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Original Article

Effectiveness of Acupressure and Reflexology Combined with NSAIDs in Acute Low Back Pain: A Prospective Cohort Study

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Abstract

Introduction: Low back pain ranks among the most prevalent musculoskeletal disorders worldwide. It greatly affects the quality of life and contributes to higher rates of work absenteeism. Traditional treatment usually involves nonsteroidal anti-inflammatory drugs (NSAIDs), but there is a growing interest in complementary therapies like acupressure and reflexology as additional options.

Objective: This study aimed to assess the effectiveness of merging acupressure and reflexology with conventional NSAID treatment in alleviating pain intensity in nonspecific low back pain in patients presenting to the emergency department (ED).

Methods: This prospective cohort study, conducted at a tertiary center from May 2021 to May 2023, involved 81 patients with nonspecific spasmodic low back pain, who were sequentially assigned to either a control group (NSAID therapy alone, $n=41$) or a combined therapy group (NSAIDs plus a 30-minute session of acupressure and reflexology, $n=40$). All individuals were administered 30 mg of intramuscular ketorolac tromethamine. The acupressure and reflexology intervention included the stimulation of Nei Guan (P6), He Gu (LI4), Zu San Li (ST36), and the lower medial arch of the foot. Pain intensity was assessed with the Short-Form McGill Pain Questionnaire (SF-MPQ) at baseline and 24 hours following the intervention. Statistical analysis utilized the Mann-Whitney *U* and Wilcoxon signed-rank tests, with a significance threshold at $P<0.05$.

Results: Baseline pain scores did not differ significantly between groups. However, the combined therapy group exhibited a significantly greater reduction in pain (mean difference: 3.85 ± 2.14) compared to the control group (mean difference: 1.27 ± 1.78, $P<0.001$).

Conclusion: The integration of acupressure and reflexology with standard NSAID therapy may provide enhanced pain relief for patients with nonspecific low back pain in the ED. Further multicenter studies with larger sample sizes and longer follow-up periods are recommended to confirm these findings and assess long-term benefits.

Keywords: Complementary therapy, Emergency department, Ketorolac tromethamine, Inflammatory cytokines, Integrated medicine

Introduction

Low back pain is the most common musculoskeletal condition globally, and one of the causes of work absenteeism (1-5). It is estimated that 50% to 80% of people experience at least one episode of low back pain (6, 7). In addition, there is a direct relationship between the rising prevalence and incidence of low back pain and an increase in age (8). Furthermore, Epidemiological studies state that the annual prevalence and lifetime prevalence of low back pain are 5% and 60–90%, respectively (9).

Patients' quality of life is highly affected by the adverse effects of low back pain. In addition, due to its recurrence and resistance to the current therapies, low back pain is still one of the significant and challenging research topics in medicine. This ongoing research effort to solve the problem is well documented by the concise diagnostic criteria and management guidelines (10).

Nonsteroidal anti-inflammatory drugs (NSAIDs) are one of the most valuable therapeutic choices worldwide for symptomatic relief of low back pain (11). There is no

evidence that a specific NSAID is superior to others (11). However, ketorolac trometamol is one of the frequently prescribed NSAIDs by emergency medicine specialists to acutely relieve pain, specifically due to its non-sedative, analgesic, and anti-inflammatory properties. Interestingly, Krebs et al. revealed that a more potent painkiller was a less practical choice for the management of chronic lower back pain, i.e., patients who received nonopioid medications reported lower pain after 12 months of administration than patients who received opioid drugs (12).

Aside from the abovementioned conventional approaches and guidelines, many patients seek alternative and oriental therapies. In the USA, about 33% of adults with low back pain received alternative therapies in 1997 (13). Acupressure is one of the choices for patients with low back pain.

Acupressure is a low-cost, efficient, feasible, effective, and practical alternative approach to alleviate the pain caused by acute nonspecific low back pain associated with muscle spasms. In the era of evidence-based medicine, great effort is made to objectively determine the efficacy of acupressure in pain relief. For instance, now it is evident that acupressure downregulates biological markers, such as proinflammatory cytokines, such as TNF-α, IL-1β, IL-6, IL-8, and IL-18, and modulates anti-inflammatory cytokines, such as IL-10 and IFN-γ, in some cases (14).

Acupressure is the application of pressure to the points located along the energy meridians of the human body (15). These points are based on the principles of TCM (traditional Chinese medicine). Twelve primary and eight extraordinary meridians are hypothesized to regulate physiological and psychological functions through the flow of qi (vital energy). Modern studies focusing on the influence of meridians in ANS activity through electrodermal activity (EDA) analysis suggest the regulation mentioned above. Among these meridians, acupoints such as Nei Guan (P6), He Gu (LI4), and Zu San Li (ST36) are widely studied for their potential effects on pain modulation, autonomic balance, and overall health (16).

Reflexology is another alternative therapy based on the concept that all body parts are reflected in the feet, palms, auricles, etc. (17). Previous studies recommend several potential mechanisms for pain reduction: mechanotransduction and fascia stimulation by applying pressure on specific points, autonomic nervous system (ANS) modulation, stimulation of sensory nerve fibers, effect on inflammatory pathways, especially on fibroblasts, and increasing hyaluronan, and some suggest psychological and placebo effects (18).

Eghbali et al. demonstrated that reflexology can be considered an easy and feasible method of managing low back pain to alleviate patients' pain. The lower arch-edge of the foot is believed to be the reflected zone of the lumbar region (19). Despite existing studies on the effects of acupressure and reflexology as noninvasive, cost-effective, and easily applied techniques on nonspecific low back pain, few studies have examined the impact of dual therapy (combining alternative and conventional therapies) and compared it with routine methods of using NSAIDs to relieve back pain in patients who have been referred to the emergency department.

The main objective of this study was to evaluate the efficacy of combining acupressure and reflexology with standard NSAID therapy in managing nonspecific low back pain (NSLBP) in pain relief, measured by the Short-Form McGill Pain Questionnaire (SF-MPQ), in emergency department (ED) patients. If proven to be more effective, this dual therapy would be a suitable, patient-friendly, and non-invasive alternative, especially for patients interested in alternative medicine due to belief in traditional treatments.

Methods

A prospective cohort study was performed on patients attending the emergency department of a tertiary center from May 2021 to May 2023 with the chief complaint of low back pain. The present study was validated by the Ethics Committee of Shahid Beheshti University of Medical Sciences (IRB.SBMU.MSP. REC.1398.206). All patients provided written informed consent. All interventions performed in the present study were in accordance with the ethical standards of the Institutional and National Research Committee of Shahid Beheshti University of Medical Sciences and the 1964 Helsinki Declaration and its updates.

The intervention was performed in a single session immediately following the administration of NSAIDs. The procedure was carried out by a certified physical therapist with 6 years of experience in complementary medicine. The therapist applied manual pressure using the thumb. Although the exact force in Newtons was not mechanically measured, the pressure intensity was standardized based on patient feedback to achieve the 'deqi' sensation (characterized by soreness, numbness, distension, or heaviness) without causing intolerable pain. The total duration of the session was 30 minutes. Pressure was applied to each acupoint (P6, LI4, ST36) bilaterally for approximately 3 minutes per point, followed by 10 minutes of reflexology massage on the reflected lumbar zone of the foot.

Patients were eligible to be included in this study if they met the following criteria:

1. Diagnosis of non-specific spasmodic low back pain (not caused by systemic disorders, including malignancies, trauma, post-op complications, and rheumatologic disorders such as systemic lupus erythematosus or rheumatoid arthritis)
2. No relative or absolute contraindications of acupressure and reflexology based on World Health Organization WHO 2013 Guidelines on Basic Training and Safety in Acupuncture and the 2017 revision of the Standards of Practice of the Reflexology Association of Canada (R.A.C). Contraindications included pregnancy, rheumatoid

arthritis, chronic diseases, pyrexia, uncontrolled hypertension, cardiovascular disorders, and active dermatologic diseases such as cellulitis, epilepsy, acute undiagnosed pain, HIV/AIDS, and hepatitis

3. No contraindications to NSAID administration (20), e.g., active or history of gastrointestinal ulcer or bleeding, heart failure, myocardial infarction, chronic kidney disease, cirrhosis, concurrent use of anticoagulants (e.g., warfarin, direct oral anticoagulants (DOACs)), pregnancy (especially the third trimester), history of asthma or aspirin-exacerbated respiratory disease
4. No use painkillers three days before admission, assessed by an independent physician.
5. Not being a surgery candidate.

The required sample size for each group was determined utilizing a comparable study. Conducted by Hsieh et al. (21). The significance level and the statistical power were determined at 0.05 (α) and 80% (1–β), respectively. The effect size calculated for this study was 9.85, so at least 23 participants were required in each group to identify clinically significant differences. A post-hoc power analysis was performed to ensure that the sample size was sufficient to detect clinically meaningful differences in the questionnaires completed by the patients (the statistical power for all variables was 1).

Patients were divided into two groups according to the treatment strategies established by emergency medicine residents: combined therapy (reflexology, acupressure, and NSAIDs) and conservative therapy (control group, NSAID therapy). Patients achieving the inclusion criteria were assigned to one of the two study groups sequentially to minimize bias.

All physicians of both groups were blinded to the cohort assignments to reduce bias induced by pain scores (Hawthorne effect). The research assistant who recorded the pain scores was trained not to ask the patients about the therapy they received if possible. The statistician was also blinded to the data they analyzed. Due to the nature of reflexology and acupressure treatments, patients could not be blinded.

All patients were informed about the outline, advantages, and disadvantages of participating in the study and asked to complete the informed consent. Thus, 81 (40 patients in the combined therapy group and 41 patients in the control group) qualified to be included in the existing cohort study and agreed to join. A brief history and a baseline pain score were recorded for each participant before initiating the intervention.

Both groups received 30 mg intramuscular ketorolac tromethamine (22-25) for the nonspecific low back pain. After ketorolac administration, study group patients were asked to wash their hands and feet and lie supine on the physical examination bed. Next, the blinded therapist cleansed the Nei Guan (P6), He Gu (LI 4), Zu San Li (ST 36) points, and the lower medial arch of the foot with ethanol 60% prep pads. The therapist then performed acupressure and zone therapy in the abovementioned regions. The alternative treatment took approximately 30 minutes. All patients were discharged from the emergency room after vital signs were monitored. All patients were contacted 24 hours after discharge and asked about their lower back pain. The short-form McGill Pain Questionnaire (SF-MPQ) (26) was used to measure and quantify patients' pain.

All statistical analyses were conducted using SPSS version 22 (IBM, Chicago, IL, USA). The Mann-Whitney *U* test was utilized to compare pain score differences between the two groups, given that the data was not normally distributed, as determined by the Shapiro–Wilk test. A *p*-value less than 0.05 was deemed statistically significant. All data were expressed as mean ± SD. Baseline characteristics were analyzed for both groups to confirm their comparability. Categorical variables, such as sex ratio and history of chronic disease, were analyzed with the chi-square test. The normality of continuous variables (e.g., age and baseline pain score) was evaluated using the Shapiro–Wilk test. Independent *t*-tests were employed to compare normally distributed variables, whereas the Mann–Whitney *U* test was utilized for non-normally distributed variables.

Results

Demographic Data

The mean ages of control and combined therapy patients were 38.58 ± 13.72 and 43 ± 12.37, respectively. The sex ratio (male-to-female ratio in numbers) was 27:13 in the control group and 17:24 in the combined therapy group.

A history of recurrent low back pain was reported by 25% ($n = 7$) of the control group and 17.1% ($n = 7$) of the combined therapy group, and 85% ($n = 34$) and 90.2% ($n = 37$) of the patients in the control and combined therapy groups had no history of chronic disease. In the intervention group, four patients had a positive past medical history of chronic diseases, including three patients with hypertension alone and one patient with both type 2 diabetes mellitus and hypertension. In the control group, six patients reported a positive medical history of chronic diseases, comprising three cases of hypertension, two cases of type 2 diabetes mellitus, and one case of chronic kidney disease. Comparison of medical history is reported in Figure 1.

No significant difference was observed between the baseline pain scores of the combined therapy and control groups (mean ± SD: 8.41 ± 1.46 vs. 7.15 ± 1.95; median [IQR]: 8 [7–10] vs. 7 [5–9]; $P > 0.05$, Mann–Whitney *U* test), indicating comparable initial pain levels. However, a significant reduction in pain scores was observed in the combined therapy group following the intervention, with mean post-intervention scores decreasing to 4.56 ± 2.19 (median [IQR]: 5 [3.5–7.5]; $P < 0.0001$, Wilcoxon signed–rank test). The control group also experienced a reduction in pain scores (mean ± SD: 5.88 ± 2.73; median [IQR]: 6 [3.25–7.75]), but the decrease was less evident. Furthermore, the mean difference in pain scores before

Table 1. Pain scores before and after intervention in control and combined therapy groups (mean ± SD and median [Q1–Q3])

Group	Baseline pain score mean ± SD	Baseline pain score median (Q1 – Q3)	Post-intervention pain score mean ± SD	Post-intervention pain score median (Q1 – Q3)	Mean pain score difference ± SD	Median pain score difference (Q1 – Q3)
Combined therapy	8.41 ± 1.46	8 (7–10)	4.56 ± 2.19	5 (3.5–7.5)	3.85 ± 2.14	4 (3–5)
Control	7.15 ± 1.95	7 (5–9)	5.88 ± 2.73	6 (3.25–7.75)	1.27 ± 1.78	1 (0–3)

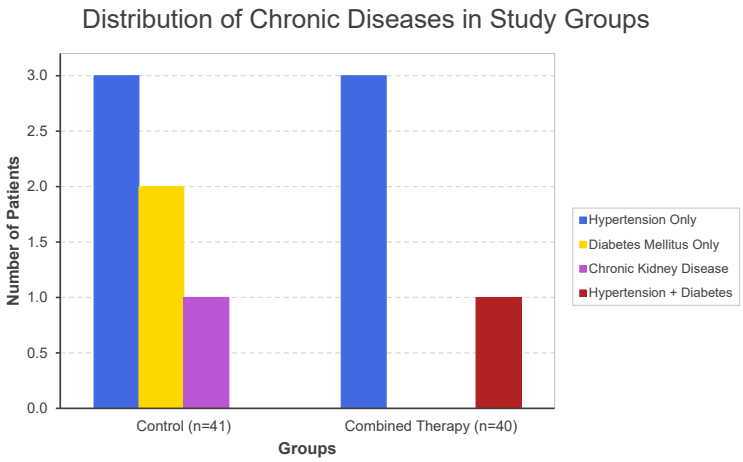

Figure 1. Comparison of the number of patients with hypertension only, diabetes mellitus only, both hypertension and diabetes mellitus, and chronic kidney disease in the control and combined therapy groups

and after the intervention was significantly greater in the combined therapy group compared to the control group (3.85 ± 2.14 vs. 1.27 ± 1.78; $P < 0.001$), supported by median difference values (4 [3–5] vs. 1 [0–3]). These results suggest that the addition of acupressure and reflexology to standard NSAID therapy led to a more substantial reduction in pain intensity than NSAID therapy alone (Table 1).

Discussion

Combining acupressure and reflexology with NSAID therapy significantly reduced the pain intensity of patients experiencing nonspecific low back pain. Due to the increased doctor-patient relationship in people undergoing reflexology and acupressure treatments, these patients feel more involved in their treatment process, resulting in higher satisfaction rates. Furthermore, these techniques may contribute to pain relief through neurophysiological mechanisms, including a variety of pain mechanisms (15). In cultures where alternative medicine is prevalent, a dual therapy strategy can effectively alleviate both physiological and psychological suffering. The increasing global interest in holistic healthcare suggests that integrating evidence-based alternative therapies with conventional medical treatment may enhance patient outcomes and expand pain management options in clinical practice.

Our study is aligned with previous studies demonstrating a significant reduction in pain scores after reflexology (19, 27-29) and acupressure therapy (21, 30-33). In a study conducted by Li-Chen Hsieh et al., it was concluded that acupressure's effect on alleviating low back pain was compared with physical therapy, and it was found that acupressure is more effective than physical therapy (30). Furthermore, Adams et al. revealed that acupressure effectively reduces lower back pain (32). Although the precise underlying biological and physiologic mechanisms involved are not clearly understood, it has been suggested that acupressure may adjust the level of pro-inflammatory cytokines (e.g., TNF-α, IL-1β, IL-6, IL-8, and IL-18) and anti-inflammatory cytokines (e.g., IL-10 and IFN-γ in some cases) (15) and play an essential, yet ambiguous, role based on the gate control theory (34). The efficacy of acupressure in other medical conditions like stroke, hypertension, and dyspnea is supported by a vast body of research (35-40). In addition, a systematic review by Godley and Smith (31) concluded that acupressure can be a feasible, costless, and safe first-line nonpharmacologic choice to manage nonspecific low back pain. Its invaluable features are its tolerability by patients and its easy-to-learn protocol to be self-administered by patients at home to reduce pain, as was investigated by Murphy et al. (41).

There is little evidence of the efficacy of reflexology in alleviating pain in the lower back. Eghbali et al. (19), reported that reflexology of the reflected zones of the lumbar region significantly reduced the pain score of patients with chronic low back pain. In addition, it has been revealed that long-term application of reflexology successfully relieves lumbar and labor pain (27, 42). Part of the pain-reducing effect of reflexology is due to the method's impact on mechanoreceptors, resulting in the release of endorphins (43). Furthermore, the effects of reflexology on pain relief are beyond a simple nonspecific massage (19). That is to say, reflexology is a precise and specific treatment, as it is believed that specific reflected zones are associated with the particular regions of the body. Reflexology has also been shown to affect other conditions, such as anxiety, relaxation, and sleep quality, which enhance the quality of life of patients (27).

A limitation of the current study was the absence of blinding for patients regarding the treatment

administered. Despite the sufficient number of patients in each group, considering the effect size, the sample size is not enough to generalize the findings of this study, and it is recommended that future multicentric studies with a larger sample size examine the effectiveness of this dual treatment on low back pain. Another limitation of this study was the lack of longer-term follow-up of patients; thus, the duration of effectiveness of these treatments is uncertain.

More comprehensive studies with greater sample sizes should be designed to evaluate whether these easy-to-learn and noninvasive alternative approaches can be adjunctive and complementary to current pharmacological treatments.

Conclusion

This study suggests that combining acupressure and reflexology alongside NSAIDs to reduce non-specific low back pain in the ED results in further pain reduction in patients.

Authors' Contribution

Conceptualization: Anita Sabzghabaei
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Competing Interests

The authors declare no conflict of interest.

Declaration of AI

During the preparation of this work, the author(s) used Grammarly to enhance quality and clarity and refine the text. After using this tool, the author(s) reviewed and edited the content to improve language and readability. The authors take full responsibility for the publication's content.

Ethical Approval

The present study was validated by the Ethics Committee of Shahid Beheshti University of Medical Sciences (IRB.SBMU.MSP.REC.1398.206). All patients provided written informed consent. All interventions performed in the present study were in accordance with the ethical standards of the Institutional and National Research Committee of Shahid Beheshti University of Medical Sciences and the 1964 Helsinki Declaration and its updates.

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