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VAGUS NERVE STIMULATOR IMPLANTATION IN BAGHDAD, OUTCOMES OF TWO YEARS FOLLOW UP

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Abstract

Background: Vagus nerve stimulation (VNS Therapy) works by stimulating the brain with small, regular electrical pulses in an effort to decrease the number and intensity of seizures. These pulses are supplied by a pulse generator.

Aim of study: The current study is a prospective investigation of the efficacy of vagal nerve stimulation (VNS) as a treatment for refractory epilepsy, following the results of patients treated with VNS over a two-year period.

Methods Patients: In this study, we follow 73 patients for 1 year (52 men and 21 women) and 29 patients for 2 years (17 men and 12 women). The patients, aged 2-58 years, had pharmacoresistant epilepsy. The results are 73 patients at 1-year Sixty-six percent of the 73 patients had reduced seizure frequency over the follow-up period. Of these 25 patients (34%), 23 patients (32%) had responses ranging from poor to medium, with a response rate of more than 50%. In 24 patients (33%), the seizure frequency did not change, while in 1 patient (1%), it increased. After two years, of the 29 patients, 29 (or 69% of the total) had fewer seizures at the time of follow-up. Also in 11 patients (38%) of the total, the reductions were <50% in the seizure frequency. In 9 patients (31%) of the total, the response was of poor to medium quality (>50%). In 9 patients (31%) of the total, no change in seizure frequency was recorded. No changes in seizure types were recorded.

Conclusion: The results of this prospective study demonstrated that the effectiveness of VNS treatment increased over time. It is important for physicians to be aware that some patients may require more time to respond favorably to VNS therapy.

Keywords: Epilepsy, Pharmacoresistant, Vagus nerve stimulation [VN], implantation.

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Introduction

Definition of epilepsy

seizure – a temporary biological breakdown of the brain. It is caused by a short circuit of pathological, hypersynchronous electrical activity in cortical neurones. [1]

Epilepsy is a seizure disorder. Seizures are temporary disturbances in brain activity. Most often, epilepsy is characterised by seizures; however, not all seizures are signs of epilepsy. In cases such as hyponatraemia, drug intoxication, or encephalitis, the seizures may be self-limited, in that they are seen only during the acute phase of the illness and subsequently stop spontaneously. Sometimes, spontaneous seizures could happen without any obvious reason. This form of seizure is not a type of epilepsy. [2]

Table (1) Predictors of Intractability[13]

Table (1) Predictors of Intractability ^[13]
Very young at onset (<2 years)
Frequent generalized seizures
Failure to achieve control readily
Evidence of brain damage
A specific cause of the seizures
Severe EEG abnormality
Low IQ
Atonic atypical absence seizures

Vagus Nerve Stimulation (VNS)

Non-drug treatment of medically refractory partial seizures with vagus nerve stimulation. Vagus nerve stimulation is a palliative procedure, similar to corpus callosotomy, because of the low success rate in terms of seizure independence.

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Vagus nerve stimulation entails the placement of a stimulating lead on the left vagus nerve. The stimulation generator is placed in the upper left chest. The device's stimulus parameters can be tailored to the individual patient, although the default is an electrical pulse every 5 minutes, lasting 30 seconds. As for individuals who have suffered from epilepsy, the implantable Neurocybernetic Prosthesis (NCP) from Cyberonics, Inc. (Houston, Tex) has been a proven treatment for those with medically resistant seizures since its 1997 Food and Drug Administration (FDA) approval.

The implantable Neurocybernetic Prosthesis (NCP) from Cyberonics, Inc. (Houston, Tex) has been a proven treatment for individuals with medically resistant seizures since its 1997 Food and Drug Administration (FDA) approval. More than 46,000 NCP devices have been implanted worldwide to treat epilepsy. Aura is a magnetic wand that can be used for on-demand vagus nerve stimulation that may prevent seizure progression. Generators have evolved far beyond the original model 100, with each model being smaller and easier to implant and program. [22]

1. The History

The earliest recorded use of VNS as an experimental therapy for epilepsy occurred in the 1880s. Bailey and Bremner (1938) revealed that the activity of the orbital cortex was out of sync. The experiment was done using a model comprising a cat and VNS. Radna and MacLean (1980) reported that VNS produced changes in single-unit activity of the basal limbic regions in squirrel monkeys. Based on these results, Zabara (1985) postulated that if VNS could depolarise electroencephalographic activity, it may be beneficial in attenuating epileptic episodes. Intermittent VNS suppressed or abolished chemically generated interictal epileptic episodes in the feline frontal cortex, as shown by Zanchetti et al. Subsequent animal research performed by Zabara and colleagues confirmed In 1987, Cyberonics Inc. was founded in Houston, Texas, to develop

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VNS therapy for human usage based on the Zabara concept and subsequent approval of human clinical trials. The first epileptic patient treated with a vagus nerve stimulator was seizure-free in 1988. [23] The topic of Cyberonics, Inc. established a long-term outcome registry to gather data from patients treated with VNS therapy. The treatment's safety and efficacy were assessed in five acute-phase clinical trials, and the FDA approved the drug "for use as an adjunctive therapy in reducing the frequency of seizures in adults and adolescents 12 years of age and older with partial-onset seizures that are refractory to antiepileptic medications." The registry was in business from November 1997 to April 2003. Physicians volunteered to join and give data at their choice. Unfortunately not all people under treatment at throughout the ages

scattered. spaced. [23] The [24] The Research indicates that the efficacy of VNS in responders grows gradually during the first three to twelve months of stimulation. Since then, numerous studies have demonstrated the effectiveness, durability, and cost-efficiency of VNS treatment for epilepsy. VNS is used off-label for the treatment of generalised epilepsy in children under 12 years old and for refractory partial-onset seizures when other surgical procedures are insufficient to control seizure activity. [23]

2.Approval and endorsement

In 1997, a vagus nerve stimulator (VNS) was submitted for clearance to the US Food and Drug Administration's neurological devices panel. At the FDA meeting, officials from Cyberonics did not provide an explanation for the way the device reduced or avoided seizures. However, they did provide 3 studies, E03, E04, and E05, which demonstrated the safety and efficacy of the device. The device is designed to help individuals with partial-onset epilepsy who do not respond to pharmacological treatment, said its maker, Cyberonics. [23] The magazine

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3. Other uses

A lot of study is going on to see if the vagus nerve may be used to treat anything from resistant depression and anxiety disorders to migraines, Alzheimers and other parts of the brain and its activities. Chronic intractable hiccups, fibromyalgia, obesity, tinnitus, alcoholism, atrial fibrillation, autism, bulimia nervosa, coronary artery disease, drop attacks, multiple sclerosis, obsessive-compulsive disorder and vegetative states after traumatic brain injury are experienced [23].

4. PATIENT SELECTION

Patients with medication-refractory epilepsy should be assessed at a comprehensive epilepsy centre before considering VNS therapy. The evaluation usually includes visual electroencephalographic monitoring to obtain ictal and interictal data, cognitive testing, functional and anatomic neuroimaging, and a complete history and physical examination. An epileptologist adjusts antiepileptic medication regimens, and surgical surgery is considered only if two or more appropriate pharmacological trials have failed. [23] The VNS is generally indicated for patients uninterested in or unsuitable for more effective resective surgical methods. We lack enough data on VNS therapy's effects on seizure control or which patients will respond well to it to make predictions based on available clinical evidence. If patients are deemed appropriate candidates for the device, they should be counselled on the risks and benefits of vagus nerve stimulation (VNS). If VNS therapy is effective, it can lower the duration, frequency or intensity of seizures and allow reduction in the amount of antiepileptic medicines required to provide appropriate seizure control. You could also explain the already available research on long-term outcomes and seizure control and the probable time it can take to reach the full benefit of the device. Such an approach will lead to better compliance and more fair expectations. [23] The

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5.NEUROCYBERNETIC PROSTHESIS

The neurocybernetic prosthesis consists of an implanted generator and an electrode stimulating nerve cells. The generator includes a titanium module that contains a lithium battery, as well as an epoxy resin header with the connection pin or pins for the electrode. The generator comes with a hex torque wrench for tightening the set screw or screws that hold the electrode to the connector pin receptacle. The generator is configured with an antenna for receiving radiofrequency signals. The electrical output of the pulse generator is regulated by sending signals from a programmable telemetry wand to a CPU. [23] The generator produces a charge-balanced waveform and has five programmable parameters: output current, signal frequency, pulse width, signal-on time and signal-off time. Increasing the stimulation frequencies and extending the signal-on times shorten the battery life. The NCP electrode is insulated with silicone elastomer so that it can be safely implanted in latex allergy patients. One end of the lead has an electrode array of three independent helical coils around the vagal nerve, while the other end has a connector pin or pins that slide directly into the generator. The positive and negative electrodes are located in the intermediate and distal coils, respectively. The most proximal coil is used as a tether to keep the device in place and to prevent the electrodes from being over-stressed when the patient turns his/her neck. Each helix of an electrode has three loops. A platinum coil is placed into the middle turn and is welded to the lead wire. The suture tails at the ends of the helix allow the coils to be handled with care without damage to the platinum connectors. [23] The electrode has a silicone collar that can be used to attach it to the soft tissue of the neck near the helical coils. The electrode portion from the collar to the inferior helix forms a "strain release loop", which is an additional safeguard to prevent undue compression of the vagus, which is an additional safeguard to prevent undue compression of the vagal nerve. The NCP magnet is a portable magnet that can be used for many different things. When positioned over the generator on the chest wall, it provides stimulation that

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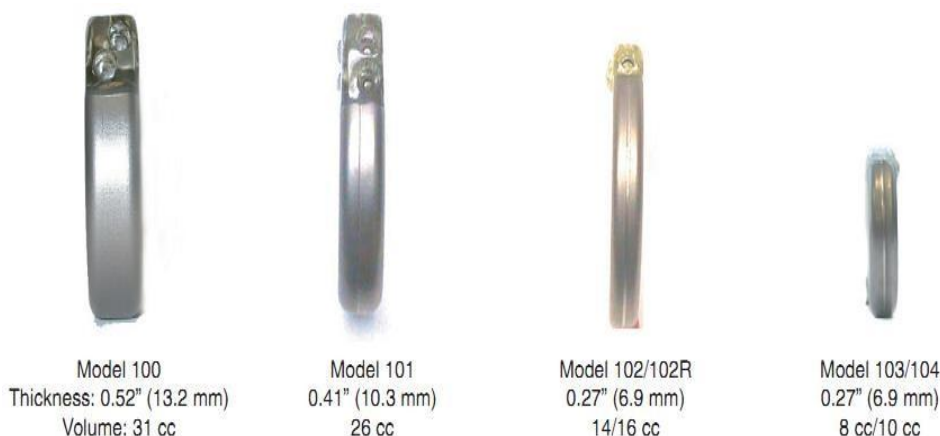
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is additive to the baseline output. This demand stimulation can be delivered by the patient or carer at the onset of an aura and may decrease or even prevent a seizure from occurring. In addition, the patient can turn off the system by holding the magnet over the generator site if the NCP is not operating well or they just wish to turn off stimulation. [62] The first programming hardware was a programming wand connected to a laptop computer. The laptop has been replaced by a PDA and a similar programming tool. During implantation in the operating room, we normally turn the generator on at a low level of stimulation. The device is gradually increased over weeks to reach the appropriate stimulation parameters. This adjustment can be made, and further adjustments can be implemented as needed every few months. Earlier generators and diagnostic instruments made it difficult to gauge the remaining service life of the battery. In VNS therapy, if the generator is replaced before battery depletion, the stimulation parameters can be preserved without interruption. When the battery dies, you have to replace the generator. This implies that you have to begin by setting the stimulation settings at the lowest possible level and progressively boost them, exactly as if the VNS were just implanted. The new PDA programme allows us to forecast the remaining life of the battery. This enhances the generator replacement planning prior to the battery end of service. [23]



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Figure 2. Side views of vagal nerve stimulation devices, demonstrating a steady reduction in size from the original model 100 generator in 1994 to the current model 103/104 generator (2007). [24]

Fig. The two generators, model 103 on the left and model 102 on the right, illustrate the relative decrease in size. [23] The

6. ANATOMIC CONSIDERATIONS

The vagus nerve is the tenth cranial nerve and provides efferent and afferent fibres to the medulla. Afferent vagal fibres provide signals to the solitary tract nucleus, which sends them to other areas of the brain. There are many hypothesised mechanisms for the effects of vagal nerve stimulation on mood and seizure control. These include changes in the release of norepinephrine through projections of the solitary tract to the locus coeruleus, increased levels of inhibitory GABA associated with vagal stimulation and inhibition of aberrant cortical activity through the reticular activation system. How exactly these systems work is hardly known.

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Efferent projections to the larynx and parasympathetic projections to the heart, lungs and gastrointestinal system exist. The vast majority of vagal nerve fibres are general somatic and specific visceral afferents that project to the brain. The VNS electrode is usually placed on the branchless midcervical portion of the vagus nerve. Head and neck A branch of the vagus nerve is the pharynx, carotid sinus, and the cardiac plexus. Studies in dogs have shown that the left vagus nerve innervates the atrioventricular node while the right vagus nerve innervates the sinoatrial node. The NCP electrode is generally placed on the left vagal nerve to prevent bradycardia or asystole from stimulation. [24] No changes in heart rate were detected in a limited group of children with right-sided VNS implants. The patients in this series were put on Holter monitoring after the operation. [24]

7. AVOIDANCE AND MANAGEMENT OF COMPLICATIONS

Nerve injury during surgery The recurrent laryngeal nerve runs with the main trunk of the vagal nerve, bifurcates caudally at the level of the aortic arch and finally ascends in the tracheo-oesophageal groove. In this respect, a change in the quality and character of the voice of the patient during nerve stimulation in the early period after NCP implantation is not rare. Most patients detect a change in their voice within a few weeks of surgery [24]. Operating on the vagus nerve may involve squeezing or cutting other neighbouring nerves. Reports of unilateral paralysis of the left hemidiaphragm have been made during VNS, and the phrenic nerve is deep to the carotid sheath. [24] The hypoglossal and facial nerve fibres are superior to the midcervical trunk, and injury to these fibres has been described following VNS implantation. Sympathetic fibres follow the internal carotid artery from the sympathetic trunk and penetrate deep into the common carotid artery. Horner's syndrome may develop with VNS implantation, and injury to the sympathetic plexus or fibres along the internal carotid is most likely responsible, according to one report. [24]

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Vocal Cord Abnormalities

Issues associated with vagal nerve stimulation include voice alterations (66% of cases), hoarseness (very common), laryngeal muscle spasm (rare), and upper airway occlusion (very unusual). [25] The meta-analysis showed a small percentage (0.7%) of patients with temporary paralysis of the vocal chords. This finding is probably a reduction in the severity of post-implant dysfunction given there was no assessment of the voice cords before and after the treatment. Fortunately, most cases with a therapeutic effect are self-limiting. When a patient appears with hypotonia, we will regularly refer them to ENT to assess the function of their voice cords in anticipation of surgery. VNS therapy will not be provided to patients with vocal cord dysfunction. [25]

Infection

Infection at the site of the generator or lead implant was the most prevalent surgical complication, according to a meta-analysis of 454 participants in five randomised clinical trials. The majority of infections (2.86% overall) responded to antibiotics alone; however, these were not enough. Only 1.1% required the device infection explanation. [25] .Smyth and colleagues discovered that 3.5 % of children experienced a deep infection requiring removal of the device. [25]

Bradycardia /Asystole

Ventricular asystole is an uncommon complication during intraoperative lead testing of VNS electrodiagnostic techniques in adult patients. This complication will happen in about one in eight hundred to one thousand patients. The VNS is turned off, and the asystole is treated with atropine. For some patients who can initially tolerate the lower settings, the VNS settings can be increased progressively to therapeutic levels. [26]

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Sleep-Related Breathing Disorder Repeatedly, individuals with VNS implants have proven that during sleep, their respiratory flow reduces periodically. This seems to be related to an increased vagal tone. VNS has been linked to clinically significant sleep-disordered breathing in both paediatric and adult patient populations. These obstructive occurrences may be relieved by decreasing the frequency or strength of VNS stimulation, having the patient sleep in a nonsupine position, or using positive airway pressure. Most patients treated with VNS suffer an increase in the apnoea hypopnea index (AHI) after treatment. About one-third of the patients acquire moderate obstructive sleep apnoea, and a tiny minority develop severe obstructive sleep apnoea because of the therapy. [27]

If a person has a seizure problem, screening for obstructive sleep apnoea should be done prior to a VNS implant. This is because patients with untreated obstructive sleep apnoea are likely to achieve better seizure control if they receive adequate therapy.

Other complications

Coughing (45%), pharyngitis (35%), throat pain (28%).[28]

Magnetic Resonance Protocol for Patients with Vagus Nerve Stimulation Implants

Recent FDA concerns have caused many clinicians to be reluctant to do MRIs on patients with VNS implants. The patient is informed of the FDA's concerns and consents before having an MRI with VNS. Imaging is performed on a 1.5-T when the device is off. Imaging is limited to the patient's brain. After the scan is completed, the VNS is reprogrammed to the pre-scan settings [30].

Transcutaneous vagus nerve stimulation (t-VNS)

Other companies are working on wearable devices that use transcutaneous stimulation and don't require surgery. These devices are similar to TENS (Transcutaneous Electrical Nerve Stimulation) units for pain alleviation. This

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approach can be used to stimulate the vagus nerve without surgery. The vagus nerve branches out into the skin at the auricle, which is the target of electrical impulses. In particular, VNS attempts have focused on the concha. [30]

Operative Technique

Patients are normally under general anaesthesia for the whole process. Intravenous antibiotics are given to patients as a precaution prior to surgery and for the first 24 hours after it. After the endotracheal intubation, the surgeon has to turn the operating table clockwise 90° from the anaesthesia setup to expose the patient's left neck and chest. The patient is observed for 24 hours for vocal cord dysfunction, dysphagia, respiratory compromise, or seizures secondary to anaesthesia. The patient's head is supported by a horseshoe headrest, and a small roll is tucked in between the shoulder blades. That's a small arching of the neck. Once the preparation is finished, the focus should be on the patient's neck. A 2- to 3-cm horizontal incision is performed in the midline of the sternocleidomastoid (SCM). Sharp dissection through platysma and blunt dissection along the medial margin of the SCM till carotid sheath is reached. Vein retractors are used to retract the soft tissue. The vagal nerve lies deep to the internal jugular vein and lateral to the common carotid artery, and the carotid sheath is opened bluntly at the level of the thyroid cartilage. [24] The vagal nerve is exposed by blunt dissection and freed for a length of approximately 4 cm. Then the nerve is gradually retracted superiorly with a vascular loop. The two lower helices of the electrodes are wrapped around the nerve. The vascular loop gently retracts the nerve inferiorly. The superior helix then encircles the nerve. Dividing the vascular loop at the skin level by gently pulling it in one direction digital compression softly to the vagal nerve and helical electrodes to prevent electrode migration. The electrode is then secured to the mesial border of the SCM with an electrode collar to complete the strain release electrode loop. Between the inferior helix and the collar, there should be approximately 6 cm of electrode space. Then look at the area just above

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the PM on the outside of the chest. Vertically above the PM an incision is made parallel to it, measuring 2–1.5 cm (for models 103 and 104) to 6 cm (for versions 100 to 102). The dissection is performed on the lateral border of the PM through soft tissue. Using a blunt technique, a plane is established between the pectoralis minor and the posterior muscle. Once a pocket of appropriate size has been created between the two muscles to accommodate the generator, a track can be laid from the pocket in the chest wall to the incision in the neck using an NCP tunnelling device. You can tunnel from your chest to your neck or from your neck to your chest. [24] Be careful not to irritate the sensitive tissues of the neck when introducing the tunnelling equipment. The metal shaft of the tunnelling equipment is attached to a bullet tip and surrounds the tunneller in a hollow, transparent sheath. Once the track is made, the bullet tip is removed and the shaft is pulled from the clear sheath. The free end of the electrode is inserted into the sheath, and they are introduced into the incision formed in the neck and pulled to the incision made in the chest wall. Then the sheath is removed from the electrode. The next step is to mount the generator in the field and lock it to the electrode using the torque wrench, set screw or screws. Then place the generator in the pocket in the interior of the chest, keeping the electrode close to it at all times. An anchoring stitch may be placed through the pectoralis and generator header to anchor the generator to the chest wall. [24] The platysma is surrounded by anatomical layers, then by subcutaneous structures, pectoralis fascia, and the soft tissues of the neck and chest. Then cover the surgical field with a sterile drape and insert the programming wand. The neurologist will perform electrodiagnostic studies using the PDA. The programme keeps the draped wand above the generator throughout this entire process. The anaesthesia team is pre-advised of the lead test that is part of the electrodiagnostic procedure and instructed to closely monitor the patient's vital signs during the test. Atropine is rarely indicated for severe bradycardia or asystole.

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was found during the lead inspection. If the diagnostic tests are abnormal, the surgeon will reopen the neck and chest incisions to verify the electrode placement and ensure the generator is in contact with them. We run the diagnostics over and over until we obtain the results we like. The neurologist then programmes the NCP with the first stimulating parameters using a PDA. The derma bond is used to close the incisions on the chest wall and neck. [24]

The monopolar electrode for vagal nerve stimulation (Fig. 3) [24]



Fig. 4 shows the programming wand for vagal nerve stimulation, along with the programming computer, which is of the personal digital assistant type. [24]

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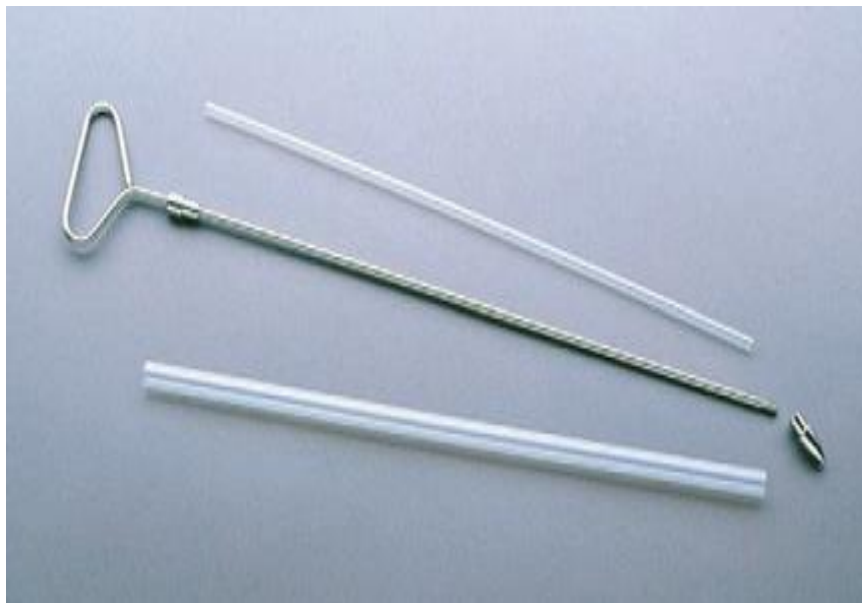


Fig. 5 Disassembled vagal nerve stimulation tunneling device, with the screw on the bullet head and clear electrode sheaths. [24]

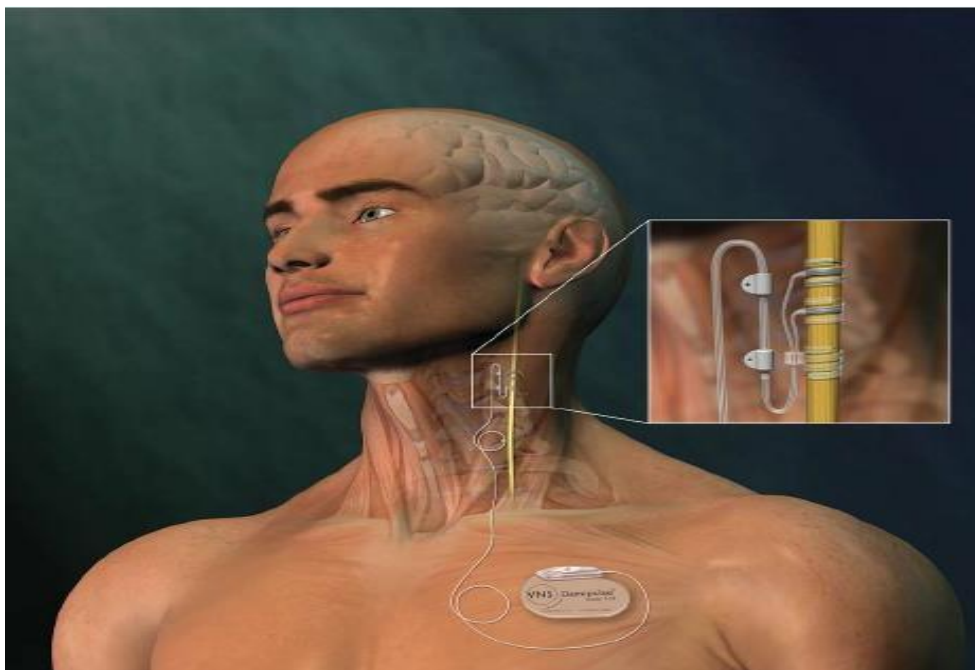


Fig. 6 VNS surgical diagram. [24]

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Patients and methods

The prospective trial of vagus nerve stimulation (VNS) for the treatment of epilepsy was initiated on January 6, 2013, and completed on January 2, 2017. Seventy-nine individuals with medically resistant epilepsy participated in the trial; 6 were excluded early owing to reasons such as device removal or inability to contact. Patients were recruited from 2 hospitals in Iraq: 1-Gazzi al-Hariry in the medical city and 2-Neurosurgical Teaching Hospital, Baghdad. All patients were referred by a neurology specialist who had previously established that their epilepsy was medically refractory and vagal nerve stimulator implantation would be an appropriate therapy choice. All 73 patients (52 males and 21 females) were followed up for 1 year. 29 patients (17 males and 12 females) were followed up for 2 years (the interval between the insertion and research data collection). The results were classified and analyzed according to the degree of response to vagal nerve stimulation, and each patient was carefully investigated. The age of the patients ranged from 2 to 58 years. All the patients were closely observed in the hospital after surgery to ensure a positive outcome. After release, patients were contacted by telephone or kept in touch with the outpatient clinic. All patients were also instructed to attend the neurology outpatient clinic frequently for neurological follow-up.

Regarding responsiveness

Those whose seizure frequency remained unchanged or decreased less than 20% were considered to have no reaction, and those whose seizure frequency decreased from 20% to 50% were considered to have a medium response. The reaction was thereafter further classified into favorable responders and non-responders.

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Statistical data analysis

The patients' data were collected in a data sheet (Microsoft Excel 2016), and the data were presented in tables, figures, or paragraphs after descriptive and analytic statistics were done using proper statistical configuration.

Results

This prospective study documented outcome of patients receiving vagus nerve stimulation (VNS) therapy for pharmacoresistant epilepsy.

Medical charts of 73 patients implanted with VNS were reviewed for changes in seizure frequency for 1 year and 29 patients of them had complete 2 years of VNS therapy.

3.1. GENDER: -

73 patients, 52 (71%) males and 21 (29%) females

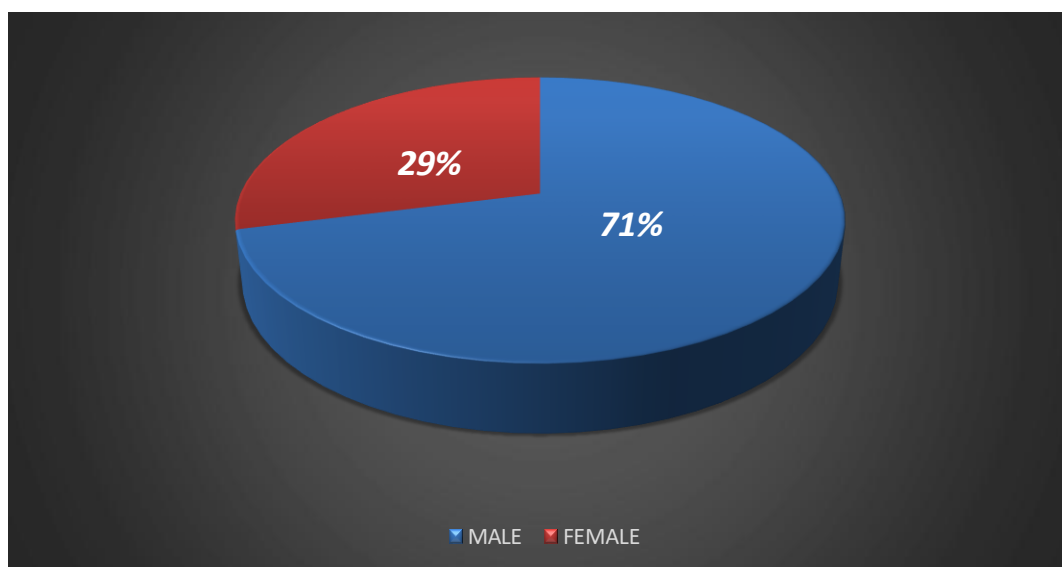


Fig.7 Pie chart for gender distribution in this study

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3.2. AGE: -

Age range was from 2 years to 58 years.

Table 2. showing age distribution of 73 VNS patient

Age group	Male	female	Total
<10 year	17	12	29
10 – 30 year	22	4	26
30 – 50 year	10	5	15
> 50 year	3	0	3
	52	21	73

3.3.Epilepsy types: -

Epilepsy syndromes were partial (67 patients), atypical absence (4 patients), and generalized (2 patients).

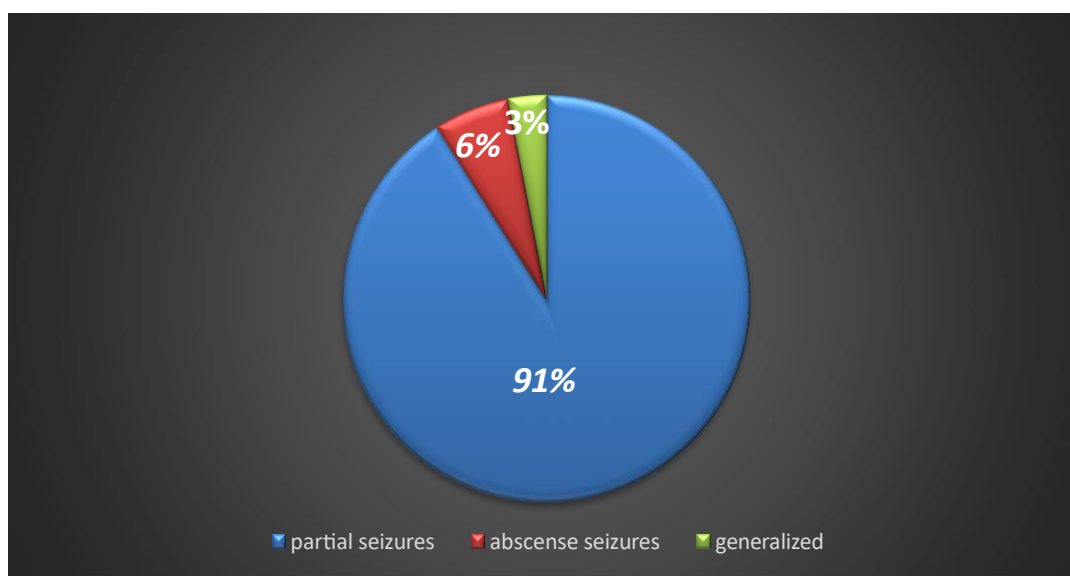


Fig.8 Pie chart showing epilepsy types distribution of 73 VNS patients.

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3.4. sign and symptoms

All patient present with uncontrolled seizure, 8 patients of them with mental retardation, 5 patients with spasticity, 3 patients with Abnormal movement, 3 patients with dystonia and 2 patients with cerebral palsy

3.5. Complications

4 patients developed post VNS treatment voice alteration, 3 patients developed coughing, 8 patients developed incision site pain, 3 patients developed hiccups, 2 patients developed dyspnea and 3 patients develop superficial infection at site of surgical incision

Table 3. showing complications distribution of 73 VNS patients.

COMPLICATION	NO. OF PATIENT	PERCINTAGE %
voice alteration	4	5.4 %
coughing	3	4.1%
incision site pain	8	10.9%
hiccups	3	4.1%
dyspnea	1	1.3%
Superficial infection	3	4.1%

3.6.Seizures reduction:

Median seizure frequency at baseline was 14 seizures per month, Median seizure frequency at follow up was 7 seizures per month, 44.1% (32 patients of total 73) had decrease in seizure frequency at one-month post VNS follow up, 50.6% (37 patients of total 73) had decrease in seizure frequency at three months' post VNS follow up, 53.4 % (39 patients of total 73) had decrease in seizure frequency at six months' post VNS follow up, 66% (48 patients of total 73) had decrease in

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seizure frequency at 1 year post VNS follow up (34% (25 patients) had <50% decreases in seizure frequency after 1 year, 25%(18 patients) had 20–50%decreases in seizure frequency after 1 year, 7 % (5 patient) had >20% decreases in seizure frequency after 1 year), 33% (24 patients of total 73) had no change in seizure frequency, 1 % (1 patient) had increase in seizure frequency.

Tow year follow up of 29 patients with implanted VNS show

Twenty of total 29 patients (69%) had decrease in seizure frequency, 11 patients (38%) had <50% decreases in seizure frequency, 9 patients (31%) had (20% – 50%) decreases in seizure frequency and 9 patients (31%) had no change in seizure frequency.

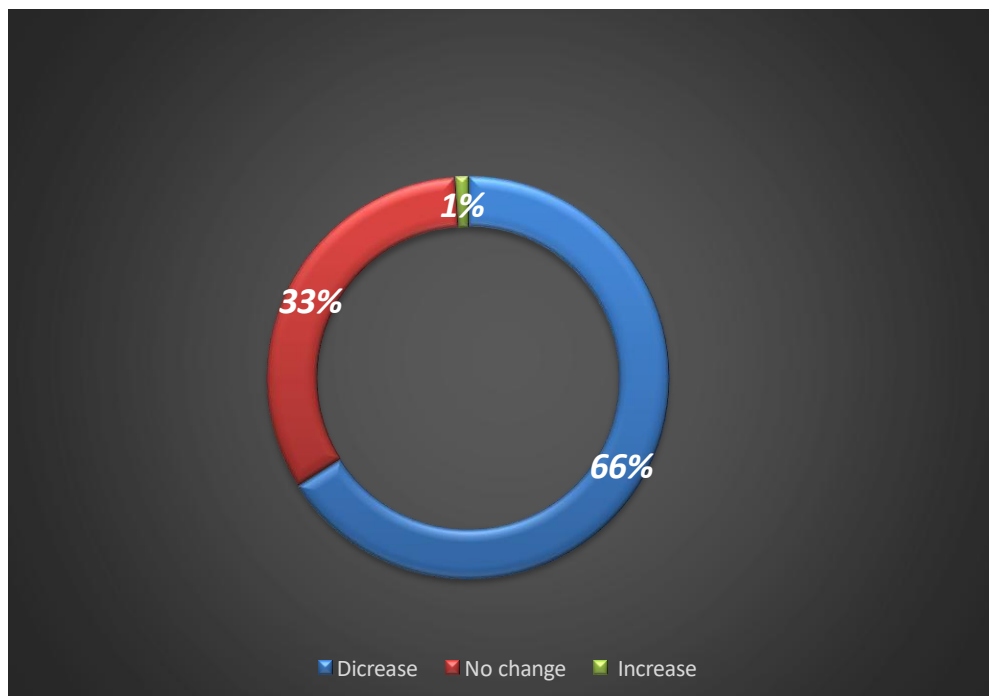


Fig.9 Pie chart Showing post op. changes in seizure frequency in 73 patients

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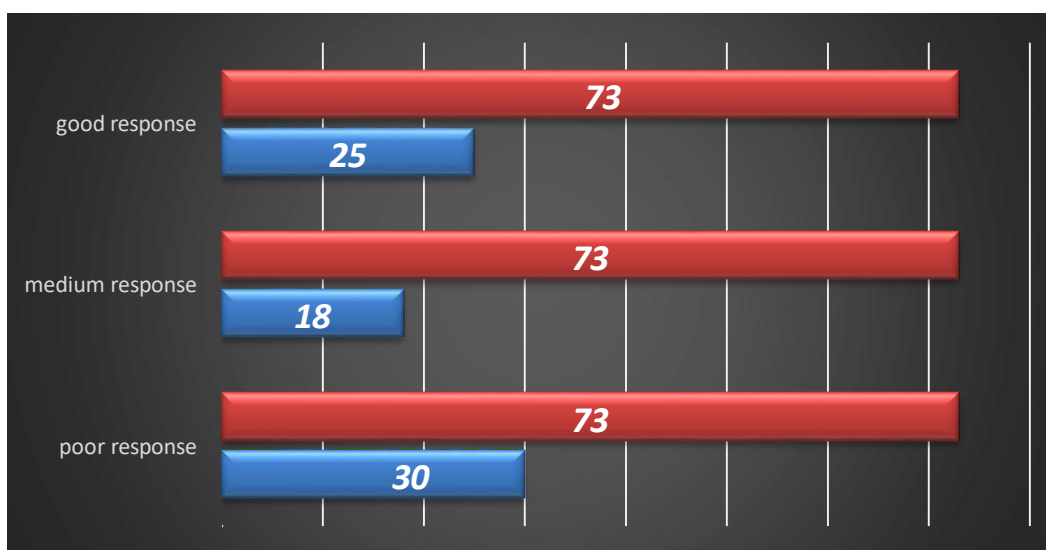


Fig.10 Bar chart showing response distribution of 73 VNS patients after 1 year.
(48 patients of 73 patient)

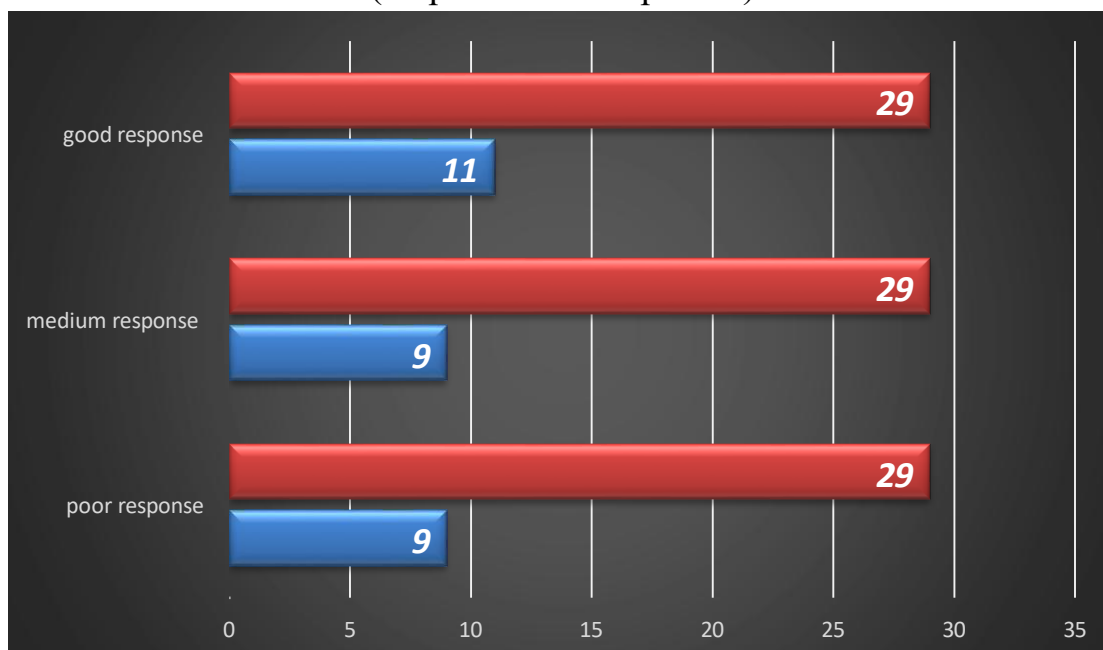


Fig.11 Bar chart showing response distribution of 29 VNS patients after 2 years.

Eureka Journal of Health Sciences & Medical Innovation (EJHSMI)

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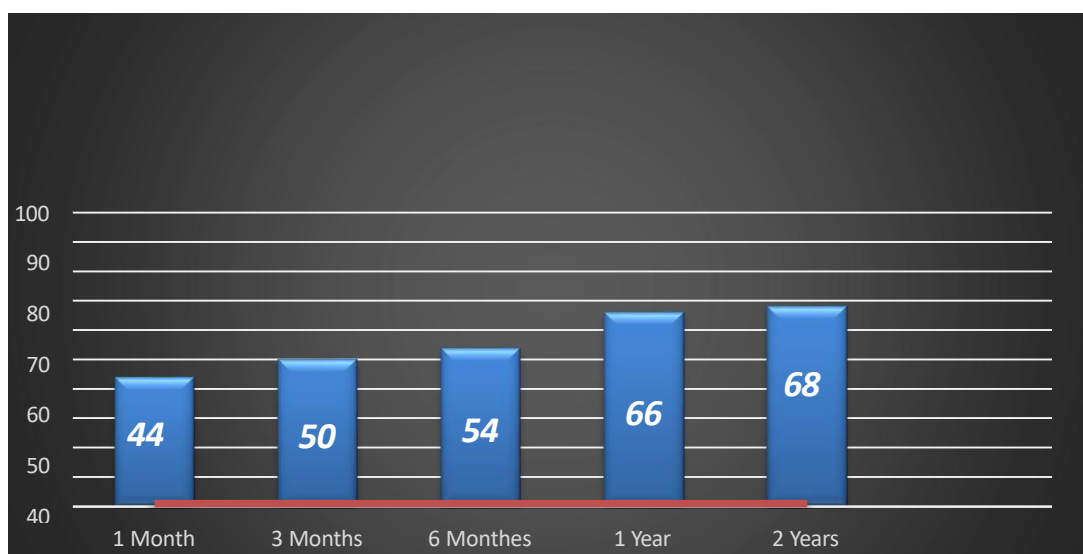


Fig.12 Column chart showing overall decrement in seizure frequency within 2 years

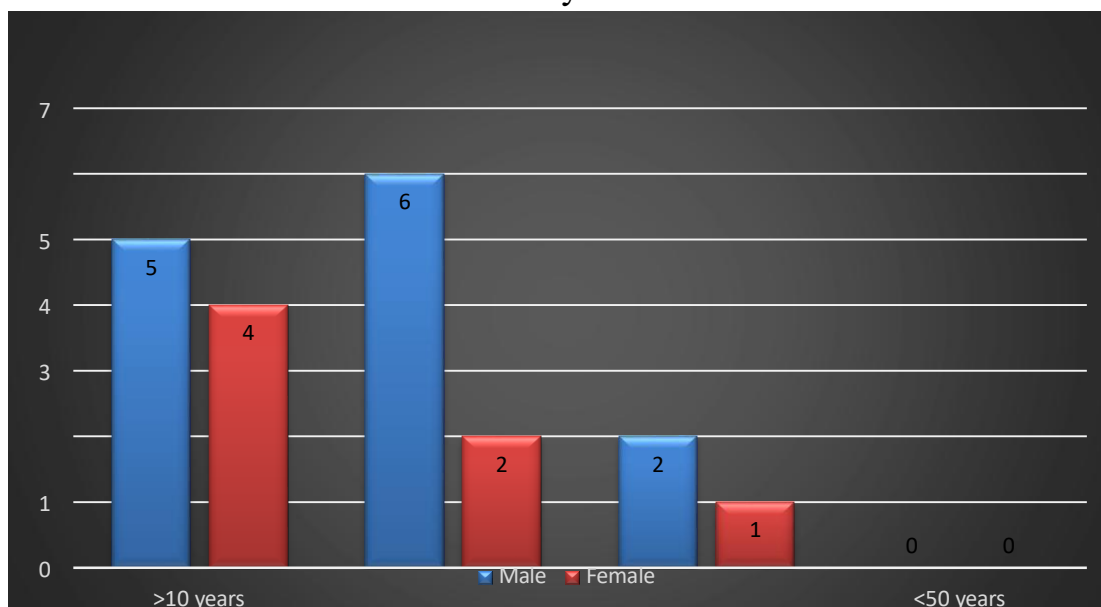


Fig.13 Column chart showing seizure frequency decrement related to age distribution and gender of 29 VNS patients (2 years follow up)

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Discussion

The conclusions of this investigation show that

A: - Generation

2: The Mean age of the patients was 17.1 years with an age range of 2 to 58 years.

3. The majority of the affected people were aged from 10 to 30 years.

The most affected population was 18 years of age and younger, with a mean age of 8.8 when compared to earlier literature (Smyth MD1, Tubbs RS, Bebin EM, Grabb PA, Blount JP.) [32].

The age gap identified in the sample of patients might be explained by possible differences in the prevalence of seizures between age groups in our population.

(B) Sex

Compared to earlier studies (Ardesch JJ1, Buschman HP, Wagener-Schimmel LJ, van der Aa HE, Hageman G.) [33], the male/female ratio was higher in our study with 72 male and 29 female patients. said that there were 57 % men and 42% women. Also, the current study has more males than females, which is similar to past studies on the topic. However, the higher male-to-female ratio can be attributed to the stigma of epilepsy in this particular demographic.

C: - Symptoms and indicators before operation

The most prevalent symptom reported by patients in this study is uncontrolled epilepsy (100%), followed by mental impairment (11%). This symptom not only satisfies our requirements for the implantation of a VNS device but also meets the referral criteria of neurologists who recommend only patients with uncontrolled epilepsy taking several and high doses of antiepileptic medicines. Neurologists in this study do not refer patients for any additional indications for VNS.

One study indicated 11.8 percent of patients had uncontrolled epilepsy and 11.9 percent had mental impairment, the vast majority of them youngsters under 10

Eureka Journal of Health Sciences & Medical Innovation (EJHSMI)

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years of age (59 percent of pediatric patients). Most children with mental impairment will have uncontrolled epilepsy, which could explain why they made up 61% of the children with uncontrolled seizures.

Complications that may occur following surgery (D)

Surgical complications were observed in 3 participants (4.1% of those of Morris GL (3rd1) and Mueller WM). Of these, 1 patient developed a superficial infection at the VNS electrode implantation site, and 2 patients had an infection at the generator implantation site. All three individuals were treated with systemic ABs. Without the need to take VNS off.

Their results were compared with previous investigations by Smyth MD1, Tubbs RS, Bebin EM, Grabb PA, and Blount JP [32]. My study revealed a similar pattern in the percentage of individuals with superficial infections, which was 3.5% of the total 74.

In this study, fifteen percent (eleven) of the individuals had some form of medical complication after VNS implantation. The incidence of stimulation-generated symptoms (hoarseness, dysphagia, and torticollis) was 5.4% compared with another study (Smyth MD1, Tubbs RS, Bebin EM, Grabb PA, Blount JP) [32]. I think this difference is due to patients inconsistently visiting the epilepsy centers and poorly communicating with the follow-up staff.

E: - Response to administration of a VNS After one year of 73 clients

The percentage of patients who responded well was 25 (34%), 18 (25%), and 30 (41%).

After ten years and thirty-nine patients, Fifteen patients (38%) responded well and nine patients (31%) responded somewhat.

Thirteen percent, or nine individuals, did not have an acceptable response.

Another study (Morris GL 3rd1, Mueller WM) [34] reported that the percentage of patients deemed strong responders was 36.8% after 1 year and 43.2% after 2

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years, while the percentage of patients considered medium responders was 35% after 1 year and 44.3% after 2 years.

Our study results are similar to the study of Morris GL (3rd1) and Mueller WM with slight variations. These could be due, for example, to the fact that the former contained a larger sample of patients, differed in age group, and followed a different technique for data collecting.

CONCLUSIONS

1. Some patients have a delayed reaction to VNS therapy but do well in the end.
 2. VNS therapy efficacy has been proven to improve over time.
 - 2: The decision to cease VNS therapy should be made carefully, even if the patient has not seen a reduction in seizure frequency.
 3. VNS is a safe, effective long-term treatment for those with very hard-to-treat epilepsy.
 4. A positive response is a reduction of around 65% in seizure events.
 - 5: - This procedure has a low incidence of surgical complications.
- Symptoms caused by stimulation are common and often resolve over a period of time.

Recommendations

- 1- Early VNS therapy is indicated to produce a positive outcome in patients with medication-refractory epilepsy.
- A positive connection with the neurologists enables the referral of epileptic patients who have become medically resistant.
3. Prior to surgery, thoroughly evaluate the patient's overall health to minimise the risk of post-surgical problems.
 - 4-Taking time to explain the gadget to the patient and any side effects that could occur.

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5. Asking them what they expect of the therapy, personally or through the relatives of the patient. 6. Additional studies of the VNS implantation outcomes and other possible applications should be done.

References

1. Fisher, Robert S; Acevedo, C; Arzimanoglou, A; Bogacz, A; Cross, JH; Elger, CE; Engel J, Jr; Forsgren, L; French, JA; Glynn, M; Hesdorffer, DC; Lee, BI; Mathern, GW; Moshé, SL; Perucca, E; Scheffer, IE; Tomson, T; Watanabe, M; Wiebe, S (April 2014). "ILAE Official Report: A practical clinical definition of epilepsy"2014; 55(4):475–482
2. Fisher R, van Emde Boas W, Blume W, Elger C, Genton P, Lee P, Engel J (2005)."Epileptic seizures and epilepsy: definitions proposed by the International League Against Epilepsy (ILAE) and the International Bureau for Epilepsy (IBE)"2005;46(4)470 –47
3. Magiorkinis E, Kalliopi S, Diamantis A (January 2010). "Hallmarks in the history of epilepsy: epilepsy in antiquity". 2010 ;17 (1): 103–108
4. Longo, Dan L. "369 Seizures and Epilepsy". Harrison's principles of internal medicine (18th ed.). McGraw-Hill.2012;369
5. Engel, Jerome. Epilepsy : a comprehensive textbook (2nd ed.). Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins.2008;1:14 – 46
6. Holmes, Thomas R. Browne, Gregory L. Handbook of epilepsy (4th ed.). Philadelphia: Lippincott Williams & Wilkins.2008;2:38 – 43
7. "Epilepsy". Fact Sheets. World Health Organization. October 2012. Retrieved January 24, 2013.
8. National Institute for Health and Clinical Excellence. Classification of seizures and epilepsy syndromes". The Epilepsies: The diagnosis and management of the epilepsies in adults and children in primary and secondary care National Clinical Guideline Centre. 2012; 9:119–129

Eureka Journal of Health Sciences & Medical Innovation (EJHSMI)

ISSN 2760-4942 (Online) Volume 2, Issue 10, October 2026



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<https://eurekaoa.com/index.php/5>

9. Goldberg, EM; Coulter, DA. "Mechanisms of epileptogenesis: a convergence on neural circuit dysfunction.". *Nature reviews. Neuroscience*. 2014 (5): 337–49.
10. Neligan, A; Hauser, WA; Sander, JW. "The epidemiology of the epilepsies.". *Handbook of clinical neurology*. 2012;107: 33–113.
11. Bhalla, D.; Godet, B.; Druet-Cabanac, M.; Preux, PM. "Etiologies of epilepsy: a comprehensive review.". *Bradley, Walter G. Bradley's neurology in clinical practice*. (6th ed.). Philadelphia 2013;6: 76 – 861
12. Stefan, Hermann. *Epilepsy Part I: Basic Principles and Diagnosis E-Book: Handbook of Clinical Neurology (Volume 107 of Handbook of Clinical Neurology ed.)*. 2012; 107 :471
13. Kwan P, Brodie MJ. Early identification of refractory epilepsy. *N Engl J Med*. 2000; 342:314-319.
14. Engel J Jr. A proposed diagnostic scheme for people with epileptic seizures and with epilepsy: report of the ILAE Task Force on Classification and Terminology. *Epilepsia*. 2001; 42:796-803.
15. National Institute for Health and Clinical Excellence. *Classification of seizures and epilepsy syndromes*". *The Epilepsies: The diagnosis and management of the epilepsies in adults and children in primary and secondary care National Clinical Guideline Centre*. 2012; 9: 119–129.
16. De Boer, HM. "Epilepsy stigma: moving from a global problem to global solutions.". *Seizure: the journal of the British Epilepsy Association* 2010; 19:6–630
17. Goldberg, EM; Coulter, DA (May 2013). "Mechanisms of epileptogenesis: a convergence on neural circuit dysfunction.". *Nature reviews. Neuroscience*. 2013;14 (5): 337–49.
18. Bhalla, D.; Godet, B.; Druet-Cabanac, M.; Preux, PM. "Etiologies of epilepsy: a comprehensive review.". *Expert Rev Neurother*. 2011; 11 (6): 76 861.

Eureka Journal of Health Sciences & Medical Innovation (EJHSMI)

ISSN 2760-4942 (Online) Volume 2, Issue 10, October 2026



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<https://eurekaooa.com/index.php/5>

19. Berg AT, Berkovic SF, Brodie MJ, et al. Revised terminology and concepts for organization of seizures and epilepsies: report of the ILAE Commission on Classification and Terminology, 2005–2009. *Epilepsia* 2010; 51: 85 –676.
20. Engel, J. Jr. and Shewmon, DA. Overview: Who Should Be Considered a Surgical Candidate? In: J. Engel Jr. (Ed.) *Surgical Treatment of the Epilepsies* 2nd Edition Raven Press, New York (1993) pp. 23–34.
21. Forsgren L, Bucht G, Eriksson S, Bergmark L. Incidence and clinical characterization of unprovoked seizures in adults: a prospective population-based study. *Epilepsia* 1996; 37:224-229.
22. Bergey, GK. "Neurostimulation in the treatment of epilepsy." *Experimental neurology* 2013;244: 87–95
23. Amar AP, Apuzzo MI, Liu CY. Vagus nerve stimulation therapy after failed cranial surgery for intractable epilepsy: results from the Vagus Nerve Stimulation Therapy Outcome Registry. *Neurosurgery* . 2004; 55:1086-1093.
24. DeGiorgio CM, Amar AP, Apuzzo MLJ. Vagus nerve stimulation: surgical anatomy, technique and operative complications. In: Schacter S, Schmidt D, eds. *Vagal Nerve Stimulation* . London: Dunitz; 2001:31-50.
25. Shaw GY, Sechtem P, Searl J, et al. Predictors of laryngeal complications in patients implanted with the Cyberonics vagal nerve stimulator. *Ann Otol Rhinol Laryngol* . 2007; 115:260-267.
26. Ali II, Pirzada NA, Kanjwal Y, et al. Complete heart block with ventricular asystole during left vagus nerve stimulation for epilepsy. *Epilepsy Behav* . 2004; 5:768-771.
27. Hsieh T, Chen M, McAfee A, et al. Sleep-related breathing disorder in children with vagal nerve stimulators. *Pediatr Neurol* . 2008; 38:99-103.
28. Smyth MD, Tubbs RS, Bebin EM, et al. Complications of chronic vagus nerve stimulation for epilepsy in children. *J Neurosurg* . 2003; 99:500-503.

Eureka Journal of Health Sciences & Medical Innovation (EJHSMI)

ISSN 2760-4942 (Online) Volume 2, Issue 10, October 2026



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<https://eurekaopenaccess.com/index.php/5>

29. Christensen J, Vestergaard M, Mortensen PB, et al. Epilepsy and risk of suicide: a population-based case-control study. *Lancet Neurol*. 2007; 6:693-698.
30. Marson AG, Al-Kharusi AM, Alwaidh M, et al. Vagus nerve stimulation therapy for intractable epilepsy: results from the Vagus Nerve Stimulation Therapy Outcome Registry. *Neurosurgery*. 2008; 55:1086-1093.
31. Peter R. Huttenlocher MD and Ronald J. Hapke BA Article first published online: 8 OCT 2004 DOI: 10.1002/ana.410280516
32. Smyth MD1, Tubbs RS, Bebin EM, Grabb PA, Blount JP. *J Neurosurg*. 2003 sep;99(3):500-3. <http://www.ncbi.nlm.nih.gov/pubmed/12959437>
33. Ardesch JJ1, Buschman HP, Wagener-Schimmel LJ, van der Aa HE, Hageman G. 2008 NOV;187-194
34. Morris GL 3rd1, Mueller WM *Neurology*. 1999 Nov; 53(8):1731-5.