Int J Clin Exp Med 2020;13(12):9593-9599
www.ijcem.com /ISSN:1940-5901/IJCEM0115662

Original Article

Early intervention of diabetic peripheral neuropathy with TCM footbath

Zhiqin Shen[1], Xue Sun[1], Xiaolong Kong[2], Yaochi Wu[3]

[1]Department of Traditional Chinese Medicine, Gumei Community Healthcare Center, Shanghai University of Traditional Chinese Medicine, Shanghai 201102, China; [2]Department of General Medicine, Gumei Community Healthcare Center, Clinical Medical College of Tianjin Medical University, Shanghai 201102, China; [3]Department of Acupuncture, Massage and Orthopedics, Shanghai Sixth People's Hospital, Shanghai 200233, China

Received June 4, 2020; Accepted July 19, 2020; Epub December 15, 2020; Published December 30, 2020

Abstract: Objective: This study aimed to analyze the effects of traditional Chinese medicine (TCM) footbath as an early intervention tool for diabetic peripheral neuropathy (DPN). Methods: A total of 113 DPN patients in our hospital were retrospectively analyzed and divided into Group A (GA, n=56, routine western medicine) and Group B (GB, n=57, TCM footbath). The clinical efficacy, integral of clinical syndromes (ICS), ankle brachial index (ABI), vibration perception threshold (VPT) and nerve conduction velocity (NCV) were compared between the two groups. Results: (1) After treatment, GB expressed lower total integral of TCM syndromes and VPT and higher ABIs, motor nerve conduction velocity (MNCV) and sensory nerve conduction velocity (SNCV) of median nerve and common peroneal nerve (P<0.05); (2) The overall response rate (OR) was 96.49% (55/57) in the GB, which was higher than that in the GA (P<0.05). Conclusion: For DPN patients, TCM footbath could further improve the clinical efficacy, clinical syndromes, ABI and NCV.

Keywords: TCM footbath, lipoic acid, DPN, glycometabolism, clinical syndromes

Introduction

Diabetic peripheral neuropathy (DPN) is a common chronic complication of diabetes with clinical manifestations such as degeneration of limb sensation, cold, numb and painful limbs, which may involve the central and peripheral nerves [1, 2]. Changes in lifestyle and aging have contributed to a sharp rise in the incidence of diabetes, which in turn has led to an increase in the number of patients with DPN [3].

Currently, clinical treatment of DPN focuses on the alleviation of clinical syndromes and improvement of neurological functions and patients' quality of life (QOL) [4]. In western medicine, therapeutic regimens including circulation improvement, oxidative stress resistance and nerve repair are often used on the basis of blood lipid and glucose control, but the therapeutic effects and clinical application are limited [5, 6]. In addition, those regimens are now at a plateau with some drug-related side effects. In contrast, Traditional Chinese medicine (TCM) is extensive, profound, diversified and increasingly studied in recent years to prove its ideal clinical efficacy with DPN [7, 8]. TCM categorizes DPN into the scope of "arthromyodynia". Frequent drinking and urination, exhaustion of Qi and Yin, stagnation of channels and collaterals, and deficiency of Yin, Yang, Qi and blood [9] are the main causes.

By fully leveraging the advantages of TCM, this study adopted TCM footbath in the treatment of patients with DPN and compare its treatment effect with routine western medicine to explore the influence of the two methods on the MNCVs and SNCVs of median nerve and common peroneal nerve, so as to find a new idea for the treatment of DPN, which is innovative and feasible.

Materials and methods

Materials

A total of 113 DPN patients in our hospital were retrospectively analyzed and divided into Group

A (GA, n=56, routine western medicine) and Group B (GB, n=57, TCM footbath). (1) Inclusion criteria: patients who were met the diagnosis criteria for DPN in TCM and western medicine; and patients without contradictions were included. This study was approved by the Ethics Committee of our hospital. Patients or their family members signed the informed consent form. (2) Exclusion criteria: impaired liver and kidney functions; mental and cognitive disorders; complications such as severe cardiovascular and cerebrovascular diseases; trauma, severe infection, diabetic hyperosmolar coma and diabetic ketoacidosis in the past month; peripheral nerve lesions due to drug toxicity, cerebral infarction, cervical and lumbar lesions; hemorrhagic tendency in the past 2 months; withdrawal during the study; allergic constitution.

Diagnosis criteria

In western medicine: (1) abnormal sensation and (or) persistent pain in extremities (at least the feet); (2) decreased ankle reflex at either or both sides; (3) obviously decreased vibration sensation; peripheral nerve lesions due to other factors (drugs, hypothyroidism, toxuria, ethylism and heredity) excluded.

In TCM: deficiency of Qi and Yin with syndrome of blood stasis. (1) Primary symptoms: electric shock-like, burning and stabbing pains in extremities, numbness, aching and tired waist and knees, dysphoria with feverish sensation in the chest, palms and soles, insomnia and dreamful sleep, choking sensation in chest and palpitation after exercise, somnolence or fatigue. (2) Secondary symptoms: intermittent, thread or irregular pulse, deep-red tongue, ecchymosis, itching or squamous and dry skin.

Methods

GA: imbued with knowledge related to diabetes, patients were required to take more exercise, quit smoking and alcohol, and maintain regular work and rest. Dietary guidance and hypoglycemic therapy were conducted according to the results of blood glucose control. Measures were taken to reduce the blood pressure of patients with hypertension while lipid-lowering drugs were orally administered to those with hyperlipemia. A mixture of 250 ml of 0.9% sodium chloride injection (approval document No.: GYZZ H37020764, manufacturer: Shandong Qidu Pharmaceutical Co., Ltd., specification: 500 ml: 4.5 g) and 600 mg of lipoic acid injection (approval document No.: GYZZ H20066706, manufacturer: Chongqing Yaopharma Co., Ltd., specification: 6 ml: 0.15 g × 2 pieces/box) was intravenously dripped once daily for 14 d.

GB: TCM footbath was given the patients in the GB. The prescription contained Raw Astragalus membranaceus (30 g), Ramulus Cinnamomi (6 g), Ligusticum chuanxiong (9 g), Caulis Spatholobus (15 g), Radix Paeoniae Rubra (12 g), safflower (6 g), angelica (15 g), Herba Siegesbeckiae (15 g). These ingredients were soaked in 5,000 ml of water for 20 min, boiled on strong fire and then slow fire for 30 min. The filtrate was collected for 20 min footbath at an appropriate temperature. Footbath was arranged once daily and preferably at 1-3 h after a meal. The treatment continued for 2 weeks. During footbath, attention was paid to the temperature in case of scald, and emphasis was laid on feet cleaning and nursing. Moderate scalds including water vacuoles and erythema were timely managed.

Observation indices

Integral of TCM syndromes: Based on the ICS in the *Code for TCM Diagnosis and Treatment of Diabetic Peripheral Neuropathy (Draft) (Edition 2010)*. Primary symptoms include myophagism, numb, weak and feeble limbs with coldness and pains, hypaesthesia, while secondary symptoms are dizziness and tinnitus, soreness and weakness of waist and knees, frigophobia, cold, fatigued and forceless limbs, dysphoria with feverish sensation in chest, palms and soles, fatigue expressions and tiredness in talking, hard breath and weakness. Scores were assigned based on severity, *i.e.*, 0 for “nil”, 2 for “mild”, 4 for “moderate” and 6 for “severe” in case of primary symptoms, and 0 for “nil”, 1 for “mild”, 2 for “moderate” and 3 for “severe” in case of secondary symptoms. The sum of the two constituted the total integral of TCM syndromes [10, 11].

Efficacy evaluation criteria: Clinical efficacy was evaluated based on the reducing rate of integral of TCM syndromes. If the signs and clinical symptoms basically disappear, and the reduc-

Table 1. Intergroup comparison for general materials [n (%)]/ ($\bar{x}$ ± s)

Material		GA (n=56)	GB (n=57)	t/X^2	*P*
Gender (n)	Male	32 (57.14)	35 (61.41)	0.213	0.645
	Female	24 (42.86)	22 (38.59)		
Age (year)		62.58±2.32	62.62±2.29	0.092	0.927
Course of diabetes (year)		8.52±0.18	8.55±0.15	0.963	0.338
Course of DPN (year)		2.53±0.22	2.56±0.21	0.742	0.459
Type of complications (n)					
Hyperlipemia		22 (39.29)	21 (36.84)	0.072	0.789
Hypertension		20 (35.71)	19 (33.33)	0.071	0.790

Table 2. Intergroup comparison for total integral of TCM syndromes ($\bar{x}$ ± s, score)

Group	Before treatment	After treatment
GA (n=56)	11.85±3.65	6.85±0.98$^{\#}$
GB (n=57)	11.88±3.62	4.12±0.12$^{\#,*}$
t	0.044	20.875
P	0.965	0.000

Note: $^{\#}P$<0.05 vs conditions before treatment; $^{*}P$<0.05 vs GA.

ing rate of integral of TCM symptom is ≥90%, the patient is cured; if the signs and clinical symptoms are obviously reduced, and the reducing rate of integral of TCM symptom is ≥70%, the treatment is markedly effective; if the signs and clinical symptoms are improved, and the reducing rate of integral of TCM symptom is ≥30%, the treatment is effective; if the signs and clinical symptoms have not changed, and the reducing rate of integral of TCM symptom is <30%, the treatment is ineffective [12]. The overall response rate (OR) = Cured + Markedly Effective + Effective.

Ankle brachial index (ABI): Patients remained quiescent for 10 to 25 min before examination, and then lay in a supine position with extremities exposed. Systolic blood pressure (SBPs) of forearms (higher value taken as the blood pressure of brachial artery), dorsalis pedis and arteriae tibialis posterior were measured. ABI was defined as the ratio of dorsalis pedis SBP to arteriae tibialis posterior SBP, and measured at both feet [13, 14].

Vibration perception threshold (VPT): A sensation threshold tester was adopted to test the front end of big toe pulp experimentally at low voltage (6-10 V), so as to familiarize the subjects with the vibration sensation and examination procedures. During normal examination, the vibration probe was vertically placed over the site to be tested. From the initial setting of 0V, the vibration amplitude was increased gradually, and patients were required to fix attention on vibration. and report immediately if there was any vibration, and record the voltage as the VPT. Both feet were alternatively tested for 3 times. The mean VPT was final [15].

Nerve conduction velocity (NCV): Electromyography was performed before and after treatment. The sensory nerve conduction velocity (SNCV) and motor nerve conduction velocity of the tibial nerve (MNCV) were recorded for median nerve and common peroneal nerve [16].

Statistical analysis

Statistical analysis was performed with SPSS 22.0. In case of numerical data expressed as mean ± standard deviation (mean ± SD), comparison studies were carried out through independent-samples T test for data which were normally distributed, and Mann-Whitney U test for data which were not normally distributed. In case of nominal data expressed as [n (%)], comparison studies were carried out through X^2 test for intergroup comparison. For all statistical comparisons, significance was defined as P<0.05.

Results

Intergroup comparison of general materials

There was no significant difference in terms of gender, age, course of diabetes/DPN, and type of complications between the two groups (P> 0.05) (**Table 1**).

Intergroup comparison of integral of TCM syndromes

There was no statistically significant difference in integrals of TCM symptoms between the two groups before treatment (P>0.05). After treatment, the integrals of TCM symptoms were reduced in both groups (P<0.05), and the GB expressed a lower level than the GA (P<0.05) (**Table 2**).

Table 3. Intergroup comparison for clinical efficacy [n (%)]

Group	n	Cured	Marked Effective	Effective	Ineffective	OR
GA	56	15 (26.79)	13 (23.21)	10 (17.86)	18 (32.14)	38 (67.86)
GB	57	28 (49.12)	15 (26.32)	12 (21.05)	2 (3.51)	55 (96.49)*
X^2						15.899
P						0.001

Note: *P<0.05 vs GA.

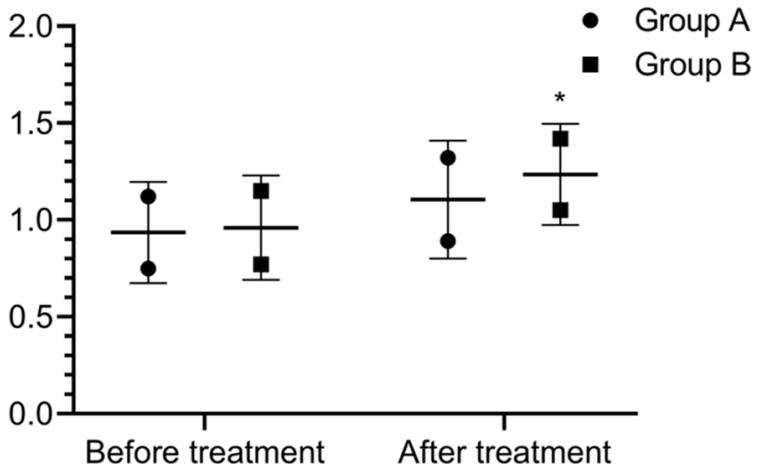

Figure 1. Intergroup comparison for right-foot ABIs before and after treatment. No significant difference was found before treatment (P>0.05); GB showed higher right-foot ABIs after treatment (P<0.05). *P<0.05 vs GA.

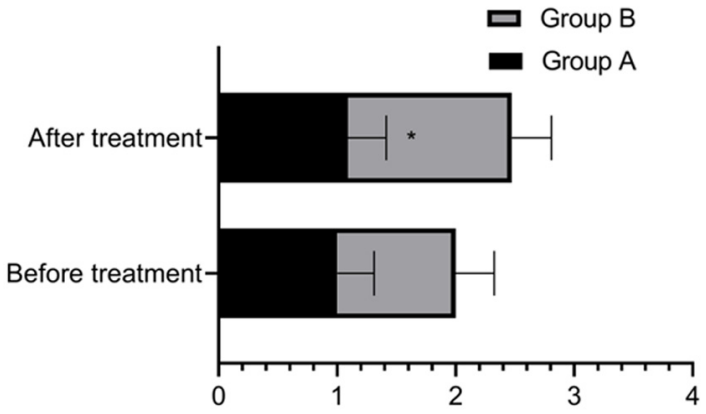

Figure 2. Intergroup comparison for left-foot ABIs before and after treatment. No significant difference was found before treatment (P>0.05); GB showed higher left-foot ABIs after treatment (P<0.05). *P<0.05 vs GA.

Intergroup comparison of clinical efficacy

The OR in the GB was significantly higher than that in the GA, showing statistical difference (P<0.05) (**Table 3**).

Intergroup comparison of ABI

There was no significant difference in right-foot ABI between the GA and the GB before treatment (P>0.05). Compared with that before treatment, the right-foot ABI was increased in both groups after treatment (P<0.05). After treatment, the GB showed higher right-foot ABI than the GA (P<0.05) (**Figure 1**).

There was no significant difference in left-foot ABI between the GA and the GB before treatment (P>0.05). Compared with that before treatment, the left-foot ABI was increased in both groups after treatment (P<0.05). After treatment, the GB showed higher left-foot ABI than the GA (P<0.05) (**Figure 2**).

Intergroup comparison of VPT

Before treatment, the two groups demonstrated no significant difference in VPT (P>0.05). After treatment, the VPT reduced in both groups (P<0.05) and was significantly lower in the GB (P<0.05) (**Table 4**).

Intergroup comparison of NCV

Before treatment, there was no significant difference in the MNCVs of median nerve and common peroneal nerve between the two groups (P>0.05). After treatment, the MNCVs of median nerve and common peroneal nerve were increased in both groups compared with those before treatment (P<0.05). After treatment, the GB showed higher MNCVs of median nerve and common peroneal nerve than the GA (P<0.05) (**Figure 3**).

Before treatment, there was no significant difference in the SNCVs of median nerve and com-

Table 4. Intergroup comparison for VPT ($\bar{x}$ ± s, score)

Group	Before treatment	After treatment
GA (n=56)	22.85±2.16	20.15±1.18#
GB (n=57)	22.89±2.12	18.02±0.85#,*
t	0.099	11.025
P	0.921	0.000

Note: #*P*<0.05 vs conditions before treatment; *P<0.05 vs GA.

mon peroneal nerve between the two groups (P>0.05). After treatment, the SNCVs of median nerve and common peroneal nerve were increased in both groups compared with those before treatment (P<0.05). After treatment, the GB showed higher SNCVs of median nerve and common peroneal nerve than the GA (P<0.05) (**Figure 4**).

Discussion

DPN is a chronic complication of diabetes with a high incidence rateand is a collective name of peripheral nerve dysfunction related signs and symptoms in diabetes patients among other reasons. It generally develops in a decade after the patient is diagnosed with diabetes [17, 18] and is believed to be a result of multiple factors, *i.e.*, high blood glucose, immunity, oxidative stress factors, abnormal cell factors, insufficient neurotrophic factors, injury of blood vessels and metabolic disturbance [19, 20], regardless of the unclear onset mechanism so far. The heteropathy in western medicine is commonly adopted in the clinic for this group of patients, but its efficacy requires further improvement [21].

Little knowledge on DPN is found in ancient TCM books. Nevertheless, according to its clinical symptoms, the disease is categorized to "Atrophy Syndrome" and "Arthralgia Syndrome". It develops from deficiency in the origin and excess in superficiality, lasts for a rather long period, changes complicatedly, and pathologically bases on deficiency of Qi and Yin [22, 23]. There are five patterns of syndromes indicating the disease, Yin deficiency and blood stasis, deficiency of liver and kidney, cold coagulation and blood stasis, phlegm stagnation and channel blocking, as well as blood stasis due to Qi deficiency. The key fatal factor, blood stasis, exists in the whole course [24]. On the theoretical basis of "pains from stasis" and the principle of "promoting blood circulation to remove meridian obstruction", this study was carried out and reported lower total integral of TCM syndromes and higher OR in the GB (P<0.05), indicating that the combination of routine western medicine treatment with TCM footbath is capable of further consolidating the clinical efficacy and improving the clinical syndromes of DPN. Yi et al. have also found that the total effective rate of footbath group was higher than that of routine treatment group, which was highly consistent with the results of this study [25]. This shall be attributed to the mechanism that the ingredients of the prescription can activate meridians to relieve pain, promote blood circulation and remove blood stasis. They are *Astragalus mongholicus* Bunge (replenishing Qi and promoting blood circulation), cinnamon twig (removing numbness and pains), *Ligusticum wallichii* (invigorating blood circulation and promoting Qi), lignum millettiae (relaxing the muscles and stimulating the blood circulation), Radix Paeoniae Rubra (cooling blood and promoting circulation), *Carthamus tinctorious* (promoting blood circulation and removing blood stasis), *Sigesbeckia* (strengthening the muscles and bones, clearing away heat and toxic material), *Lycopodium clavatum* (relieving rigidity of muscles and activating collaterals) and *Loranthus parasiticus* (relieving pain, promoting blood circulation and replenishing blood). Modern pharmacological studies have shown that lignum millettiae and *Carthamus tinctorious* can resist thrombogenesis, platelet aggregation, inflammation and oxidation, ease pains, improve microcirculation, reduce blood pressure and dilate vessels. Furthermore, *Carthamus tinctorious* can effectively protect vascular endothelial functions and reduce blood lipid level [26]. *Lycopodium clavatum* has antibacterial, anti-inflammatory and anti-oxidation effects. Combination of these herbs can relieve DPN related symptoms and consolidate the clinical efficacy.

In this study, the GB demonstrated higher ABIs, MNCV and SNCV of median nerve and common peroneal nerve and lower VPT, which supported the effectiveness of TCM footbath treatment of DPN (P<0.05). The possible mechanism of TCM footbath to improve NCV and ABI is that the drugs were in direct contact with the feet and reached the site through thermodynamic activity to stimulate the local vascular nerves, alleviate the blood hypercoagulation, dilate vessels,

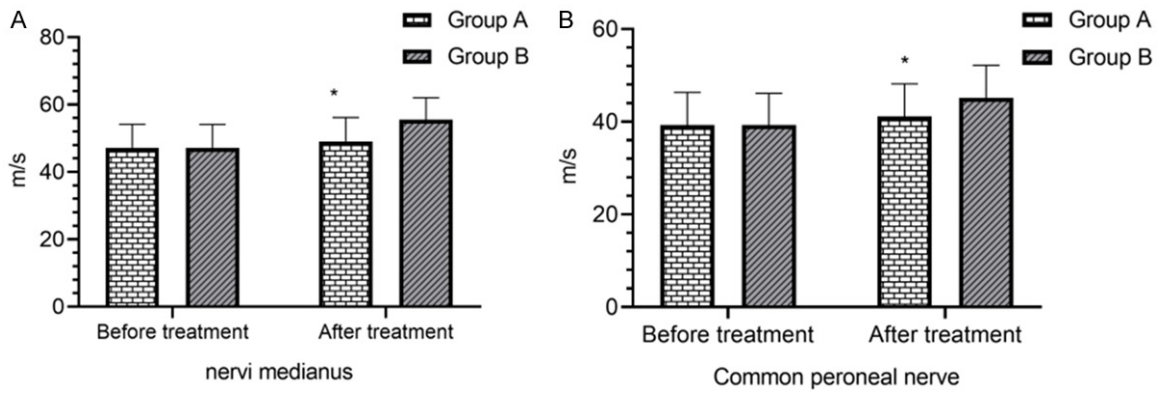

Figure 3. Intergroup comparison for MNCVs of median nerve and common peroneal nerve before and after treatment. No significant difference was found before treatment ($P>0.05$); GB showed higher MNCVs of median nerve and common peroneal nerve after treatment ($P<0.05$). *$P<0.05$ vs GA.

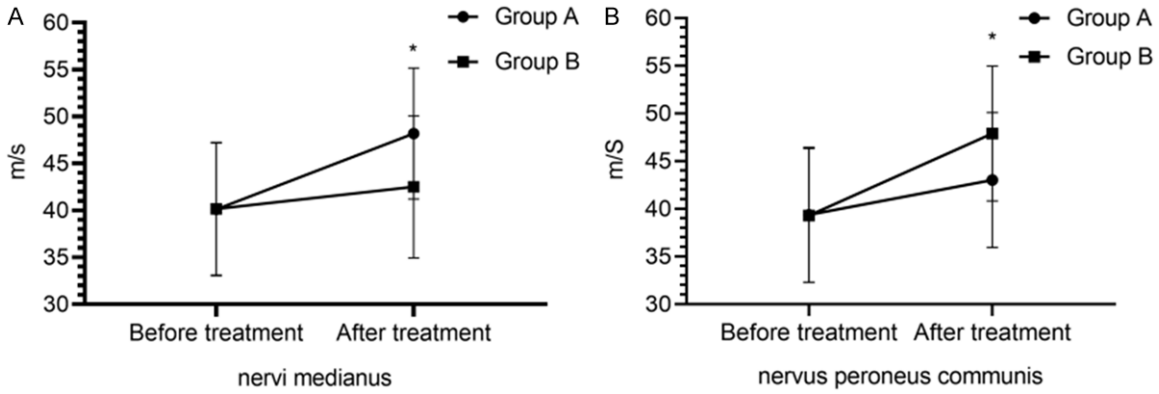

Figure 4. Intergroup comparison for SNCVs of median nerve and common peroneal nerve before and after treatment. No significant difference was found before treatment ($P>0.05$); GB showed higher SNCVs of median nerve and common peroneal nerve after treatment ($P<0.05$). *$P<0.05$ vs GA.

accelerate the blood circulation of the extremities, promote the metabolism, blood supply and microcirculation at the extremities, reduce the oxidative stress injury, and repair the damaged nerve. The combination of drugs in the prescription has the effect of activating collaterals and blood circulation, which accords with the treatment principles of frequent drinking and urination as well as arthralgia, so as to improve the effect of clinical treatment.

In conclusion, the adoption of TCM footbath for patients with DPN can further improve the clinical efficacy, clinical symptoms, ABI and NCV.

However, due to the limited number of samples in this study, results are not representative enough. In the future, long-term studies covering more aspects and a larger number of samples are expected.

Acknowledgements

The Construction of Diabetes Specialist Alliance of Traditional Chinese Medicine Grant No.: ZY (2018-2020)-FWTX-4011.

Disclosure of conflict of interest

None.

Address correspondence to: Yaochi Wu, Department of Acupuncture, Massage and Orthopedics, Shanghai Sixth People's Hospital, No. 600, Yishan Road, Xuhui District, Shanghai 200233, China. Tel: +86-13916501238; E-mail: wycyaochi@163.com

References

[1] Iqbal Z, Azmi S, Yadav R, Ferdousi M, Kumar M, Cuthbertson DJ, Lim J, Malik RA and Alam U.

Diabetic peripheral neuropathy: epidemiology, diagnosis, and pharmacotherapy. Clin Ther 2018; 40: 828-849.
[2] Cakici N, Fakkel TM, van Neck JW, Verhagen AP and Coert JH. Systematic review of treatments for diabetic peripheral neuropathy. Diabet Med 2016; 33: 1466-1476.
[3] Stino AM and Smith AG. Peripheral neuropathy in prediabetes and the metabolic syndrome. J Diabetes Investig 2017; 8: 646-655.
[4] Chung YC, Lim JH, Oh HM, Kim HW, Kim MY, Kim EN, Kim Y, Chang YS, Kim HW and Park CW. Calcimimetic restores diabetic peripheral neuropathy by ameliorating apoptosis and improving autophagy. Cell Death Dis 2018; 9: 1163.
[5] Bailey A, Wingard D, Allison M, Summers P and Calac D. Acupuncture treatment of diabetic peripheral neuropathy in an american indian community. J Acupunct Meridian Stud 2017; 10: 90-95.
[6] Pai YW, Lin CH, Lee IT and Chang MH. Prevalence and biochemical risk factors of diabetic peripheral neuropathy with or without neuropathic pain in Taiwanese adults with type 2 diabetes mellitus. Diabetes Metab Syndr 2018; 12: 111-116.
[7] Shillo P, Selvarajah D, Greig M, Gandhi R, Rao G, Wilkinson ID, Anand P and Tesfaye S. Reduced vitamin D levels in painful diabetic peripheral neuropathy. Diabet Med 2019; 36: 44-51.
[8] Hewston P and Deshpande N. Falls and balance impairments in older adults with type 2 diabetes: thinking beyond diabetic peripheral neuropathy. Can J Diabetes 2016; 40: 6-9.
[9] Jin HY and Park TS. Role of inflammatory biomarkers in diabetic peripheral neuropathy. J Diabetes Investig 2018; 9: 1016-1018.
[10] Han Y, Wang M, Shen J, Zhang Z, Zhao M, Huang J, Chen Y, Chen Z, Hu Y and Wang Y. Differential efficacy of methylcobalamin and alpha-lipoic acid treatment on symptoms of diabetic peripheral neuropathy. Minerva Endocrinol 2018; 43: 11-18.
[11] Ghavami H, Radfar M, Soheily S, Shamsi SA and Khalkhali HR. Effect of lifestyle interventions on diabetic peripheral neuropathy in patients with type 2 diabetes, result of a randomized clinical trial. Agri 2018; 30: 165-170.
[12] Abdel-Wahhab KG, Daoud EM, El Gendy A, Mourad HH, Mannaa FA and Saber MM. Efficiencies of low-level laser therapy (LLLT) and gabapentin in the management of peripheral neuropathy: diabetic neuropathy. Appl Biochem Biotechnol 2018; 186: 161-173.
[13] Parasoglou P, Rao S and Slade JM. Declining skeletal muscle function in diabetic peripheral neuropathy. Clin Ther 2017; 39: 1085-1103.
[14] Liu X, Xu Y, An M and Zeng Q. The risk factors for diabetic peripheral neuropathy: a meta-analysis. PLoS One 2019; 14: e0212574.
[15] Vas PRJ, Pafili K and Papanas N. Exercise to improve diabetic peripheral neuropathy: an additional option? Neurophysiol Clin 2018; 48: 191-193.
[16] Chen L, Gong HY and Xu L. PVT1 protects diabetic peripheral neuropathy via PI3K/AKT pathway. Eur Rev Med Pharmacol Sci 2018; 22: 6905-6911.
[17] McGregor BA, Eid S, Rumora AE, Murdock B, Guo K, de Anda-Jauregui G, Porter JE, Feldman EL and Hur J. Conserved transcriptional signatures in human and murine diabetic peripheral neuropathy. Sci Rep 2018; 8: 17678.
[18] Jin J, Wang W, Gu T, Chen W, Lu J, Bi Y and Zhu D. The application of SUDOSCAN for screening diabetic peripheral neuropathy in Chinese population. Exp Clin Endocrinol Diabetes 2018; 126: 472-477.
[19] Gewandter JS, Burke L, Cavaletti G, Dworkin RH, Gibbons C, Gover TD, Herrmann DN, McArthur JC, McDermott MP, Rappaport BA, Reeve BB, Russell JW, Smith AG, Smith SM, Turk DC, Vinik AI and Freeman R. Content validity of symptom-based measures for diabetic, chemotherapy, and HIV peripheral neuropathy. Muscle Nerve 2017; 55: 366-372.
[20] Mu ZP, Wang YG, Li CQ, Lv WS, Wang B, Jing ZH, Song XJ, Lun Y, Qiu MY and Ma XL. Association between tumor necrosis factor-alpha and diabetic peripheral neuropathy in patients with type 2 diabetes: a meta-analysis. Mol Neurobiol 2017; 54: 983-996.
[21] Tang W, Chen X, Liu H, Lv Q, Zou J, Shi Y and Liu Z. Expression of Nrf2 promotes schwann cell-mediated sciatic nerve recovery in diabetic peripheral neuropathy. Cell Physiol Biochem 2018; 46: 1879-1894.
[22] Yang D and Liang XC. Strategies and research progress of Chinese medicine in prevention and treatment of diabetic peripheral neuropathy. Chin J Integr Med 2018; 24: 794-800.
[23] Aghdam AM, Shahabi P, Karimi-Sales E, Ghiasi R, Sadigh-Eteghad S, Mahmoudi J and Alipour MR. Swimming exercise induced reversed expression of miR-96 and its target gene NaV1.3 in diabetic peripheral neuropathy in rats. Chin J Physiol 2018; 61: 124-129.
[24] Su JB, Zhao LH, Zhang XL, Cai HL, Huang HY, Xu F, Chen T and Wang XQ. HbA1c variability and diabetic peripheral neuropathy in type 2 diabetic patients. Cardiovasc Diabetol 2018; 17: 47.
[25] Yi C and Chen P. Treatment of 90 cases of diabetic peripheral neuropathy with Chinese medicine foot bath. Henan Traditional Chinese Medicine 2014; 34: 2366-2367.
[26] Tang HY, Jiang AJ, Ma JL, Wang FJ and Shen GM. Understanding the signaling pathways related to the mechanism and treatment of diabetic peripheral neuropathy. Endocrinology 2019; 160: 2119-2127.