

Transcutaneous vagus nerve stimulation: A treatment option in drug resistant epilepsy?

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Drug resistant epilepsy accounts for more than 30% of patients (1). Alternative treatment options are surgical intervention and vagus nerve stimulation (VNS). VNS has been shown to be highly effective in animal models of epilepsy. Within the last decade more than 50.000 patients have been treated by VNS. After an initial neurosurgical intervention the cervical vagus nerve is electrically stimulated. Due to surgery and electrical stimulation of afferent and efferent nerve fibers frequent side effects include hoarseness, cough, and pain. It has been assumed, that the vagus nerve can be stimulated transcutaneously at the outer ear (2). This procedure would avoid any neurosurgical intervention and probably would reduce side effects.

Anatomical studies provide evidence for cutaneous receptive fields at the outer ear with exclusive innervation by the auricular branch of the vagus nerve (ABVN) (3). Transection of the intracranial root of the human vagus nerve causes complete sensory loss in ABVN receptive fields (4). Correspondingly, isolated vagus nerve palsy due to varicella zoster infection affects the same receptive fields (5).

Electrical stimulation (monophasic pulse, width: 200 μ s) at ABVN innervation sites was performed in 10 healthy volunteers. The detection threshold was 0.8 ± 0.3 mA (mean \pm sd). Stimulation intensities just above the detection threshold preferentially evoked pulsating sensations without any painful components. These data emphasize primary excitation of A β fibers with no or minor contribution of thinner A or even C fibers. Thus, transcutaneous vagus nerve stimulation (t-VNS[®]) and VNS probably aim at the same afferent fiber class (6). Recent experiments in rats documented similar reduction of epileptic seizures with t-VNS[®] and VNS (7).

Anatomical and physiological data indicate that t-VNS[®] may be a promising alternative to invasive VNS. A clinical pilot project in drug resistant epilepsy patients is running in order to prove therapeutic benefit from t-VNS[®]. Treatment of pain, tinnitus and dementia may be further indications for t-VNS[®].

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