was no significant difference in safety between the treatment group and the control group in the included studies (P=0.27), which was not statistically significant. This may be because the operation itself is relatively safe, and acupuncture is an intervention therapy with less trauma and low adverse reactions. There was no significant difference in the safety of treatment between the two groups because the adverse reactions were not aggravated after surgery. The results suggest that the treatment regimen has a high safety, but at the same time, attention should be paid to the possibility of intraoperative bone cement leakage. Moreover, the funnel plot of the incidence of adverse reactions shows publication bias, which suggests that further results of the incidence of adverse reactions may need to be supported by a larger sample size trial.

This study conducted a meta-analysis of clinical controlled trials of acupuncture and moxibustion combined with surgery and surgery alone in the treatment of OVCF, and explored the effectiveness of acupuncture and moxibustion combined with surgery in the treatment of OVCF, which has certain guiding significance for clinical practice. Although this study confirmed that acupuncture and moxibustion combined with surgery has certain advantages over surgery alone in the treatment of OVCF, it also has certain limitations: ① The sample size of the included study was small, and the literature types were insufficient, mainly in Chinese core journals, especially in foreign literatures. More literature and a larger sample size are needed to provide data support. ② The methodological quality of the included literature was poor, and the allocation of literature was hidden and the blind method was rarely mentioned. There was a lack of high-level randomized controlled trials, and some literatures only mentioned "randomized" without specifying the specific randomized method. ③ Measurement indicators such as Oswestry disability index and cobb Angle may have artificial measurement bias. ④ The number of included literatures is too small, and there may be publication bias. ⑤ There are only literatures of PKP and PVP combined with acupuncture and moxibustion, and there is a lack of literature of mesh vertebroplasty combined with acupuncture and moxibustion. ⑥ There are few reports on the incidence of adverse reactions in the included literature, and the safety evaluation data need to be supported by the literature with a larger sample size. ⑦ There is no subgroup analysis for the literature with high heterogeneity, which is mainly related to the small number of the included literature.

5. Summary

Summarizing the above literature views and synthesizing the results of Meta-analysis, the author believes that acupuncture combined with vertebroplasty is effective in improving kyphosis and reducing pain scores in the treatment of OVCF for patients with osteoporotic vertebral compression fractures. Therefore, acupuncture combined with vertebroplasty can be considered in the clinical treatment of OVCF. In order to obtain better treatment effect. However, this result still needs to be confirmed by large-sample and high-quality randomized controlled studies in the future.

Fund Project

Xianyang Key Research and Development Program (L2022ZDYFSF058).

References

[1] Wang Zhen, WANG Congan, WANG Yongquan, LI Xujie, ZHOU Ziyang, ZHANG Lijuan, LI Miaoxiu. Efficacy and safety of oral Chinese patent drugs for the treatment of postmenopausal osteoporosis: a network Meta-analysis [J]. Chinese Herbal Medicine, 2012, 53(13): 4084-4099.

[2] Malik A T, Retchin S, Phillips F M, et al. Declining trend in osteoporosis management and screening following vertebral compression fractures–a national analysis of commercial insurance and medicare

advantage beneficiaries[J]. The Spine Journal, 2020, 20(4): 538-546.
[3] Orhurhu V, Agudile E, Chu R, et al. Socioeconomic disparities in the utilization of spine augmentation for patients with osteoporotic fractures: an analysis of National Inpatient Sample from 2011 to 2015[J]. The Spine Journal, 2020, 20(4): 547-555.
[4] Huang S, Zhu X, Xiao D, et al. Therapeutic effect of percutaneous kyphoplasty combined with anti-osteoporosis drug on postmenopausal women with osteoporotic vertebral compression fracture and analysis of postoperative bone cement leakage risk factors: a retrospective cohort study[J]. Journal of orthopaedic surgery and research, 2019, 14(1): 1-12.
[5] Sun X, Liu X, Wang J, et al. The effect of early limited activity after bipedicular percutaneous vertebroplasty to treat acute painful osteoporotic vertebral compression fractures[J]. Pain physician, 2020, 23(1): E31.
[6] Yeh K L, Wu S H, Wu S S, et al. Rare episode of cement leakage during vesselplasty in a case of vertebral compression fracture[J]. World Neurosurgery, 2020, 137: 416-420.
[7] FENG M G. Effect of percutaneous vertebroplasty combined with acupuncture on osteoporotic vertebral compression fractures [J]. Minimal Invasive Medicine, 2017, 12(5): 697-698.
[8] Gu Hongqiu, Wang Yang, Li Wei. Application of Cochrane Risk of Bias tool in Meta-analysis of randomized controlled trials [J]. Chinese Journal of Circulation,2014,29(02):147-148.
[9] Liang Huahua, Wang Yajun. CONSORT, STRICTA and Jadad to evaluate the quality of randomized controlled trials of acupuncture for anxiety [J]. Henan Traditional Chinese Medicine,2019,39(01):126-129.
[10] Chen Xinlin, Hu Yue, Lang Jianying, Chen Lixia, Xu Qian, Mo Chuanwei, Wu Zhili. Application of RevMan, Stata and R software in Meta-analysis of survival data [J]. Chin J Evidence-based Medicine, 2016, 16(06): 736-740.
[11] Chen S. Therapeutic observation on point-toward-point needling at points on the low back regions for residual back pain after percutaneous kyphoplasty[J]. Journal of Acupuncture and Tuina Science, 2019, 17(2): 131-136.
[12] Xu C. Warm needling moxibustion plus PKP for vertebral compression fracture due to kidney deficiency and blood stasis: a randomized controlled trial[J]. Journal of Acupuncture and Tuina Science, 2021, 19(2): 133-138.
[13] Zheng Xinlei, Li Xinming, Yao Yuhan. Effect of modified Bugu decoction combined with acupuncture and moxibustion in the treatment of osteoporotic vertebral compression fractures after PKP [J]. Chinese PLA Med J, 2020, 32(8): 100-103.
[14] Huang Mi, DU Shiyang, Feng Jing, et al. A prospective study on the efficacy of PKP and acupuncture in the treatment of osteoporotic thoracic vertebral compression fracture with intercostal neuralgia [J]. Shi Zhen Traditional Chinese Medicine and Chinese Medicine, 2016, 27(3): 647-649. (in Chinese)
[15] Zhu Ruifei. Effect of electroacupuncture on low back pain after PVP for thoracolumbar osteoporotic compression fractures [D]. Fujian University of Traditional Chinese Medicine, 2017
[16] Chen Zhensheng, Zhang Zhifeng. Clinical study of acupuncture combined with percutaneous vertebroplasty in the treatment of postmenopausal osteoporotic vertebral compression fractures [J]. Clinical Journal of Acupuncture and Moxibustion, 2018, 34(10): 18-21.
[17] Chen Ping, WANG Haidong, Li Xiangjun, et al. Effect of silver needle therapy on postoperative complications and quality of life in patients with osteoporotic thoracolumbar compression fractures after percutaneous kyphoplasty [J]. Chin J Traditional Chinese Medicine, 2021.
[18] LIU K. Curative effect analysis of PKP combined with acupuncture in the treatment of primary osteoporotic vertebral fractures [D]. Hubei University of Traditional Chinese Medicine, 2017.
[19] Liu Zhicang, Qin Lin, Zhang Huiwu. Efficacy of warm acupuncture combined with percutaneous kyphoplasty in the treatment of osteoporotic vertebral compression fractures and its effect on bone mineral density and blood calcium [J]. Shaanxi Traditional Chinese Medicine, 2020.
[20] Zhang Lianqiang. Clinical effect of acupuncture combined with celecoxib capsule on residual low back pain after PKP in patients with OVCF [D]. Fujian University of Traditional Chinese Medicine, 2020.
[21] Zhang Huaguo, Song Mi, Xu Yue, PI Hongying. Research progress of osteoporotic fracture recurrence in the elderly [J]. Chinese General Practice, 2021, 24(07): 886-889.
[22] Jin Zhenxiong, Shu Bing, Wang Qian, Shi Qi, Wang Yongjun, Tang Dezhi. Research progress of TCM syndrome differentiation in the treatment of osteoporotic fractures [J]. Chinese Journal of Osteoporosis, 2020, 26(12): 1843-1846.
[23] D'Oria S, Dibenedetto M, Squillante E, et al. Traumatic compression fractures in thoracic-lumbar junction: vertebroplasty vs conservative management in a prospective controlled trial [J]. Journal of NeuroInterventional Surgery, 2022, 14(2): 202-206.
[24] Zhu HaiTao, Ding DeGang, Wang Shui, Zhu YuLong. Comparison Between Percutaneous Kyphoplasty and Percutaneous Vertebroplasty in Terms of Efficacy in Osteoporotic Vertebral Compression Fractures: A Meta-analysis. [J]. Alternative therapies in health and medicine, 2022.
[25] Baroncini A, Maffulli N, Eschweiler J, et al. Acupuncture in chronic aspecific low back pain: a Bayesian network meta-analysis[J]. Journal of Orthopaedic Surgery and Research, 2022, 17(1): 1-15.
[26] Zhang Fen, Wang Huaize, Sun Kui, Liu Dechun, Song Yangchun. Clinical observation of small needle knife in prevention of residual pain after vertebroplasty for osteoporotic vertebral compression fractures [J]. Clinical Journal of Traditional Chinese Medicine, 2021, 33(05): 972-975.
[27] Hu Xiangling, Yin Xinsheng, He Nianhong, et al. Clinical observation of acupuncture combined with Shujin Jiegu pill on the recovery of osteoporotic vertebral compression fractures after PKP [J]. Yunnan Journal of Traditional Chinese Medicine, 2020.
[28] Zhang Xingguo, Ding Lei, Li Xiaojun. Clinical observation of traditional Chinese medicine external treatment of early residual low back pain after

percutaneous kyphoplasty for osteoporotic vertebral compression fracture [J]. Journal of Practical Chinese Medicine, 2020.
[29] Niu Qiangwei. Clinical study of manual reduction combined with percutaneous vertebroplasty and traditional Chinese medicine three-stage syndrome differentiation in the treatment of osteoporotic thoracolumbar compression fractures [J]. Chinese Medicine Bone Setting, 2017, 29(04):16-22.
[30] Woodforde J M, Merskey H. Some relationships between subjective measures of pain[J]. Journal of Psychosomatic Research, 1972, 16(3): 173-178.
[31] Fairbank J C, Couper J, Davies J B, et al. The Oswestry low back pain disability questionnaire[J]. Physiotherapy, 1980, 66(8): 271-273.
[32] Irmak R, Baltaci G, Ergun N. Long term test-retest reliability of Oswestry Disability Index in male office workers[J]. Work, 2016, 53(3): 639-642.