

It's Electric!

Vagus nerve stimulation may improve uncontrolled epileptic seizures.

BY ANDREW M. WILNER, M.D.

Gina's* first seizure occurred when she was 6 years old. According to her mother, Mary, "It came out of nowhere. Gina had normal development. But she suddenly dropped to the floor in the kitchen and had a seizure."

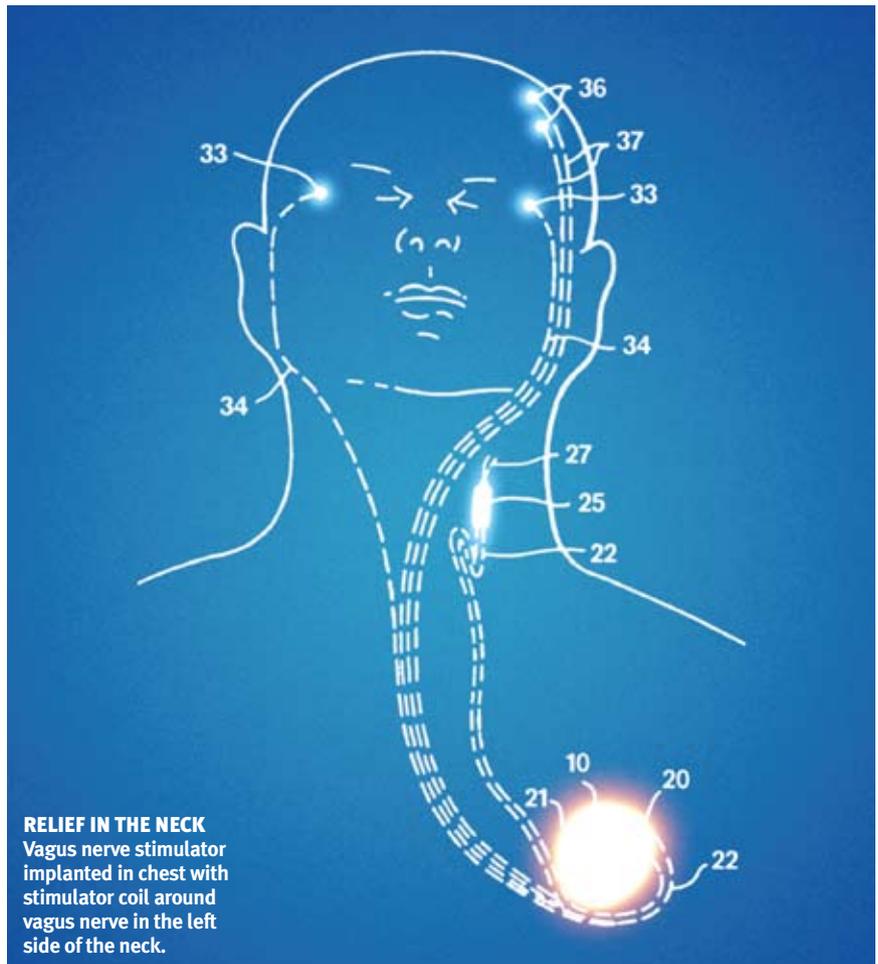
Epilepsy is a condition of recurrent seizures that affects approximately one out of every 200 people worldwide. Most people respond to treatment with antiepileptic medications, but those who have uncontrolled seizures (termed "refractory" or "intractable") may need other treatments, such as surgery. In 1997, the Food and Drug Administration approved the vagus nerve stimulator (VNS) for "add-on" treatment of partial seizures that don't respond fully to antiepileptic drugs in patients over 12 years of age.

An MRI failed to find a cause for Gina's seizure, but her seizures continued. Gina's schoolwork deteriorated, she stopped socializing, and she had memory problems. Doctors tried different antiepileptic drugs, but Gina experienced side effects with each one. At one point, she was having over 300 seizures a day.

Desperate to find an effective therapy, Gina started the ketogenic diet. Some neurologists are skeptical of this approach, but Gina's seizures decreased by about 90 percent. Unfortunately, she was still having memory and behavior problems along with complex partial seizures. (See box, page 35.) In August 2007, Gina began treatment with a VNS. Two months later, the seizures stopped completely.

HOW DOES IT WORK?

The VNS consists of an electrical generator, similar to a cardiac pacemaker, which is surgically implanted into the chest; and an electrode that connects to the left vagus nerve in the neck (see illustration). The battery lasts three to eight years, depending upon the stimulation settings, and can be replaced when necessary.



A couple weeks after surgery, the patient's neurologist will program the VNS during an office visit. Using a laptop computer and a special wand, the neurologist can adjust the amplitude, duration, and frequency of the stimulation.

Experts believe the VNS works because the vagus nerve connects to different regions in the brain where seizures originate. The vagus nerve acts as a major pathway between the brain and the heart, lungs, and gastrointestinal tract. The VNS uses the vagus nerve as a built-in "wire" to send electrical impulses to the brain. The repetitive stimulation of the brain by the VNS, usually once every five minutes, interferes with the formation of seizure discharges.

VNS EXPERIENCE

Susan Spencer, M.D., professor of neurology and neurosurgery at the Yale School of Medicine, served on the expert Food and Drug Administration (FDA) panel that approved the VNS in 1997. Between 1997 and 2009, Dr. Spencer treated over 100 patients with the VNS. (She sadly passed away right before press time.)

"We use the VNS for patients who have intractable seizures and cannot have their seizures treated with surgery. Most patients have about a 30 percent decrease in their seizures, but there's a big range," Dr. Spencer observed. "A few patients have a 95 percent decrease in their seizures, but some have no response at all."

In general, the VNS is well tolerated,

“VNS plays a big role when patients are not responding to pharmacotherapy,” Dr. Vazquez says.

Dr. Spencer said. “We only had to remove three stimulators, because the patients insisted. We prefer to leave them in, because the literature suggests and our experience confirms that they work better over time,” she said.

One of Dr. Spencer’s patients, Robert, has had the VNS for four years. “I was taking an outrageous amount of medications and dealing with the side effects,” Robert says. “The cocktail of medicines didn’t completely control the seizures. I wasn’t a good surgery candidate because my seizures start deep in my frontal lobe, so Dr. Spencer recommended the VNS. It made a big change in my life very quickly and allowed me to be on only one medication. I have no side effects at all. If they turn up the settings, it makes my voice change, but after three to five days, I don’t feel it anymore.” The VNS does not replace medications, according to Dr. Spencer. However, some patients, like Robert, may be able to reduce the number of medications they take or decrease their dosage, which may reduce medication-related side effects.

Blanca Vazquez, M.D., director of clinical trials at the Comprehensive Epilepsy Center at New York University Medical Center, participated in the development of the VNS. Her center has treated over 800 patients with the stimulator, including children as young as one year old and a patient in his 60s.

“VNS plays a big role when patients are not responding to pharmacotherapy,” Dr. Vazquez says. “If they are not a surgical candidate, then VNS is probably the best option.”

The VNS comes equipped with a magnet, which one can use to trigger the generator in order to stop a seizure. “The magnet gives us extra confidence,” Mary says. “When Gina is in class, she uses the magnet when she feels

the aura coming on. Just before her seizure, Gina may have a sensation of her ears ringing, flashing lights, or odd smells. The magnet stops the seizure. Her teacher has one too.”

“The magnet doesn’t always work, but you are empowering caregivers so that they can intervene when the patient has a seizure,” Dr. Vazquez says.

BENEFITS AND SIDE EFFECTS

In a 2009 study published in the journal *Epilepsia*, roughly half the patients who used a VNS in addition to their regular medications cut their seizures by about 50 percent. And a 2007 study of 138 patients with VNS, published in the journal *Epilepsy and Behavior*, showed that patients with VNS were able to work more days and had fewer outpatient and ER visits as well as hospitalizations compared to the year prior to VNS implantation.

VNS treatment may also reduce seizure severity, duration, and recovery time.

Most side effects occur when the vagus nerve is stimulated, usually once every few minutes. Between 20- to 60-percent experience these side effects: voice alteration, hoarseness, shortness of breath, tingling in the neck, coughing, and throat pain. Complications related to the surgery, such as wound infections, may also occur in a small percentage of patients.

The stimulus-related side effects can be reduced by manipulating the settings of the

VNS generator. “We have the unique opportunity to change the settings and make it tolerable while the patients are in the office,” Dr. Vazquez says.

Before the VNS surgery, Gina’s parents were concerned that she might have problems with the stimulator as she grew. But the surgeon reassured her that there was plenty of room under the stimulator coil to accommodate growth of the vagus nerve.

Unfortunately, Dr. Spencer said, some patients get the VNS implanted without a proper seizure evaluation. “All patients considering the VNS should be seen at an epilepsy center to be certain that they are not potential surgical candidates. There is so much more to gain with surgery because patients may become seizure free. In our hands, the VNS has never completely stopped anyone’s seizures,” she said.

TREATMENT RESULTS

“Gina is doing well in school now, getting all As,” Mary says proudly. However, she still has about two small seizures a week. In the hopes of being completely seizure-free, Gina will soon have an evaluation for surgery.

As for Robert, “My life is at a good place right now,” he says. “Between medicine and VNS, my seizures are relatively controlled. I live a good life.” 

Andrew N. Wilner, M.D., is the author of Epilepsy: 199 Answers, A Doctor Responds to His Patients’ Questions, 3rd Edition (Demos Health, New York, NY).

*Names have been changed to protect the privacy of the individuals.

Common Seizure Types

ABSENCE: Staring spells, also called “petit mal”

PARTIAL COMPLEX: Episodes of confusion

GENERALIZED TONIC CLONIC: Convulsions, also called “grand mal”



For more information on the VNS, see RESOURCE CENTRAL on page 36.