

Original Article

Clinical observation on the effect of warming meridian medicinal wine, polarized light external application combined with acupuncture and moxibustion on pain after vertebroplasty

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DOI: 10.19852/j.cnki.jtcm.2025.03.018

Received: February 28, 2024

Accepted: September 23, 2024

Available online: May 21, 2025

Abstract

OBJECTIVE: To evaluate the effects of external application of warm meridian medicated wine and polarized light therapy combined with acupuncture on pain management following vertebroplasty.

METHODS: A total of 120 patients with osteoporotic vertebral compression fractures treated by vertebroplasty at our hospital were divided into four groups. The control group received non-steroidal anti-inflammatory drugs, the Treatment Group I received acupuncture alone, Treatment Group II was treated with medicated wine for warming meridians alongside polarized light physiotherapy, and Treatment Group III received a combination of medicated wine for warming meridians, polarized light therapy, and acupuncture. The clinical efficacy, pain thresholds at various time points, temperature pain threshold, electric pain threshold, quality of life, sleep quality index, lumbar dysfunction index, visual analog scale (VAS) scores, and incidence of adverse reactions were compared and analyzed across the four groups.

RESULTS: The total clinical effective rate in Treatment Group III was significantly higher than that in the control group, Treatment Group I, and Treatment Group II ($P < 0.05$). At 24 and 72 h post-treatment, the VAS scores, temperature pain thresholds, and electric pain thresholds in Treatment Group III were significantly lower than those in the control group, Treatment Group I, and Treatment

Group II ($P < 0.05$). Additionally, quality-of-life scores in Treatment Group III were markedly higher compared to the control group, Treatment Group I, and Treatment Group II, while the Pittsburgh Sleep Quality Index scores, Oswestry Disability Index scores, and incidence of adverse reactions in Treatment Group III were significantly lower than in the other groups ($P < 0.05$).

CONCLUSION: The external application of warm meridian medicated wine and polarized light therapy combined with acupuncture significantly reduces postoperative pain following vertebroplasty, enhances lumbar function, and improves both sleep quality and overall quality of life for patients. This approach is recommended for clinical application.

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Keywords: pain, postoperative; vertebroplasty; acupuncture; polarized light therapy; external application of warm meridian medicated wine

1. INTRODUCTION

With the rapid aging of the population in modern society, the incidence of osteoporotic vertebral compression fractures among the elderly has also increased.¹ Percutaneous kyphoplasty is a new minimally invasive surgical technique that has gained popularity in recent years. Clinical research indicates that this method aids in rapid recovery for patients, making it a favored choice among both patients and healthcare providers.² However, postoperative pain remains a significant challenge for patients.

In recent years, linearly polarized near-infrared light irradiation, a non-invasive technique, has been effectively utilized to alleviate chronic pain associated with conditions such as osteoarthritis, rheumatoid arthritis, and post-herpetic neuralgia. Polarized light is part of the electromagnetic wave spectrum in the optical range, and its application in pain management is becoming increasingly widespread.³ Both acupuncture and polarized light therapy can stimulate acupoints, promote the flow of *Qi* and blood, enhance local circulation, and relieve pain.

Recent studies have highlighted the benefits of medicinal liquor for warming meridians, a common blood-regulating agent in Traditional Chinese Medicine. This type of medicated wine is known for its properties of warming meridians, dispelling cold, nourishing blood, and alleviating blood stasis.⁴ Postoperative pain following vertebroplasty is primarily attributed to insufficient *Qi*, which leads to poor circulation of *Qi* and blood, resulting in blockages within the meridians. The herbal formula Chuanwu (*Radix Aconiti*) can effectively warm and unblock meridians, while other ingredients such as Xuduan (*Radix Dipsaci Asperoidis*), Honghua (*Flos Carthami*), Sumu (*Lignum Sappan*), Shenjincao (*Herba Lycopodii Japonici*), and Tougucao (*Herba Gaultheriae Grenulatae*) are known for their abilities to dispel wind and dampness, promote blood circulation, unblock meridians, and relieve spasms and pain.

In clinical practice, based on pharmacological principles, the use of Huoxue Analgesic Tincture aims to promote blood flow, relax muscles, unblock collaterals, and alleviate pain. When applied to the affected area, Huoxue Analgesic Tincture can improve microcirculation and provide analgesic effects. Additionally, using an infrared polarized light therapy device on the treated area can enhance blood flow and tissue nutrition. Infrared polarized light has a strong capacity for penetration into human skin tissue, allowing it to reach an ideal treatment depth. It possesses several therapeutic effects, including photoelectric, photomagnetic, photothermal, photopressure, photochemical, immune, and photoenzyme effects. These mechanisms facilitate various reactions in the body, helping to treat multiple conditions and alleviate pain.

Pain in this context is often the result of local vasoconstriction and inadequate blood flow, leading to tissue ischemia and hypoxia. The infrared polarized light therapy device can target ganglia and pain points, promoting local blood flow, relieving pain, and breaking the cycle of discomfort. Combining these therapeutic approaches can effectively address postoperative pain following vertebroplasty. In this study, we randomly divided 120 patients with osteoporotic vertebral compression fractures treated by vertebroplasty into four groups: a control group and three treatment groups. The aim was to explore the effects of external application of warm-meridian medicinal liquor and polarized light therapy combined with acupuncture on pain management after vertebroplasty, thereby providing a theoretical reference for selecting appropriate methods to alleviate postoperative pain.

2. MATERIALS AND METHODS

2.1. Research subjects

The study involved 120 patients with osteoporotic vertebral compression fractures who underwent vertebroplasty at our hospital between June 2021 and January 2023. The cohort consisted of 74 males and 46 females, with an average age of (76 ± 6) years. Inclusion

criteria were as follows: a *t* value of bone mineral density ≤ -2.0 ; a single-segment vertebral fracture; fresh fractures; significant back pain without spinal cord or nerve damage; complete clinical data; and signed informed consent. Exclusion criteria included previous percutaneous kyphoplasty, spinal cord or nerve injury, old vertebral fractures, poor surgical tolerance, other chronic diseases unsuitable for surgery, and inability to cooperate with the study.

2.2. Research grouping

Patients were randomly assigned to four groups using a random number method. The 120 patients with osteoporotic vertebral compression fractures treated by vertebroplasty were divided into four groups as follows: the control group received non-steroidal anti-inflammatory drugs (NSAIDs); Treatment Group I received acupuncture alone; Treatment Group II received medicated wine for warming meridians combined with polarized light physiotherapy; and Treatment Group III received medicated wine for warming meridians and polarized light physiotherapy combined with acupuncture.

2.3. Treatment methods

2.3.1. Oral NSAIDs treatment

Celecoxib capsules [Pfizer Pharmaceutical Co., Ltd., Pfizer Pharmaceutical Co., Ltd. (New York, NY, USA), National Medicine Zhunzi J20140072] were administered once, twice daily for 4 weeks.

2.3.2. Simple acupuncture therapy

Acupuncture was performed 3 times a week for a total of 12 sessions over 4 weeks. Acupoints included Jiaji (EX-B2), Guanyuan (CV4), Dachangshu (BL25), Yaoyan (EX-B6), Ashi, Zhibian (BL54), Huantiao (GB30), Weizhong (BL40), Chengshan (BL57), and Kunlun (BL60) points, with needles retained for 20 minutes. Post-treatment, the bleeding area was compressed and disinfected.⁵

2.3.3. External application of medicated wine for warming meridians and polarized light physiotherapy⁶

The medicated wine formula included multiple traditional Chinese medicines including Zirantong (*Pyritum*), Honghua (*Carthami Flos*), Taoren (*Persicae Semen*), ZhiChuanwu (*Aconiti Radix Cocta*), ZhiCaowu (*Aconiti Kusnezoffii Radix Cocta*), Wugong (*Scolopendra*), and Dilong (*Pheretima*), soaked in 75% medical alcohol for 15 d. Sterile gauze soaked in the medicated wine was applied to the affected area, centered on the point of lumbar pain, covered with plastic wrap. Polarized light therapy was then applied directly to the gauze for 30 min at a distance of 30-40 cm. Post-physiotherapy, the gauze was removed and the area was massaged for 5 min. This treatment was conducted twice daily for 30 min each session for 10 consecutive days,

followed by a 2-day rest period before repeating the course for a total of 2 courses.

2.3.4. Combined treatment

Patients received both acupuncture and the medicated wine plus polarized light physiotherapy as described above for 4 weeks.

2.3.5. All acupuncture and moxibustion practitioners

All practitioners had 3-5 years of experience.

2.4. Clinical efficacy comparison

Clinical efficacy was assessed based on marked effect, effectiveness, and ineffectiveness. A marked effect indicated no complications, no pain, and no loss of fracture height post-operation. Effective indicated minor complications that resolved with treatment, slight pain, and minor fracture height loss. Ineffectiveness indicated significant complications, severe pain, and substantial fracture height loss.

2.5. Pain thresholds at different time points

Pain thresholds were measured using the visual analog scale (VAS) before treatment, 24 h post-treatment, and 72 h post-treatment. VAS scores ranged from 0 (no pain) to 10 (worst pain imaginable).

2.6. Temperature and electric pain thresholds

Temperature pain threshold was measured using a CO₂ laser with parameters controlled by a computer,⁷ and electric pain threshold was measured using an electric stimulator.⁸ Specific details included settings and increments until the patient reported a tingling sensation, with the average of three measurements recorded.

2.7. VAS score

VAS scores ranged from 0 to 10, with higher scores indicating greater pain severity.

2.8. Quality of life comparison

Quality of life was assessed using a scale measuring physical, psychological, social, and health self-awareness, with scores ranging from 1 to 5. Higher scores indicated better quality of life. The Cronbach's α coefficient of the scale was 0.937, and the test-retest reliability was 0.802.

2.9. Pittsburgh sleep quality index (PSQI)

PSQI was used to assess sleep quality before and three months after treatment, covering six components and yielding a total PSQI score.⁹

2.10. Lumbar dysfunction index (ODI) scores

ODI scores were compared before treatment and at 1, 2, and 4 weeks post-treatment. ODI consists of 10 items, each scored 0-5, with higher scores indicating more severe lumbar dysfunction.¹⁰

2.11. Incidence of adverse reactions

Adverse reactions included needle fainting, hematoma, and nausea and vomiting.

2.12. Statistical methods

Data were input into Excel and analyzed using SPSS 23.0 (IBM Corp., Armonk, NY, USA). Measurement data were expressed as mean and percentage, and comparisons were made using independent sample *t*-tests and χ^2 analysis. A *P* value < 0.05 was considered statistically significant.

3. RESULTS

3.1. Comparison of clinical efficacy among the four patient groups

The total clinical effectiveness rates of the control group, Treatment Group I, Treatment Group II, and Treatment Group III were 73.33%, 76.67%, 83.33%, and 100.00%, respectively. The total clinical effectiveness rate of Treatment Group III was significantly higher than those of the control group, Treatment Group I, and Treatment Group II, with statistical significance (*P* < 0.05) (Table 1).

3.2. Comparison of pain thresholds at different time points among the four groups

Compared to before treatment, the VAS scores of all four groups significantly decreased at 24 and 72 h after treatment (*P* < 0.05). The VAS scores of Treatment Group III were significantly lower than those of the control group, Treatment Group I, and Treatment Group II at 24 and 72 h after treatment (*P* < 0.05) (Table 2).

Table 1 Comparison of clinical efficacy among the four patient groups

Group	<i>n</i>	Significant effect (<i>n</i>)	Effective (<i>n</i>)	Ineffective (<i>n</i>)	Total effective rate [<i>n</i> (%)]
Control	30	7	15	8	22 (73.33)
Treatment group I	30	7	16	7	23 (76.67)
Treatment group II	30	11	14	5	25 (83.33)
Treatment group III	30	20	10	0	30 (100.00)
χ^2 value					22.093
<i>P</i> value					0.001

Notes: control group received oral celecoxib (200 mg, twice daily, 4 weeks); treatment Group I received acupuncture (3 times/week, 12 sessions); Treatment Group II received medicated wine external application combined with polarized light physiotherapy (twice daily, 10 d/course, 2 courses); Treatment Group III received the combined therapy of acupuncture, medicated wine, and physiotherapy. Count data are presented as case numbers, and the total effective rate is presented as [*n* (%)]. χ^2 test was used for intergroup comparisons of categorical data.

3.3. Comparison of temperature pain threshold among the four groups

Before treatment, there was no significant difference in temperature pain threshold among the four groups ($P > 0.05$). The temperature pain thresholds of all four groups decreased at 24 and 72 h after treatment, and the decrease in Treatment Group III was significantly greater than that in the control group, Treatment Group I, and Treatment Group II at 24 and 72 h after treatment, with statistical significance ($P < 0.05$) (Table 3).

3.4. Comparison of electric pain threshold among the four groups

Before treatment, there was no significant difference in the electric pain threshold among the four groups ($P > 0.05$). The electric pain thresholds of all four groups decreased at 24 and 72 h after treatment, and the decrease in Treatment Group III was significantly greater than that in the control group, Treatment Group I, and Treatment Group II at 24 and 72 h after treatment ($P < 0.05$) (Table 4).

3.5. Comparison of quality of life among four groups of patients

Before treatment, there were no statistical differences in the scores for physical self-awareness, psychological

self-awareness, social self-awareness, or health self-awareness among the four groups of patients ($P > 0.05$). However, three months post-treatment, the scores for physical self-awareness, psychological self-awareness, social self-awareness, and health self-awareness in Treatment Group III were significantly higher than those in the control group, Treatment Group I, and Treatment Group II ($P < 0.05$) (Table 5).

3.6. Comparison of pittsburgh sleep quality index among four groups of patients

There were no statistical differences in PSQI scores between the four groups before treatment ($P > 0.05$). However, three months post-treatment, the PSQI scores in Treatment Group III were significantly lower than those in the control group, Treatment Group I, and Treatment Group II (0.05) (Table 6).

3.7. Comparison of VAS scores among four groups of patients

There were no statistical differences in VAS scores before treatment and one week after treatment ($P > 0.05$). However, at 2, 3, and 4 weeks post-treatment, the VAS scores for patients in Treatment Group III were significantly lower than those in the control group, Treatment Group I, and Treatment Group II ($P < 0.05$) (Table 7).

Table 2 Comparison of pain thresholds at different time points among the four groups ($\bar{x} \pm s$)

Group	<i>n</i>	Before treatment	24 h after treatment	72 h after treatment	Variance ratio	<i>P</i> value
Control	30	9.63±3.41	5.46±1.26	2.12±0.43	14.872	0.001
Treatment group I	30	9.28±2.90	7.98±2.75	6.98±2.65	18.631	0.001
Treatment group II	30	9.34±2.13	4.25±0.78	1.54±0.23	19.056	0.001
Treatment group III	30	9.76±1.48	3.62±0.57	1.08±0.14	12.764	0.001
<i>t</i> value		0.843	17.775	11.032	-	-
<i>P</i> value		0.551	0.001	0.001	-	-

Notes: control group received oral celecoxib (200 mg, twice daily, 4 weeks); Treatment Group I received acupuncture (3 times/week, 12 sessions); Treatment Group II received medicated wine external application combined with polarized light physiotherapy (twice daily, 10 d/course, 2 courses); Treatment Group III received the combined therapy of acupuncture, medicated wine, and physiotherapy. Repeated measures analysis of variance was used for intragroup comparisons, and Bonferroni post-hoc test was used for intergroup comparisons at each time point.

Table 3 Comparison of temperature pain threshold among the four groups ($\bar{x} \pm s$)

Group	<i>n</i>	Before treatment	24 h after treatment	72 h after treatment	Variance ratio	<i>P</i> value
Control	30	8.24±0.65	4.31±0.39	3.58±0.65	13.423	0.001
Treatment group I	30	8.01±0.67	7.14±0.09	3.41±0.64	18.426	0.005
Treatment group II	30	8.14±0.82	3.43±0.45	3.17±0.16	10.884	0.001
Treatment group III	30	8.09±0.36	3.14±0.36	2.21±0.32	9.445	0.001
<i>t</i> value		0.783	17.984	19.741	-	-
<i>P</i> value		0.652	0.008	0.001	-	-

Notes: control group received oral celecoxib (200 mg, twice daily, 4 weeks); Treatment Group I received acupuncture (3 times/week, 12 sessions); Treatment Group II received medicated wine external application combined with polarized light physiotherapy (twice daily, 10 d/course, 2 courses); Treatment Group III received the combined therapy of acupuncture, medicated wine, and physiotherapy. Two-way analysis of variance was used to analyze the main effects of group and time, with Tukey's post-hoc test for pairwise comparisons.

Table 4 Comparison of electric pain threshold among the four groups ($\bar{x} \pm s$)

Group	<i>n</i>	Before treatment	24 h after treatment	72 h after treatment	Variance ratio	<i>P</i> value
Control	30	7.86±1.12	7.13±0.65	5.57±0.31	15.464	0.001
Treatment group I	30	7.90±0.35	6.09±0.30	4.58±4.10	15.698	0.001
Treatment group II	30	7.87±2.31	4.46±0.19	3.19±0.26	10.832	0.001
Treatment group III	30	7.81±1.09	3.69±0.27	2.01±0.32	19.989	0.001
<i>t</i> value		0.556	15.461	14.454	-	-
<i>P</i> value		0.474	0.001	0.001	-	-

Notes: control group received oral celecoxib (200 mg, twice daily, 4 weeks); Treatment Group I received acupuncture (3 times/week, 12 sessions); Treatment Group II received medicated wine external application combined with polarized light physiotherapy (twice daily, 10 d/course, 2 courses); Treatment Group III received the combined therapy of acupuncture, medicated wine, and physiotherapy. Mixed-effects model was used to analyze longitudinal changes, with Dunnett's test for comparisons against the control group.

3.8. Comparison of Lumbar Dysfunction Index (ODI) scores among the four groups

There was no statistically significant difference between the ODI scores of patients in each group before treatment and one week after treatment ($P > 0.05$). However, the ODI scores of patients in Treatment Group III were significantly lower than those in the Control Group, Treatment Group I, and Treatment Group II at 2 weeks, 3 weeks, and 4 weeks after treatment, with the differences being statistically significant ($P < 0.05$) (Table 8).

3.9. Incidence of adverse reactions in four groups of patients

The incidence of adverse reactions in the Control Group, Treatment Group I, Treatment Group II, and Treatment Group III was 40.00%, 26.67%, 23.33%, and 3.33% respectively, with each group comprising 30 patients. Specifically, the Control Group had 4 cases of haematoma, 6 cases of nausea, and 2 cases of vomiting, resulting in a total of 12 adverse reactions (40.00%); Treatment Group I reported 2 cases of haematoma, 3

cases of nausea, and 3 cases of vomiting, totaling 8 adverse reactions (26.67%); Treatment Group II had 1 case of haematoma, 3 cases of nausea, and 3 cases of vomiting, with a total incidence of 7 adverse reactions (23.33%); and Treatment Group III showed the lowest incidence, with only 1 case of nausea and no occurrences of acupuncture syncope, haematoma, or vomiting, totaling 1 adverse reaction (3.33%). Statistical analysis indicated a significant difference in the incidence of adverse reactions among the four groups ($\chi^2 = 26.769$, $P = 0.001$), with the incidence in Treatment Group III being significantly lower than that in the Control Group, Treatment Group I, and Treatment Group II ($P < 0.05$).

4. DISCUSSION

Pain following vertebroplasty is categorized as "arthralgia syndrome" in Traditional Chinese Medicine, with syndrome types mainly involving *Qi* stagnation and blood stasis. Consequently, the clinical treatment strategy focuses on warming and dredging the meridians, dispelling wind and cold, promoting blood circulation,

Table 5 Comparison of quality of life among four groups of patients ($\bar{x} \pm s$)

Group	n	Body self-consciousness	Psychological self-awareness	Social self-awareness	Health self-consciousness
		Before treatment	3 months after treatment	Before treatment	3 months after treatment
Control	30	21.0±3.3	22.0±3.9	28.2±3.9	30.2±3.1
Treatment group I	30	21.3±3.0	26.0±4.3	27.6±4.3	31.5±3.4
Treatment group II	30	21.2±1.3	28.5±3.4	29.8±2.0	34.8±1.5
Treatment group III	30	21.3±2.5	31.1±2.0	28.8±1.0	38.4±0.9
t value		0.581	16.667	0.679	18.923
P value		0.343	0.001	0.346	0.001

Notes: control group received oral celecoxib (200 mg, twice daily, 4 weeks); Treatment Group I received acupuncture (3 times/week, 12 sessions); Treatment Group II received medicated wine external application combined with polarized light physiotherapy (twice daily, 10 d/course, 2 courses); Treatment Group III received the combined therapy of acupuncture, medicated wine, and physiotherapy. Analysis of covariance was used with baseline scores as covariates, followed by Scheffé's test for post-hoc comparisons.

Table 6 Comparison of pittsburgh sleep quality index among four groups of patients ($\bar{x} \pm s$)

Group	n	Before treatment	3 months after treatment	Variance ratio	P value
Control	30	7.97±0.45	7.18±0.35	10.423	0.001
Treatment group I	30	7.34±0.11	5.61±0.27	12.879	0.001
Treatment group II	30	7.12±0.36	3.65±0.48	8.945	0.001
Treatment group III	30	7.36±0.72	1.77±0.39	9.664	0.001
t value		0.664	19.051	-	-
P value		0.594	0.001	-	-

Notes: control group received oral celecoxib (200 mg, twice daily, 4 weeks); Treatment Group I received acupuncture (3 times/week, 12 sessions); Treatment Group II received medicated wine external application combined with polarized light physiotherapy (twice daily, 10 d/course, 2 courses); Treatment Group III received the combined therapy of acupuncture, medicated wine, and physiotherapy. Independent-samples *t*-test was used for between-group comparisons at each time point, with Bonferroni correction for multiple comparisons.

Table 7 Comparison of VAS scores among four groups of patients ($\bar{x} \pm s$)

Group	Control group (n = 30)	Treatment group I (n = 30)	Treatment group II (n = 30)	Treatment group III (n = 30)	t value	P value
Before treatment	8.09±1.31	8.25±1.49	8.01±1.38	8.18±1.26	0.986	0.592
1 week after treatment	7.48±1.25	7.32±1.17	7.08±1.02	6.95±1.17	0.794	0.352
2 weeks after treatment	7.24±1.09	7.16±1.03	7.02±0.93	6.42±1.05	7.532	0.014
3 weeks after treatment	7.03±0.59	6.52±1.05	6.31±0.83	6.11±0.85	8.439	0.001
4 weeks after treatment	6.32±0.53	5.12±0.93	4.39±1.02	2.19±0.61	14.523	0.001
Variance ratio	11.328	12.693	16.149	14.129	-	-
P value	0.001	0.015	0.001	0.001	-	-

Notes: control group received oral celecoxib (200 mg, twice daily, 4 weeks); Treatment Group I received acupuncture (3 times/week, 12 sessions); Treatment Group II received medicated wine external application combined with polarized light physiotherapy (twice daily, 10 d/course, 2 courses); Treatment Group III received the combined therapy of acupuncture, medicated wine, and physiotherapy. Mixed-effects modeling was used to assess time-dependent changes, with Bonferroni correction for intergroup comparisons at each time point.

Table 8 Comparison of Lumbar Dysfunction Index (ODI) scores among four groups of patients ($\bar{x} \pm s$)

Group	Control (n = 30)	Treatment Group I (n = 30)	Treatment Group II (n = 30)	Treatment Group III (n = 30)	t value	P value
Before treatment	44.5±2.7	43.3±2.1	45.1±3.4	45.9±3.0	0.942	0.547
1 week after treatment	40.5±2.1	40.7±3.2	39.9±3.1	39.5±2.6	0.763	0.339
2 weeks after treatment	35.2±3.2	34.3±1.3	32.4±4.7	28.4±10.5	8.045	0.009
3 weeks after treatment	32.5±2.5	30.0±2.1	27.7±3.1	21.1±1.3	10.645	0.001
4 weeks after treatment	29.1±3.6	25.2±3.6	21.7±2.1	13.2±1.7	16.368	0.001
Variance ratio	10.663	14.534	15.097	13.656	-	-
P value	0.001	0.013	0.001	0.001	-	-

Notes: control group received oral celecoxib (200 mg, twice daily, 4 weeks); Treatment Group I received acupuncture (3 times/week, 12 sessions); Treatment Group II received medicated wine external application combined with polarized light physiotherapy (twice daily, 10 d/course, 2 courses); Treatment Group III received the combined therapy of acupuncture, medicated wine, and physiotherapy. Mixed-effects modeling was used to assess time-dependent changes, with Bonferroni correction for intergroup comparisons at each time point.

reducing swelling, removing arthralgia, and relieving pain. The application of externally applied medicated wine to warm the meridians has shown certain curative effects.¹¹ In this study, we incorporated polarized light physiotherapy and local acupuncture therapy in addition to the external application of medicinal liquor for warming meridians. This combination aims to enhance local blood circulation, promote blood flow, dredge collaterals, and shorten the treatment duration, thereby relieving clinical symptoms more rapidly, aiding the recovery of back muscle function, and further improving the treatment efficacy for pain after vertebroplasty.

Our findings indicate that the combination of warm meridian medicinal liquor, polarized light, and acupuncture has the most significant effect on alleviating pain post-vertebroplasty. This effectiveness is attributed to the infrared rays (wavelength 600-1600 nm) in polarized light, which can penetrate deeper tissues without being easily reflected, dispersed, or absorbed on the body surface. The energy light is partially converted into heat energy, creating a warming sensation.¹² Polarized light combined with acupuncture therapy differs from simple acupuncture, as it provides continuous stimulation to acupuncture points, modulating the meridians and skin system of the affected area. The cumulative, weak but prolonged stimulation to acupuncture points can be far more effective than simple acupuncture therapy.¹³ Additionally, the medicinal liquor used for warming the channels is composed of pure Chinese herbs such as Danggui (*Angelicae Sinensis Radix*), Penfujiao (*Asini Corii Colla*), Baishao (*Paeoniae Radix Alba*), Hongshen (*Ginseng Radix Rubra*), Yugu (Cinnamomi Cortex), Xiangguo (*Fructus Fragrantis*), Mudanpi (*Moutan Cortex*), Fabianxia (*Pinelliae Rhizoma Praeparatum*), Shengjiang (*Zingiberis Rhizoma Recens*), Wuying (*Evodiae Fructus*), Gancao (*Glycyrrhizae Radix et Rhizoma*), etc. These herbs collectively have potent effects in promoting blood circulation and removing blood stasis. Studies have shown that Danggui (*Angelicae Sinensis Radix*) and Penfujiao (*Asini Corii Colla*) can play a role in improving microcirculation and relieving pain; Baishao (*Paeoniae Radix Alba*), Hongshen (*Ginseng Radix Rubra*), and Fabianxia (*Pinelliae Rhizoma Praeparatum*) have anti-inflammatory effects, which can interfere with pain signal transmission, reduce the likelihood of

stimulating signals, increase the body's pain threshold, and achieve the goal of relieving patients' pain.¹⁴ Feehan *et al*¹⁵ compared the efficacy of polarized light combined with acupuncture to simple acupuncture in treating pain after vertebroplasty and found that the combined approach significantly reduces pain scores. Tang *et al*¹⁶ also demonstrated that the external application of medicinal liquor for warming meridians combined with acupuncture therapy effectively reduces post-vertebroplasty pain. Yang *et al*¹⁷ studied the effects of polarized light combined with acupuncture, revealing that after four sessions of polarized light irradiation (wavelength = 795 nm, power = 80 mW), patients experienced significant pain reduction. Following acupuncture treatment, VAS scores decreased even further. Increased treatment sessions led to progressive pain reduction, enhancing sleep quality and overall quality of life. About 70% of patients treated with external application of warm-meridian medicinal liquor and polarized light combined with acupuncture experienced relief in muscle bundle tension, and 83% showed improved lumbar function.¹⁸ In this study, the ODI scores of patients in Treatment Group III were significantly lower than those in the other three groups. This is because the external application of warm-meridian medicated liquor and polarized light combined with acupuncture treatment improves the liquid phase of bone cement during the mixing process, effectively reducing the dispersion distance. This combination also enhances post-vertebroplasty strength, making it less prone to torsion and promoting lumbar function improvement. Post-operation, the ODI scores in Treatment Group III were lower than those in the other three groups. The external application of medicated wine for warming meridians, combined with polarized light and acupuncture, promotes the recovery of patients' vertebral body structure to normal and effectively relieves their pain.

During the onset of pain after vertebroplasty, significant inflammatory albumin leakage from the nerve roots causes local ischemia and electrolyte imbalance, severely affecting daily activities and quality of life. In TCM, pain after vertebroplasty is classified under "lower back pain disease." The *Qi* stagnation and blood stasis type manifests as lower back pain due to blocked veins in the flesh, which can worsen with coughing, causing rapid

muscle contractions. TCM posits that lumbar disc herniation results from internal factors like gradual kidney *Qi* deficiency and external factors like trauma and strain-induced wind, cold, and dampness invasion, leading to inflammation and congestion of surrounding tissues and lower back and leg pain. External application of Chinese medicinal liquor, combined with polarized light, acupuncture, and moxibustion, can enhance local blood circulation and improve drug penetration. The effective ingredients of Wenjing Medicinal Wine directly penetrate deep tissues, fully exerting pharmacological effects to relieve pain and reduce swelling.

In conclusion, the external application of medicated wine and polarized light combined with acupuncture significantly reduces pain after vertebroplasty, enhances lumbar function, and improves patients' sleep quality and life quality, making it worthy of clinical application. A limitation of this study is the relatively small number of included cases, leading to a lack of regional representativeness in the study results.

5. REFERENCES

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