ABSTRACTS OF THE THIRTY-FIRST ANNUAL MIDWINTER RESEARCH MEETING OF THE

Association for Research in Otolaryngology

February 16-21, 2008

Phoenix, Arizona, USA

Peter A. Santi, PhD
Editor

Association for Research in Otolaryngology
19 Mantua Road, Mt. Royal, NJ 08061 USA

705 Exposure to Intense Noise Causes Paracellular Permeability of Supporting Cells in the Organ of Corti

Bo Hua Hu[1], Gui-Liang Zheng[2]

[1]*State University of NY at Buffalo,* [2]*State University of NY at Buffalo and Institute of Otolaryngology, Chinese PLA General Hospital*

Exposure to intense noise traumatizes the cochlear structures, leading to the death of hair cells (HCs) and supporting cells. As a sign of structural defects, the presence of macromolecular markers in HCs with the compromised plasma membrane has been observed in noise-traumatized cochleae. Although the presence of the fluorescence markers in the HCs is an indicator of the structural failure of the reticular lamina, it is not clear whether the macromolecular tracers could reach HCs through the compromised basilar membrane and the extracellular connection between supporting cells. in the current study, we observed the paracellular permeability of the basilar membrane in normal and noise-exposed cochleae with a fluorescent marker, fluorescein isothiocyanate-dextran with graded molecular weights. Chinchillas were exposed to 75 pairs of impulses at 155 dB pSPL. Immediately after the noise exposure, the animals were anesthetized, and the compartment of the scala tympani of the cochlea was perfused with the FITC-dextran solution. the cell viability was assessed with a propidium iodide assay. in the normal cochleae without acoustic trauma, there was no dextran fluorescence in the organ of Corti. Following the noise exposure, the fluorescence of the 3 and 40 kD FITC-dextrans was observed in several paracellular spaces including the reticular lamina between HCs and the phalangeal process of Deiters cells, as well as around Deiters and Hensen cells. in addition, there was strong dextran fluorescence in the cytoplasm of dying HCs. Since HCs are not directly accessible to the perufsed dextran solution, the presence of the dextran fluorescence in the dying HCs suggests the passage of the dextrans through the paracellular pathway of supporting cells. Moreover, the current study demonstrated that the level of paracellular permeability was limited in noise-damaged cochleae because there was no FITC-dextran fluorescence in the cochleae stained with large molecular weights of FITC-dextrans (500 kD or 2,000 kD). Collectively, the results of the current study suggest the occurrence of mechanical injury to cell-cell junctions of supporting cells. Study of the biological role of this structural defect of the supporting cell attachment in induction of HC death seems imperative.

706 Relation of Focal Hair-Cell Lesions to Noise-Exposure Parameters

Gary W. Harding[1], Barbara A. Bohne[1]

[1]*Washington University School of Medicine*

Previously, we examined the relation between total energy in the noise exposure & percentage losses of outer (OHC) & inner (IHC) hair cells in the apical & basal halves of 607 chinchilla cochleae (Harding & Bohne, JASA 115, 2004). the animals had been exposed continuously to either a 4-kHz octave band of noise (OBN) at 47-108 dB SPL for 0.5 hr-36 days, or a 0.5-kHz OBN at 65-128 dB SPL for 3.5 hr-433 days. Interrupted exposures were also employed for both OBNs. Post-exposure recovery times ranged from 0-913 days. Cluster analysis was used to separate the data into 3 magnitudes of damage. the data were also separated into recovery times of 0 days (acute) & > 0 days (chronic). It was found that moderate-level, moderate-duration exposures produced OHC & IHC losses that were related to total energy, while hair-cell losses from high-level, short-duration exposures were not related to total energy. a substantial part of the hair-cell losses occurred in focal lesions (i.e., >/= 50% loss of IHCs, OHCs or both cell types over a distance of >/= 0.03 mm). This abstract describes, within the same 3 clusters, the apex-to-base distribution of 1820 lesions found in 468 of 660 noise-exposed cochleae. in these cochleae, organ-of-Corti (OC) length in mm was converted to % distance from the apex. the data were analyzed to determine % distance from the apex and size (mm) of the lesions. in 55 of 140 non-noise-exposed OCs, there were 186 lesions, the characteristics of which were also determined. Focal lesions involved IHCs only, OHCs only or combined OHCs & IHCs. the OHC only and combined lesions were grouped for the analysis. the distributions of lesion location were tallied in 2 %-distance bins. in controls, focal lesions were uniformly distributed from apex to base & 70% of them were pure IHC lesions. in cochleae exposed to the 4-kHz OBN, lesions were distributed in the basal half of the OC. in cochleae exposed to the 0.5-kHz OBN, lesions occurred in both halves of the OC. with continuous exposures, 74% of the lesions were pure OHC or combined lesions. with interrupted exposures, 48% of the lesions were pure IHC lesions. Lesion size was larger in the chronic compared to acute cochleae with similar exposures. There was a minimum total energy at which focal lesions began to appear & slightly higher energies resulted in nearly all exposed cochleae having focal lesions.

707 Phosphorylation of Nuclear Factor-Kappa B in the Inner Ear by Loud Sound Stimulation

Hiroshi Yamamoto[1], Xiaorui Shi[1], Irina Omelchenko[1], Alfred Nuttall[1]

[1]*Oregon Health and Science University*

Nuclear factor-kappa B (NF-κB) plays an essential role in the regulation of genes involved in various biological processes, such as inflammation, immune responses, neuronal development, and cellular apoptosis. NF-κB activation can be achieved through two main pathways. the canonical (classical) pathway is known to be involved in the response of various cell types to pathogen associated molecules as well as proinflammatory cytokines, such as tumor necrosis factor alpha (TNF-α) and interleukin-1 (IL-1). the noncanonical (alternative) is activated by a different specific set of stimuli, including B-cell activating factor (BAFF), lymphotoxin β, and CD40L.

in this study, using immunohistochemistry and immunoblot analysis, we determined whether one or both NF-κB pathways, canonical (classical) or noncanonical (alternative), were involved in the loud sound-induced