



# Electroacupuncture for Painful Diabetic Peripheral Neuropathy: A Multicenter, Randomized, Assessor-Blinded, Controlled Trial

Kyung-Min Shin,<sup>1</sup> Seunghoon Lee,<sup>2</sup> Eun Yong Lee,<sup>3</sup> Cheol-Hong Kim,<sup>4</sup> Jung Won Kang,<sup>2</sup> Cham Kyul Lee,<sup>3</sup> Bok-Nam Seo,<sup>5</sup> Ae-Ran Kim,<sup>1</sup> So-Young Jung,<sup>1</sup> Ojin Kwon,<sup>1</sup> and Sun-Mi Choi<sup>6,7</sup>

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Painful diabetic peripheral neuropathy (PDN) is one of the most common complications of diabetes. In patients with PDN, greater pain intensity leads to poorer quality of life, sleep, function, and work productivity (1–3). According to the clinical practice guideline, electrical stimulation is probably effective and should be considered for the treatment of PDN (evidence level B) (4). The aim of this study is to evaluate the effectiveness and safety of electroacupuncture (EA) for the management of PDN in patients with type 2 diabetes.

This multicenter, randomized, assessor-blinded, controlled trial was conducted between June 2014 and March 2016 at four centers in South Korea (clinical trial reg. no. KCT0001135, <https://cris.nih.go.kr>). A total of 126 participants with a  $\geq 6$ -month history of PDN and a mean weekly pain score of  $\geq 4$  on the Pain Intensity Numerical Rating Scale (PI-NRS) were randomly assigned in a 1:1 ratio to an EA group ( $n = 63$ ) or control group ( $n = 63$ ). Randomization was performed by using a computer-generated random code, and allocation concealment was achieved using sequentially numbered, opaque sealed envelopes. The participants in the

EA group received EA treatment with a mixed current of 2 Hz/120 Hz at 12 acupuncture points (bilateral Zusanli [ST36], Xuanzhong [GB39], Yinlingquan [SP9], Sanyinjiao [SP6], Taichong [LR3], and Zulinqi [GB41]) twice per week for 8 weeks. Depending on the sites of pain, the additional acupuncture point Bafeng (EX-LE10) was available. The locations of acupuncture points were determined according to the general guidelines published by the World Health Organization (5). Participants in the control group did not receive any EA treatment. Education on diet and lifestyle modification for diabetes was provided to both groups through a brochure. Antidiabetes medications were allowed with stable doses throughout the study. The participants in both groups were allowed to take a rescue medication (acetaminophen 500 mg, with a maximum dosage of 3,000 mg per day), but no other analgesic medication was permitted during the study. The intent-to-treat analysis was used in the main analysis. Missing data were imputed by multiple imputations. To compare the groups, a  $t$  test was used for continuous data, and the categorical data were analyzed with a  $\chi^2$  test or Fisher exact test.

Of the 126 patients, 106 (84.1%) completed the 8-week treatment and 98 (77.8%) completed the 8-week follow-up assessment. Nine participants in the EA group and 19 in the control group dropped out during the study. There were no significant differences between groups in any of the demographic characteristics, including age, sex, duration of diabetes (EA group 12.53 years, control group 11.32 years), pain duration (EA group 3.81 years, control group 3.23 years), and antidiabetes medication use. The primary outcomes were PI-NRS score and the proportion of responders (defined as achieving a reduction of  $\geq 50\%$  on the PI-NRS) at the 9th week. For the PI-NRS scores, patients in the EA group showed significantly more improvement than those in the control group (least squares mean difference  $-0.67$  [95% CI  $-1.29$  to  $-0.06$ ];  $P = 0.0136$ ) (Fig. 1A). Among the patients receiving EA treatment, nine (15.52%) were responders, while only three (6.25%) patients in the control group were responders ( $P = 0.2176$ ) (Fig. 1B). The EA treatment group also showed significantly greater improvement than the control group on the short-form McGill Pain Questionnaire, sleep

<sup>1</sup>Clinical Medicine Division, Korea Institute of Oriental Medicine, Daejeon, South Korea

<sup>2</sup>Department of Acupuncture & Moxibustion Medicine, College of Korean Medicine, Kyung Hee University, Seoul, South Korea

<sup>3</sup>Department of Acupuncture & Moxibustion Medicine, College of Korean Medicine, Se-Myung University, Je-cheon, South Korea

<sup>4</sup>Department of Acupuncture & Moxibustion Medicine, College of Korean Medicine, Dong-Eui University, Busan, South Korea

<sup>5</sup>Future Medicine Division, Korea Institute of Oriental Medicine, Daejeon, South Korea

<sup>6</sup>Korea Institute of Oriental Medicine, Daejeon, South Korea

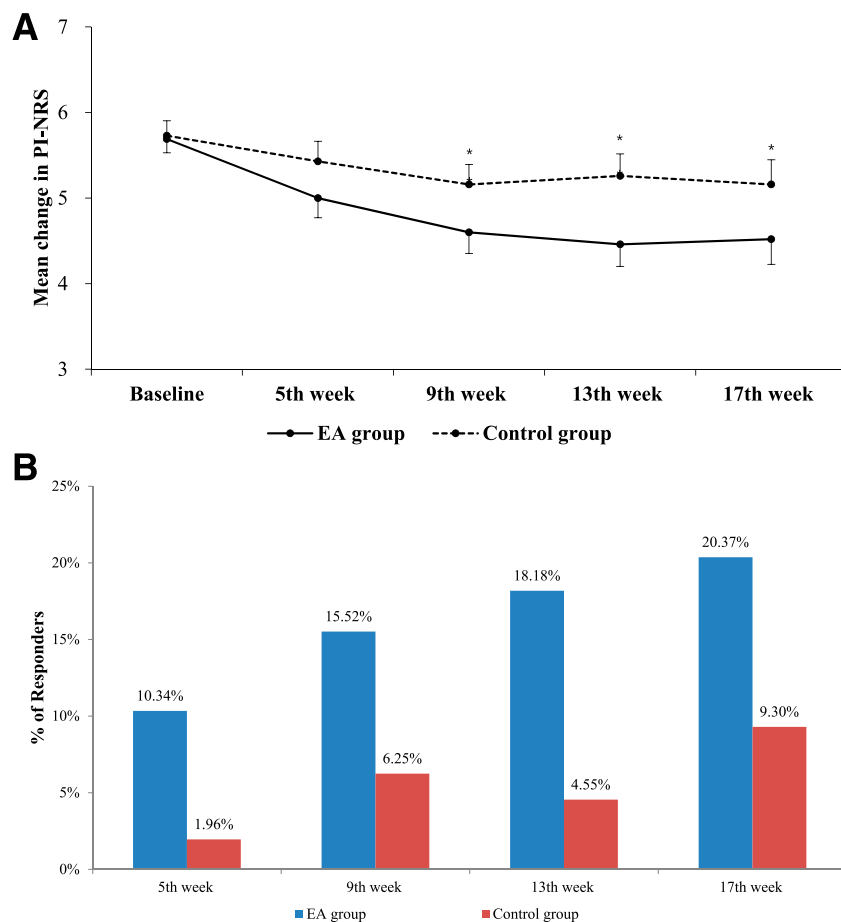
<sup>7</sup>Korean Medicine Life Science, University of Science & Technology, Campus of Korea Institute of Oriental Medicine, Daejeon, South Korea

Corresponding author: Sun-Mi Choi, [smchoi@kiom.re.kr](mailto:smchoi@kiom.re.kr).

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**Figure 1**—Weekly mean changes from baseline in PI-NRS score (A) and the proportion of responders, defined as those achieving a  $\geq 50\%$  reduction in PI-NRS score from the baseline score (B). \* $P < 0.05$ .

interference scores, and the EuroQol-5 Dimensions questionnaire at the 9th week ( $P < 0.05$ ). The percentage of patients reporting improvement in the Patient Global Impression of Change was greater in the EA group (82.5%) than in the control group (34.1%) at the 9th week. This improvement was maintained throughout the study. However, there were no differences in rescue medication consumption or nerve conduction studies between groups. With respect to the safety of EA, there was no significant difference in the incidence of adverse events (AEs) and serious adverse events (SAEs) between groups (EA group: 12 AEs and 3 SAEs; control group: 12 AEs

and 3 SAEs;  $P = 0.9999$ ). None of the AEs that occurred were related to EA treatments, and laboratory evaluations were unremarkable.

To our knowledge, this is the first multicenter randomized controlled trial to evaluate the effectiveness and safety of EA treatment for the management in PDN. One limitation is that neither a placebo nor sham EA was used as an active control; therefore, the possibility of a placebo effect was not excluded.

In conclusion, the results of this study demonstrate that EA treatment is effective for reducing pain and improving sleep disturbance and quality of life in PDN. In addition, EA treatment was well

tolerated and safe during this study. These findings suggest that EA treatment may be recommended as a non-pharmacological treatment for pain reduction in PDN.

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