Synaptic degradation of cardiac autonomic nerves in streptozotocin-induced diabetic rats

Shamarendra N. Sanyal a,1, Tomoyuki Wada b,1, Motoko Yamabe a, Hirofumi Anai b, Shinji Miyamoto b, Tatsuo Shimada c, Katsushige Ono a,∗

a Department of Pathophysiology, Oita University School of Medicine, Yufu, Oita 879-5593, Japan
b Department of Cardiovascular Surgery, Oita University School of Medicine, Yufu, Oita 879-5593, Japan
c Department of Health Science, Oita University School of Nursing, Yufu, Oita 879-5593, Japan

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Abstract

Background: Cardiac autonomic neuropathy (CAN) is a common complication in type 1 diabetes mellitus (DM). Nevertheless, the relationship between functional and structural disturbances of cardiac autonomic nerves remains unclear. Methods and results: To clarify this relationship, we studied heart rate variability (HRV) and ultrastructural changes of cardiac autonomic nerves in streptozotocin (STZ)-induced DM in rats. STZ was injected (65 mg/kg intravenous) into the tail vein of male Wistar rats to destroy β cells in the pancreatic islets. After STZ injection, fasting blood sugar (FBS) increased from baseline values of 75 ± 3 mg/dl up to 328 ± 12 mg/dl within 1 week and it reached up to 353 ± 24 mg/dl within 17 weeks. HR in these rats was decreased within 20 days and low HR was maintained for the observation period. TP and HF power started decreasing 20 days after STZ injection, and this decrease progressed throughout the observation period. The L/H power ratio was decreased 80 days after STZ. Electron microscopic findings indicated a depletion of neurotransmitter vesicles and degradation of parasympathetic nerve endings but not of sympathetic ones in the SA node region of the heart in the early stages of DM. In the late stages of DM, the same region showed degradation of both sympathetic and parasympathetic nerve endings. Conclusion: Synaptic degradation in parasympathetic nerves immediately after the onset of DM, and in sympathetic nerves much later in the development of DM is consistent with functional derangements in cardiac autonomic nerve activities assessed by HRV analysis.

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