Deep brain stimulation: the spectrum of application

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Brain stimulation of deep, subcortical structures developed with stereotactic surgery in the mid-20th century to treat various conditions including movement disorders and chronic pain. Chronic electrical stimulation eventually largely replaced radiofrequency lesioning because of its inherent safety and treatment versatility. Regardless of the site of stimulation, parameters can be adjusted to reduce side effects and optimize clinical outcomes. Deep brain stimulation (DBS) is now widely accepted as the primary treatment for movement disorders that are refractory to medical therapies—namely Parkinson disease, tremors, and dystonia. Recent clinical studies have suggested beneficial effects of DBS applied to other conditions such as depression, obsessive-compulsive disorder, and epilepsy.

Several key factors have led to widespread interest in investigating the use of DBS as a new treatment for additional conditions. First, the relative safety of contemporary stereotactic surgery has resulted in more acceptance of DBS as a potential modality for patients in whom other treatment options are absent. Second, DBS is recognized by referring clinicians as a therapy that, unlike the lesioning procedures, is both reversible and adjustable. Third, an improved understanding of brain targets and their role in disease has become possible because of electrophysiological studies, high-resolution MR imaging, and functional imaging techniques. Thus, numerous diseases previously thought to have limited medical therapeutic options are now being considered as conditions potentially amenable to surgery and, specifically, brain stimulation.

This current issue of Neurosurgical Focus examines the current state of DBS and explores the emerging applications in disorders other than Parkinson disease and tremor. The first section is devoted to setting the historical context and to the treatment of movement disorders. This includes uses of DBS in the pediatric population and the neurochemical effects of brain stimulation that can be measured with a new wireless device for near real-time detection. Professor Hariz provides a most thorough historical review of brain stimulation.

Newer indications of DBS in the treatment of psychiatric disease and epilepsy are currently under active investigation, and several articles are included that expand the basis for the use of brain stimulation. Lipsman and colleagues address the ethical issues involved in clinical trials for psychiatric patients, and they provide “criteria” for the psychiatry and neurosurgery communities to consider as surgical therapies are advanced. In addition, this section covers some potentially interesting applications of DBS being investigated for such indications as cluster headache, impaired consciousness, and morbid obesity.

This issue of Neurosurgical Focus serves as a modern, online chapter describing the current state of DBS and the next generation of disorders that may be successfully treated. (DOI: 10.3171/2010.8.FOCUS.Intro)

References