Review World Neurosurg. 2023 Jun:174:11-24. doi: 10.1016/j.wneu.2023.02.101.
Epub 2023 Feb 28.

Application of Vagus Nerve Stimulation in Spinal Cord Injury Rehabilitation

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PMID: 36858292 DOI: 10.1016/j.wneu.2023.02.101

Abstract

Spinal cord injury (SCI) is a prevalent devastating condition causing significant morbidity and mortality, especially in developing countries. The pathophysiology of SCI involves ischemia, neuroinflammation, cell death, and scar formation. Due to the lack of definitive therapy for SCI, interventions mainly focus on rehabilitation to reduce deterioration and improve the patient's quality of life. Currently, rehabilitative exercises and neuromodulation methods such as functional electrical stimulation, epidural electrical stimulation, and transcutaneous electrical nerve stimulation are being tested in patients with SCI. Other spinal stimulation techniques are being developed and tested in animal models. However, often these methods require complex surgical procedures and solely focus on motor function. Vagus nerve stimulation (VNS) is currently used in patients with epilepsy, depression, and migraine and is being investigated for its application in other disorders. In animal models of SCI, VNS significantly improved locomotor function by ameliorating inflammation and improving plasticity, suggesting its use in human subjects. SCI patients also suffer from nonmotor complications, including pain, gastrointestinal dysfunction, cardiovascular disorders, and chronic conditions such as obesity and diabetes. VNS has shown promising results in alleviating these conditions in non-SCI patients, which makes it a possible therapeutic option in SCI patients.

Keywords: Neuronal plasticity; Rehabilitation; Review; Spinal cord injuries; Vagus nerve stimulation.

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