Short Communication

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Skin Blood Flow in Diabetic Peripheral Neuropathy: A Focused overview of Patho-Anatomical Diagnosis and Therapy

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Abstract

The aim of this short communication article was to explore the literature background behind cutaneous circulatory changes in diabetic peripheral neuropathy (DPN). Measurement of skin blood flow using Laser doppler flowmetry and thermography for amplitude, flow rate and volume was indicative of autonomic dysfunction in DPN, and treatment using Alpha-lipoic acid, Frequency modulated rhythmic electromagnetic stimulation, Pentoxifylline and Ruboxistaurin were shown to improve skin blood flow in subjects with DPN.

Keywords: Neuroanatomy; Structural Endocrinology; Diabetic Neuropathy; Cutaneous Circulation.

The aim of this short communication article was to explore the literature background behind cutaneous circulatory changes in diabetic peripheral neuropathy (DPN).

Urbancic-Rovan et al [1] studied basal skin blood flow (BSBF) and its differences in dynamic components (1) among 25 diabetic patients without autonomic neuropathy (D) and 18 with (DAN) and 36 healthy control subjects (C), and (2) among the upper and lower extremities. The mean flow, mean amplitude of the total spectrum and mean amplitudes at all frequency intervals were highest in C, followed by DAN and lowest in D.

Hauer et al [2] determined changes in hand skin blood flow in diabetic men using liquid crystal contact thermography to assess the relative effects of autonomic neuropathy and microangiopathy in 34 diabetic and 12 age-matched nondiabetic men. After ice-cold water immersion, right-hand recovery in diabetic men was found to be abnormally slow compared with nondiabetic men.

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Jin et al [3] assessed the effect of alpha-lipoic acid on skin blood flow 13 control subjects and 19 patients with diabetic neuropathy using the laser Doppler blood flow technique, and found no significant differences in absolute values of skin blood flow but symptoms were reduced after alpha-lipoic acid treatment.

Frequency Rhythmic Electrical Modulation System (FREMS):Bocchiet al [4] evaluated the changes in laser Doppler flow in the volar part of the forearm before, during and after FREMS in diabetics and 10normal controls,and observed an increase of 0.1Hz vasomotion power spectra only in the diabetic group, which suggested that FREMS was able to synchronize smooth cell activity, inducing and increasing 0.1Hz vasomotion.

Isoform-specific protein kinase C beta inhibitor, Ruboxistaurin:Brooks et al [5] studied the effects of ruboxistaurin (RBX) on skin microvascular blood flow (SkBF) and evaluated the relationship between endothelial and neural control of SkBF in patients with diabetic peripheral neuropathy (DPN) in 11 placebo- and 9 RBX (32 mg/day)-treated patients. The study did not find significant differences for post-iontophoresis SkBF: endothelium-dependent; endothelium-independent; and C fiber-mediated vasodilatation.

Another study by Caselliniet al [6] investigated the effects of the isoform-selective PKC-beta inhibitor ruboxistaurinmesylate on endothelium-dependent and C fiber-mediated SkBF in 20 placebo-

and 20 ruboxistaurin-treated (32 mg/day) DPN patients and found improvements in endothelium-dependent and C fiber-mediatedSkBF at the distal calf increased for the drug-treated group.

Pentoxifylline: Rendell and Bamisedun[7] measured skin blood flow usinglaser Doppler in 24 pentoxifylline-treated diabetic patients with sensory neuropathy. On the lower extremity, there was an increase in laser Doppler measured flow score (FS) both at 35 degrees and at 44 degrees C, with both FSDW (35 degrees) and FSDW (44 degrees) beingincreased at six months.

Measurement of skin blood flow using Laser doppler flowmetry and thermography for amplitude, flow rate and volume was indicative of autonomic dysfunction in DPN, and treatment using Alpha-lipoic acid, Frequency modulated rhythmic electromagnetic stimulation, Pentoxifylline and Ruboxistaurin were shown to improve skin blood flow in subjects with DPN.

References

1. Urbancic-Rovan V, Stefanovska A, Bernjak A, Azman-Juvan K, Kocijancic A. Skin blood flow in the upper and lower extremities of diabetic patients with and without autonomic neuropathy. J Vasc Res. 2004;41(6):535-45.
2. Hauer JL, Boland OM, Ewing DJ, Clarke BF. Hand skin blood flow in diabetic patients with autonomic neuropathy and microangiopathy. Diabetes Care. 1991;14(10):897-902.
3. Jin HY, Joung SJ, Park JH, Baek HS, Park TS. The effect of alpha-lipoic acid on symptoms and skin blood flow in diabetic neuropathy. Diabet Med. 2007;24(9): 1034-8.
4. Bocchi L, Evangelisti A, Barrella M, Scatizzi L, Bevilacqua M.Recovery of 0.1Hz microvascular skin blood flow in dysautonomic diabetic (type 2) neuropathy by using Frequency Rhythmic Electrical Modulation System (FREMS).Med Eng Phys. 2010;32(4):407-13.
5. Brooks B, Delaney-Robinson C, Molyneaux L, Yue DK.Endothelial and neural regulation of skin microvascular blood flow in patients with diabetic peripheral neuropathy: effect of treatment with the isoform-specific protein kinase C beta inhibitor, ruboxistaurin. J Diabetes Complications. 2008;22(2): 88-95.
6. Casellini CM, Barlow PM, Rice AL, Casey M, Simmons K, Pittenger G, et al. A 6-month, randomized, double-masked, placebo-controlled study evaluating the effects of the protein kinase C-beta inhibitor ruboxistaurin on skin microvascular blood flow and other measures of diabetic peripheral neuropathy. Diabetes Care. 2007;30(4):896-902.
7. Rendell M, Bamisedun O. Skin blood flow and current perception in pentoxifylline-treated diabetic neuropathy. Angiology. 1992;43(10):843-51.