

Title: The Effect of VNS on Vocal Fold EMG and Laryngeal Morphodynamics

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Content: RATIONALE:

VNS is an effective treatment for patients with medically refractory epilepsy. It is generally accepted that VNS owes its antiepileptic effect from afferent nerve fiber stimulation. Co activation of efferent fibers can cause side-effects. One of the most frequent reported side-effects is hoarseness due to stimulation of the recurrent laryngeal nerve. At high stimulation amplitudes even spastic contractions of ipsilateral intrinsic laryngeal muscles can occur. For a group of VNS-therapy users this side-effect interferes severely with their daily activities. We investigated the recruitment properties of the recurrent laryngeal nerve and analyzed electromyographic and morphometric alterations on the vocal folds during VNS.

METHODS:

Vocal fold EMG experiments were conducted intra-operatively during the implantation of a VNS system. When the patient was anesthetized the endotracheal EMG tube (XOmed) was inserted, and the recording wires connected to the Monitor.

During surgery the VNS-therapy stimulation lead and pulse generator were implanted following normal procedure. The pulse generator was then programmed to stimulate in magnet mode for 14 seconds at 2 Hz, and one of the following pulse durations: 130, 250, 500, 750, or 1000 micros. At each pulse width the EMG-threshold current was determined by electrical stimulation of the VN with increasing stimulation currents. When EMG signal amplitude saturated upon stimulation a second pulse duration was randomly selected and the above procedure repeated.

Laryngostroboscopic examination was performed 1 and 6 months after surgery. Special attention was given to the effects of spontaneous stimulation on the larynx. If no effect was noticed a higher intensity stimulation cycle was given by means of 'magnet-activation'.

RESULTS:

The vocal fold EMG and morphodynamic changes in the larynx have been analyzed in 5 patients. In all patients left vocal fold EMG threshold was between 0.25 and 0.50 mA. Pulse duration had little influence on the EMG threshold level. Vocal fold EMG saturation levels were reached between 0.75 and 1.00 mA.

Videostroboscopic monitoring at therapeutic levels (1.25 – 2.25 mA) showed that VNS is well tolerated. 'Magnet' stimulation induced an adductory spasm of either the ipsilateral vocal fold or the vestibular fold, and was present remarkably irrespective of the presence of hoarseness.

CONCLUSIONS:

VNS causes pronounced effects on the vocal folds even at low stimulation amplitudes. At therapeutic levels the effect on the vocal folds is maximal even at the lowest stimulation pulse durations. The vocal fold contractions, however, do not necessarily give audible effects (hoarseness).