Pediatric Vagus Nerve Stimulation: Where are we now and Where do we go from here?

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Neurosurgeons for Kids. Walt Disney Pavilion at the Florida Hospital for Children

Introduction

This study will review data variables that lead to improved outcome in pediatric VNS patients. It will also review surgical technique for single incision implantation. It is among the largest pediatric series ever presented.

Methods

Data was gathered on 53 patients of a single neurosurgeon undergoing vagus nerve stimulator implantation from 2003 to 2009. Patients were followed for a minimum of 1 year and follow-up data recorded for seizure frequency, VNS variables, and complications. Patients who had surgery in 2005 or later had a single clavicular incision and patients prior to 2005 had a neck incision and an axillary incision.

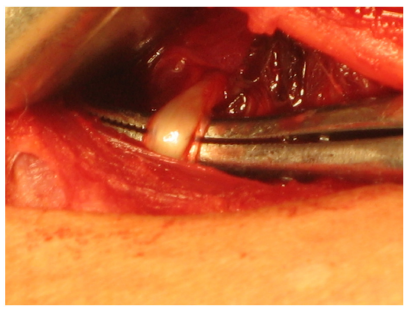
Figure 1

Marked incision

Technique note

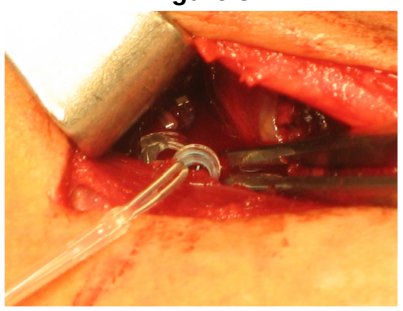
Since 2005, unless the patient or referring MD requested otherwise, all VNS implanted by the senior author have been implanted using a single clavicular incision(see Figure 1). Dissection is performed to create a sub-cutaneous pocket large enough to accept the vagus nerve stimulator generator overlying the left pectoralis muscular fascia. Attention is then turned to skeletonize the left vagus nerve, enterring the triangle bounded the the clavicle inferiorly, the sternal head of the left sterno-cleido-mastoid muscle medially, and the clavicular head of the left sterno-cleido-mastoid muscle laterally. Blunt and sharp dissection are performed down to the carotid sheath. The left vagus nerve is identified(see Figure 2). The lead(3mm is used if possible) is the attached to the vagus nerve using the unitized pig tail connectors(see Figure 3). The lead is attached to the generator using the supplied ratchet screwdriver. A lead test is performed to confirmed good DC-DC conversion. The incision is then closed in anatomical layers(see Figure 4).

Figure 2



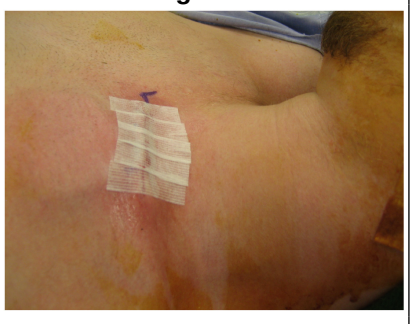
Skeletonized vagus nerve

Figure 3



Lead attachment

Figure 4



Closed incision

Results

53 pediatric (>18 years of age) patients were implanted over the study time frame. Mean DC-DC conversion was 1.5 in patients with 3mm leads and 2.2 in patients with 2mm leads. 81% of patients had a >50% reduction in seizures. 45% of patients had a >75% reduction in seizures. 18% of patients became seizure free. 12% of patients had no change in seizure frequency. There were no permanent morbidities, nor any mortality. Variables related to improved outcomes were DC-DC conversion, duration of epilepsy, and size of lead implanted($p<0.01$).

Conclusions

VNS continues to be a safe and highly effective treatment modality for multi-focal refractory epilepsy, regardless of age. Results and complication rates did not significantly vary for variables of patient age or single or two incision techniques. The 3 mm leads had a lower DC to DC conversion. Lower DC-DC conversion led to improved seizure control.

Learning Objectives

By the conclusion of this session, participants should be able to: 1) Understand that pediatric patients have a similar outcome to adult patients with VNS 2) Identify factors that may improve outcome with VNS 3) Understand the anatomical issues involved with a single sub-clavicular incision for VNS implantation.

References

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