Expression of protein gene product 9.5, tyrosine hydroxylase and serotonin in the pineal gland of rats with streptozotocin-induced diabetes.

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摘要

Abstract

Hyperglycemia is a well-known factor in reducing nocturnal pineal melatonin production. However, the mechanism underlying diabetes-induced insufficiency of pineal melatonin has remained uncertain. This study was undertaken to examine the structure, innervation and functional activity of the pineal gland in streptozotocin (STZ)-induced diabetes in rats by immunohistochemistry, Western blotting and image analysis. The number of the pinealocytes and the volume of pineal were also estimated using stereologic quantification including the optical fractionator and Cavalieri's method. It has also shown a progressive reduction of the total area of the pineal gland and the nuclear size of pinealocytes beginning at 4 weeks of induced diabetes. Surprisingly, the immunoreactive intensities and protein amounts of serotonin (5-HT) and protein gene product (PGP) 9.5 in the pineal gland were progressively increased from 4 weeks of diabetes. Meanwhile, nerve fibers immunoreactive for PGP 9.5 had disappeared. Diabetes-induced neuropathy was observed in nerve fibers containing tyrosine hydroxylase (TH). The affected nerve fibers appeared swollen and smooth in outline but they showed a distribution pattern, packing density and protein levels comparable to those of the age-matched control animals. Ultrastructural observations have revealed diabetes-induced deformity of Schwann cells and basal lamina, accumulation of synaptic vesicles and deprivation of the dense-core vesicles in the axon terminals and varicosities. The increase in immunoreactivities in 5-HT and PGP 9.5 and shrinkage of pineal gland in the diabetic rats suggest an inefficient enzyme activity of the pinealocytes. This coupled with the occurrence of anomalous TH nerve fibers, may lead to an ineffective sympathetic innervation of the pinealocytes resulting in reduced melatonin production in STZ-induced diabetes.