



Western Neurosurgery REVIEW

A quarterly newsletter for referring doctors

Fall 1999

Vagus Nerve Stimulation: Epilepsy Treatment

By John Anson, M.D.

Epilepsy is the world's second most prevalent neurological disorder. In the United States alone it affects more than 2.5 million people, and more than 125,000 new cases are diagnosed every year. Epilepsy can be caused by any trauma to the brain, including head injury, brain tumor, or stroke. But in many cases, the cause remains unknown.

An often unpredictable disease, epilepsy is marked by bursts of abnormal electrical activity between nerve cells in the brain, which cause disruption of normal brain patterns. This can result in altered thoughts or consciousness, abnormal movements, or "grand mal" seizures with loss of consciousness and shaking. Until recently, epilepsy treatment consisted of medication therapy or specific brain surgeries to help control epileptic seizures.

New Hope for Some Epilepsy Patients

The latest innovation in epilepsy therapy is called a Vagus Nerve Stimulator (VNS), which is an implanted computerized electronic brain stimulator. A primary pathway of communication from the body to the brain, the vagus nerve has few pain fibers and has been shown to conduct the majority of supplied electrical impulses up to the brain. Because of this, medical researchers have found a way to use the vagus nerve to provide electrical input to the brain that results in positive results for some epilepsy patients. This therapy is a surgical pathway that offers new hope for reducing the frequency and intensity of seizures in those patients for whom traditional epilepsy therapy has failed.

A "Pacemaker" Used in Epilepsy Treatment

The VNS is a computerized implant, also called the Neuro Cybernetic Prosthesis (NCP), developed by Cyberonics, Inc., specifically for the treatment of epilepsy. The NCP system is made up of two principal parts: A) a titanium-encased "pacemaker," which is a multiprogrammable pulse generator implanted under the skin in the upper chest, and B) an electrode, which is a nerve stimulation lead that runs up to the lower part of the neck. The electrode has coils that are wrapped around the vagus nerve, which acts as an inhibitory pathway carrying the pacemaker's low-voltage current to the brain. The stimulator triggers regularly, in a typical cycle delivering a 30-

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Case Study: Vagus Nerve Stimulator Implant

In February of 1998, Matthew King, who has had epilepsy for almost 30 years, became the first person in Nevada to receive an implanted vagus nerve stimulator as a way of treating his seizures. Dr. Randall Moody, Matthew's longtime neurologist in Las Vegas, and Dr. John Anson, a neurosurgeon of our practice, performed the region's first vagus nerve stimulator procedure by implanting the NeuroCybernetic Prosthesis (NCP) developed by Cyberonics, Inc. This pulse generator and nerve-stimulation lead that wraps around the vagus nerve relieves symptoms of severe epilepsy in many patients who have not previously responded well to medication therapy.

The Course of Matthew's Epilepsy

The origin of Matthew's epilepsy may lie as far back as a crash on a mini-bike when he was eight years old. The skull fracture he received in this accident may have been a significant factor in the subsequent development of his seizures. It is just this kind of head trauma that elicits epilepsy in some people. At thirteen, Matthew had his first seizure while he was playing pool with a friend. At that point a diagnosis of epilepsy was made, and subsequently Matthew had many seizures—a number of which were of

Case Study, continued on page 2

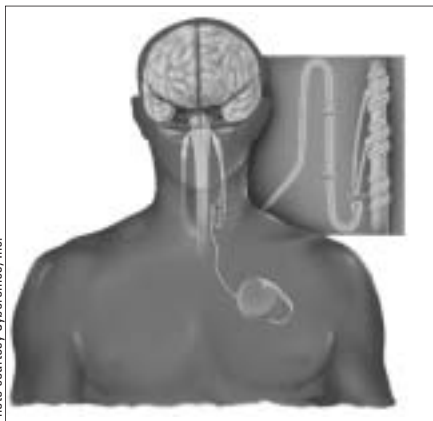
Vagus Nerve Stimulation, continued from page 1

second burst of electricity to the vagus nerve followed by a five-minute period of rest during which no stimulation occurs. For many epileptic patients, this electrical stimulation reduces the frequency and severity of seizure events.

The parameters and pulse settings of the NCP are set in the days or weeks after it is implanted in the patient. The physician uses a programming wand and self-testing software to determine the pattern of electrical stimulation that is best for the patient. The NCP incorporates a strict communications protocol to safeguard against the possibility of environmental sources interfering with its operation. When the physician has found the optimum stimulation pattern for the particular patient, the electrical stimulation is delivered at all times on the chosen cycle.

Impact on Incipient Seizures

In addition to the timed electrical bursts, VNS patients relying on the NCP system can activate the stimulator



The operation to implant the Vagus Nerve Stimulator usually is completed in less than two hours. A small incision is made to insert the lead around the vagus nerve in the patient's neck and another incision is made in the chest to implant the generator.

by waving a magnet over the generator if they or their caregiver sense a seizure developing. When a seizure has already started, a family member or friend can use the magnet to decrease the intensity or duration. Waving the magnet over the pulse generator implanted in

the patient's chest activates the electrical stimulation and thereby provides extra, on-demand pulses to the brain by way of the vagus nerve. In some cases, this extra dose of electrical stimulation prevents the oncoming seizure, makes it less intense, makes it shorter, or lessens recovery time after the seizure. For other patients, the increased electrical stimulation may have little or no effect.

NCP Development

The NCP system received FDA approval in July 1997 after 15 years of testing on animals and then on humans. The first human implant of the NCP system occurred in 1988. Since then, more than three thousand patients have had NCPs installed during clinical trials or on the open market world-wide. The results of the long-term studies show that for many patients VNS maintains and even increases its efficacy over time. A clinical study of 454 patients showed a doubling of the median reduction of seizures from the three-month to the three-year marker.

This procedure is for people who have limited options and who have failed multiple medications. Approximately five percent of people with epilepsy experience the most severe type of seizures and are candidates for the NCP procedure. It is estimated that 75 percent of the patients who undergo this procedure will have some degree of improvement. Half of the candidates will experience more than a 50 percent reduction of their seizures, and a small number will have complete relief. Typically, the patient will remain on the same medications prescribed prior to the implant procedure.

Vagus Nerve Stimulation in Nevada

Dr. John Anson and a local neurolo-

gist performed Nevada's first Vagus Nerve stimulation implant with the

Vagus Nerve Stimulation, continued on page 4



The Vagus Nerve Stimulator (VNS) is made up of two principal parts: a titanium-encased "pacemaker" and an electrode that has coils that are surgically wrapped around the vagus nerve in a patient's neck.

Case Study: Vagus Nerve Stimulator Implant, continued from page 1

the "grand mal" type.

Matthew had no other serious medical conditions, and he reports that epilepsy did not affect his education. But as he grew older, he had a number of seizures each month and was not able to drive a car or find employment. His physicians guided him to a variety of medication therapies over time, but these brought only limited improvement. Matthew was not a candidate for any of the epilepsy surgeries that often help other patients.

Hope from Vagus Nerve Stimulation

Matthew was still having severe seizures when one of his brothers saw an article about the NCP system and sent it to him. He conferred with his neurologist and determined that Matthew was a patient who fit the medical and surgical profile for this new epilepsy

Keeping in Touch

Here at the Western Regional Center for Brain & Spine Surgery, we are constantly expanding to serve better the needs of our patients and referring doctors. In the previous issue of *Western Neurosurgery Review*, we introduced you to our newest associates, Derek Duke, M.D., and Max Carter, Ph.D., PA-C, who joined us in early summer 1999. Since then, we have added an office in Green Valley (Henderson, NV) and will soon be seeing patients from our newest clinic at the Colorado River Medical Center in Needles, CA.

While this expansion allows us to see patients in a more timely manner and closer to their homes, we realize that keeping track of who and where we are can be a confusing proposition. For this reason, we have compiled the addresses of all our offices and reference the doctor who holds clinic in each and how often. Please note that all our doctors see patients at least once a week in our main office.

Main Office
3006 South Maryland Pkwy.
Suite 265
Las Vegas, NV 89109

Las Vegas—Summerlin, NV
Summerlin Hospital
653 Town Center Drive
Suite 308

Bullhead City, AZ
Mohave Valley Medical Cntr.
1225 East Hancock Road

St. George, UT
342 East 600 South

Henderson—Green Valley, NV
Parkway Medical Center
100 No. Green Valley Parkway
Suite 332

Kingman, AZ
Professional Medical Center
1736 Beverly Avenue
Suite 106

Laughlin, NV
Laughlin Medical Center
150 Edison Way

Lake Havasu City, AZ
1951 Mesquite Avenue
Suite E

Needles, CA (opening soon)
Colorado River Medical Cntr.
1402 Bailey Avenue

Location	Doctor	Frequency
Henderson, NV	Derek Duke, M.D.	Once a week
Summerlin, NV	Steven Agata, M.D.	Every other week
Laughlin, NV	Benjamin Venger, M.D.	Every other week
Bullhead City, AZ	Benjamin Venger, M.D.	Every other week
Kingman, AZ	Benjamin Venger, M.D.	Once a month
St. George, UT	Benjamin Venger, M.D.	Once a month
Lake Havasu City, AZ	John Anson, M.D.	Once every three weeks

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treatment. After gaining the proper approvals and permissions, the procedure was performed at Desert Springs Hospital.

Implanting the NeuroCybernetic Prosthesis

Dr. Anson performed the surgery by implanting the titanium-encased pulse generator in Matthew's upper chest and inserting the helical electric lead around the vagus nerve in the neck. The lithium thionyl chloride battery within the generator lasts for about five years and can be replaced when necessary. This type of battery has been used for cardiac pacemakers and implantable spinal cord stimulators.

During recovery Matthew felt only slightly stiff and sore. He did have hoarseness at first because of the stimulation of the nerves in his throat, but it was not too troublesome. The seizures improved immediately, reducing dramatically in frequency and severity. Over time

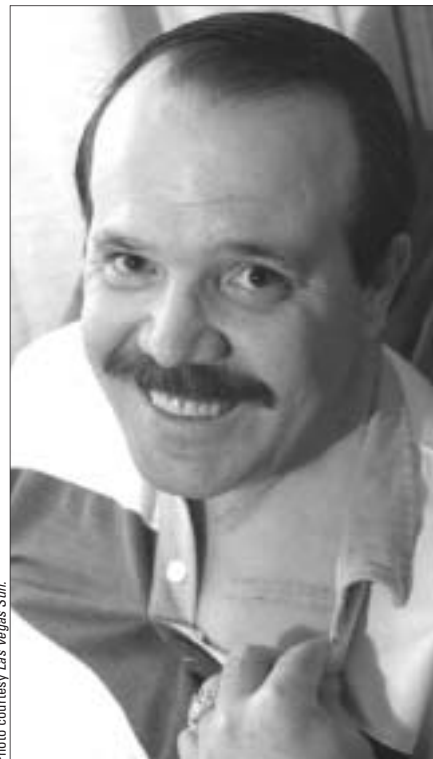


Photo courtesy Las Vegas Sun.

Matthew King, the first person in Nevada to receive an implanted vagus nerve stimulator, shows the small scars on his chest where the NCP generator and lead were implanted.

Matthew's physicians optimized the settings of the implanted generator, and now he doesn't even notice when the periods of electric pulses begin and end.

Matthew's Results

The VNS has significantly improved Matthew's condition. The frequency and severity of the seizures are much improved. His family and friends notice a big difference due to the absence of severe seizures. They also notice how much weight he has lost—about 35 pounds—since implantation. Matthew reports that as the first person in Nevada to receive such an implant he has received a lot of media attention in the form of television and newspaper interviews. At this point Matthew still cannot work or drive, but has had a significant improvement in quality of life. Matthew recommends without reservation the VNS to those who may be candidates for it. ■



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Las Vegas	Bullhead City
Green Valley	Kingman
Summerlin	Lake Havasu City
Laughlin	
Utah	California
St. George	Needles (opening soon)

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Comments, questions, requests to be added to our mailing list, and requests for back issues of our newsletter are welcome and may be directed to Nafija Mujic by calling (702) 737-1948 or (800) 334-0878. Our fax number is (702) 735-0736. © Copyright 1999, Western Regional Center for Brain & Spine Surgery. All rights reserved. All articles are intended for informational purposes only and should not be interpreted as medical advice.

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lead device at Desert Springs Hospital in February 1998. The implant operation was successfully performed on a 40-year-old man who had suffered from severe epileptic seizures since childhood. The patient had been prescribed countless medication therapies to control his seizures, including medications with the most serious side effects. Despite the multiple medications, he still suffered several seizures a month, preventing him from driving or obtaining employment.

The operation was completed in less than two hours and the patient remained in the hospital overnight. A small incision was made to insert the lead around the vagus nerve in the neck and another incision was made in the chest to implant the generator. The patient recovered quickly from surgery, and the device was activated two weeks

after his discharge from Desert Springs Hospital.

VNS Results

Since activation of the NCP device, our patient has had dramatic reduction in his seizures. Of course, results will

The results of long-term studies show that for many patients VNS maintains and even increases its efficacy over time. A clinical study of 454 patients showed a doubling of the median reduction of seizures from the three-month to the three-year marker.

vary from patient to patient. One possible side effect of the NCP stimulator is intermittent voice hoarseness and throat discomfort resulting from stimulation of vagus nerve fibers to the throat. These

side effects most typically are felt during the time that the electrical impulses are cycling to the vagus nerve, not during the "off" period. Our patient has experienced hoarseness, but he has not found it to be very uncomfortable. The battery in the NCP device lasts approximately five years and can be replaced when necessary.

Since working with this first patient in 1998, in Las Vegas we have performed the NCP implantation in approximately 30 patients. There have been no complications from the surgery and overall results have been very good. Consistent with what was found in national study, approximately 75 percent of patients have had some degree of improvement with 50 percent reporting good or excellent outcomes. ■