

Innervation of the Human Cavum Conchae and Auditory Canal: Anatomical Basis for Transcutaneous Auricular Nerve Stimulation

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The innocuous transcutaneous stimulation of nerves supplying the outer ear has been demonstrated to be as effective as the invasive direct stimulation of the vagus nerve for the treatment of some neurological and nonneurological disturbances. Thus, the precise knowledge of external ear innervation is of maximal interest for the design of transcutaneous auricular nerve stimulation devices. We analyzed eleven outer ears, and the innervation was assessed by Masson's trichrome staining, immunohistochemistry, or immunofluorescence (neurofilaments, S100 protein, and myelin-basic protein). In both the cavum conchae and the auditory canal, nerve profiles were identified between the cartilage and the skin and out of the cartilage. The density of nerves and of myelinated nerve fibers was higher out of the cartilage and in the auditory canal with respect to the cavum conchae. Moreover, the nerves were more numerous in the superior and posterior-inferior than in the anterior-inferior segments of the auditory canal. The present study established a precise nerve map of the human cavum conchae and the cartilaginous segment of the auditory canal demonstrating regional differences in the pattern of innervation of the human outer ear. These results may provide additional neuroanatomical basis for the accurate design of auricular transcutaneous nerve stimulation devices. Copyright © 2017 P. Bermejo et al.