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Electronic Implants Improve Lives of Patients with Neurologic Disorders

"Implantable electronic devices represent a new field in therapy for neurologic diseases."

Over the past decade, neurologists have used a number of implantable electronic devices to improve symptoms in patients with neurologic disorders such as epilepsy, stroke and multiple sclerosis. These devices include vagal nerve stimulators, deep brain stimulators and implantable baclofen pumps. Based on the same technology used in cardiac pacemakers, they have proven to be reliable, resulting in reduction of disabling symptoms and improvement in quality of life.

Vagal nerve stimulators have been used to treat patients with seizures and, since 2006, to treat patients with resistant depression. A pacemaker-like device sits in the left chest, connected by a wire to the vagal nerve in the neck on the left. It fires intermittent pulses of low electrical current, stimulating the vagal nerve. Although the mechanism of action is unknown, it results in reducing the frequency of seizures in patients with intractable partial epilepsy, including temporal lobe seizures and the Lennox-Gastaut syndrome.

The device also has improved depression symptoms in about a third of patients with treatment resistant depression (patients who do not respond to two or more antidepressant agents). Studies have included patients with bipolar disorder and major depressive disorder.

For the last eight years, **deep brain stimulation** has been used for patients with movement disorders and has been FDA approved for treatment of patients with classic Parkinson's disease and benign essential tremor. It is also used in patients with dystonia, Tourette's and obsessive-compulsive disorder.

Brain stimulation for the treatment of epilepsy is presently being studied with two devices being tested. A Medtronics stimulator uses an intracranial electrode (implanted in the thalamus) with a chest stimulator that delivers intermittent stimulation throughout the day and night to suppress the underlying epileptic activity. A device developed by Neuropace utilizes a second treatment paradigm. This stimulator is placed entirely in the skull to stimulate the cerebral cortex rather than the thalamus. It records ongoing electrical activity and stimulates only when it detects an apparent seizure discharge. Because the machine can be "taught" to respond only to a seizure discharge, it uses much less current, needs a smaller battery, and is entirely intracranial.

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Patients with spasticity from stroke, multiple sclerosis or spinal cord injury can be treated effectively with a **baclofen infusion** into the spinal canal where it acts on the anterior horn cells in the spinal cord, preventing the increased electrical activity that manifests itself as muscle tightness spasms. The rate of the baclofen infusion can be patterned either as a continuous steady dose 24 hours a day, or higher doses can be infused during parts of the day to improve symptoms such as restless legs or spasms in the legs. These pumps are very effective in patients with multiple sclerosis, spinal cord injury, stroke, cerebral palsy, an unusual neurologic syndrome of Stiff-Man Syndrome, but show modest effect on patients with traumatic brain injury and hypoxic encephalopathy.

These three implantable electronic devices represent a new field in therapy for neurologic diseases. All are becoming more widely used in treatment of neurologic patients, resulting in control of neurologic symptoms and significant improvement in quality of life.

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