

HISTOPATHOLOGIC EFFECTS OF CHRONIC COCHLEAR IMPLANT USE

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Purpose: Spiral ganglion neurons (SGNs) are the target neurons for cochlear implants; therapies designed to prevent their degeneration, or the degeneration of more central portions of the auditory pathway, would therefore be expected to result in improved clinical performance among cochlear implant patients. There is continued debate as to whether chronic electrical stimulation (ES) of SGNs, in ototoxically deafened animals, results in the rescue of SGNs *in vivo*. The present study examined the effects of chronic ES, via a commercially available cochlear implant, on the cochlea and cochlear nucleus of long-term deaf animals.

Methods: Sixteen cats were neonatally deafened with daily subcutaneous injections of neomycin sulfate, resulting in a severe-profound sensorineural hearing loss. At eight weeks of age, eleven of these animals were implanted with an eight ring scala tympani electrode array and lead-wire assembly and received chronic ES, using a commercial cochlear implant system, for >16hr/day, 7 days/week over 8-12 months to reflect normal clinical usage. On completion of the stimulation program, histopathological examination of the cochleae and cochlear nuclei were performed on all deafened animals and an additional 3 age-matched normal hearing controls. **Results:** There was no significant difference in SGN density between the implanted left cochlea and the contralateral, unstimulated right cochlea in all turns (P 's > 0.05). However, chronic ES resulted in a significant ($P < 0.01$) reduction in the shrinkage of the anteroventral cochlear nucleus (AVCN) normally associated with long-term deafness. **Conclusion:** Chronic ES, delivered from a commercially available cochlear implant, is able to prevent some of the atrophy in the AVCN caused by long-term deafness; however, it is unable to rescue SGNs in long-term deaf animals. More research into clinically viable techniques for the preservation of SGNs *in vivo* is required.