



RESEARCH ARTICLE

Fifteen-day Acupuncture Treatment Relieves Diabetic Peripheral Neuropathy

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Received: Feb 21, 2010
Accepted: Apr 12, 2010

KEY WORDS:

acupuncture;
diabetic peripheral
neuropathy;
nerve conduction
velocity;
subjective symptom

Abstract

Our study aimed to investigate the effects of acupuncture on diabetic peripheral neuropathy. We compared 42 cases treated with acupuncture with 21 cases exposed to sham acupuncture and observed the effects on nerve conduction velocity and a variety of subjective symptoms associated with diabetic peripheral neuropathy. Three of the six measures of motor nerves, and two measures of sensory function, demonstrated significant improvement ($p < 0.05$) over the 15-day treatment period in the acupuncture group, while no motor or sensory function significantly improved in the sham acupuncture group. There were also significant differences in vibration perception threshold between the groups ($p < 0.05$) and when compared to the baseline levels ($p < 0.01$) in the acupuncture group. Acupuncture was significantly more effective than sham for treatment of numbness of the lower extremities, spontaneous pain in the lower extremities, rigidity in the upper extremities and alterations in temperature perception in the lower extremities after therapy. Our pilot study has, therefore, provided evidence that acupuncture may be clinically useful for the radical treatment of diabetic peripheral neuropathy.

1. Introduction

Diabetic peripheral neuropathy (DPN) is the most common late complication of diabetes, often associated with considerable morbidity and mortality [1]. It is estimated that 12–50% of people with diabetes have some degree of DPN [2]. Approximately 15% of people with diabetes develop at least one foot ulcer during their lifetime [3–4]. While vascular disease leading to ischemia is certainly a factor in the pathogenesis, 60–70% of diabetic foot ulcers are primarily neuropathic in origin [4].

DPN may be asymptomatic. When symptoms are present, they may be negative or positive. Negative

symptoms include loss of sensation and strength, while positive symptoms include prickling or pain [5]. Affected nerve functions include reduced nerve conduction velocity, decreased temperature sensation, decreased tendon reflex response, and a decreased ability to detect vibration and touch.

The pathophysiology of DPN remains unclear, although it is associated with increased age, duration of diabetes, lipotoxicity and glucotoxicity, genetic susceptibility, inflammation, and oxidative stress [6,7]. The total annual cost of DPN and its complications in the United States was estimated to be more than four billion. Up to 27% of the direct medical cost of diabetes may be attributed to DPN [8].

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Although several pivotal trials have shown that strict glycemic control reduces the occurrence and progression of diabetes-related complications [9,10], this approach alone does not completely eliminate complications. Thus the development of new therapy to manage diabetes complications remains a high priority.

Acupuncture, one of the oldest and most commonly used forms of alternative medicine, has existed for more than 2500 years. Acupuncture is a meridian-based therapy. In traditional acupuncture, needles are inserted into precisely defined, specific points on the body, each of which has distinct therapeutic actions [11]. According to traditional Chinese medicine (TCM), when an acupoint is stimulated, treatment effects tend to occur on the specific parts of the body along a particular meridian that contains this specific acupoint. Investigators have demonstrated that the nervous system and neurotransmitters respond to needling stimulation and electroacupuncture [12–14]. As a safe form of treatment [15,16], acupuncture offers clear clinical advantages in the reduction of symptoms related to nervous disorders. Paul et al [17] reported that two of the total three patients showed increased benefit when a series of six acupuncture sessions was added to the ongoing nefazodone therapy for the treatment of DPN. Unfortunately, to date, only a few trials on acupuncture have specifically targeted DPN. In a randomized controlled trial in China, Chen et al [18] concluded that the point through point method of acupuncture was superior to mecobalamin for the improvement of motor nerve conduction velocity (MNCV) of the common peroneal nerve. The results of another randomized trial showed that acupuncture lowered the pain caused by painful DPN [19]. Given these findings, we also performed a prospective randomized controlled trial to investigate whether acupuncture is useful for DPN.

2. Materials and Methods

2.1. Study site and participants

The study was conducted at the Jilin Chinese Medical Hospital between June 2005 and December 2005. DPN patients aged 35–52 years were invited to participate.

2.2. Study protocol

The study protocol was approved by the Jilin Chinese Medical Hospital. Protocol summaries were reviewed by the participants, and written, informed consent was obtained on the day of the

study after a detailed explanation of the study purpose and methods. These participants were diagnosed with mild DPN based on subjective symptoms, no foot ulceration, and neurological dysfunctions (at least two parameters: MNCV [indispensable] and vibration perception threshold [VPT] or Achilles tendon reflex). MNCV in the tibial nerve of patients ranged between 30m/s and 45m/s. Participants' sensory nerve conduction velocity (SNCV) in the median nerve (the distal area) ranged between 35m/s and 55m/s with stable glycemic control ($HbA_{1c} \leq 9\%$, with $\pm 0.5\%$ variation in the previous 3 months). Subjects were excluded if their primary cause of neurologic disorder was not diabetes (e.g., alcoholic neuropathy, carpal tunnel syndrome, sequelae of cerebrovascular disease), if their F-wave response had disappeared, if they had arteriosclerosis obliterans (ankle brachial pressure index of ≤ 0.8) or severe hepatic or renal disorder, if they were participating in other interventional studies, or if they were receiving other experimental medications for DPN, prostaglandin E1 preparations, or any other medication that affects symptoms of DPN. After the baseline period, 63 participants meeting the inclusion criteria were randomized (by random number table) into one of the two groups in a 2:1 ratio (acupuncture group and sham acupuncture group) which differed only in the type of needle manipulation used. This randomization meant 42 cases were allocated to the acupuncture group and 21 cases to the sham acupuncture group. There were no statistically significant differences ($p > 0.05$) between the two groups in any of the baseline characteristics. Table 1 shows the baseline characteristics for all 63 patients.

Both groups continued conventional therapy (diet treatment, hypoglycemic agents, insulin and hypotensive agents) with medication to aid neuropathy control prohibited. No major changes in diabetic management had taken place during the 3 months before the study, and no therapeutic alteration was made throughout the study. All patients participated in one session per day lasting 30 minutes for 15 days, during which a total of five acupuncture point locations on the body received acupuncture needling. Sterile disposable one-time-use needles were used. For each location, a pair of corresponding acupoints on the right and left sides of the body were identified and marked with a skin marker (10 acupoints total). These acupoints were Hegu (LI4), Fenglong (ST40), Quchi (LI11), Zusanli (ST36), and San Yin Jiao (SP6) identified by an experienced acupuncturist (Jianmin Lang) according to traditional methods. Approximate position was determined in relation to anatomic landmarks (e.g., bones, tendons) and proportional measurements (e.g., fraction of the distance between wrist and

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