

Application of Polyvagal Theory to Auricular Acupuncture

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IN PAUL NOGIER'S (MD) original *Treatise of Auriculotherapy*,¹ his description of the somatotopic arrangement of auricular points in an inverted fetus pattern focused on neurologic reflexes affecting the musculoskeletal system. I worked with colleagues on a controlled, blinded evaluation of auricular diagnosis at the University of California, Los Angeles.² For this research, the clinical conditions evaluated included the auricular pattern of the musculoskeletal system. From the perspective of Traditional Chinese Medicine, ear acupuncture was understood through connections between the external ear and the primary acupuncture meridians,³ whereas Paul Nogier discussed a neuroanatomical connection between the auricle and the nervous system.¹

Until recently, both Western medicine and traditional Oriental medicine paid little attention to the autonomic nervous system (ANS) and its relationship to the external ear. Nonetheless, several of the acupoints used in the classic National Acupuncture Detoxification Association (NADA) protocol⁴ for drug detoxification included the ear points for the Lung, Liver, and Kidney, all of which are found in the concha region of the auricle that is innervated by the parasympathetic vagus nerve. The NADA protocol also includes the nearby Sympathetic point, the functionally opposing part of the ANS. More recent research and newer theoretical perspectives have highlighted the role of the vagus nerve and its regulation by the hypothalamus of the brain; this research has enabled a broader understanding of the underlying complex mechanisms of auriculotherapy.

In 1994, Porges⁵ developed the polyvagal theory, which identifies two functionally distinct branches of the vagus, or tenth cranial nerve. One vagal branch affects visceral experiences and parasympathetic control of the heart, lungs, and digestive tract. The more primitive vagal nerve branch elicits immobilization behaviors (such as freezing or feigning death when a predator is near), whereas the more evolved ventral vagal branch is linked to emotional expression, social communication, and self-soothing behaviors. The measurement of vagal tone in humans has become one index of stress vulnerability.

The dorsal branch of the vagus nerve is considered to be the phylogenetically older branch. This branch is unmyelinated and slower in nerve conduction; it exists in most vertebrates. This branch is also known as the “vegetative vagus,” because it is associated with primal survival strategies of primitive vertebrates, reptiles, and amphibians. This dorsal vagal nerve maintains regulation of subdiaphragmatic visceral organs, such as gastrointestinal activity; respiratory difficulties; and disorders related to the heart, blood pressure, and blood circulation.

The ventral branch of the vagus nerve originates in the nucleus ambiguus in the brainstem and is myelinated to provide better control and faster speed in responding to an outside stimulus. This ventral branch of the vagus nerve can inhibit or disinhibit defensive limbic circuits in the subcortical brain. When vagal tone of the heart's “pacemaker” is high, the vagus nerve acts as a restraint—or brake—limiting the heart rate. The opposing sympathetic ANS is associated with regulation of arousal and “fight-or-flight” behaviors.

Attention to polyvagal theory and the ANS was of great interest at the Ninth International Symposium on Auriculotherapy (*Advances in Auricular Acupuncture*), in Singapore, August 10–12, 2017. Franca Deriu, MD, PhD, from Italy, presented “Anatomo-Physiologic Basis for Auricular Stimulation,” a

detailed review of the neuroanatomical pathways and brain structures that have connections to the ANS. The article, with the same title, by Mercante et al., appears in this issue (pp. 141–150).

The association between polyvagal theory and the external ear was highlighted at the Symposium by Dr. Howard Wu, from the United States, in “A look at SubCortex Through the Prism of Polyvagal Theory.” He noted that the three different SubCortex points on the inner wall of the antitragus—which were delineated by Huang⁶ from China—are associated with both the thalamus and the hypothalamus, and with the two branches of the vagus nerve as well as the autonomic sympathetic nerve. Huang divided the classical SubCortex point on the antitragal wall into a Neuro-, a Vasocoronary, and a Digestive SubCortex. Paul Nogier, had a slightly different perspective, describing the antitragal wall as representing different nuclei of the thalamus, whereas the hypothalamus was represented in the nearby inferior concha.¹

Invasive surgical procedures have been developed to stimulate the actual vagus nerve electrically within the anatomical body in order to alleviate major depression and other health disorders. Given that the concha of the auricle is the only place on the body where the vagus nerve neurons reach the surface of the skin, several investigators have evaluated noninvasive, transcutaneous electrical nerve stimulation (TENS) at auricular points. Dr. Cheng Kai—who presented “Potential for the Combination of Auricular Point Electrotherapy and TENS: The Significance and Prospects”—had conducted a comprehensive, systematic analysis of scientific literature over the past 10 years. He concluded that the application of auricular electrotherapy had received extensive support in multiple research studies.

Transcutaneous auricular vagus nerve stimulation led to improvements in pancreatic cells and insulin secretion in a controlled study by Prof. Rong Peijing, from China, who presented “Mechanisms Underlying the Regulation of Impaired Glucose Tolerance by Auricular Concha Electro-Acupuncture.” This study also showed that electroacupuncture (EA) on the Stomach ear point reduced gastric dysrhythmia in diabetic rats. Such effects were not seen in a sham EA group of rats who also had diabetes.

In yet another study entitled “Gamma Frequency Transcutaneous Auricular Vagus Nerve Stimulation: A Promising Therapy for Alzheimer’s Disease,” the investigators found reduced dementia symptoms in Alzheimer’s patients who had been treated with electrical stimulation of the vagus nerve region of the ear concha. This research was presented by Yu Yutian, from China.

Dr. Li Shao Yuan, from China, presented “Transcutaneous Vagus Nerve Stim: A New Type of Auriculo-Acupuncture for the Treatment of Depression.” This study examined TENS applied to the auricular vagus nerve area of rats whose behavior indicated a depressed mood. The auricular stimulation lead to increased functional magnetic resonance activity in each rat’s orbital prefrontal cortex—a brain area known to be associated with clinical depression in human patients. Auricular stimulations also altered levels of c-FOS, a chemical associated with increased neuron activity, in the dorsal raphe nuclei, the locus coeruleus, and the nucleus of the solitary tract found in the lower brainstem. Other brain regions affected by auricular vagal stimulation included the hippocampus, amygdala, and prefrontal cortex. In addition, auricular TENS given to these depressed rats led to an increase in plasma cortisol and adrenocorticotrophic hormone.

A particularly interesting auricular diagnosis study that was presented by Jasmin Stadler, MD, from Austria—“Active Ear Acupuncture Points in Sick and Healthy Term and Late-Preterm Neonates: A Blinded, Controlled, Observational Trial”—was conducted by Dr. Jasmin Stadler and Dr. Wolfgang Raith (See “Active Ear Acupuncture Points in Neonates: Initial Results in a New Research Field” in this issue; pp. 155–158). An electrical pointer search device was used to examine the reactivity of the external ears of newborn infants. Electrically conductive ear points were detected significantly more often in sick neonates than in healthy neonates.

A separate study, presented by Wolfgang Raith, MD, from Austria, and conducted by Dr. Raith et al.—“Active Somatic and Psychic* Ear Acupuncture Points in Newborn Infants with Neonatal Abstinence Syndrome”—determined that active ear acupuncture points in neonates were electronically detected more often in children with neonatal abstinence syndrome than in newborns who were not diagnosed with this condition (See “Auricular Medicine in Neonatal Care,” by Dr. Raith, in this issue; pp. 138–140).

The scientific research now being conducted to evaluate electrical stimulation of the vagus area of the ear and to observe electrical detection of auricular acupuncture points as active or not is receiving increased interest.

*Among some authors outside the United States, the term *psychic* is used to denote *psychologic*. There is no connection in this usage to extrasensory perception.

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