A Thesis

Entitled

Vagus Nerve Stimulation Therapy for Intractable Epilepsy: A Patient’s Perspective

By

Mark Cuthbertson

Submitted as partial fulfillment of the requirements for

The Master of Liberal Studies Degree

Adviser: Dr. Mark Sherry

Graduate School

The University of Toledo

May 2006
This study documents the journey of one intractable Epilepsy patient contemplating the implantation of a Vagus Nerve Stimulation (VNS) device. Intractable, or pharmacoresistant, Epilepsy is Epilepsy that is uncontrolled despite appropriate medical treatment with antiepileptic drugs (AED’s). More than 30% of patients continue to have seizures in spite of multiple trials with pharmacologic therapy (Kwan & Brodie 2000).

Scientists had long known that electrical stimulation of the vagus nerve in the neck could “flatten out” brain waves, thus possibly decreasing seizure activity, and in 1997, the U.S. Food and Drug Administration (FDA) approved VNS Therapy in combination with seizure medication. On the surface, it might appear that the decision would be an easy one, yet past frustrations and the uncertainty of favorable results make this decision one worth studying.
Dedication

This thesis is dedicated to the woman who is actually the subject of study, my wife of thirty-two years. Seeing the battles she has faced, and won, is truly inspiring. The social stigma of a young person with a seizure disorder can be suffocating. First-line seizure medications, even now, can make concentration and studying very difficult, and the educational process a frightening one. This was the case with my wonderful wife, yet she persevered and taught me more about life than she can possibly know. A very successful co-owner and co-teacher at a Christian preschool, her support of my pursuit of higher education has been unwavering. Loved dearly by her two children and two grandchildren, she shares unselfishly, loves unconditionally, and lives faithfully, always true to her God and to herself. She has my undying love always.
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* Dave Naess is the owner of the website, “VNS From a Patient’s Perspective” located at http://www.howdydave.com
CHAPTER ONE: INTRODUCTION

Through participatory study, I have examined the journey of one patient with medically refractory (intractable) Epilepsy as she sought to make the best possible decision regarding Vagus Nerve Stimulation Therapy. This decision can indeed be daunting, and very little from the patient perspective has been written to help in the process. As the spouse of the study’s subject, I endeavored to help her in her decision process by researching VNS Therapy as thoroughly as possible. It was during this research that we discovered just how little of substance had been written from the viewpoint of the patient. In fact, we could only find one book that had been written by an actual VNS patient, describing the procedure, its efficacy, and the quality of life after a successful implant (Donovan, 2005). The fact that we found this book on a website called “vagusnervestimulation.com” diminished its credibility somewhat, as did the fact that Cyberonics, the manufacturer of VNS devices, sponsors many of the Epilepsy clinics throughout the United States. It became obvious that unbiased information was going to be hard to find, and that some doctors may be “pushing” VNS for reasons beyond the needs of patients.

For someone with intractable Epilepsy, just the possibility of relief from seizures might be sufficient motivation to undergo VNS implantation, a procedure that can promise little more than the odds of tossing a coin. Epilepsy
can be a disease of frustration, especially if it repeatedly fails to respond to medication. Epilepsy is a disorder characterized by recurring seizures, which are caused by electrical disturbances in the nerve cells in a given section of the brain. Seizures can have many forms, and those affected can have more than one type of seizure. Reported incidences and prevalence of Epilepsy has varied because of uncontrolled data gathering methods. The Epilepsy Foundation (www.epilepsyfoundation.org) reports:

- Epilepsy and seizures affect 2.7 million Americans of all ages, at an estimated annual cost of $12.5 billion in direct and indirect costs.
- Approximately 200,000 new cases of seizures and Epilepsy occur each year.
- Ten percent of the American population will experience a seizure in their lifetime.
- Three percent will develop Epilepsy by age 75.

Most people with Epilepsy lead outwardly normal lives. Approximately 80 percent can be significantly helped by modern therapies, and some may go months or years between seizures (CDC, 2006). However, the condition can and does affect daily life for people with Epilepsy, their family, and their friends. According to the National Institute of Neurological Disorders and Stroke (NINDS), people with severe seizures that resist treatment have, on average, a shorter life expectancy and an increased risk of cognitive impairment,
particularly if the seizures developed in early childhood. These impairments may be related to the underlying conditions that cause Epilepsy or to Epilepsy medications rather than the Epilepsy itself. More than 2 million people in the United States -- about 1 in 100 -- have experienced an unprovoked seizure or been diagnosed with Epilepsy. For about 80 percent of those diagnosed with Epilepsy, seizures can be controlled with modern medicines and surgical techniques. However, about 20 percent or about 600,000 people in the United States have intractable seizures, and another 400,000 feel they get inadequate relief from available treatments. These statistics make it clear that improved treatments are desperately needed. The emergence of VNS came at a propitious time and certainly found a needful population.

To someone with intractable Epilepsy, facing the decision to implant an electrical device in one’s chest can be a daunting time. Many have struggled for years searching for the right “cocktail” of medications to best treat their particular seizure pattern. When an individual starts taking a new Epilepsy drug, it is important to tailor the dosage to achieve the best results. People's bodies react to medications in very different and sometimes unpredictable ways, so it may take some time to find the right drug(s) at the right dose(s) to provide optimal control of seizures while minimizing side effects. A drug that has no effect or very bad side effects at one dose may work very well at another dose. Doctors will usually prescribe a low dose of a new drug initially and monitor
blood levels of the drug to determine when the best possible dose has been reached. Many of those patients with intractable Epilepsy have been through this process many times, and each failure led to a greater loss of hope and an increase in frustration and despair. Depression occurs in large numbers of people with Epilepsy (Kanner 2003). This can result from psychological reactions such as fear and from the side effects of medications. The acceptance of a diagnosis often involves grief reactions such as denial, anger and depression. There are adjustments to be made to seizures, effects on self-esteem and confidence. It is reported that 58% of those with intractable epilepsy develop depression, making it the most prevalent psychiatric illness associated with Epilepsy (Tucker 1998).

The following paragraph is quoted from an article written by Dr. Alan Lowe from Department of Psychiatry of the Toronto Hospital, Western Division:

The impact of depression on people with Epilepsy is significant. In addition to impairing daily functioning, it can lead to greater seizure frequency and less seizure control through sleep deprivation and a failure to comply with medication or due to its role as an emotional stressor (Lowe 2003).

The label “intractable” comes with a cost. The patient has already been through the medication dosage tailoring routine many times, and each failure brought renewed sense of doom. At this juncture, then, it is of little doubt that the VNS decision would be met with skepticism and reservation. An unbiased
answer base would be very welcome at this point, but as we have found, one does not exist. It is from this position, then, that this study has sought to answer those questions most pertinent to prospective VNS patients:

**Key Research Question**

What factors are particularly important to individuals making a decision about whether to have VNS Therapy and how can their concerns be resolved in a fair and unbiased fashion?

**Methodology**

To thoroughly research the VNS decision, I not only studied all the readily available material, but also took on a participatory role as well. In late 2004, after years of medication changes and dosage tailoring with minimal degrees of success, the subject’s neurologist revealed that he had nothing more to offer her and recommended she see someone with more expertise in handling intractable Epilepsy. The Cleveland Clinic was suggested, but insurance issues led her to visit the area’s most renowned expert on Epilepsy at the Medical University of Ohio in Toledo. I stayed with her for more than three days while she underwent in-patient video EEG monitoring at the Medical University of Ohio Hospital, and sat in on her initial and all subsequent visits to her psychiatrist. Even prior to the time VNS Therapy was offered to her as a possible course of treatment in March of 2005, I had accompanied the subject on all her visits to her epileptologist, read
promotional material with her and helped her search the Internet for all available material about VNS Therapy. One website was discovered that dealt with VNS from a patient’s perspective, albeit from a post-procedure viewpoint. I then analyzed her correspondence with other VNS patients she had found at the site. I documented her seizures, monitored her medications, discussed the advantages and disadvantages of VNS with her, and interviewed her numerous times over the ensuing months on a variety of Epilepsy-related topics. Psychotherapy was also ordered and started, but as I was not allowed to observe those sessions, I interviewed the subject at length about their content following each visit. I regularly participated in the relaxation/meditation sessions that were prescribed.

Limitations

This study will not offer an evaluation of the efficacy of VNS Therapy. Many AED’s will be discussed, along with possible side effects and shortcomings, both realized and unrealized by the study’s subject. This study will not offer any judgment on any AED; nor will it advocate any medication over any other. It will not evaluate Epilepsy surgery as an option. VNS Therapy, the device itself and its different parts and accessories, will be described and detailed; nothing contained herein, however, should be construed as an effort to make the all-important decision for anyone, either for or against VNS implantation.
Definitions

Many different terms will be used in this study, and some are unique to neurology and Epilepsy. The following is a short description of each of those terms, from the National Institute of Neurological Disorders and Stroke, a Federal agency:

*Absence Epilepsy*

Epilepsy in which the person has repeated absence seizures.

*Absence Seizure*

the type of seizure seen in absence Epilepsy, in which the person experiences a momentary loss in consciousness. The person may stare into space for several seconds and may have some twitching or jerking of muscles.

*Adjuvant*

a drug or agent added to another drug or agent to enhance its medical effectiveness

*Aura*

unusual sensations or movements that warn of an impending, more severe seizure. These auras are actually simple focal seizures in which the person maintains consciousness.
**Automatism**

strange, repetitious behaviors that occur during a seizure. Automatisms may include blinks, twitches, mouth movements, or even walking in a circle.

**Biofeedback**

a strategy in which individuals learn to control their own brain waves or other normally involuntary functions. This is an experimental treatment for Epilepsy.

**Clonic Seizure**

seizures that cause repeated jerking movements of muscles on both sides of the body.

**Complex Focal (Partial) Seizure**

seizures in which only one part of the brain is affected, but the person has a change in or loss of consciousness.

**Convulsion**

sudden contractions of the muscles that may be caused by seizures.

**CT (Computed Tomography)**

a type of brain scan that reveals the structure of the brain.

**Electroencephalogram (EEG)**

a test which uses electrodes to record brain waves.

**Focal (Partial) Seizure**

seizures that occur in just one part of the brain.
Frontal Lobe Epilepsy

a type of Epilepsy that originates in the frontal lobe of the brain. It usually involves a cluster of short seizures with a sudden onset and termination.

Functional MRI (Functional Magnetic Resonance Imaging)

a type of brain scan that can be used to monitor the brain's activity and detect abnormalities in how it works.

GABA (Gamma-Aminobutyric Acid)

an inhibitory neurotransmitter that plays a role in some types of Epilepsy.

Generalized Seizure

seizures that result from abnormal neuronal activity in many parts of the brain. These seizures may cause loss of consciousness, falls, or massive muscle spasms.

Grand Mal Seizure

an older term for tonic-clonic seizures.

Hemiplegia

total or partial inability to move, experienced on one side of the body, and caused by brain disease or injury.

Hippocampus

a brain structure important for memory and learning.
Idiopathic Epilepsy

Epilepsy with an unknown cause.

Intractable

about 20 percent of people with Epilepsy will continue to experience seizures even with the best available treatment.

Ketogenic Diet

a strict diet rich in fats and low in carbohydrates that causes the body to break down fats instead of carbohydrates to survive.

Lennox-Gastaut Syndrome

a type of Epilepsy that begins in childhood and usually causes several different kinds of seizures, including absence seizures.

Lesion

damaged or dysfunctional part of the brain or other parts of the body.

Lesionectomy

removal of a specific brain lesion.

Lobectomy

removal of a lobe of the brain.

Monotherapy

treatment with only one antiepileptic drug.

MRI (Magnetic Resonance Imaging)

a type of brain scan that reveals the structure of the brain.
**Myoclonic Seizure**

seizures that cause sudden jerks or twitches, especially in the upper body, arms, or legs.

**Neurotransmitter**

nerve signaling chemicals.

**Nonconvulsive**

any type of seizure that does not include violent muscle contractions.

**Nonepileptic Event**

any phenomena that look like seizures but do not result from abnormal brain activity. Nonepileptic events may include psychogenic seizures or symptoms of medical conditions such as sleep disorders, Tourette’s syndrome, or cardiac arrythmia.

**Partial Seizure**

another term used to describe focal seizures, those that occur in just one part of the brain.

**Petit Mal Seizure**

an older term for absence seizures.

**Progressive Epilepsy**

Epilepsy in which seizures and/or the person's cognitive abilities get worse over time.
Seizure Focus

an area of the brain where seizures originate.

Seizure Trigger

phenomena that trigger seizures in some people. Seizure triggers do not cause Epilepsy but can lead to first seizures or cause breakthrough seizures in people who otherwise experience good seizure control with their medication.

Simple Focal Seizure

seizures that affect only one part of the brain. People experiencing simple focal seizures remain conscious but may experience unusual feelings or sensations.

Status Epilepticus

a potentially life-threatening condition in which a seizure is abnormally prolonged. Although there is no strict definition for the time at which a seizure turns into status epilepticus, most people agree that any seizure lasting longer than 5 minutes should, for practical purposes, be treated as though it was status epilepticus.

Temporal Lobe Epilepsy

the most common Epilepsy syndrome with focal seizures.

Temporal Lobe Resection

a type of surgery for temporal lobe Epilepsy in which all or part of the affected temporal lobe of the brain is removed.
Tonic Seizure

seizures that cause stiffening of muscles of the body, generally those in the back, legs, and arms.

Tonic-Clonic Seizure

seizures that cause a mixture of symptoms, including loss of consciousness, stiffening of the body, and repeated jerks of the arms and legs. In the past these seizures were sometimes referred to as grand mal seizures.

Conclusion

Within the framework of this study, formal research was conducted for a period of fourteen months, from March 2005 to May 2006. Informal research began long before, especially that related to Epilepsy. During the fourteen month span, careful documentation and monitoring has yielded what should be called the first totally unbiased and comprehensive tool for prospective VNS Therapy patients as they seek to make the best possible decision they can make for themselves and their families and situations. In the ensuing chapters, I will review the literature available on VNS Therapy and intractable Epilepsy; discuss and justify the methodology used in this study; present and analyze the data collected; and finally offer a conclusive summary.
CHAPTER TWO: REVIEW OF LITERATURE

A study of VNS Therapy would be incomplete without first describing Epilepsy and its various forms, and how the disease is treated. Following that will be a rudimentary description of the Vagus Nerve, the VNS device and its history. Much of the following information is drawn from the National Institute of Neurological Disorders and Stroke, as well as other academic sources.

Epilepsy

Epilepsy is a disorder of the brain in which groups of nerve cells, or neurons, in the brain occasionally and sporadically send abnormal signals (Richard and Reiter, 1995). In Epilepsy, the normal pattern of neuronal activity becomes disturbed, causing strange sensations, emotions, and behavior or sometimes convulsions, muscle spasms, and loss of consciousness. Epilepsy is a disorder with many possible causes. Anything that disturbs the normal pattern of neuron activity - from illness to brain damage to abnormal brain development - can lead to seizures (Gumnit, 1997). Epilepsy may develop because of an abnormality in brain “wiring”, an imbalance of nerve signaling chemicals called neurotransmitters, or some combination of these factors. Having a seizure does not necessarily mean that a person has Epilepsy. Only when a person has had two or more seizures is he or she considered to have Epilepsy (Weaver, 2001).
EEGs and various brain scans, such as the CT and MRI are common diagnostic tests for Epilepsy. While Epilepsy cannot currently be cured, for some people it does eventually go away. Most seizures do not cause brain damage (Lechtenberg, 1999). It is not uncommon for people with Epilepsy, especially children, to develop behavioral and emotional problems, sometimes the consequence of embarrassment and frustration or bullying, teasing, or avoidance in school and other social settings (Freeman, Vining and Pillas, 1997). For many people with Epilepsy, the risk of seizures restricts their independence (some states refuse drivers licenses to people with Epilepsy) and recreational activities. People with Epilepsy are at special risk for two life-threatening conditions: status epilepticus and sudden unexplained death. Most women with Epilepsy can become pregnant, but they should discuss their Epilepsy and the medications they are taking with their doctors. Women with Epilepsy have a 90 percent or better chance of having a normal, healthy baby (Weaver, 2001).

Seizure Types

Just as there are many different kinds of seizures, there are many different kinds of Epilepsy. Doctors have identified hundreds of different Epilepsy syndromes – disorders characterized by a specific set of symptoms that include Epilepsy. Some of these syndromes appear to be hereditary. For other syndromes, the cause is unknown. Epilepsy syndromes are frequently described
by their symptoms or by where in the brain they originate. People should discuss
the implications of their type of Epilepsy with their doctors to understand the
full range of symptoms, the possible treatments, and the prognosis.

**Absence Epilepsy**

People with Absence Epilepsy have repeated absence seizures that cause
momentary lapses of consciousness. These seizures almost always begin in
childhood or adolescence, and they tend to run in families, suggesting that they
may be at least partially due to a defective gene or genes (Wilner, 1996). Some
people with absence seizures have purposeless movements during their seizures,
such as a jerking arm or rapidly blinking eyes. Others have no noticeable
symptoms except for brief times when they are "out of it." Immediately after a
seizure, the person can resume whatever he or she was doing. However, these
seizures may occur so frequently that the person cannot concentrate in school or
other situations. Childhood Absence Epilepsy usually stops when the child
reaches puberty (Richard and Reiter, 1995). Absence seizures usually have no
lasting effect on intelligence or other brain functions.

**Temporal Lobe Epilepsy**

Temporal Lobe Epilepsy, or TLE, is the most common Epilepsy syndrome
with focal seizures. These seizures are often associated with auras. TLE often
begins in childhood. Research has shown that repeated temporal lobe seizures can cause a brain structure called the hippocampus to shrink over time (Kalviainen et al, 1998). The hippocampus is important for memory and learning. While it may take years of temporal lobe seizures for measurable hippocampal damage to occur, this finding underlines the need to treat TLE early and as effectively as possible.

**Neocortical Epilepsy**

Neocortical Epilepsy is characterized by seizures that originate from the brain's cortex, or outer layer. The seizures can be either focal or generalized. They may include strange sensations, visual hallucinations, emotional changes, muscle spasms, convulsions, and a variety of other symptoms, depending on where in the brain the seizures originate.

There are many other types of Epilepsy, each with its own characteristic set of symptoms. Many of these, including Lennox-Gastaut Syndrome and Rasmussen's Encephalitis, begin in childhood. Children with Lennox-Gastaut Syndrome have severe Epilepsy with several different types of seizures, including atonic seizures, which cause sudden falls and are also called drop attacks. This severe form of Epilepsy can be very difficult to treat effectively. Rasmussen's Encephalitis is a progressive type of Epilepsy in which half of the
brain shows continual inflammation. It sometimes is treated with a radical surgical procedure where the entire hemisphere of the brain is removed. Some childhood Epilepsy syndromes, such as childhood Absence Epilepsy, tend to go into remission or stop entirely during adolescence, whereas other syndromes such as Juvenile Myoclonic Epilepsy and Lennox-Gastaut Syndrome are usually present for life once they develop. Seizure syndromes do not always appear in childhood, however.

Epilepsy syndromes that are easily treated, do not seem to impair cognitive functions or development, and usually stop spontaneously, are often described as benign. Epilepsy syndromes in which the seizures and/or the person's cognitive abilities get worse over time are called Progressive Epilepsy.

Several types of Epilepsy begin in infancy. The most common type of infantile Epilepsy is infantile spasms, clusters of seizures that usually begin before the age of 6 months. During these seizures the infant may bend and cry out. Anticonvulsant drugs often do not work for infantile spasms, but the seizures can be treated with ACTH (adrenocorticotropic hormone) or prednisone.

There are several different types of seizures, and they are often not mutually exclusive. That is, a patient with Epilepsy may have different types of seizures at
different times. These seizures can range from nuisance status to totally and are (thankfully) only temporarily debilitating.

**Focal Seizures**

Focal seizures, also called partial seizures, occur in just one part of the brain. About 60 percent of people with Epilepsy have focal seizures. These seizures are frequently described by the area of the brain in which they originate. For example, someone might be diagnosed with focal frontal lobe seizures. In a simple focal seizure, the person will remain conscious but experience unusual feelings or sensations that can take many forms. The person may experience sudden and unexplainable feelings of joy, anger, sadness, or nausea. He or she also may hear, smell, taste, see, or feel things that are not real. In a complex focal seizure, the person has a change in or loss of consciousness. His or her consciousness may be altered, producing a dreamlike experience. People having a complex focal seizure may display strange, repetitious behaviors such as blinks, twitches, mouth movements, or even walking in a circle. These repetitious movements are called automatisms. More complicated actions, which may seem purposeful, can also occur involuntarily. Patients may also continue activities they started before the seizure began, such as washing dishes in a repetitive, unproductive fashion. These seizures usually last just a few seconds.
Some people with focal seizures, especially complex focal seizures, may experience auras -- unusual sensations that warn of an impending seizure. These auras are actually simple focal seizures in which the person maintains consciousness. The symptoms an individual person has, and the progression of those symptoms, tend to be stereotyped, or similar every time.

The symptoms of focal seizures can easily be confused with other disorders. For instance, the dreamlike perceptions associated with a complex focal seizure may be misdiagnosed as migraine headaches, which also may cause a dreamlike state. The strange behavior and sensations caused by focal seizures also can be mistaken for symptoms of narcolepsy, fainting, or even mental illness. It may take many tests and careful monitoring by an experienced physician to tell the difference between Epilepsy and other disorders.

**Generalized Seizures**

Generalized seizures are a result of abnormal neuronal activity on both sides of the brain. These seizures may cause loss of consciousness, falls, or massive muscle spasms. There are many kinds of generalized seizures. In absence seizures, the person may appear to be staring into space and/or have jerking or twitching muscles. These seizures are sometimes referred to as petit mal seizures, which is an older term. Tonic seizures cause stiffening of muscles of
the body, generally those in the back, legs, and arms. Clonic seizures cause repeated jerking movements of muscles on both sides of the body. Myoclonic seizures cause jerks or twitches of the upper body, arms, or legs. Atonic seizures cause a loss of normal muscle tone. The affected person will fall down or may drop his or her head involuntarily. Tonic-clonic seizures cause a mixture of symptoms, including stiffening of the body and repeated jerks of the arms and/or legs as well as loss of consciousness. Tonic-clonic seizures are sometimes referred to by an older term: grand mal seizures.

Not all seizures can be easily defined as either focal or generalized. Some people have seizures that begin as focal seizures but then spread to the entire brain. Other people may have both types of seizures but with no clear pattern.

A Need for Public Education

Society's lack of understanding about the many different types of seizures is one of the biggest problems for people with Epilepsy. People who witness a non-convulsive seizure often find it difficult to understand that behavior which looks deliberate is not under the person's control. In some cases, this has led to the affected person being arrested or admitted to a psychiatric hospital. To combat these problems, education of people everywhere is needed to understand the many different types of seizures and how they may appear.
Doctors who treat Epilepsy come from many different fields of medicine. They include neurologists, pediatricians, pediatric neurologists, internists, and family physicians, as well as neurosurgeons and doctors called epileptologists who specialize in treating Epilepsy. People who need specialized or intensive care for Epilepsy may be treated at large medical centers and neurology clinics at hospitals or by neurologists in private practice. Many Epilepsy treatment centers are associated with university hospitals that perform research in addition to providing medical care. Finding the right medication(s) in the right dosages is critical in accomplishing adequate Epilepsy treatment. The list of approved medicines for Epilepsy is quite long and it is sufficient for our purpose here to say that different medications treat Epilepsy in different ways, with differing levels of success in treating the various types of seizures and Epilepsy.

One of the major downfalls in treating Epilepsy with medications is their propensity for unwanted and undesirable side effects (Rados, 2005). It is true that the majority, roughly 80%, of Epilepsy patients respond quite well to medications, and either experience little or no ill effects or are able to tolerate the side effects that do occur. It is for the other 20% who do not respond adequately, along with others who for whatever reason do not wish to continue on a lifetime of medication, that alternative treatments are being explored. Epilepsy surgery is one such treatment option.
There are three broad categories of Epilepsy that can be treated successfully with surgery. These include focal seizures, seizures that begin as focal seizures before spreading to the rest of the brain, and unilateral multifocal Epilepsy with infantile hemiplegia. Doctors generally recommend surgery only after patients have tried two or three different medications without success, or if there is an identifiable brain lesion—a damaged or dysfunctional area—believed to cause the seizures (NIH, 1990). Surgical treatment of Epilepsy might not be needed if we knew more about ways to prevent brain injury or if we had more effective and less toxic anticonvulsant drugs. In children, studies have shown that certain types of seizures may respond to a strict diet high in fats and low in carbohydrates. The "ketogenic diet," which is not the same as other popular low-carbohydrate diets, causes the body to break down fats instead of carbohydrates to survive. This condition is called ketosis. Doctors recommend the ketogenic diet for children whose seizures have not responded to several different seizure medicines. The ketogenic diet is also not easy to maintain, according to NINDS. It requires strict adherence to an unusual and limited range of foods, usually requiring the help of a dietitian. Possible side effects include retarded growth due to nutritional deficiency and a buildup of uric acid in the blood, which can lead to kidney stones. Children who are on the ketogenic diet also need to take seizure medications (Rados, 2005).
It is quite clear that continued fundamental research in the basic sciences of Epilepsy is warranted. It is from such research that the VNS Therapy emerged.

**The Vagus Nerve**

From the base of the brain downward into the neck area is where the vagus nerve is located (see Fig. 1). It is the 10th cranial nerve (one of 12 pairs of nerves that begin in the brain). The name vagus comes from Latin and means “wandering.” The vagus is a mixed nerve. It has a role in sensory, motor and secretory functions. It supplies sensory functions for:

- Ears
- Tongue

It supplies motor functions for:

- Larynx (voice box)
- Diaphragm
- Stomach
- Heart

It supplies both motor and sensory functions for:

- Pharynx (sinuses)
- Esophagus

It supplies secretory functions for:

- Stomach
- Intestine
A theory about a relationship between the vagus nerve and Epilepsy actually dates back to the 1930s. At that time, scientists had discovered the EEG, and, in the process of electrically stimulating different parts of the body, they found that the vagus nerve caused the brain waves to flatten out, or "de-synchronize."

It wasn't until the 1980s that technology allowed the idea of stimulating the vagus nerve to treat Epilepsy to be developed. After just 3 years of animal testing, the technique was first tested in a human in 1988. In 1997, the U.S. Food and Drug Administration (FDA) approved Vagus Nerve Stimulation in combination with seizure medication for partial Epilepsy in adults and adolescents (Epilepsy.com 2006).
The VNS Device

The Cyberonics© Vagus Nerve Stimulator is a fairly small disk shaped device (see Fig. 2), described by the manufacturer as:

- The Model 102 NCP Pulse Generator
- Titanium case
- Size: 6.9 mm x 52.2 mm x 51.6 mm (roughly the size of a silver dollar)
- Weight: 25 grams
- Battery Life: 6-11 years

Implanting the VNS device is a two hour operation and is usually performed on an outpatient basis. The device is surgically placed under the skin in the area of the left upper chest (See Fig. 3). There are two different ways that the VNS
may be activated. The VNS automatically generates a charge at preset time intervals.

If the patient senses an aura or the onset of a seizure, a magnet can be waved over the chest implant to activate the VNS and deliver an immediate "extra burst". Although many people do not benefit from starting stimulation with the magnet, some report that their seizures are stopped, less intense and/or of a shorter duration.
Wire leads from the device are threaded under the skin to the vagus nerve, where they are wrapped around the nerve sheath (See Fig. 4). These wires facilitate the reception of electrical impulses which can serve to level out erratic brain wave spikes known to signify seizure onset.

The stimulation process is illustrated in Fig. 5. The doctor, via computer, programs the device to deliver small electrical stimulation bursts at set intervals. The energy is supplied by a battery inside the device, which presently has an average life of 8-9 years, and must be surgically replaced upon expiration.
Statistics

Two important studies of VNS Therapy both found a significant reduction in seizure frequency (Ben-Menachem 1994, Handforth, 1998). These were double-blind studies conducted at several medical centers. Each of the patients studied had a VNS implant, but some had only low-level stimulation.

These studies showed that patients receiving high-level stimulation had a mean decrease in frequency of seizures of about 25% after three months. About one-third of the patients actively treated with VNS experienced a reduction in seizure frequency of at least 50%. In addition, a 1994 long-term study showed a cumulative improvement in efficacy at one year (George, 1994).

Vagus nerve stimulators are not on-demand devices like cardiac pacemakers, which are designed to abort an event. Rather, they mostly function
between seizures, producing long-term adaptations in the brain and thus decreasing seizure frequency. These long-term changes are not fully understood, as the characteristic spike frequently seen on the electroencephalogram is largely unchanged (Guberman, 2004).

VNS Therapy reduced the frequency of seizures by 50% or more in 30%-40% of patients. Efficacy tends to increase over time in the first year; changing the stimulation parameters to a more rapid cycle may improve efficacy (and also shortens battery life). The technique appears to be effective in the prevention of both generalized and partial seizures and to be equally effective in pediatric (age two) and adult patients (Wheless, 2002). As an adjuvant therapy VNS has comparable efficacy to most of the newer generation antiepileptic drugs, with a better side-effect profile. The devices are expensive, limiting more widespread use. Although VNS Therapy does not replace pharmacotherapy or traditional Epilepsy surgery, some patients have been able to reduce the number of drugs they need to take and their dosage. The cost-effectiveness of VNS Therapy remains to be determined; additional clinical trials are necessary to answer questions around patient selection and the types of seizures VNS Therapy is most effective in preventing (Guberman, 2004).
CHAPTER THREE: METHODOLOGY

Introduction

Since very little research has been done on VNS Therapy from the patient perspective, the good fortune I experience as the spouse of a prospective patient gave me a unique and fully participatory angle from which to study this matter. Having been diagnosed on several occasions by various experts in the field as having medically refractory Epilepsy, the subject and her decision-making journey was certainly a wonderful research opportunity, one that appears to be an incredibly useful source of information for a large number of people in similar situations.

Yin (1981) suggests that a case study is a particularly useful approach when examining contemporary phenomenon within its real-life context, because it provides such rich and detailed information into a human experience. Yin also suggests that in order to be rigorous, a case study must identify and analyze multiple sources of evidence.

Methodological Issues

In designing this study, a few methodological issues warranted consideration. One such issue centered on single-case versus group designs, and the appropriateness of question to be investigated. Various discussions in the literature examine the utility of single-subject design, its contributions and the
validity of the information it provides (Lundervold & Bellwood, 2000; Morgan & Morgan, 2001). Single case research data can provide highly detailed information that would be very difficult to replicate in any form of group study. For many decades, single-subject designs have been chosen as a means to conduct preliminary studies of psychological phenomena (Morgan & Morgan, 2001). At the moment, the outcomes of VNS Therapy are simply written in clinical literature, and there is little “human” feel to such literature. The subjective stories of coming to a decision, weighing up various factors, is missing. The actual process of a prospective patient’s decision making has therefore not been adequately investigated. Because these mechanisms of cognitive determination in this process have not yet been identified, this study employed a single-participant design to examine thought processes that change throughout the evaluation, assessment, and determination phases. The ensuing section examines the distinctiveness of single-case designs, the inherent advantages and disadvantages, and addresses concerns involving the scientific accuracy and validity of single-participant versus group designs.

Although single-case designs may generalize across additional participants, data analysis cannot be employed to produce verifiable group norms. Rather, the goal is to examine the detailed developments over time within a single individual, and to draw careful inferences about generalization (Morgan & Morgan, 2001). While single-participant designs do not customarily use the
types of testing common to group designs, they are entrenched in the scientific method and can produce very rigorous and meaningful results (Barlow, Hayes, & Nelson, 1984; Morgan & Morgan, 2001).

The single-case study is an appropriate design under several circumstances and under certain conditions - where the case represents a critical test of existing theory, where the case is a rare or unique event, or where the case serves a revelatory purpose (Yin, 1989). For those interested in aggregates, single case study may not be appropriate. But there are those practitioners who are concerned with individuals, not aggregates, and, for them, questions about meaning and perspective are central and outgoing. If research is to assist practitioners, an alternative way of conceptualizing generalizability is required (Donmoyer, 2000). To provide meaningful results, a study such as this must be undertaken with great care. It is imperative to gain as much meaningful insight into the thought processes and behaviors that lead to the ultimate end. Validation of the data requires meticulous observation. To single case researchers, the quantity and quality of observable data are critical. In fact, many proponents of single-participant designs argue that effects are only meaningful if clearly observable by visual inspection (Hopkins, Cole & Mason, 1998; Parsonson & Baer, 1986; Perone, 1999). Single-subject research, a subcategory of social research, may well be the point of origin for all scientific research. Single-subject research, coupled with new developments in statistical methodology and
computer technology, has been used to better understand the patterns of individuals’ behaviors well beyond what was thought possible only a few decades ago (Ittenbach & Lawhead, 1997).

The principal difficulty with single-subject designs is external validity, or generalizability of findings. Questions may arise as to whether information gained from the response of one client will be relevant to the majority of other cases, or whether other researchers would achieve similar results. To address those questions, the subject of this study is seen almost daily as one in a quest for knowledge. Although I personally have not interviewed others who have gone through the process of deciding whether or not to undergo VNS Therapy, it should be noted that the study’s subject diligently and repeatedly sought out those who had been through similar experiences. The thoughts and ideas of those she sought out are related through the subject, and emphasize the validity, inferred generalizability, and veracity of the study’s ultimate findings and conclusions.

**Data Sources**

Sources of data used in this study are numerous and comprehensive. They include extensive journaling, participatory observation, corporate promotional flyers and handouts, personal interviews, and discussions with mental health care professionals, to name a few. As the spouse of the study’s subject, I became
a pseudo-participant in the study, as well as researcher and recorder. From that perspective, it was incumbent on me to ensure that my participation was completely neutral, and that the study never became more important than the actual experience.

Validity and Reliability of Data

The validity and reliability of the study’s data is substantiated by the analogous experiences of those other patients sought out by the subject of this study. The inferred generalizability is compelling. Fastidious record keeping, thorough and exact description, and the unprejudiced observations of those involved throughout the study’s timeframe also attest to its legitimacy and dependability.

Ethics

Any ethical concerns pertaining to this study were addressed prior to its outset. The investigator received approval from the Human Subjects Research Committee at the University of Toledo. The letter of approval may be found in the Appendix. There were no risks to participation in this study. The subject was a willing volunteer, and was free to stop participation in the research at any time. None of the VNS Therapy patients contacted by the subject, nor the health care professionals who worked with the subject, had their names included in the data. The contacted VNS Therapy patients received follow-up contact with the
researcher for the purpose of reviewing and validating the information supplied by the subject, and each was ensured confidentiality. In addition, the contact information was secured in a password-protected file in the researcher’s personal computer, unavailable to anyone other than the researcher.

**Conclusion**

Given the goals and ultimate purpose of this endeavor- to present the difficulties and stress involved in the decision whether to undergo VNS Therapy implant surgery, much thought and consternation went into the best way to proceed. After much discussion, investigation of prior VNS Therapy research, and review of available methodologies, it was determined that the single-subject case study method would yield the best and most efficacious results. Further, it was determined, and ultimately borne out, that the results of the study generated eminently inferred generalizability.
CHAPTER FOUR: ANALYSIS OF DATA

Intractable Epilepsy is a life of frustration, an emotional roller coaster ride. The optimism and hope that arise with each new medication turn to despair when seizures again appear. The subject of this study, Rebecca, exemplifies quite typically this way of life. She daily faces the three-fazed challenge of Epilepsy: side effects of strong antiepileptic drugs, the intense anxiety that accompanies the fear of losing control, and the societal stigma associated with seizures (Lepik, 2000). We will now explore fully Rebecca’s struggle as she wrestled with the possibility of VNS Therapy, following a brief personal history of her life with seizures.

Subject Background

Rebecca’s first seizure occurred in 1966 at the age of twelve, during a Christmas pageant at her church while performing a vocal solo. She simply lost awareness for a few seconds, just long enough to cause a complete and very embarrassing halt to her music. More such events occurred, and her seizure disorder was diagnosed as Petit Mal Epilepsy, characterized by such absence seizures. An EEG confirmed seizure activity and she started on a lifelong journey in search of the best medication for her condition. Dilantin© worked well for a while, and for a couple years Rebecca only had a few absence seizures. The powerful drug made concentration in school difficult, but she was able to
persevere and managed to get by. In 1968, during a routine school day, her seizure disorder took on a new personality, when she had her first tonic-clonic (grand mal) seizure. Her parents were summoned, and her neurologist determined that a new medication, Mesantoin©, should be added. Unfortunately, Mesantoin© caused a severe allergic reaction, with hives, extreme swelling, high fever, and nausea. It was so severe that the family doctor made a house call, and the drug was discontinued. Phenobarbital became the next quasi-success story, and for several years only occasional absence seizures, very brief in nature, were endured. Adjunctive medications such as Diamox© and Mysoline© were added in an effort to stop the less-than-two-second variety absences, with varying degrees of success. There were no additional tonic-clonic seizures.

School work was a challenge. Tests and quizzes brought about a great deal of anxiety, but Rebecca was able to graduate as a very popular and outwardly quite normal girl. She had always been guided by her parents to keep Epilepsy to herself, and told that the social stigma attached to the disease would only make life more difficult. This was confirmed in her mind when another youngster on her junior high bus route routinely had violent grand mal seizures upon boarding the bus, and other children shunned and mocked him. Other than not driving, Rebecca was able to maintain the façade of normalcy quite well. She was able to work in the restaurant area of a local golf course, perform in high school plays and musicals, find a boyfriend and fall in love, find a new job as a
credit card biller for a local retailer, and get married a year after high school. Always with the specter of seizure possibilities in the background, Rebecca led a very normal life.

Marriage brought the possibility of children, and Phenobarbital is a Category D drug, meaning that it is known to cause harm to fetuses. A reduced dosage of Dilantin© was initiated. Absence frequency increased slightly, but nothing significant was experienced. Fertility problems arose, however, and repeated efforts to conceive were met with failure. According to the Epilepsy Foundation, women with Epilepsy have fewer children than women in general, with a fertility rate 25 to 33 percent lower than average. Research has indicated that women with Epilepsy have a higher incidence of menstrual irregularities, polycystic ovarian disease and reproductive endocrine disorders. Any of these may reduce fertility. Rebecca’s gynecologist advised forgetting about having children, as the chances for pregnancy, in his opinion, were almost nil. A fertility clinic he suggested, however, was successful using artificial insemination with the husband’s sperm, and along with the beautiful baby girl, Rebecca received an addition benefit- almost six years without any seizures. She even obtained a driver’s license.

Five years later, she conceived again, this time conventionally, and the decision was made to wean her off meds completely for the duration of the
pregnancy, and hopefully beyond. Things went well until the beginning of the
third trimester, when she experienced her second tonic-clonic seizure while
napping one afternoon. After a short stay in the hospital for monitoring, meds
were restarted, and the pregnancy was incident free, although occasional
absences were again endured up to, and after, the birth of a healthy baby boy.

Rebecca’s long-time neurologist retired and her new doctor recommended
a switch to Depakene®, hopefully as a monotherapy. Depakene® (valproic acid)
was known to be quite useful for a variety of seizure types, and side effects at
low doses were not too likely. Again, Rebecca was fortunate to have several
nearly seizure-free years, with only an occasional, and very brief, absence
seizure. Progressively, over those years, however, the dosage had to be increased
periodically until side effects began to be experienced. These included weight
gain, tremor, and hair loss. In 1994, she again had to be referred to a new doctor,
and again it was due to retirement. The new neurologist immediately decided to
get her off Depakene® and begin Lamictal®, a new and very popular drug with
few side effects and efficacy with multiple seizure types. Almost immediately
following the switch, Rebecca began to encounter very strange nocturnal
episodes, where she would awake with a start, jump up and move around the
room, trying to catch her breath. A lump in the throat accompanied these
episodes and they were routinely followed by the need to urinate and profuse
sweating and trembling. These episodes increased in frequency and severity, and
Rebecca became quite depressed. Sleep quality suffered, as did quantity. She was more and more anxious and depressed, and the episodes began occurring even while taking afternoon naps. When she began having thoughts of suicide, it was determined by the new doctor that she should remain on Lamictal© and even increase the dosage. Rebecca decided to find a new doctor.

Her fourth neurologist quickly decided that a return to Depakote©, a new form of valproic acid, was the answer, and diagnosed the sleep episodes as complex partial seizures, with the possibility of Sleep Apnea as a trigger. The return to valproic acid stopped any absence seizures she may have been having, but did nothing for the nighttime episodes. The dosage was increased on several occasions, and the side effects returned and worsened. The episodes continued and a sleep study was ordered. It showed restless sleep with only an unconfirmed possibility of Apnea. The weight gain was becoming more pronounced, and her tremor was growing more and more noticeable, to the point of her feeling public embarrassment. Inderal© was added to her meds to counteract the tremor. In 1998 Rebecca was diagnosed with Type 2 Diabetes, and told by her family physician to lose weight. She dieted, but found only minimal success.

Throughout the ensuing years, the episodes continued and worsened, with the appearance of hallucinations to accompany the other nocturnal
symptoms. Occasionally, Complex Partial seizures were experienced during waking hours, usually during periods of relaxation. These were accompanied by strange automatisms and frequently loss of bladder control. She also began having some peculiar Simple Partial seizures. Needless to say, these effects made Rebecca very apprehensive about doing anything in a social setting. There were no absence or tonic-clonic seizures, but they would have been much preferred to the “complex partials” she was having on an almost nightly basis.

Zonegran®, a newly approved AED with success in Japan, was added as an adjunctive therapy. The dosages of both Inderal® and Depakote® were increased, yet the episodes worsened in frequency, duration, number, and intensity. Nocturnal hallucinations were now commonplace, with and without the episodes. Finally, in May of 2004, the decision was made to wean Rebecca off Depakote®, and to replace it with Topamax®, another fairly new AED with potent, but different side effects, the most pronounced of which was weight LOSS. Cognitive function impairment was the other, and although temporary, it was indeed perceptible. For a few weeks following each dosage increase, even basic arithmetic was a challenge, and finding the right words to complete sentences was difficult. Rebecca’s Depakote® dosage had been at such a level that the weaning process was set to take eight months.
Zonegran© was discontinued, with the feeling being that it was not contributing anything positive to her condition. The weaning process was not lacking for surprises. As the Depakote© dosage was decreased, the tremor that had socially isolated Rebecca began to disappear. By September, she was allowed to stop taking Inderal©, and almost immediately the hallucinations ceased. (It was later determined that they had, in fact, been a side effect of the Inderal©, a known possibility for the drug.) And the excess weight she had struggled so intensely with began to slowly melt away. Along with the weight loss, the diabetes was now able to be controlled without meds. By December, Depakote© was finally a thing of the past, and Topamax© was being used as a monotherapy. The nocturnal episodes were not quite as frequent, but they did not completely go away. The now-puzzled neurologist suggested that Rebecca consult someone with more Epilepsy expertise, and started her on Gabatril©, another newer AED with a somewhat unique antiepileptic mechanism, as an adjunctive therapy. When, after a few months, the episodes failed to respond and the third and fourth tonic-clonic seizures of her life occurred in a two week span, he recommended an epileptologist at the Medical University of Ohio in Toledo.

Her first visit to the new doctor brought her to the subject of this study, when she was informed that she would be undergoing inpatient video EEG monitoring, and that she should consider the possibility of Vagus Nerve Stimulation Therapy. She was given a promotional package, with pamphlets and
a video to describe the new procedure that the doctor described as a viable alternative to her current path. While awaiting the hospital admission for EEG monitoring, Rebecca spent much of her time on a month-long search for unbiased information on VNS Therapy from which she could form a good decision. That was the actual formal starting point of this study. She found virtually nothing from a patient’s perspective, other than the one previously mentioned website.

Rebecca’s Decision

On June 12, 2005, Rebecca was admitted at the Medical University of Ohio’s Hospital into their Neurology ward, where she was wired to an EEG for 24 hour per day video surveillance. Her meds were eliminated, and she was told she would be in the room for three to five days, depending on how many seizures she experienced. The first day passed slowly, with only an occasional brief “complex partial” episode. On the afternoon of day two, a Code Blue was sounded for a patient down the hall, and Rebecca found herself in the midst of a prolonged episode. When it had finally subsided, she was sure that the doctor would have the valuable information he needed to make a solid diagnosis. The nurse was told to notify him of what had transpired. He would surely be able to tell exactly where in her brain the electrical “shorts” were occurring and be able to properly medicate her or possibly surgically alleviate the condition.
The following morning the epileptologist confirmed that he had indeed found seizure activity on the EEG. But what she had assumed to be a complex partial seizure was in fact not a seizure at all. It was instead most assuredly a panic attack. He said he had suspected this and now had confirmation that all her nocturnal “episodes” were not seizures but panic attacks that were the result of an anxiety disorder. The seizure activity he had seen on the recording was most likely manifested as brief absence seizures while she was still asleep. He assured her that anxiety and depression disorders were quite common for Epilepsy patients and asked for a psychiatric consult while she was still an inpatient. After conferring and being reassured by a psychiatrist that the epileptologist was correct in his diagnosis, Rebecca was started on a small dose of Valium© at bedtime to combat the anxiety, and allowed to go home with a new adjunctive medication, Keppra©, to go along with the Topamax©. Keppra© was another newer AED with success in treating absence and focal seizures. She was also again encouraged to consider VNS Therapy as a possible add-on, as the number of appropriate remaining AED’s was quite limited. It became evident over time that VNS Therapy was a very well-marketed product. However, Rebecca found it difficult to obtain unbiased information.

Like many people with intractable epilepsy, Rebecca was desperately keen to rid herself of her seizures, and felt as if she would virtually try anything if it offered the hope of a cure. The emotional and physical pain of someone in this
situation should not be underestimated – they are very vulnerable. Some, clasping at straws for a solution, seem to undergo the risks of surgery associated with VNS Therapy without sufficient research and examination of the risks and possible benefits. Rebecca was not in this situation. She began researching the topic and contacting VNS patients whose email addresses she got from the aforementioned website. The responses she received only served to cloud her decision more. The first, from a 29 year old female, was indeed encouraging:

“I would be glad to help you in anyway that I could. Let me give you a little bit of me.... Well........First off I have been seizure free for over 6 months. I have had Epilepsy since I was 10 years old (I am now 29). It has definitely been a struggle. My seizures have evolved over time from the violent jerks to the left, to "sleepwalking", to falling through plate glass coffee tables, drywall, splitting my head open on the piano, falling in an empty bathtub, to now where my chosen profession involves knives and fire; I am a Le Cordon Bleu Certified Chef. That went over well with the doctors (sarcasm). I have been on basically every med on the market but found a combination that works for me. I take 700 mg Dilantin capsules (I have been on every form of dilantin there is), 1500mg Trileptal capsules, and 650mg of Zonegran, Doctors have actually asked me how I function on this medication without walking around like a zombie 24/7. Anyway the VNS is what has done the real difference. I am actually on my second one, as the first was outdated and the battery dead so they put in a new one last August. The one that I have now is so much better than the original. I can tell when it is working and when I could/should swipe the magnet over the VNS but I don't. I don't really say this enough but it has changed my life for the better. I don't regret my decision one bit and I tell everyone who wants my opinion that:

a.) My opinion ultimately doesn't mean squat; it’s you who will be the deciding factor.

b.) Do the research. its out there places like www.cyberonics.com are great.

c.) Talk to your doctor, make sure this is the right course of action because it is a fairly new procedure
d.) Pray for guidance because it is your choice but like I said earlier I DON’T regret it one bit and hopefully neither will you.”

The next response was not quite so flattering. It came from a 43 year-old male:

“I would be glad to help you in any way that I can. The VNS did not control my seizures as I had hoped. I still have uncontrolled seizures even after having Brain Surgery after having the VNS. I think that the VNS has lessened the severity of the seizures and may have even stopped some of them. But I would recommend it to anyone thinking about having it done. If meds are not doing anything for your seizures the only other course besides the VNS is brain surgery and that doesn’t always work. And you must have the seizures coming from your Right or Left Temporal Lobe to even be a candidate for surgery. We have one member of our support group who had to have surgery twice because the first time they didn’t get the right spot where the seizures were coming from and she still has seizures. So any thing that the general public can find out about Epilepsy is only a help to those of us who have it and our families. Sorry for being so long winded but as you well know if you don’t have it or are not with someone who does it is hard to explain. Good luck and stay in touch.”

Others only added to the mixed message:

“I've had my VNS for 10 months and there has been very little change since I got my VNS implanted. I am a 38 yr old woman who has had Epilepsy since she was 2 years old. Since I've gotten the VNS I've gotten stitches once and staples twice in my head. There has been no great improvement. I had 40 or more seizure last month alone. I don't go down as much in seizures, though.”

“My seizure activity has gone from about 50 seizures a month to almost none.( my last seizure breakthrough was the first of June) The device is aborting the seizures within the timing set. I also believe that the more seizures that are aborted, the fewer seizures I have. Meaning, my brain is at ease and not as active as it was. I am a cartoonist/artist/puzzle maker and publish my own books. As far as I am concerned, this VNS is the greatest thing since ice cream. Yes, I also call it a "MIRACLE", at least it has been for me.”
“I think this is promising treatment and I say this guardingly after living roller-coaster hopes and despairs from 12 years of severe and uncontrolled seizures.”

Rebecca found herself in quite a quandary as her follow-up visit approached. She was no closer to a decision than before. Some patients indicated that their epilepsy had been misdiagnosed, and that they had experimented with various medications (some of which caused serious negative side-effects). Rebecca had read and researched all she could find on VNS Therapy, but still had reservations about such a “coin-toss” proposition. VNS Therapy was not a cure, and it was not a permanent solution. Rebecca hoped the doctor could help her. The only tangible benefit she seemed to be getting from her current meds was weight loss, and although she was more than pleased with the 70 pounds she had lost, her seizures were no closer to control. She had experienced yet another tonic-clonic seizure, and the absences were occurring much more regularly. The doctor concurred that Keppra© was doing little, if anything, to help her. He had given her situation much thought, he said, and wanted her to try Zonegran© again as a complement to Topamax©. Her records from the previous neurologist suggested to him that maybe Zonegran© had been doing a better job than was thought, since Rebecca had been treated in error for complex partial seizures that were in actuality panic attacks. This, the epileptologist told her, would buy her more time to ponder VNS Therapy, and he felt there was a good chance it might actually work. Zonegran© also had the propensity toward
weight loss, and along with Topamax© could possibly cause kidney stones, so he cautioned her to drink large amounts of water.

For the next several months, Rebecca enjoyed a life with fewer and fewer seizures, as Zonegran© proved to be a very effective addition to the Topamax©. Complex partial and tonic-clonic seizures had stopped. Absence seizures decreased from 15 in June, to 8 in August, to only 3 in October. In early December 2005, Rebecca had her last absence seizure, and for a three month period was seizure free. The only downfall proved to be additional hair loss, so much so that the dose of Topamax© was decreased slightly. It appeared that the VNS Therapy decision might be a moot point as it appeared she had finally found the right meds in the right quantities. In March 2006, an additional advantage was incurred when a generic equivalent was made available for Zonegran©, a thirty dollar a month savings in insurance co-pay. Rebecca had begun to see the psychiatrist and a psychotherapist regularly to conquer her anxiety disorder and depression, and everything seemed to be coming to a happy ending.

On March 21, an overtired Rebecca experienced two unusually hard absence seizures. As fatigue had always been one of her seizure triggers, she dismissed the seizures as an aberration. However, over the next couple weeks she had several more, and during the night of April 7, she had a very rough and
prolonged tonic-clonic. A call to the epileptologist the following day resulted in a Zonegran© dosage increase. But the absences continued and another tonic-clonic was suffered on April 12. Again, thoughts turned to VNS Therapy as a possibility, but the subsequent April 14 office visit brought new questions as the epileptologist discussed various options, including VNS Therapy, medications and possible drug trial participation. During this discussion, the doctor mentioned that a new generic equivalent had been released for Zonegran© but that Rebecca should not take it, as generic AED’s were known to work differently than their brand name counterparts, even though the active ingredients were exactly the same. When Rebecca informed him that she had already started taking the generic version, he asked when this had happened.

It became quite clear that the timing of the break-through seizures coincided perfectly with the commencement of the generic drug. Rebecca left with renewed hope, and a return to the brand name drug quickly reduced the absences and no additional tonic-clonics have occurred. The new plan is to continue the anti-anxiety strategies with the psychiatrist and psychotherapist, and later in the summer to replace Topamax© with either Lyrica© (another newly approved AED) or one of two other AED’s that await FDA approval. VNS Therapy remains an option, but for now the decision is being delayed.
As noted, Rebecca’s VNS Therapy decision-making process is still ongoing. Her general mental health continues to improve, with panic and anxiety events diminishing in number, severity and frequency. Only three absence seizures have been experienced in the past few weeks, with no additional tonic-clonics. She remains optimistic that medications alone can control her Epilepsy but does not rule out VNS Therapy if they don’t.
CHAPTER FIVE: CONCLUSION

As a follow up to this study, it is helpful to review some key findings. Clearly, Rebecca’s case is not uncommon within the community of those with Epilepsy. Clearly, the disease is one with little public understanding or awareness, and therefore its victims are routinely stigmatized and discriminated against. The World Health Organization reports that a fundamental part of ridding the world of this stigma is to raise public and professional awareness (WHO 2001). The effectiveness of available treatments continues to be improved, and novel new non-pharmaceutical approaches are being developed. VNS Therapy is one such treatment, and its efficacy is proven, as is its long-term benefit to some patients.

What factors, then, are particularly important to individuals making a decision about whether to have VNS Therapy and how can their concerns be resolved in a fair and unbiased fashion? This is the key question this study has sought to answer. The major implications drawn from Rebecca’s experience are clear:

- The makers of VNS devices have done an effective job of promoting their product. Yet little unbiased material is available from the patient’s perspective.
• Those with intractable Epilepsy are willing to try almost anything to rid themselves of the three-phased Epilepsy challenge. This can potentially lead to regrettable decisions.

• Seizure disorders are easily misdiagnosed, and the administration of medications is far from an exact science, with side effects being at times worse than the disease.

• Like medication, VNS Therapy should never be considered as a permanent solution. Nor should it be viewed as a cure, or miracle.

People with perceptible needs are often offered potential remedies and are faced with making decisions that will impact their lives. Many times those decisions are made more difficult by the lack of good data from which to base the decisions. Obviously, in our capitalist economy manufacturers and marketers are anxious to sell as many of their products as they can, and their advertising material is slanted to that end. Countless goods and services are purchased needlessly. VNS Therapy, however, is not something that should qualify as an impulse buy. The potential repercussions of having an electronic device surgically implanted in one’s chest with wires tied to nerves that connect to the brain are daunting. No one can predict the long-term consequences or the
potential for long-term success. Removing the leads has been shown to be risky, as has been the implant procedure and the device itself. These risks include infection, vocal chord paralysis, and wire erosion through skin (NYU, 2005). Yet, as with other surgical procedures, the rewards can far outweigh the risks and both should be considered when making the final decision.

Implications of the study’s methodology are also quite clear. Rebecca’s struggle with Epilepsy demonstrates the peculiarity of the disease. While Epilepsy can be characterized and categorized, and seizures themselves also have a certain recognizable taxonomy, the disease affects no two people exactly the same. It is the taxonomy of the disease that strongly supports the need for more efficacious treatment options. That taxonomy also intimates that Rebecca’s case is typical of many of those with the medically refractory forms of Epilepsy. Certainly there is nothing to suggest that Rebecca’s journey with Epilepsy is unique or exclusive of the struggles of others.

Further research is needed on intractable Epilepsy, especially from the viewpoint of the patient. The propensity of those with Epilepsy toward anxiety and depression is also an area in need of further study. The VNS device, and other similar devices still in the experimental stage, should be further studied, both for long-term efficacy, and for emotional and mental health considerations.
In conclusion, there are several key points that this study highlights:

- The device is designed to be used along with medications, not in place of them.

- Nobody should expect the device to totally eliminate his or her seizures.

- The VNS may reduce seizures although there are a fairly hefty percentage of people who experience no reduction in the number of seizures that they have after the device has been implanted. (As a matter of fact, the number of seizures has actually increased in a few cases!)

- Medications can be changed and adjusted quite easily. The VNS device cannot.

- Those with Intractable Epilepsy face disappointment and frustration constantly. VNS could only add to that disappointment.

Is VNS Therapy right for Rebecca, or for the thousands of other people with intractable Epilepsy? There is no “correct” pre-procedure answer to this question.

Only after careful consideration can the best decision be made by each individual, since Epilepsy is such an individualized disease. Those with Intractable Epilepsy face disillusionment and relentless emotional turmoil. Implanting a VNS device that ultimately does little or nothing to help the disorder could only add to that distress. Yet, armed with the facts and knowing the odds, VNS Therapy could be a person’s best opportunity to experience
normalcy. Doctors should not advocate VNS Therapy unless traditional methods of treatment are completely exhausted, regardless of any clinical sponsorship that Cyberonics® might be engaged in. Finally, the only psychologically sound outlook that a prospective patient can adopt for him/herself is a decision based ultimately on knowledge, not despair.
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