Susceptibility to Tinnitus Revealed at 2 kHz Range by Bilateral Lower DPOAEs in Normal Hearing Subjects with Noise Exposure

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Abstract

We investigated potential markers of susceptibility to tinnitus in a group of normal hearing young pilots aged 25–35 years and with 8 ± 5 years of aircraft noise exposure. 316 pilots were interviewed about their tinnitus status and were tested for hearing thresholds (audiograms) and distortion products otoacoustic emissions (DPOAE-grams). There was no subject with permanent tinnitus. 23% reported having occasionally perceived tinnitus after flight missions and 77% reported never having experienced tinnitus after flight missions. General discomfort in the ears to noise was higher in the occasional tinnitus group (15 vs. 6%). The major finding was that difference of susceptibility to tinnitus in normal hearing subjects exposed to noise on a daily basis seemed to be clearly related to lower DPOAEs, bilaterally, in the 1500–2800-kHz range. However, no difference could be observed between groups on audiograms at the 2-kHz frequency range. This study provided evidence of outer hair cell dysfunctions in normal hearing subjects exposed to noise and susceptible to tinnitus. Hypersensitivity to noise and decreased DPOAEs in a non-noise-specific frequency range support the idea of another alteration mechanism than noise itself. This point was discussed in the light of recent publications.

Short-Term Pathophysiologic Changes and Histopathologic Findings of the Auditory Pathway after Closed Head Injury, Using a Rabbit Model

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Abstract

Hearing impairment is a well-known consequence of closed head injury (CHI). The aim of this study was to elucidate the pathogenesis of CHI-induced hearing loss, using a rabbit model. Twelve New Zealand white rabbits were divided into two groups of 6. In the first group, CHI was induced mechanically, whereas the rabbits of the second group served as controls. Baseline distortion product otoacoustic emissions (DPOAEs), contralateral suppression (CS) of the DPOAEs and auditory brainstem response (ABR) were obtained. The same measurements were performed in the first group after CHI. Three hours later, the animals were sacrificed and their brain was excised and subjected to histopathologic examination. Mean I-III ABR latencies were increased and DPOAE amplitudes and CS values were reduced in the trauma group after CHI, at a statistically significant level. Histopathologic examination of the temporal lobe and brainstem showed multiple hemorrhagic and necrotic areas, with edema in the surrounding region. The vestibulocochlear nerve was severely damaged at its emerging site at the brainstem. In conclusion, both peripheral and central involvement of the auditory pathway was found after CHI. Otoacoustic emissions in conjunction with ABR may provide significant information on both peripheral and central auditory function.
**Mechanism and Rate of Middle Ear Fluid Absorption** Petia Petrova, Sharon Freeman, Haim Sohmer

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**Abstract**

Several mechanisms have been suggested to explain the clearance of fluids from the middle ear. These include a pumping action through the eustachian tube, mucociliary beating through the tube, outflow of water to the blood due to osmotic gradients and an active Na⁺ transport driving water absorption. In order to assess these mechanisms, the middle ear cavity of paralyzed, ventilated (eustachian tube occluded) guinea pigs was filled with fluids varying in osmotic pressure (hypotonic, isotonic, hypertonic) to which a vertical tube was attached. The change in height of fluid in the tube was taken as a measure of changes in middle ear fluid volume. A greater fluid volume reduction was seen with the hypotonic (1/5 saline) solution. A small volume increase was observed with the hypertonic solution. These results provide evidence that in these experimental conditions, water absorption due to osmotic gradients can contribute to middle ear fluid clearance.

**Ganglioneuroma of the Internal Auditory Canal: A Case Report** Levent Naci Ozluoglu, Ismail Yilmaz, Can Alper Cagici, Nebil Bal, Bulent Erdogan

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**Abstract**

Ganglioneuroma is a rare, benign, slow-growing tumor thought to develop from cells of neural crest origin, even though hypotheses on the pathogenesis of that lesion differ. Ganglioneuromas, which do not release excessive catecholamine or steroid hormones, develop primarily in the posterior mediastinum and retroperitoneum. Because of their slow growth, many ganglioneuromas are large when they are diagnosed. In this case report, a 50-year-old woman with hearing loss is described. Magnetic resonance imaging revealed a mass (3 × 4 mm) in the internal auditory canal (IAC). The encapsulated tumor was entirely excised via the middle fossa approach. The results of histopathological examination indicated that the excised lesion was a ganglioneuroma. To our knowledge, this is the first report of a ganglioneuroma of the IAC. We suggest that ganglioneuroma be considered in the differential diagnosis of all tumors of the IAC.

**Residual Hearing Thresholds in Cochlear Implantation and Reimplantation** Walter Di Nardo, Italo Cantore, Francesca Cianfrone, Pietro Melillo, Mario Rigante, Gaetano Paludetti

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**Abstract**

Implant and reimplantation surgery should be carried out with preservation of residual hearing. The aim of this study is to evaluate the effects of such a surgery on hearing threshold. We report the results on 40 patients, 20 males and 20 females, aged between 5 and 70 (mean 29) years, 16 pre-verbal and 24 post-verbal, with measurable pre-operative auditory thresholds.
thresholds. We used the following implants: Advanced Bionics, Med-El, Cochlear, and MXM Digisonic. Four of the patients underwent cochlear reimplantation owing to device failure. A complete insertion was obtained in all patients. Responses to pure-tone stimuli were evaluated in each ear in pre-implant conditions and 3 months after cochlear implant or reimplantation. The explantation was performed with minimal cochlear trauma and preservation of the explanted electrode integrity. 35% showed no change of the hearing threshold, 45% showed a slight worsening of the hearing threshold level in the implanted ear, and 20% had a total loss of residual hearing. Median increases of threshold levels were 10, 5, 10 and 3 dB HL respectively for 125, 250, 500 and 1 kHz. In the group of 4 patients who underwent cochlear reimplantation, 2 showed no variation of the hearing threshold, 1 preserved an appreciable hearing threshold, and 1 had a total loss of residual hearing. The data seem to suggest that hearing function is rather resistant to mechanical trauma during implant and reimplant surgery; the authors hypothesize a role for direct spiral ganglion activation under intense mechanical stimulation.

**Effects of a Single High Dose of Cisplatin on the Melanocytes of the Stria Vascularis in the Guinea Pig**

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**Abstract**

The antineoplastic drug cisplatin is known to cause a reduction in endocochlear potential. The hypothesis to be tested was whether a single high dose of cisplatin affects the melanocytes by altering the expression of melanin. Pigmented guinea pigs received a bolus injection of cisplatin (8 mg/kg as a 15-second intravenous infusion). Auditory brainstem response (ABR) thresholds and morphological analysis of the hair cells and the stria vascularis were made 96 h after injection. ABR thresholds were elevated (15-40 dB) at 12-30 kHz and a significant loss of outer hair cells in the more basal regions was found. Cisplatin caused a significantly lower density of melanin in the intermediate cells in the basal region without any signs of apoptosis. Changes in melanin content were not noted in the middle or apical cochlear regions. Significant correlations were found between melanin density, ABR threshold shifts and outer hair cell loss in the region corresponding to 30 kHz. The findings reported here further support the multiple cytotoxic effect of cisplatin on the inner ear.

**Enterovirus, Cytomegalovirus, and Epstein-Barr Virus Infection Screening in Idiopathic Sudden Sensorineural Hearing Loss**

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**Abstract**

Sudden sensorineural hearing loss (SSNHL) is frequently classified as 'idiopathic' since the causative factor is not identified in most cases. In the present study we determined whether SSNHL is associated with common viral infections, namely enterovirus, cytomegalovirus (CMV) and Epstein-Barr virus (EBV). Between April 2004 and March 2005, we conducted a prospective cohort study on 48 unselected patients with unilateral idiopathic SSNHL. Plasma samples obtained at presentation were analyzed for the presence of enterovirus RNA by reverse-transcription polymerase chain reaction (RT-PCR). Recent occurrence of CMV and EBV infection was determined by serological tests. Among 23 men and 25 women aged 18-84 years (mean age 51.67 years), none presented with clinical symptoms of a viral infection.
compatible with preceding or concurrent viral infection. One patient (2.08%) had evidence of enterovirus infection by RT-PCR, 3 patients (6.25%) had EBV IgM, and none were positive for CMV IgM. The majority of SSNHL patients (91.67%) did not have evidence of any of the three common viral infections upon presentation. The present study failed to identify recent or concurrent systemic viral infections among SSNHL patients, except for a small proportion who demonstrated recent viral infection. Therefore the theory that viral infection is a factor in SSNHL pathogenesis is not supported by this study. Further studies in larger patient populations and different epidemiological settings are required in order to verify the true role of viral infections in SSNHL.

**Impact of Alcohol on Vestibular Function in Relation to the Legal Limit of 0.25 mg/l Breath Alcohol Concentration** Hou-Hsien Chiang, Yi-Ho Young Department of Otolaryngology, National Taiwan University Hospital and National Taiwan University College of Medicine, Taipei, Taiwan

**Abstract**

The aim of this study was to investigate the effect of alcohol on sacculocollic and vestibulocular reflex systems, when the breath alcohol concentration (BrAC) is close to the legal limit of 0.25 mg/l. Twenty healthy male volunteers underwent vestibular evoked myogenic potential and caloric coupled with visual suppression tests. These tests were conducted prior to imbibing alcohol at a dosage of 0.5 g/kg to achieve a peak BrAC of around 0.25 mg/l. Once the peak BrAC was reached, these tests were performed again. Predosing and postdosing analytical results were compared, as were those with BrAC levels 0.25 mg/l and <0.25 mg/l. After ingesting alcohol, 36 ears (90%) showed vestibular evoked myogenic potential responses, with a significantly increased latency of peak p13. The mean slow-phase velocity of caloric nystagmus in 40 ears after dosing was significantly reduced, and that with BrAC 0.25 mg/l was significantly less than that with BrAC <0.25 mg/l. Likewise, the visual suppression index decreased considerably after alcohol ingestion. In conclusion, from the perspective of vestibular function, the 0.25-mg/l BrAC limit gains clinical significance, because the vestibulo-ocular reflex performance deteriorates further, when the BrAC exceeds 0.25 mg/l. However, impaired performance of sacculocollic reflex and vestibulocerebellar interaction has occurred, when the BrAC was <0.25 mg/l, suggesting that a lower legal threshold is appropriate.

**Mechanisms of Vibration-Induced Nystagmus in Normal Subjects and Patients with Vestibular Neuritis** HongJu Park, JungEun Shin, DaeBo Shim Department of Otorhinolaryngology-Head and Neck Surgery, Konkuk University School of Medicine, Seoul, South Korea

**Abstract**

It has been reported that vibration applied either on the mastoid or on the sternocleidomastoid (SCM) muscles induces nystagmus in normal subjects or patients after unilateral vestibular neuritis (VN). The aims of the study were to characterize vibration-induced nystagmus (VIN) in normal and patient groups and to propose the mechanism of VIN. We recorded eye movements during unilateral 100-Hz vibration on the mastoid bone and SCM muscles in 22 normal subjects and 19 patients with unilateral VN. In normal subjects, the direction of slow-phase velocity (SPV) tended to be toward the vibrated side. Vibration on the right/left SCM muscles induced mean SPV of 1.7°/s, -1.9°/s toward the stimulated side in all normal subjects. Vibration on the right/left mastoid bone induced mean SPV of -1.5°/s, -0.4°/s toward the stimulated side in most of the normal subjects. Positive value means SPV to the right side. This directional preponderance to the vibrated side was
statistically significant. Among the patients with VN, the slow phase of the VIN was directed towards the lesioned side, irrespective of whether vibration was applied on the lesioned or intact side. Vibration on the right/left mastoid bone induced mean SPV of -10.4°/s, -10.8°/s toward the lesioned side. Vibration on the right/left SCM induced mean SPV of -7.9°/s, -10.5°/s toward the lesioned side. The amplitude of SPV showed a significant correlation with the unilateral weakness of caloric test. Our results suggest that the proprioceptive stimulation plays a major role in producing VIN in normal subjects, while VIN is generated mostly by the vestibular stimulation in patients with unilateral VN, which helps us localize the lesion side. Vibration tests on the SCM muscles as well as on the mastoid are recommended and our hypothetic mechanisms of VIN are presented.

Identification of Mutations in Members of the Connexin Gene Family as a Cause of Nonsyndromic Deafness in Taiwan Jiann-Jou Yanga, b, Shih-Hsin Huanga, c, Kvei-Hsiu Choua, b, Pei-Ju Liaoa, b, Ching-Chyuan Sua, d, Shuan-Yow Li a aGenetics Laboratory and Department of Biomedical Sciences, bInstitute of Medicine and cCollege of Oral Medicine, Chung Shan Medical University, Taichung, and dTian-Sheng Memorial Hospital, Tong Kang, Pin-Tong, Taiwan, ROC

Abstract

Connexins (Cx), a large family of membrane proteins, are key components of gap junction channels. These channels are critical intercellular pathways through which ions or small molecules are passed, regulating a variety of physiological and developmental processes. One of these processes is hearing. In the current study, a genetic survey was made on 380 Taiwanese individuals, 260 with nonsyndromic deafness and 120 with normal hearing. All the 380 Taiwanese were screened for the presence of mutations in 8 genes of the Cx gene family. These genes included Cx26 (GJB2), Cx29 (GJE1), Cx30 (GJB6), Cx30.3 (GJB4), Cx31 (GJB3), Cx32 (GJB1), Cx43 (GJA1) and pseudogene of Cx43 (GJA1). Mutations were identified in 7 out of the 8 screened genes of the Cx family from 62 of the 260 deaf subjects (23.85%). Of the 17 mutations observed in the Cx gene family, 11 were novel mutations. Fourteen polymorphisms that were not associated with hearing loss were identified in the Cx gene family. The first 2 most frequently occurring mutations were found in the Cx26 (28/62; 45.16%) and the Cx43 (17/62; 27.42%), respectively. Nine cases of mutations were found in the Cx30.3 (9/62; 14.52%). In the Cx30, 1 novel mutation was identified in 1 case (1/62; 1.61%). Two patients with mutations of each of Cx29 and Cx43 were found (2/62; 3.23%). One novel mutation of Cx31 was identified in 3 patients with nonsyndromic deafness (3/62; 4.84%). The Cx32 was the only gene without detecting any mutation or polymorphism. Our study provides information for understanding the importance of genetic factors in nonsyndromic deafness of the Taiwanese and may be of use in the improvement of genetic diagnosis of hearing loss in Taiwan.