COCHLEAR IMPLANT - BIOMEDICINE

FP143

INTRACOCHLEAR FACTORS CONTRIBUTING TO PSYCHOPHYSICAL PERCEPTS FOLLOWING COCHLEAR IMPLANTATION

A. Kawano, H.L. Seldon, G.M. Clark, R. Ramsden and C. Raine
The University of Melbourne, Dept. of Otolaryngology, Melbourne, Australia

Variations of performance of cochlear implant patients may be related to several factors. In this anatomical study we focus on determining how intracochlear factors affect postoperative psychophysical perceptual scores of the 22-channel cochlear implant system. We have used 3-dimensional (3D) computer reconstruction of cochleas of former Nucleus 22-channel implant patients to quantitatively map intracochlear pathology relative to electrode positions, and relate the type and quantity of pathology to the T and C levels and dynamic ranges of individual electrodes. Preliminary results of this study were presented at the International Symposium on Cochlear Implants, Speech and Hearing Research in Melbourne, October, 1994 (1).

Using the system described by Seldon (2), temporal bone sections were reviewed and analysed on a computer monitor via a Data Translation DT2851 frame-grabber card. We made 3D computer reconstructions from five temporal bones of cochlear implant patients and measured the following factors: distance between electrode ring's center and Rosenthal's canals center ('dis'), the cross-sectional areas of fibrous tissue ('ft') and new bone ('nb') as intracochlear pathology along the electrode array, and there was considerable interrelationship between the postoperative psychophysical parameters (T and C levels, DR) and these factors were analyzed. To correlate the psychophysical perceptual with the anatomical factors, Pearson's correlation coefficients were calculated. Multiple regression analysis was also performed to find the combination of factors that contribute to the performance. In the multiple regression analysis, T and C levels and DR were used as dependent variables, and the anatomical factors as independent variables.

Values for 'dis' were 1.1-2.2 mm and tended to be shorter toward the apex of the cochlea. All cochleas had several histological changes ('ft' and 'nb') along the electrode array, and there was considerable individual variation. Four had notable changes (more than 10 mm3), and two of those had much new bone formation. The histological changes tended to be greater in the lower basal turn, and there was a high correlation between histological changes and 'dis'. The total number of residual spiral ganglion cells was 5591-11001, with one exception (2158).

The results showed several significant correlations and regressions, allowing us to draw some overall conclusions. For the T level, three cochleas showed a significant relation with 'dis', i.e., a longer distance contributes to a higher T level. For the DR, a higher 'sgc' contributed to a higher DR in three cases, and a longer distance contributed to a higher DR in two cases. A lower T level with a wider DR was considered to be related to sensitivity and function of the inner ear and speech recognition ability (3). So a shorter 'dis' and a higher residual 'sgc' (or, in the other cases, lower intracochlear changes) contribute to good speech recognition ability.

2) Seldon HL: Three-dimensional reconstruction of temporal bone from CT scans on a personal computer. Arch Otolaryngol Head Neck Surgery 1991; 117:1158-1161

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MONDINI MALFORMATION. IS A COCHLEAR IMPLANT INDICATED?

Aina Hamed, MD
14 Tahrir St, Dokki, Cairo, Egypt

Are Mondini's patients with profound sensorineural hearing impairment candidates for a cochlear implant? There is no preoperative test to determine a sufficient number of cochlear neural elements for stimulation. Based on results of examinations of successfully implanted non-Mondini temporal bones, it is believed that the spiral ganglion cells are most probably not stimulated by cochlear implant. Therefore, attempts to determine if Mondini's bones may have enough spiral ganglion cells for cochlear implant stimulation. We counted the population of spiral ganglion cells in the mid-modiolar sections of twelve temporal bones from four patients with Mondini's malformation and with cochlear implant and in sections from five bones from four patients without Mondini's but with two-to-ten-year history of successful implant use. Five bones with normal anatomy from three patients with normal hearing served as controls. The six Mondini's ears showed an average of 390 spiral ganglion cells, with a range of 254 to 347. The implant ears had 384, with a range from 291 to 504. The numbers are almost the same. Both are about 45% of the population of the control bones, which averaged 846.

Results of this limited sample of Mondini's bones indicate the possibility that they may have enough spiral ganglion cells for auditory response to cochlear implant stimulation.

FP145

THE ROLE OF ENDOTHELIUM IN VASOREGULATION BY COCHLEAR NEUROTRANSMITTERS IN GUINEA PIGS. THE INVOLVEMENT OF ATP-SENSITIVE POTASSIUM CHANNELS.

Judith Schüttler, Józef Géza Kiss, Józef Jóri, John Mieszkowski*, Jenö Czilgen
*Cochlear AG Basel, Switzerland

Background: Acetylcholine, calcitonine gene-related (CGRP) and nitric oxide (NO) have been found to have neuromodulatory role in cochlear function. These neuromodulators are known to induce vasodilation, therefore, we have investigated whether there is a neurotransmitter release from cochlear nerves, due to electric signals might contribute to an increase in blood flow to the cochlea through vasodilation. Aim: Since the vasodilation by these mediators is believed to be underlain at least in part by a direct activation of ATP-sensitive potassium (KATP) channels, our work was to study whether KATP channel opening is involved in the vascular effect of electrical activation of cochlear nerves.

Methods: Cochleas prepared from adult male guinea pigs were placed in an organ chamber (5 ml) filled with tempura solution and PH (7.2)-controlled oxygenized Krebs solution. The cochleas were then mounted on small plastic hooks. The organ was stimulated (FS) with 50 Hz, 40 V square wave pulses for over 10 s were applied via two platinum wire electrodes, each side of the preparations connected to an "Exprem" two channel programmable stimulator. Thoracic aortic rings prepared from adult male guinea pigs were used as control. The preparations were then mounted on small plastic hooks. The organ was stimulated (FS) with 50 Hz, 40 V square wave pulses for over 10 s were applied via two platinum wire electrodes, each side of the preparations connected to an "Exprem" two channel programmable stimulator.
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Judith Schjødt, József Géza Kiss, József Jóri, John Mieszkowski*; Jénő Czigner

Dept. Oto-Rhino-Laryngology, Albert Szent-Györgyi University Szeged H-6723 Szeged, Tisza Lajos kr. 111, H*
*Cochlear AG Basel, Switzerland

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Methods: Cochleas from adult male guinea pigs were placed in an organ chamber (5 ml) filled with temperature- and pH (7.2)-controlled oxygenated Krebs solution. Mesocochlear arteries were then mounted on small plastic hooks and subjected to 0.2 Hz, 10 V square impulses of 100 ms duration per stimulus (FS) with 50 Hz, 40 V square impulses of over 10 s were applied via two platinum wire electrodes placed on each side of the preparations connected to an *Eppendorf two channel programmable stimulator. Thoracic
Author/s:
Kawano, A.; Seldon, H. Lee; Clark, Graeme M.; Ramsden, R.; Raine, C.

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