Percutaneous Acupotomy Combined with Selective Nerve Root Block in the Treatment of Degenerative Spine and Joint Diseases: A Multicenter Clinical Application and Safety Evaluation

Hanzhong Zhou*
Master of Medicine, Chongqing He'an Hospital, Luzhou 402289, China
*Corresponding email: 15206705105@163.com

Abstract

Objective: To investigate the efficacy and safety of percutaneous acupotomy combined with selective nerve root block (SNRB) in the treatment of degenerative spine and joint diseases. Methods: A multicenter, prospective, randomized controlled trial was conducted, enrolling 360 patients with degenerative spine and joint diseases admitted to three hospitals between January 2022 and December 2024. Patients were randomly assigned to an observation group (n=180, acupotomy + SNRB) or a control group (n=180, SNRB alone). Disease types included cervical spondylotic radiculopathy (CSR, n=90), lumbar disc herniation (LDH, n=120), degenerative lumbar spinal stenosis (LSS, n=60), and knee osteoarthritis (KOA, n=90). Visual analog scale (VAS) scores, oswestry disability index (ODI) or Japanese orthopaedic association (JOA) or western ontario and mcmaster universities osteoarthritis index (WOMAC) scores, modified Macnab efficacy ratings, adverse events, and serum interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF)-α concentrations were assessed at 1, 3, and 6 months post-treatment. Results: At 6 months post-treatment, the observation group showed a significantly lower VAS score than the control group [(2.11±0.91) vs. (3.89±1.18), $p<0.001$], and superior functional scale scores (all $p<0.05$). The observation group achieved a total effective rate of 92.22% and an excellent or good rate of 78.89%, compared with 76.67% and 56.11% in the control group (both $p<0.001$). The observation group demonstrated greater reductions IL-6 and TNF-α than the control group ($p<0.05$). The adverse reaction rate was 5.56% in the observation group and 4.44% in the control group, with no statistically significant difference ($p>0.05$) and no serious adverse events. Conclusion: Percutaneous acupotomy combined with selective nerve root block is effective in the treatment of degenerative spine and joint diseases, capable of significantly alleviating pain, improving function, and maintaining a favorable safety profile.

Keywords

Percutaneous acupotomy, Selective nerve root block, Degenerative spine and joint diseases, Cervical spondylotic radiculopathy, Functional scale

Introduction

Degenerative spine and joint diseases are highly prevalent in clinical practice, with cervical spondylotic radiculopathy (CSR), lumbar disc herniation (LDH), degenerative lumbar spinal stenosis (LSS), and knee osteoarthritis (KOA) being the most representative conditions. Global data indicate that chronic spinal musculoskeletal pain affects approximately 720 million people. With accelerating population aging and lifestyle transitions, the incidence of these diseases has been steadily rising, constituting a global public health challenge.

Current treatment pathways may be broadly categorized into three tiers: conservative management, minimally invasive intervention, and open surgery. Conservative approaches can yield some benefit for mild to moderate cases, yet in a proportion of patients, symptom relief remains inadequate. Open surgery produces reliable outcomes but is associated with substantial trauma, high economic cost, and long-term concerns such as failed back surgery syndrome and accelerated adjacent segment degeneration. Consequently, identifying safe and effective minimally invasive approaches holds

proofread a manuscript

genuine clinical value [1].

Selective nerve root block (SNRB) relies on the precise delivery of local anesthetics and glucocorticoids to the vicinity of the affected nerve root, rapidly suppressing inflammatory edema and interrupting nociceptive signal transmission. However, SNRB alone acts only on the inflammatory component. It lacks direct release intervention against pathological changes such as paravertebral soft tissue adhesions, fibrous scarring, and mechanical instability. This results in limited long-term benefit for some patients.

Percutaneous acupotomy is rooted in traditional Chinese acupuncture theory while incorporating concepts from modern anatomy and minimally invasive surgery. The technique employs a flat-bladed acupotome to perform dissection and release of the pathological region. This procedure removes soft tissue adhesions and contractures, alleviates neurovascular compression, re-establishes the mechanical stability of the spine and joints, and stimulates local endogenous opioid peptide secretion for analgesia [2]. In recent years, the widespread adoption of ultrasound guidance has substantially enhanced the visualization and precision of acupotomy procedures, correspondingly reducing the risk of neurovascular injury.

Acupotomy and nerve block are complementary at the therapeutic mechanism level: nerve block rapidly suppresses pain and inflammation, providing a window for acupotomy intervention. Acupotomy, in turn, eliminates the soft tissue pathological factors at the source, sustaining and extending the therapeutic effect. Small-scale studies have preliminarily validated the additive benefits of their combination, yet high-level evidence regarding the clinical utility and safety of this combined approach in a large-sample multicenter setting remains insufficient. Accordingly, the present study employs a multicenter, prospective, randomized controlled framework to systematically evaluate the efficacy and safety of this combined strategy in the treatment of degenerative spine and joint diseases.

Materials and methods

Study design and ethics

This trial adopted a multicenter, prospective, randomized, parallel-controlled clinical study design. It was approved by the Ethics Committee of Chongqing He'an Hospital (Approval No. 2022-LC-018) and registered with the Chinese Clinical Trial Registry (ChiCTR2200056872). All participants provided written informed consent.

Study population

Between January 2022 and December 2024, 360 patients with degenerative spine and joint diseases were consecutively enrolled from three participating centers. These patients comprised CSR (n=90), LDH (n=120), LSS (n=60), and KOA (n=90). Inclusion criteria: meeting clinical and imaging diagnostic criteria for the corresponding disease; aged 40-80 years old; inadequate response to standardized conservative treatment of at least 4 weeks; VAS score ≥4. Exclusion criteria: definitive surgical indications; spinal or joint infection, space-occupying lesions, or fractures; coagulation disorders; allergy to local anesthetics or glucocorticoids; pregnancy or lactation. Using a random number table, patients were allocated in a 1:1 ratio to the observation group (n=180) and the control group (n=180). The allocation sequence was generated by an independent statistician and concealed with sealed envelopes. Baseline characteristics were well balanced between the two groups ($p>0.05$) [3].

Treatment methods

Control group: Ultrasound-guided selective nerve root block was performed. The corresponding nerve root or articular nerve branch was selected according to the lesion site. After the puncture pathway was confirmed by ultrasound, an injection was performed. The injection comprised 2 mL of 2.00% lidocaine and 10 mg of triamcinolone acetonide, supplemented with 0.90% sodium chloride to a final volume of 5 mL. Cervical nerve root block was selected for cervical segments. Lumbar nerve root or transforaminal block was selected for lumbar segments. For the knee, periarticular nerve branches (including the superomedial, superolateral, inferomedial, and inferolateral branches) were selected. Treatment was administered once every 2 weeks for a total of 3 sessions [4].

Observation group: In addition to the control group treatment, percutaneous acupotomy (Hanzhang Type I No. 4, 0.80 mm × 50 mm) was performed. For cervical segments, the posterior cervical extensor muscles and the soft tissues around the zygapophyseal joints were released. For lumbar segments, the multifidus muscle,

Proofread a manuscript

erector spinae aponeurosis, and zygapophyseal joint capsule were released. For the knee, the peripatellar retinaculum, iliotibial band, and pes anserinus were released. Under ultrasound monitoring, longitudinal and transverse dissection was performed, with 3-5 release strokes applied to nodular or cord-like areas. Hemostasis was achieved by pressure on the puncture site for 3 minutes after needle withdrawal, followed by application of a wound dressing. Acupotomy and nerve block were performed on the same day, with the block preceding the acupotomy, once every 2 weeks for a total of 3 sessions. All procedures were performed by physicians with at least 5 years of experience.

Outcome measures and statistical analysis

The following data were collected before treatment and at 1, 3, and 6 months post-treatment. These included VAS score (0-10) for assessing pain at rest and during activity. They also included the neck disability index (NDI) scale for cervical disease, ODI and JOA scales for lumbar disease, and the WOMAC scale for knee disease. Modified Macnab criteria at 6 months were used to classify outcomes into four grades, with the excellent or good rate and total effective rate calculated. Peripheral blood samples were collected before treatment and at 1 month post-treatment for IL-6 and TNF-α measurement using enzyme-linked immunosorbent assay (ELISA) [5]. Completing documentation of adverse events was also included. Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) 26.0. Continuous variables are expressed as $\bar{x}\pm s$, with intergroup comparisons using independent-samples t-tests, within-group pre-post comparisons using paired t-tests, and repeated-measures Analysis of Variance (ANOVA) for multiple time points. Categorical variables are presented as frequencies and percentages, with intergroup comparisons using χ^2 tests or Fisher's exact test. $p<0.05$ was considered statistically significant.

Results

Baseline characteristics

The observation group comprised 82 males and 98 females, with a mean age of 58.30±10.20 years old and a mean disease duration of 4.60±2.10 years old. The control group comprised 79 males and 101 females, with a mean age of 57.90±10.50 years old and a mean disease duration of 4.50±2.20 years old. Baseline characteristics were comparable between the two groups ($p>0.05$). Five patients (2.78%) withdrew from the observation group and 7 patients (3.89%) from the control group; the difference in withdrawal rates was not statistically significant ($p>0.05$).

Pain and functional improvement

At each follow-up time point post-treatment, VAS scores in both groups decreased significantly from baseline ($p<0.001$). At 1 month, the observation group VAS score was lower than that of the control group [(3.42±1.06) vs. (4.15±1.23), $p<0.05$]. At 3 months, the gap widened further [(2.68±0.94) vs. (3.97±1.15), $p<0.001$]. At 6 months, the observation group VAS was (2.11±0.91) vs. (3.89±1.18) in the control group ($p<0.001$), with the LDH and KOA subgroups exhibiting the most pronounced differences [6].

With respect to functional assessment, at 6 months post-treatment, the observation group NDI [(15.32±4.86) vs. (21.47±5.93)], ODI [(16.18±5.44) vs. (22.96±6.51)], and WOMAC [(18.75±6.37) vs. (27.34±8.12)] scores were all significantly lower than those of the control group. The JOA score [(23.45±3.21) vs. (19.87±3.89)] was significantly higher than that of the control group (all $p<0.05$). Repeated-measures ANOVA showed that the main effects of time and group and their interaction effect all reached statistical significance ($p<0.01$).

Clinical efficacy and inflammatory factors

At 6 months, the efficacy distribution in the observation group was: excellent 62 cases (34.44%), good 80 cases (44.44%), fair 24 cases (13.33%), and poor 14 cases (7.78%). The excellent or good rate was 78.89%, and the total effective rate was 92.22%. In the control group, the distribution was: excellent 31 cases (17.22%), good 70 cases (38.89%), fair 37 cases (20.56%), and poor 42 cases (23.33%). This yielded an excellent or good rate of 56.11% and a total effective rate of 76.67% (both $p<0.001$). The observation group showed a superior excellent or good rate across all four disease types. The rates were: CSR 82.22% vs. 57.78%; LDH 80.00% vs. 58.33%; LSS 73.33% vs. 53.33%; KOA 77.78% vs. 53.33% [7].

At 1 month post-treatment, in the observation group, IL-6 decreased from 38.56±12.34)pg/mL to 18.23±7.45 pg/mL, and TNF-α decreased from 52.18±15.67 pg/mL to 25.46±9.38 pg/mL. In the control group, IL-6

Proofread a manuscript

decreased from 37.89±11.98 pg/mL to 26.45±9.12 pg/mL, and TNF-α decreased from 51.64±14.95 pg/mL to 36.78±11.45 pg/mL. The magnitude of reduction was significantly greater in the observation group than in the control group ($p<0.05$) [8].

Safety

Cumulative adverse events in the observation group totaled 10 cases (5.56%). These included local pain at the puncture site (n=4), subcutaneous ecchymosis (n=3), transient dizziness (n=2), and superficial puncture site infection (n=1, resolved after dressing changes). The control group recorded 8 adverse events (4.44%). These included puncture site pain (n=5), transient lower limb numbness (n=2), and drug-related allergy (n=1, local rash resolved with oral antihistamines). The difference in adverse event rates between the two groups was not statistically significant ($p=0.628$). No serious events such as nerve injury, major vascular injury, intraspinal infection, or anaphylactic shock occurred in either group.

Discussion

Degenerative spine and joint diseases share pathological foundations including intervertebral disc degeneration, cartilage loss, osteophyte formation, and secondary soft tissue pathology. These constitute disabling conditions centered on chronic pain and functional limitation. Within the local degenerative microenvironment, inflammatory mediators such as IL-6 and TNF-α not only activate nociceptors to induce pain but also participate in the positive feedback loop of cartilage matrix degradation and disc degeneration. Therefore, an ideal intervention should simultaneously target both anti-inflammatory analgesia and the resolution of soft tissue mechanical abnormalities [9].

From the data obtained in this trial, the observation group demonstrated significant advantages over the control group at each post-treatment time point in VAS scores, functional scale scores, and the excellent or good rate. The most pronounced intergroup differences emerged at 6 months, with a VAS difference of 1.78 points and an excellent or good rate difference of 22.78%, reflecting the superior long-term benefits of the combined approach. This finding resonates with a 6-month follow-up result of ultrasound-guided acupotomy release for CSR, which confirmed that acupotomy yields superior long-term efficacy over SNRB alone. A study on LSS similarly demonstrated that acupotomy combined with injection consistently exhibited superior analgesic and functional recovery effects compared with conventional treatment over a 6-14-week observation period. The combined advantage may stem from the following synergies: nerve block, via lidocaine, rapidly blocks nociception, while triamcinolone acetonide suppresses nerve root inflammation, achieving rapid control of acute pain. Acupotomy release, at the anatomical level, removes adhesion and contracture tissue, alleviates mechanical compression of neurovascular structures, and re-establishes local mechanical equilibrium. The synergistic action of both pathways serves to interrupt the vicious pathological chain of "inflammation- adhesion-compression" [10].

At the laboratory indicator level, the observation group showed greater reductions in IL-6 and TNF-α than the control group, suggesting that acupotomy intervention may enhance the anti-inflammatory effect through the modulation of inflammatory signaling pathways. Existing literature has noted that acupotomy can inhibit the nuclear factor kappa-light-chain-enhancer of activated B cells (NF-κB) pathway and reduce pro-inflammatory cytokine expression via activation of transient receptor potential vanilloid 1 (TRPV1) ion channels. The present findings further support the additive role of combined therapy in regulating the inflammatory microenvironment.

Safety is invariably a critical yardstick for assessing the clinical promotion value of novel techniques. In this study, the overall adverse event rate in the observation group was 5.56%, all events being mild and recoverable, and the difference from the control group (4.44%) did not reach statistical significance. This result is consistent with findings from a meta-analysis of 32 randomized controlled trials (RCTs). Ultrasound-guided acupotomy carries a low overall adverse event rate (0%-13.80%), with local pain and subcutaneous ecchymosis being the most common events, and real-time ultrasound visualization being the core element for ensuring procedural safety [11].

The innovations of this study may be summarized in three main dimensions. First, it is grounded in a multicenter prospective randomized controlled design, aggregating a relatively large sample of 360 cases across

proofread a manuscript

four representative degenerative spine and joint diseases. Second, serum inflammatory factors were also introduced into the efficacy assessment, supplementing objective biological parameters. Third, the safety of the combined therapy was systematically evaluated. Limitations of the study include the following. The inability to blind the operators or participants to acupotomy may introduce bias. Follow-up was limited to 6 months, requiring longer tracking to assess long-term outcomes. Variability in operator experience across centers necessitates the future establishment of standardized training and operational quality control systems.

Conclusion

Overall, percutaneous acupotomy combined with selective nerve root block yields clear clinical benefits in the treatment of degenerative spine and joint diseases. It alleviates persistent pain, improves function, reduces inflammatory cytokine levels, and maintains an acceptable overall safety profile. This combined modality integrates the strengths of a traditional Chinese minimally invasive technique with modern interventional pain management. It offers a comprehensive regimen that addresses both symptom relief and functional maintenance for degenerative diseases. This regimen has promotion value in suitably equipped medical institutions.

Future research may be directed along the following lines. First, designing larger-scale, longer-follow-up multicenter RCTs incorporating quality of life and health economic indicators. Second, establishing a comprehensive standardized training and quality monitoring system for acupotomy procedures to minimize the impact of inter-operator technical variability on efficacy evaluation. Third, exploring the molecular mechanisms through which acupotomy participates in the modulation of inflammatory signaling pathways, thereby accumulating more persuasive foundational evidence for combined treatment strategies.

Funding

This work was not supported by any funds.

Acknowledgements

The author would like to show sincere thanks to those technicians who have contributed to this research.

Conflicts of Interest

The author declares no conflict of interest.

References

[1] Fang, T., Li, Q., Zhou, F. Y., Liu, F., He, Z., Wang, X. (2020) Effect and safety of acupotomy in treatment of knee osteoarthritis: a systematic review and meta-analysis. *Journal of Traditional Chinese Medicine*, 40(3), 355-364.

[2] Kim, J., Han, C. H., Lee, T., An, S., Yang, C., Choi, Y. E., Kang, B. K., Oh, Y., Kim, K. H., Yang, G. Y., Kim, E. (2025) Effectiveness and safety of combining pharmacopuncture therapy and acupotomy for treating patients with degenerative lumbar spinal stenosis: a pragmatic, assessor-blinded, randomized, controlled trial. *Integrative Medicine Research*, 14(2), 101204.

[3] Lee, J. H., Lee, H. J., Woo, S. H., Park, Y. K., Han, J. H., Choi, G. Y., Han, C. H. (2023) Effectiveness and safety of acupotomy on lumbar spinal stenosis: a pragmatic, pilot, randomized controlled trial. *Journal of Pain Research*, 659-668.

[4] Pu, J., Cao, W., Chen, Y., Fan, Y., Cao, Y. (2023) Ultrasound-guided injection acupotomy as a minimally invasive intervention therapy for cervical spondylotic radiculopathy: a randomized control trial. *Annals of Medicine*, 55(1), 2233556.

[5] Jiang, G., Wan, B., Huang, W., Chen, L., Duan, B., Wang, Y. (2018) Influence of acupotomy loosing on IL-6, IL-10 and TNF-α in synovial fluid of rheumatoid arthritis patients with elbow joint stiffness. *World Journal of Acupuncture-Moxibustion*, 28(2), 91-96.

[6] Kwon, C. Y., Yoon, S. H., Lee, B. (2019) Clinical effectiveness and safety of acupotomy: an overview of systematic reviews. *Complementary Therapies in Clinical Practice*, 36, 142-152.

[7] Zhou, S., Liu, B., Guo, J. (2021) Comparison of the efficacy and safety of acupuncture and acupotomy for patients with cervical spondylotic radiculopathy: a protocol for systematic review and meta-analysis. *Medicine*, 100(13), e25239.

[8] Hua, Z., Deng, H., Tang, H., Ruan, Z., Wang, P., Zhang, M., Chen, D. (2021) Clinical study of acupotomy for knee osteoarthritis based on the

proofread a manuscript

meridian-sinew theory: a randomized controlled clinical trial. *Evidence-Based Complementary and Alternative Medicine*, 2021(1), 3987002.

[9] Li, S. M., Li, T. L., Guo, R., Chen, P., Du, W. S., Kang, S. B., Yan, M. Z., Cheng, W. Z. (2021) Effectiveness and safety of acupotomy for knee osteoarthritis: study protocol for a randomized controlled trial. *Trials*, 22, 953.

[10] Choi, H. K., Lee, S. H., Lee, J. H., Choi, S., Park, S., Lim, Y. S., Kim, H. J., Kim, Y. I., Park, T. Y. (2025) Effectiveness of acupotomy combined with nerve block therapy for cervical radiculopathy: a systematic review and meta-analysis. *Medicine*, 104(24), e42771.

[11] Jeong, J. K., Kim, E., Yoon, K. S., Jeon, J. H., Kim, Y. I., Lee, H., Kwon, O., Jung, S. Y., Lee, J. H., Yang, C., Kang, J. H., Han, C. H. (2020) Acupotomy versus manual acupuncture for the treatment of back and/or leg pain in patients with lumbar disc herniation: a multicenter, randomized, controlled, assessor-blinded clinical trial. *Journal of Pain Research*, 13, 677-687.

proofread a manuscript