Vietnam Journal of Community Medicine, Vol. 66, English version No. 2, 193-198

EVALUATION OF THE THERAPEUTIC EFFECTS OF ELECTROACUPUNCTURE COMBINED WITH ULTRASOUND THERAPY AND THE "LUC VI" HERBAL FORMULA IN THE MANAGEMENT OF KNEE OSTEOARTHRITIS

Do Duy Cuong[2], Tran Thi Hong Ngai[1]

[1]*Vietnam University of Traditional Medicine - 2 Tran Phu, Ha Dong Ward, Hanoi City, Vietnam*
[2]*Phu Tho Provincial Hospital of Traditional Medicine and Rehabilitation - Gia Cam Ward, Viet Tri City, Phu Tho Province, Vietnam*

Received: 07/11/2025
Revised: 17/12/2025; Accepted: 20/12/2025

ABSTRACT

Objective: To evaluate the therapeutic effects of electroacupuncture combined with therapeutic ultrasound and the Lục Vị formula in the treatment of knee osteoarthritis at Phu Tho Traditional Medicine and Rehabilitation Hospital, and to describe some undesirable effects of the treatment method.

Methods: A prospective clinical study with before–and–after comparison was conducted on 50 patients diagnosed with knee osteoarthritis of the Cold-Dampness obstruction type combined with Liver-Kidney deficiency. Patients were treated with a combined regimen of electroacupuncture, therapeutic ultrasound, and the Lục Vị decoction for 20 days. Treatment effectiveness was assessed based on changes in VAS pain score, WOMAC index (pain, stiffness, physical function), and clinical indicators (knee joint range of motion, heel–to–buttock distance) at three time points: before treatment (D0), day 10 (D10), and day 20 (D20).

Results: After 20 days of treatment, the combined regimen showed significant improvement in all evaluated indicators. The mean VAS pain score decreased from 6.02 ± 0.14 to 2.32 ± 1.65 ($p < 0.01$). The total WOMAC score decreased from 55.66 ± 3.47 to 15.36 ± 4.94 ($p < 0.01$). The knee flexion range increased from 95.4 ± 7.61° to 111.5 ± 12.83° ($p < 0.01$). Other clinical symptoms of Traditional Medicine, such as stiffness, joint crepitus, and poor sleep, also improved significantly ($p < 0.05$). The treatment regimen was well-tolerated and safe.

Conclusion: The combination of electroacupuncture, therapeutic ultrasound, and the Lục Vị formula is an effective and safe treatment that helps reduce pain, relieve stiffness, and significantly improve mobility in patients with knee osteoarthritis.

Keywords: Knee osteoarthritis, electroacupuncture, therapeutic ultrasound, Lục Vị Địa Hoàng decoction, Traditional Medicine.

1. INTRODUCTION

Knee osteoarthritis (KOA) is the most common chronic musculoskeletal disease, resulting from mechanical and biological processes that disrupt the balance between synthesis and degradation of articular cartilage and subchondral bone. It is one of the leading causes of pain and disability in older people worldwide. In Vietnam, KOA ranks third among musculoskeletal disorders, accounting for 56.5% of all degenerative joint diseases requiring inpatient treatment.

Modern medicine in the treatment of KOA focuses mainly on relieving symptoms using analgesics, anti-inflammatory drugs (NSAIDs), and physical therapy modalities. However, long-term medication use poses risks of adverse effects, while the effectiveness of physical therapy as a monotherapy is sometimes limited.

Traditional Medicine (TM), with methods such as electroacupuncture and classical herbal formulas, has

*Corresponding author
Email: cuongdd01051966@gmail.com **Phone**: (+84) 846879920 **DOI:** 10.52163/yhc.v66i8.4054

been proven effective in treating KOA, which falls under the Bi syndrome or Stork knee wind category according to TM theory. Clinical practice has shown that integrating modern and traditional approaches yields improved therapeutic outcomes and safety.

The combined regimen of electroacupuncture, therapeutic ultrasound (a modern physical therapy modality), and the Lục Vị formula (a fundamental prescription for Kidney–Liver deficiency patterns) provides a comprehensive approach that addresses both symptomatic relief and the root causes of the disease, in line with TM principles. However, systematic studies evaluating this multimodal therapeutic regimen are still limited.

Therefore, we conducted this study with the following objectives:

1. To evaluate the therapeutic effects of electroacupuncture combined with therapeutic ultrasound and the Lục Vị formula in the treatment of knee osteoarthritis at Phu Tho Traditional Medicine and Rehabilitation Hospital.

2. To describe some undesirable effects of the treatment.

2. METHODS

2.1. Study subjects

A total of 50 patients with a confirmed diagnosis of knee osteoarthritis were treated at Phu Tho Traditional Medicine and Rehabilitation Hospital.

- Inclusion criteria:

+ Patients diagnosed with knee osteoarthritis according to the 1991 American College of Rheumatology (ACR) criteria.

+ Diagnosed with Cold-Dampness obstruction syndrome combined with Liver–Kidney deficiency according to Traditional Medicine.

+ Voluntarily agreed to participate in the study.

- Exclusion criteria:

+ Secondary knee osteoarthritis (e.g., due to rheumatoid arthritis, gout, etc.).

+ Intra-articular corticosteroid injection within the last 3 months.

+ Contraindications to electroacupuncture or therapeutic ultrasound.

+ Pregnant or breastfeeding women.

2.2. Methods

- Study design:

A prospective clinical study with a before-and-after comparison.

- Intervention: All 50 patients were treated with a standardized combination regimen continuously for 20 days.

+ Electroacupuncture (20 minutes/session/day): Using the KWD808-I electroacupuncture device, tonifying and reducing frequency mode; stimulation at local acupoints (Dubi, Xiyan, Liangqiu, Xuehai, Yinlingquan, Yanglingquan) and systemic acupoints (Ganshu, Shenshu, Zusanli, Sanyinjiao).

+ Therapeutic ultrasound (20 minutes/session/day): Using the ITO US-100 device at 0.8 MHz and 0.5–1 W/cm^2, the probe was moved over the painful knee joint area.

+ Liu Wei Di Huang Decoction: Given in decoction form (Rehmannia 24 g, Dioscorea 12 g, Cornus 12 g, Poria 9 g, Moutan bark 9 g, Alisma 9 g), packed in 150 ml/sachet, taken twice daily 1 hour after meals.

- Evaluation indicators:

+ Assessed at baseline (D_0), day 10 (D_{10}), and day 20 (D_{20}).

+ Pain severity: Visual Analog Scale (VAS, 0–10 points).

+ Knee function: WOMAC Index (pain, stiffness, physical function).

+ Knee range of motion: measured with a goniometer.

+ Heel-buttock distance: measured with a measuring tape.

+ Traditional Medicine symptoms: knee and low-back soreness, poor sleep, tinnitus, pulse, tongue, etc.

- Adverse effects: Recorded daily.

- Data analysis: Data processed using SPSS 20.0. Paired t-test used to compare mean values before and after treatment. Statistical significance was set at $p < 0.05$.

3. RESULTS

Table 1. Number of affected knee joints

Joint position	NC Group (1) (n = 50)	
	n	%
1 joint Right	8	16%
Left	8	16%
Both joints	34	68%

Comment: Based on the data in the table, bilateral knee involvement was the most common condition in the study population, accounting for 68%. Among patients with unilateral knee osteoarthritis, the rates of right and left knee involvement were equal, each representing 16%.

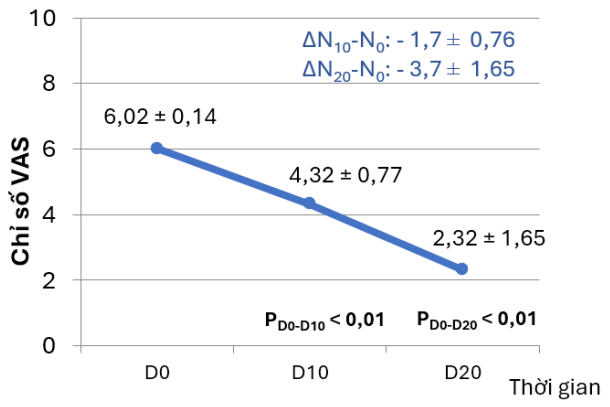

Figure 1. Change in mean VAS score

Comment: At D_0, the mean pain score of the study population was 6.02 ± 0.14 points.

After 10 days of treatment, the mean pain score decreased to 4.32 ± 0.77 points, representing a reduction of −1.7 ± 0.76 points compared with baseline ($p < 0.01$).

After 20 days of treatment, the mean pain score further reduced to 2.32 ± 1.65 points, with a reduction of −3.7 ± 1.65 points, and the difference was statistically significant compared with baseline ($p < 0.01$).

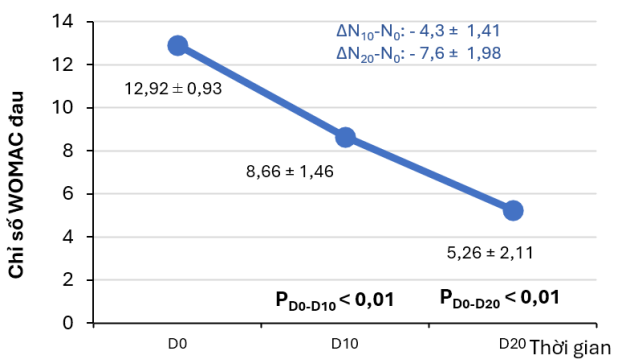

Figure 2. Change in WOMAC pain score

Comment: At D_0, the mean WOMAC pain score of the patient group was 12.92 ± 0.93 points.

After 10 days of treatment, the mean WOMAC pain score at D_{10} was 8.66 ± 1.46 points, with a reduction compared to D_0 of ΔD_{10}–D_0: −4.3 ± 1.41 points, showing a statistically significant decrease ($p < 0.01$).

At D_{20}, the mean WOMAC pain score was 5.26 ± 2.11 points, with a reduction compared to D_0 of ΔD_{20}–D_0: −7.6 ± 1.98 points, showing a statistically significant improvement ($p < 0.01$).

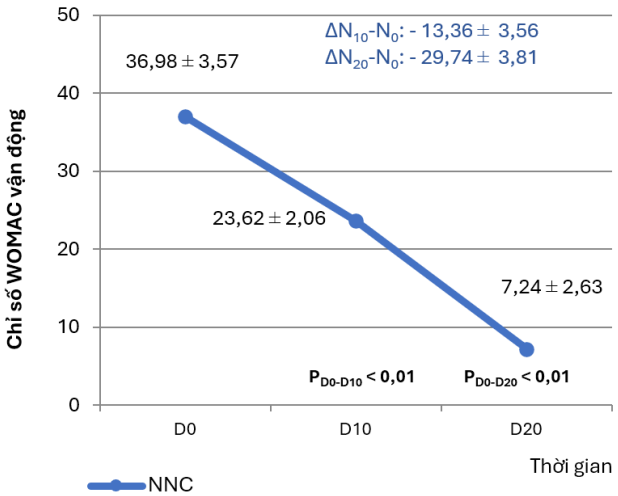

Figure 3. Change in WOMAC physical function score

Comment: At D_0, the mean WOMAC physical function score of the patient group was 36.98 ± 3.57 points.

After 10 days of treatment, the mean WOMAC physical function score at D_{10} was 23.62 ± 2.06 points, with a reduction compared to D_0 of ΔD_{10}–D_0: −13.36 ± 3.56 points, showing a statistically significant decrease ($p < 0.01$).

At D_{20}, the mean WOMAC physical function score was 7.24 ± 2.63 points, with a reduction compared to D^0 of ΔD_{20}–D_0: −29.74 ± 3.81 points, showing a statistically significant decrease ($p < 0.01$).

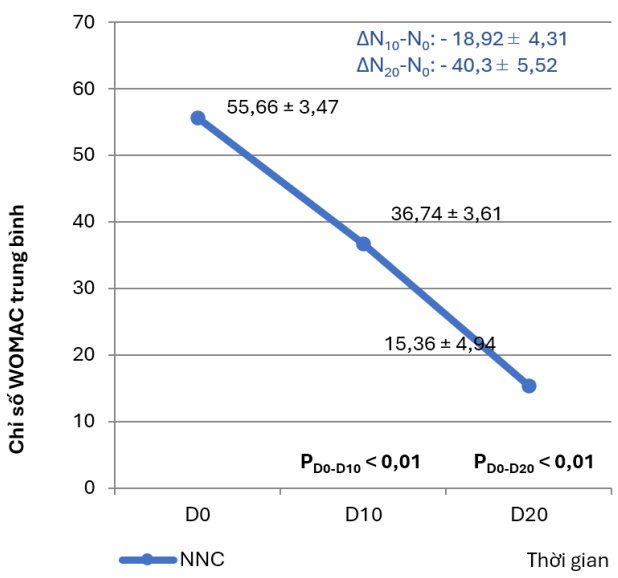

Figure 4. Change in mean WOMAC score

Comment: At D_0, the mean WOMAC score of the patient group was 55.66 ± 3.47 points.

After 10 days of treatment, the mean WOMAC score at D_{10} was 36.74 ± 3.61 points, with a reduction compared to D_0 of ΔD_{10}–D_0: −18.92 ± 4.31 points, showing a statistically significant decrease ($p < 0.01$).

At D_{20}, the mean WOMAC score was 15.36 ± 4.94 points, with a reduction compared to D_0 of ΔD_{20}–D_0: −40.3 ± 5.52 points, showing a statistically significant decrease (p < 0.01).

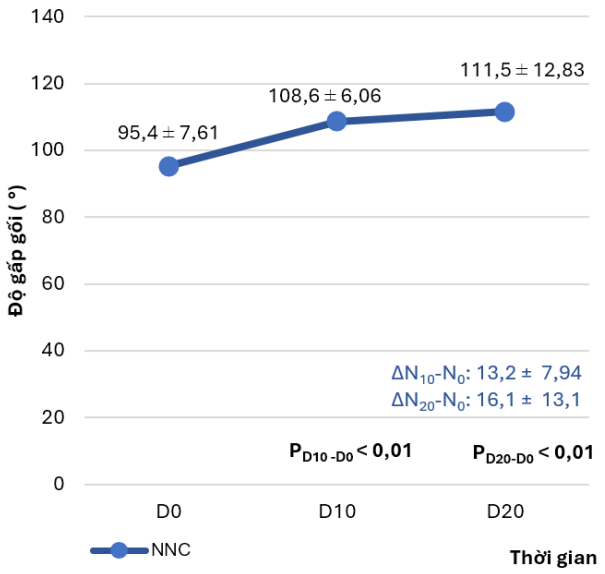

Figure 5. Improvement in the knee range of motion

Comment: Before treatment, the mean knee flexion range of motion in the study group was 95.4 ± 7.61 (°).

After 10 days of treatment, the mean knee flexion range of motion was 108.6 ± 6.06 (°), with an improvement compared to D_0 of ΔD_{10}–D_0: 13.2 ± 7.94 (°), showing a statistically significant difference (p < 0.01).

After 20 days of treatment, the mean knee flexion range of motion was 111.5 ± 12.83 (°), with an improvement compared to D_0 of ΔD_{20}–D_0: 16.1 ± 13.1 (°), showing a statistically significant difference (p < 0.01).

Table 2. Effectiveness of clinical symptom improvement after treatment?

Symptom	NC Group (n=50)				P_{D0-D20}
	D_0		D_{20}		
	n	%	n	%	
Joint pain	50	100	50	100	> 0.05
Joint stiffness lasting less than 30 minutes	38	76	2	4	< 0.05
Clicking sound during joint movement	41	82	5	10	< 0.05

Comments: After 20 days of treatment, the proportion of patients with persistent knee pain remained 100%, with no statistically significant difference (p > 0.05). However, the number of patients experiencing morning stiffness lasting less than 30 minutes markedly decreased from 76% to 4%, and the number of patients with knee crepitus decreased from 82% to 10%. These differences were statistically significant (p < 0.05).

Table 3. Improvement of Traditional Medicine Symptoms After Treatment

Symptoms	NC Group (n=50)				P_{D0-D20}
	D_0		D_{20}		
	n	%	n	%	
Knee joint pain	50	100	50	100	> 0.05
Difficulty in flexion and extension	50	100	3	6	< 0.05
Joint deformity	50	100	5	10	< 0.05
Knee joint swelling	50	100	1	2	< 0.05
Lower knee pain	11	22	1	2	< 0.05
Tinnitus	0	0	0	0	> 0.05
Poor sleep	50	100	0	0	< 0.05
White, sticky tongue coating	50	100	50	100	> 0.05
Slow and weak pulse	50	100	50	100	> 0.05

Comments: At the time of D_0, 100% of the patients presented with symptoms of limited knee flexion-extension, joint deformity, and knee swelling. However, after 20 days of treatment, these symptoms were significantly reduced: limited flexion-extension decreased by 6%, joint deformity decreased by 10%, and knee swelling decreased by 2%, with statistically significant differences (p < 0.05).

At D_0, 100% of patients had poor sleep quality. By D_{20}, this symptom had markedly decreased to 0%, with a statistically significant difference (p < 0.05).

Table 4. Assessment of Adverse Clinical Effects

Adverse Reactions	NC Group	n %
Medication Headache	0	0
Nausea	0	0
Gastrointestinal disturbances	0	0
Abdominal pain	0	0
Allergies, rash	0	0
Acupuncture Bleeding	0	0
Pain at the needle insertion site	2	4
Ultrasound Pain at the ultrasound site	1	2

Pinching sensation 3 6Comments: During the study, 4% of patients experienced needling-site pain, which lasted for approximately one day and resolved spontaneously

without intervention; 2% of patients reported discomfort at the ultrasound treatment site, which gradually improved and disappeared after about 20 minutes; 6% of patients experienced needle sensation discomfort, which gradually subsided and resolved spontaneously after about 20 minutes. No other adverse clinical effects were recorded throughout the study period.

4. DISCUSSION

Our study demonstrated that the combined regimen of electroacupuncture, therapeutic ultrasound, and the Liu Wei (Lục Vị) herbal formula provided high efficacy and safety in the treatment of knee osteoarthritis in elderly patients. This effectiveness can be explained by the synergistic, multi-mechanism actions of the three modalities:

- Electroacupuncture: Produces rapid and strong analgesic effects through mechanisms such as the gate control theory and endogenous endorphin release, while also exerting local anti-inflammatory effects, thereby reducing pain and muscle stiffness.

- Therapeutic ultrasound: The profound thermal effect enhances local circulation, increases cell membrane permeability, promotes the removal of inflammatory mediators, and softens fibrotic and contracted periarticular tissues, leading to better joint mobility and reduced stiffness.

- Liu Wei herbal formula: A classical prescription that nourishes Liver and Kidney Yin. According to Traditional Medicine, “the Kidney governs bones and marrow” and “the Liver governs tendons.” In the elderly, a deficiency in liver and kidney function fails to nourish the tendons and bones, resulting in degeneration and pain. Therefore, using Liu Wei targets the root cause, helping to strengthen bones and nourish tendons from within, ensuring a more sustainable and comprehensive therapeutic effect.

The marked improvement in sleep disturbances (from 100% to 0%) strongly reflects the herbal medicine's systemic regulatory action. This combination constitutes a treatment strategy of “internal supplementation and external intervention,” addressing both symptoms (branch) and underlying causes (root), highlighting the essence of integrated Traditional and Modern Medicine.

- Regarding safety:

The treatment protocol demonstrated a high safety profile, with only mild, transient local adverse effects that did not affect vital signs. This is especially important for elderly patients who often have comorbidities and are more susceptible to the adverse impacts of modern medications such as NSAIDs.

5. CONCLUSION

- Bilateral knee joint involvement was the most common condition in the study population, accounting for 68%. Among patients with unilateral involvement, the rates of right- and left-knee damage were equal, each accounting for 16%.

- After 20 days of treatment, the mean VAS pain score of the study patients was 2.32 ± 1.65 points, with a reduction of -3.7 ± 1.65 points compared with baseline, showing a statistically significant improvement ($p < 0.01$).

- At D_{20}, the mean WOMAC pain score was 5.26 ± 2.11 points, with a reduction $\Delta N_{20}–N_0$ of -7.6 ± 1.98 points compared with baseline, showing a statistically significant improvement ($p < 0.01$).

- At D20, the mean WOMAC function score was 7.24 ± 2.63 points, with a reduction ΔN20–N0 of -29.74 ± 3.81 points compared with baseline, showing a statistically significant improvement ($p < 0.01$).

- At D20, the mean total WOMAC score was 15.36 ± 4.94 points, with a reduction ΔN20–N0 of -40.3 ± 5.52 points compared with baseline, showing a statistically significant improvement ($p < 0.01$).

- After 20 days of treatment, the mean knee flexion range of motion was 111.5 ± 12.83°, with an improvement ΔN20–N0 of 16.1 ± 13.1°, showing a statistically significant difference compared with baseline ($p < 0.01$).

- During the study, 4% of patients in the intervention group experienced localized pain at the acupuncture needle site, lasting for approximately one day and resolving spontaneously without any intervention; 2% of patients reported pain at the ultrasound-treated area, with symptoms gradually subsiding and disappearing within 20 minutes after treatment; and 6% of patients experienced needle sensation discomfort, which also gradually decreased and resolved within 20 minutes of treatment. No other clinically significant adverse events were observed throughout the study.

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