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STUDY

Objectives: Learn the indications and procedure for vagal nerve stimulator implantation (VNSI) in pediatric patients with refractory seizures. Understand the surgical outcomes and complications for the procedure.

Methods: A retrospective review of prospectively collected data from 2002-2007 was undertaken on VNSI. The cohort consisted of all pediatric patients ages 0-21 at a single institution tertiary children's hospital. All patients were included if they had treatment resistant seizures and had not previously undergone VNSI. The surgical indications, outcomes, complications, and follow-up were recorded.

Results: Over the 5 year period, 36 patients underwent VNSI. Age at surgery ranged from 3 to 20 years (mean 10.5 years). The indications for surgery for all patients included seizures refractory to antiepileptic medications (>5 medications). There were no intraoperative complications and all patients had successful electrode placement as measured by intraoperative testing. After an overnight hospital stay, patients were discharged and programmed by the pediatric neurologist at 2 weeks post-operatively. There were two post operative complications (5.5%), scar hypertrophy of a chest incision and left-sided Horner's syndrome. Both patients have been managed conservatively without sequelae. Follow up ranged from 6 to 72 months (mean 42 months). There were no device failures and all patients and families were subjectively satisfied with the postoperative outcome. Intraoperative and postoperative photos will demonstrate technique and outcomes.

Conclusions: Pediatric VNSI is a reliable procedure for refractory seizures with a low complication rate and can be performed safely by otolaryngologists. This represents the largest cohort of patients in the otolaryngology literature.

Background and Discussion

Afflicting up to 1% of the general population, epilepsy is the most prevalent neurological condition that impacts people of all ages and the second most common neurologic condition overall. Specifically in children, one third of those with epilepsy, the seizures are difficult to control by one or more antiepileptic drugs (AEDs). The side effects of AEDs may be considerable in the pediatric population. Fortunately, the recent use of vagus nerve stimulation (VNS) offers an adjunct in the treatment of these patients. The device, produced by Cyberonics, Inc (Houston, Tx), delivers intermittent electrical stimulation to the cervical vagus nerve trunk, which secondarily transmits rostral impulses to exert widespread effects on neuronal excitability throughout the CNS. This effect demonstrates both acute abortive and chronic prophylactic seizure reduction. Previous clinical data in children have demonstrated that VNS implantation is safe and effective with an average seizure reduction in the range of 30-50%. The electrode is placed via a cervical incision around the left vagal nerve. The pulse generator is placed in a subcutaneous pocket over the chest, much in the manner of a pacemaker. Potential complications include infection, left true vocal cord paralysis/paresis, hematoma, bradycardia, and ventricular asystole. Side effects may include coughing, laryngismus, voice alteration, muscle twitching, dyspnea, or local pain in the vicinity of the device. In a series of 15 patients, implanted and followed by otolaryngologists, 3 of 15 predominately adult patients had voice change due to device activation. Two patients had left vocal cord paresis, and one patient had an immobile vocal cord. The authors correctly stated that the otolaryngologist is well qualified to perform the VNS implant procedure, and to assess postoperative laryngeal function. Large pediatric series of VNS implantation arise from the neurosurgical literature. We sought to characterize our surgical population in terms of surgical outcome and complications in a pediatric otolaryngology practice. This surgery can be safely performed by the pediatric otolaryngology, who is in a unique situation to monitor laryngeal side effects.

Surgical Methods and Outcomes

A 3 cm cervical incision is fashioned in a neck crease for electrode placement (Figure 1A). The carotid sheath is exposed and a 3 cm segment of the left vagus nerve is isolated (Figure 2). Care is taken to handle the nerve by the surrounding adventitia and epineurium. A 2 mm electrode is routinely placed in children due to smaller nerve diameter. The negative (cephalad) and positive (middle) electrodes are placed around the nerve first, followed by the anchor tether (caudal) (Figure 3). A strain relief bend is fashioned to offer adequate slack and the electrode is then secured to the SCM fascia via tie downs (Figure 4). We prefer a 5 cm subcutaneous chest pocket placed 2 fingerbreadths below the clavicle. We have found this to be less prone to wound infection/irritation when compared to the traditional preaxillary incision. Once an adequate pocket is fashioned, the electrode is tunneled under the skin and connected to the pulse generator (Figure 5). A lead diagnostic test is performed and then the generator is secured to the pectoralis fascia (Figure 6). The incisions are closed with absorbable sutures, no drains are left, and a final diagnostic test is performed. The patients are discharged on POD#1, seen one week post-op for wound check (Figure 1B), and programmed at two weeks by the pediatric neurologist.

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FIGURE 1

A: Preop incisions

B: One week post-op

FIGURE 2

Left Vagus Nerve Isolated

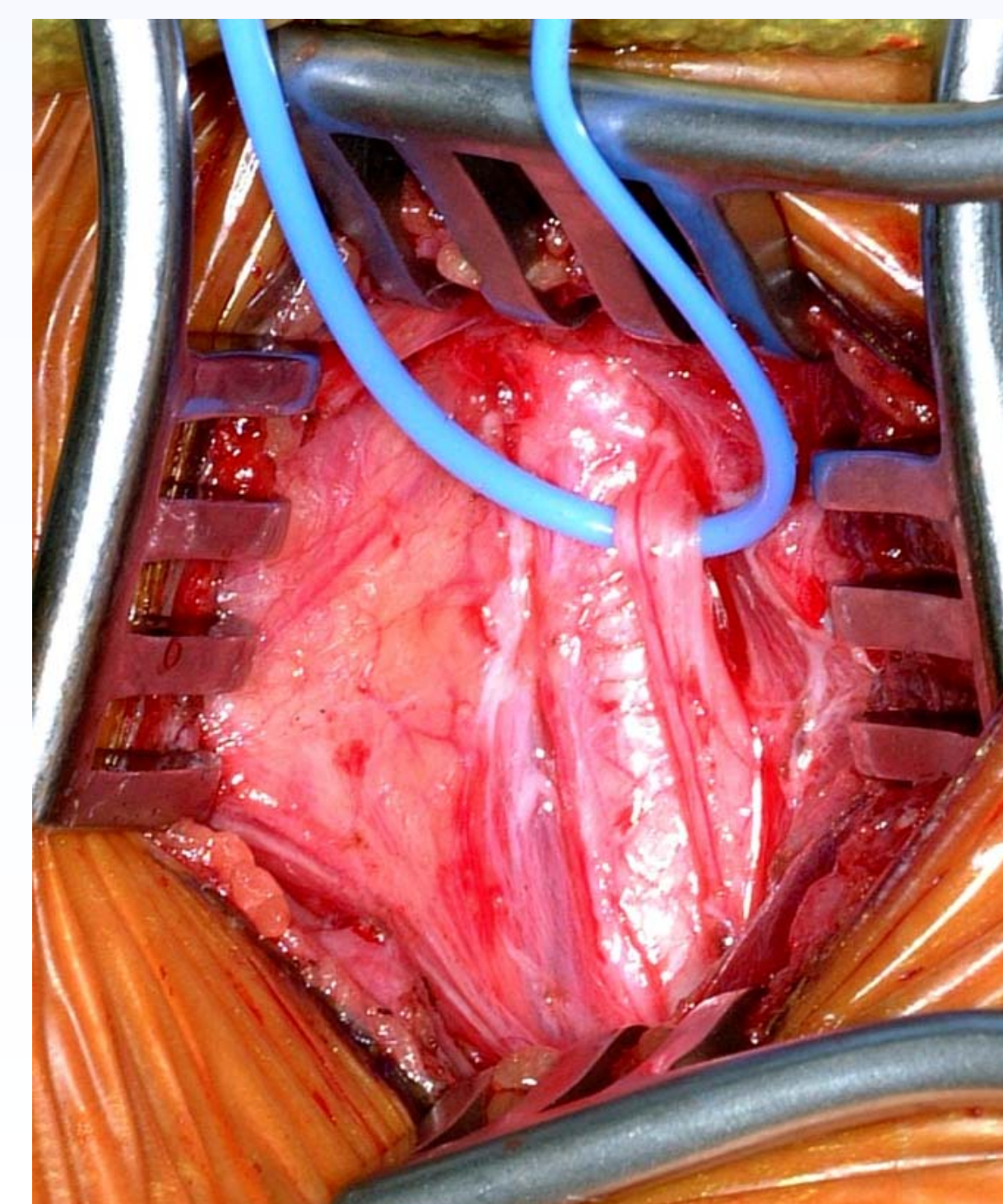


FIGURE 3

Electrodes Placed

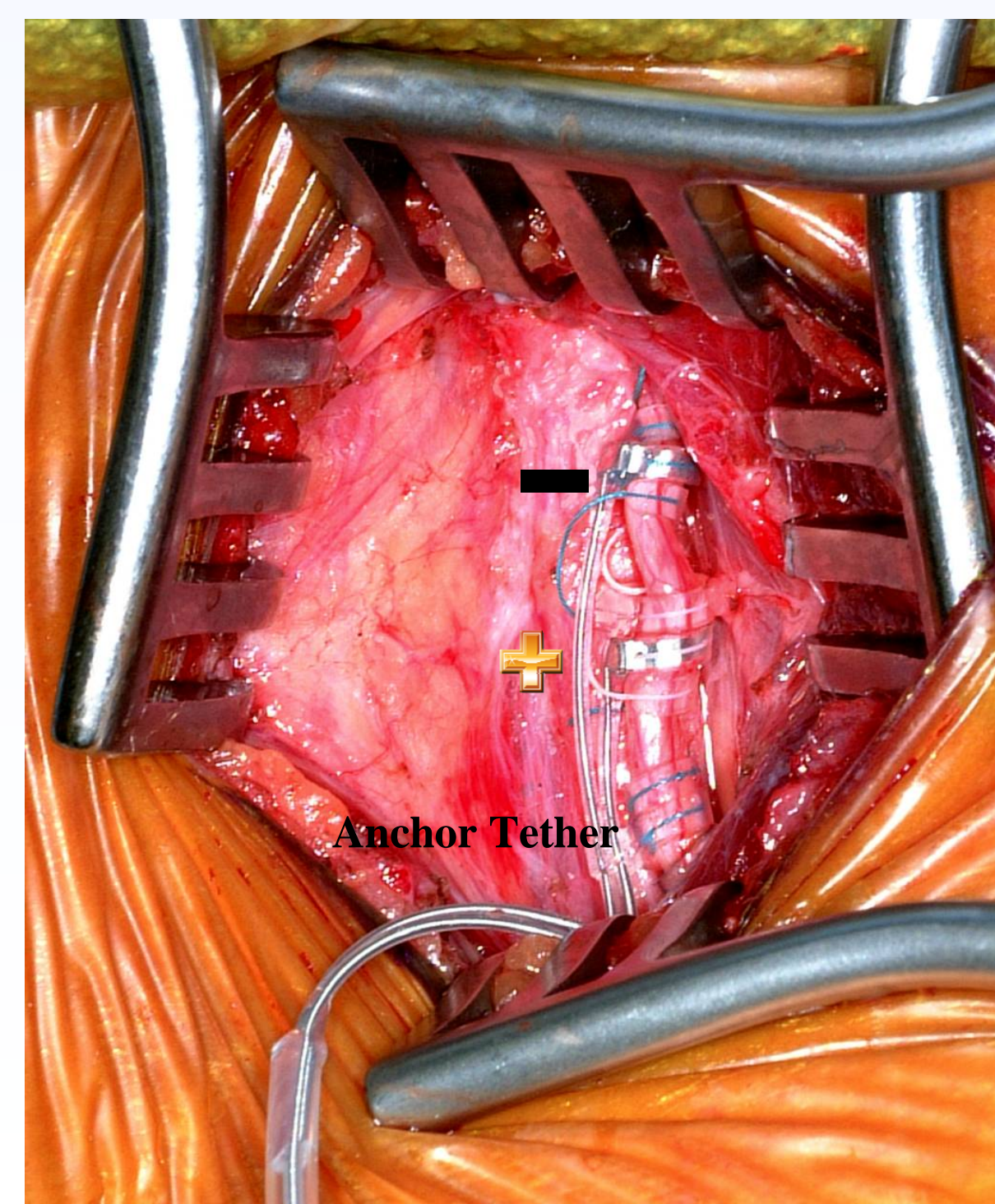


FIGURE 4

Strain relief bend with tie downs



FIGURE 5

Tunneler passed subcutaneously

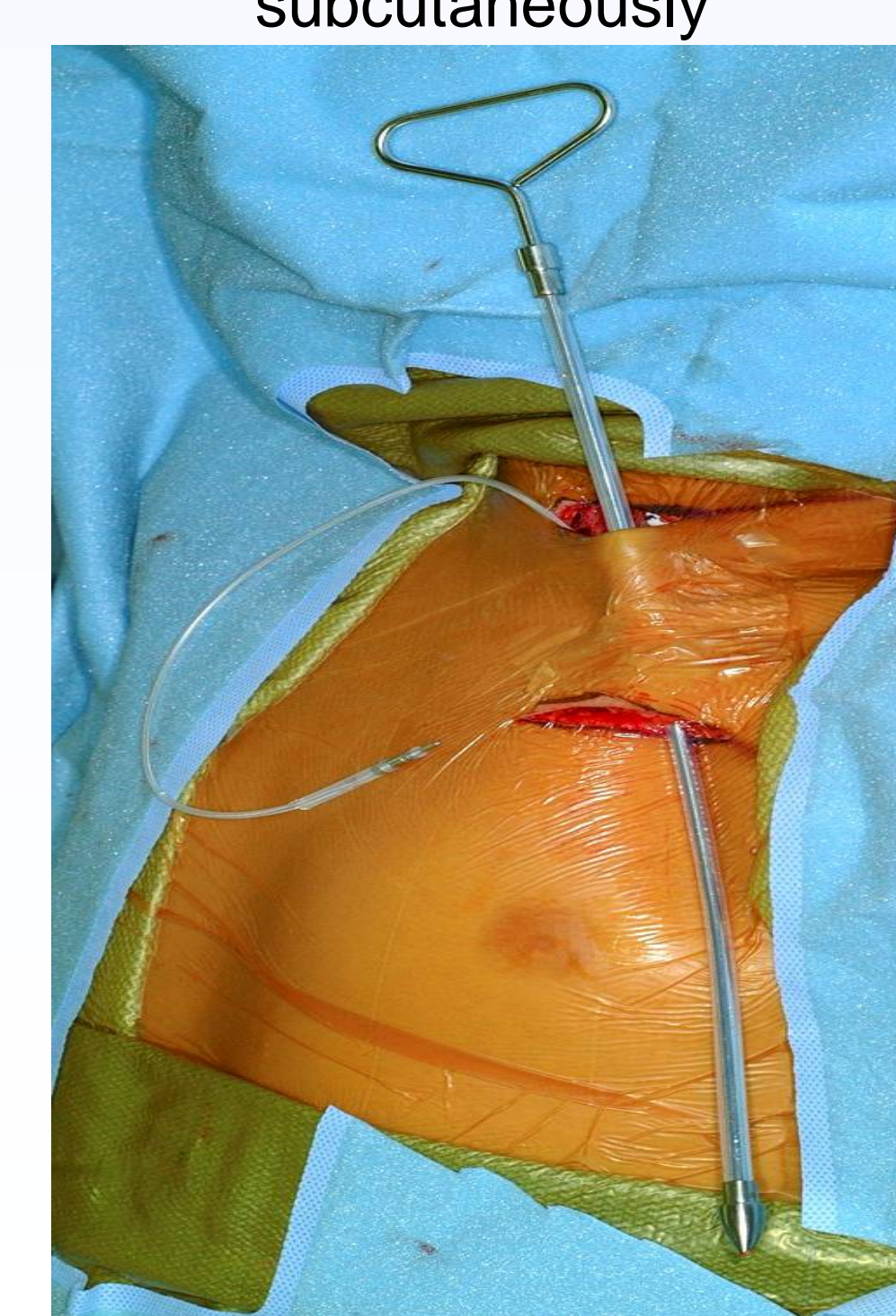


FIGURE 6

Pulse generator placed in chest wall pocket

