

Vagal nerve stimulation was originally shown in the 1960's to have an effect on EEG activity in laboratory animals. In 1990 the first study of vagal nerve stimulation was published on 16 patients with refractory epilepsy who were older than the age of 10 years.

### **How does vagal nerve stimulation work?**

It is poorly understood how vagal nerve stimulation reduces seizure activity. There are several theories but the precise mechanism is not understood. The procedure involves placement of a battery generator under the skin on the left side of the chest and a lead connects the generator to the vagus nerve in the neck where a small connection is wrapped around the nerve.

Neurosurgeons, vascular surgeons, and otolaryngologists may implant vagal nerve stimulators. The generator is programmed by a laptop computer and attached to a wand. Stimulation parameters vary. Low stimulation parameters are used with the stimulator being on for 30 seconds and off for five minutes. However, it can be programmed to be on for 30 seconds and off for three minutes or on for seven seconds and off for 20 seconds (rapid cycling). In general, neurologists tend to program the stimulator 30 seconds on and three to five minutes off and change to rapid cycle, that is seven seconds on and 20 seconds off, if there has been no benefit after one year. The intensity of the stimulation is gradually increased to a level that improves seizure control without side effects.

The vagal nerve stimulator has been shown to shorten a seizure. A magnet that is worn by a patient on a belt or wrist may be swiped over the generator during a seizure and releases a preset magnet current. Half of patients notice that the magnet shortens or stops a seizure.

The present generator model has an eight to 12 year life span. The life of a generator will vary according to the cycle and the magnet induced current.

### **Patient Selection**

Vagal nerve stimulation has been approved in the United States and Canada as adjunctive therapy for seizures that do not respond to medical treatment particularly partial seizures. Half of patients experience a 50% reduction in seizure frequency. There are very few patients whose seizures stop with vagal nerve stimulation.

Vagal Nerve stimulation is generally considered after a patient has failed to respond to appropriate antiepileptic drugs. In patients who have seizures where epilepsy surgery has a strong likelihood of improving seizure control, epilepsy surgery would be preferable to vagal nerve stimulation, which is a more palliative type of treatment.

### **Side Effects of Vagal Nerve Stimulation**

As vagal nerve stimulation is a foreign device placed in the body there is a risk of the device becoming infected. Infections may be serious and require removal of the device. There are also risks associated with having an anesthetic and with bleeding, particularly if the patient is on medications that may alter their bleeding tendencies such as valporic acid.

Hoarseness or voice alteration, congestion, vomiting, and nausea have been reported in patients. There is a remote risk of damaging the vagus nerve or the blood vessels in the neck close to the vagus nerve at the time of implantation of the stimulator.

### **Vagal Nerve Stimulation and MRI**

It is believed that when the vagal nerve stimulator and vagus nerve are heated it may cause injury to tissues of the body if exposed to magnetic resonance imaging (MRI). It is recommended that MRI head scans be performed using a closed head coil system. It is very important that the radiologist who performs the MRI be aware that the patient has a stimulator and tries to reduce any potential risk of injury.

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