Abstract

Background Vagus nerve stimulation (VNS) exerts neuroprotective and antiinflammatory effects in preclinical models of central nervous system disorders, including Parkinson's disease (PD). VNS setting applied for experimental models is limited into single-time or intermittent short-duration stimulation. We developed a VNS device which could deliver continuous stimulation for rats. To date, the effects of vagal afferent- or efferent-selective stimulation on PD using continuous electrical stimulation remains to be determined.

Objective To investigate the effects of continuous and selective stimulation of vagal afferent or efferent fiber on Parkinsonian rats.

Methods Rats were divided into 5 group: intact VNS, afferent VNS (left VNS in the presence of left caudal vagotomy), efferent VNS (left VNS in the presence of left rostral vagotomy), sham, vagotomy. Rats underwent the implantation of cuff-electrode on left vagus nerve and 6-hydroxydopamine administration into the left striatum simultaneously. Electrical stimulation was delivered just after 6-OHDA administration and continued for 14 days. In afferent VNS and efferent VNS group, the vagus nerve was dissected at distal or proximal portion of cuff-electrode to imitate the selective stimulation of afferent or efferent vagal fiber respectively.

Results Intact VNS and afferent VNS reduced the behavioral impairments in cylinder test and methamphetamine-induced rotation test, which were accompanied by reduced inflammatory glial cells in substantia nigra with the increased density of the rate limiting enzyme in locus coeruleus. In contrast, efferent VNS did not exert any therapeutic effects. **Conclusion** Continuous VNS promoted neuroprotective and anti-inflammatory effect in experimental PD, highlighting the crucial role of the afferent vagal pathway in mediating these therapeutic outcomes.