Dear Colleagues and Friends,

Last month most of you participated in the Tinnitus Research Initiative Meeting in Monaco. The event gathered over 120 people, from 20 different countries and a large number of different specialities. But more important than these numbers, a sense of urgency and a striving for breakthroughs seemed to run through the sessions like an electric charge, all inspired by the shared opinion that together we will find a cure.

It is up to us now, to keep alive this spirit in our research efforts or in our clinical routine. Only in the impact on our daily work the meeting can achieve sustained success.

With this 3rd Newsletter, we want to provide you again with an overview of the latest progress. It is expression of our conviction that regular communication between us scientists is essential for the path to success. And again, any form of feedback - critics, suggestions, contributions.. – are welcome.

Berthold Langguth           Susanne Staudinger

NB: for further information concerning the TRI meeting, please visit our website www.tinnitusresearch.org. Choose the option TRI Meetings.
News

Here we would like to forward you an e-mail which reached us during the last days and which might be interesting for you:

Dear all,

During our TRI Monaco meeting, I have heard many people complaining (and rightly so) about lack of proper forum for publishing and discussing the negative (not meaning not important) results.

In response to this, I send you the address of a Journal of Negative Results in Biomedicine (dob 2004; http://www.jnrbm.com/) and another one (CBS) that is about the JNRBM itself (http://www.acfnews.org/science/negative_results.html).

stay well,

Agnieszka

Agnieszka J. Szczepak, PhD
Project Leader
Tinnitus Center, CC16 Research laboratory
Charite University Hospital
Chariteplatz. 1
D-10117 Berlin, Germany
Upcoming Meetings

International Tinnitus Forum - Transitional Research in Tinnitus Therapy III:
Nuclear Medicine imaging. Preceding the AAO-HNS Foundation Annual Meeting

When: September 15, 2007
Where: Renaissance Washington DC Hotel, Renaissance Ballroom,
       East 999 Ninth Street NW, Washington, DC 2001 USA
Contact: Dr. Barbara Goldstein, METRC, Inc
Phone: +1-718-773-888
Fax: +1-718-465-3669
E-Mail: metrc@inch.com

2007 Annual Meeting & OTO EXPO

When: September 16 – 19, 2007
Where: Washington D.C., USA
Contact: American Academy of Otolaryngology – Head and Neck Surgery
Phone: +1-703-836-4444
Fax: +1-703-683-5100
E-Mail: OTOEXPO@entnet.org
or meetings@entnet.org
Detailed information: http://www.entlink.net/meetings/meetings/Annual-Prep.cfm

IEB2007: Inner Ear Biology Meeting - 44th Inner Ear biology Workshop

When: September 16 – 19, 2007
Where: Institute for Child Health, 20 Guilford Street, London WC1N 1EH
Phone: +44 (0) 20 7905 2135
Fax: +44 (0) 20 7905 6902
E-Mail: info@ichevents.com
Detailed information: http://www.ieb2007ucl.org

Fifteenth annual Conference on Management of the tinnitus patient

When: September 20 – 22, 2007
Where: University of Iowa, Iowa City
Contact: Richard Tyler PhD
Phone: +1-319-356-2471
E-Mail: rich-tyler@uiowa.edu

13th Tinnitus update lecture course

When: September 24 – 25, 2007
Where: Bristol UK
Contact: Dr Amr El Refaie, Lucy Handscombe
Phone: +1-319-356-2471
Detailed information: tulc-chbs@bristol.ac.uk
October 2007

British Tinnitus Association - BTA Conference 2007
Tinnitus - The Way Ahead
When: Thursday October 4, 2007
Where: The Royal College of Surgeons, London, UK
Detailed information: http://www.tinnitus.org.uk/events/conf07/conf07.htm

Aging and Speech Communication:
An international and interdisciplinary research conference
When: October 7-10, 2007
Where: Indiana University, Bloomington
Detailed information: http://www.indiana.edu/~ascpost/index.htm

November 2007

Neuroscience 2007, the Society's 37th annual meeting
When: November 3-7, 2007
Where: San Diego, California
Detailed information: http://www.sfn.org/am2007/?CFID=7679509&CFTOKEN=57216251

June 2008

IXth International Tinnitus Seminars
When: June 15 – 18, 2008
Where: Göteborg, Sweden
Contact: Congrex Sweden AB, Ref. Tinnitus 2008
P.O.Box 5078
402 22 Göteborg, Sweden
Phone: +46-31-708-6000
Fax: +46-31-708-6025
E-Mail: tinnitus2008@congrex.com
Detailed information: http://www.congrex.se/ITS2008

July 2008

The 10th International Workshop on the Mechanism of Hearing
When: July 27 – 31, 2008
Where: Keele University, UK
Contact: Dr. N.P. Cooper
School of Life Sciences
Keele University
Keele, Staffordshire
ST5 5BG
UK
Phone: +44-1782-583056
Fax: +44-1782-583055
E-Mail: secretary@mechanicsofhearing.com
Detailed information: http://www.mechanicsofhearing.com
Recently published literature

I Epidemiology

**Occupational noise-induced hearing loss reports and tinnitus in Finland.**

Mrena R, Ylikoski M, Mäkitie A, Pirvola U, Ylikoski J
Department of ORL, Helsinki University Central Hospital. Helsinki.

**Conclusion:** In occupational noise-induced hearing loss (NIHL) reports, many tinnitus sufferers probably remain undetected and untreated at present. Attention should be focused on tinnitus, as well as threshold shifts resulting from NIHL.

**Objectives:** Occupational NIHL is frequent among workers in industrialized countries and it is one of the greatest occupational health hazards. Hearing conservation programs have led to a reduction in the numbers of severe occupational NIHL. Our objectives were to analyze the severity of occupational NIHL reported in Finland, identify risk occupations, and investigate the occurrence of tinnitus among the reported cases.

**Materials and methods:** We examined the records of 857 NIHL cases with an identifiable disability category of the total 858 NIHL cases reported in 2000. We sent tinnitus questionnaires to 366 of these NIHL cases.

**Results:** The degree of speech-frequency hearing loss was generally low, and a mention of tinnitus was reported in only 34 cases (4.0%). However, 88.7% of the patients actually had unreported tinnitus.

**Alcoholism: effects on the cochleo-vestibular apparatus.**

Bellé M, Sartori Sdo A, Rossi AG
UFSM, Santa Maria, Brazil. marcielibelle@yahoo.com.br
Several ototoxic drugs are harmful to the human being and lead to problems such as tinnitus, many types of hearing loss, and vertigo. Alcohol is among the main agents considered ototoxic.

**Aim:** To study the effects of alcoholism in the vestibular-cochlear system. STUDY DESIGN: cross-sectional contemporary cohort.

**Materials and methods:** The sample comprehended 37 individuals in the Experimental Group, members of Alcoholics Anonymous of the City Santa Maria-RS, and 37 non-alcoholic individuals in the Control Group, age and gender matching. All of the individuals examined were submitted to anamnesis, otorhinolaryngological examination, basic hearing evaluation, and vecto-electronystamography.

**Results:** 67.57% of the individuals from the Experimental Group showed abnormalities in the audiometry and 24.32% presented abnormalities in the computerized vecto-electronystamography. In the Control Group, 27.03% of the individuals showed abnormalities in the audiometry and 10.81% presented abnormalities in the computerized vecto-electronystamography.

**Conclusion:** Alcohol interferes on an individuals hearing and balance, causing deleterious effects on the human organism.

**The impact of tinnitus on quality of life in older adults.**

Department of Ophthalmology and Visual Sciences, University of Wisconsin, 610 Walnut Street, Room 1040, Madison, WI 53726-2397, USA. Nondahl@episense.wisc.edu
Few population-based data exist to assess the impact of tinnitus on quality of life. As part of the Epidemiology of Hearing Loss Study, self-reported data on tinnitus and quality of life were obtained by interview at the first follow-up examination (1998-2000; N = 2800; ages 53-97 years). The Medical Outcomes Study Short Form Health Survey (SF-36) was used to assess quality of life. Adjusted mean SF-36 scores decreased (worsened) with increasing tinnitus severity (None, Mild, Moderate, Severe) for the Role-Physical, Bodily Pain, Vitality, and Mental Health domains, and the Physical Component Summary scale (F-tests for linear trend, p < .05). Scores tended to be lower for those who first reported tinnitus at the follow-up (five-year incidence of tinnitus) compared to those who reported tinnitus at the baseline and follow-up examinations (prevalent tinnitus). This study documents clear associations between tinnitus and reduced quality of life in this large cohort of older adults.

Characteristics of tinnitus in childhood.

Savastano M
Department of Otolaryngology Head and Neck Surgery, University of Padua, Via Giustiniani 2, 35128, Padova, Italy. marina.savastano@unipd.it.

Despite its incidence, there are still few reports in literature relating to tinnitus in children. Almost all data were collected by means of questionnaires or in a limited population of children. In order to collect data in a homogeneous way and directly from the patients, the protocol of study proposed by Savastano has been applied to 1,100 children. The results showed tinnitus as present in 374 children but only 6.5% of the cases complained spontaneously about it. In all, 76.4% of the children demonstrated normal hearing, whereas 64.5% reported being bothered by their tinnitus. Tinnitus measurements were obtained and are reproducible in all patients older than 8 years of age. The loudness level was <10 dB in 48.6% of cases, which was higher than 10 dB in 51.4%. As for the frequency distribution, in most cases it appears to be between 0 and 1,000 Hz. There is a correspondence between the loudness level and masking level. A total inhibition of <60 s for most children with lower loudness was obtained. The present study demonstrates that the application in the infancy of a specific protocol of study allows the presence of tinnitus to be discovered, giving specific and detailed information about it so as to minimize its damage to be obtained. Moreover, for the first time, data regarding the measurement of tinnitus in childhood has been gathered.

Breathing difficulty and tinnitus among children exposed to airbag deployment.

Mittal MK, Kallan MJ, Durbin DR
Division of Emergency Medicine, The Children's Hospital of Philadelphia, 34th Street and Civic Center Boulevard, Philadelphia, PA 19104, United States. mittal@email.chop.edu <mittal@email.chop.edu>

Objective: To assess the incidence of breathing difficulty and tinnitus in children involved in motor vehicle crashes with and without passenger airbag (PAB) deployment, and its relationship to seating position and to whether the airbag deployed was first versus second-generation.

Methods: We studied motor vehicle crashes with child passengers, over a 3-year period, in three large regions of the United States, by means of telephone interviews with the driver/parent. The crashes were classified into those with and without a PAB deployment. Complete data were collected on 7383 children in 4817 crashes, who, because of the sample design of the study, represent an estimated 120,987 children in 83,267 crashes.

Results: Among children involved in crashes with PAB deployment, 6.6% complained of breathing difficulty versus 1.4% without airbag deployment (OR 5.2, 95% CI 3.3-8.2). The corresponding figures for tinnitus were 5.0% versus 0.7% (OR 7.4, 95% CI 4.0-13.7). Analysis of data for children exposed to PABs indicated that 14.1% of children in the front seat versus 1.1% in the rear complained of tinnitus.

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(OR 14.4, 95% CI 5.9-34.7). Seating row did not significantly affect the incidence of breathing difficulty. The type of airbag deployed did not significantly affect the incidence of breathing difficulty or of tinnitus. **Conclusion:** Breathing difficulty and tinnitus were much more common among children in crashes with PAB deployment as against those without PAB deployment. Among children in crashes with PAB deployment, tinnitus was about 14 times more likely for those sitting in the front versus rear seat. The incidence of breathing difficulty was not affected significantly by seating row. Introduction of second-generation airbags has not affected the incidence of breathing difficulty or of tinnitus.

II Pathophysiology

**Chloroquine ototoxicity.**
Clin Rheumatol. 2007 Jun 27; [Epub ahead of print]

**Bortoli R, Santiago M**
Serviço de Reumatologia do Hospital Santa Izabel (HSI), Praça Conselheiro Almeida Couto, 500, Nazaré, Salvador, CEP: 40000-000, Bahia, Brazil.

Chloroquine (CQ), a 4-aminoquinoline drug, has been largely used for the treatment of rheumatoid arthritis and other connective tissue diseases. Besides the well-known retinal toxicity, its use has been suspected of being associated to ototoxicity. Some reports have described mainly sensorineural hearing loss, tinnitus, sense of imbalance, and cochleovestibular manifestations. Differently from what occurs in retinopathy, in which there is a predominance of CQ toxicity, there are reports of alterations in hearing related to either CQ or hydroxychloroquine. Brain-evoked response audiometry seems to be the most sensitive test in detecting early manifestations of cochlear injury caused by CQ when still in a reversible stage. The reversibility of CQ ototoxicity has been debatable, but there is suggestion that such complication can be corrected if the medication is stopped and appropriate therapy, with steroids and plasma expanders, is instituted.

**Severe tinnitus and its effect on selective and divided attention.**
Int J Audiol. 2007 May;46(5):208-216.

**Stevens C, Walker G, Boyer M, Gallagher M**
MARCS Auditory Laboratories, University of Western Sydney, Australia. kj.stevens@uws.edu.au

The effect of chronic, severe tinnitus on two visual tasks was investigated. A general depletion of resources hypothesis states that overall performance would be impaired in a tinnitus group relative to a control group whereas a controlled processing hypothesis states that only tasks that are demanding, requiring strategic processes, are affected. Eleven participants who had experienced severe tinnitus for more than two years comprised the tinnitus group. A control group was matched for age and verbal IQ. Levels of anxiety, depression, and high frequency average hearing level were treated as covariates. Tasks consisted of the say-word (easy) and say-color (demanding) conditions of the Stroop task, a single (baseline) reaction time (RT) task, and dual tasks involving word reading or category naming while performing a concurrent RT task. Results supported the general depletion of resources hypothesis: RT of the tinnitus group was slower in both conditions of the Stroop task, and in the word reading and category naming conditions of the dual task. Differences were not attributable to high frequency average hearing level, anxiety, or depression.
Differential gene expression profiles in salicylate ototoxicity of the mouse.

Im GJ, Jung HH, Chae SW, Cho WS, Kim SJ
Department of Otolaryngology-Head and Neck Surgery, Korea University College of Medicine, An Am-Dong 5Ka 126-1, Sungbuk-Ku, Seoul 136-705, Korea.

Conclusion: This study demonstrated differential gene expression profiles in salicylate ototoxicity with oligonucleotide microarray. This study may also provide basic information on candidate genes associated with hearing loss and/or tinnitus or recovery after salicylate-induced cochlear dysfunction.

Objectives: Salicylate ototoxicity is accompanied by temporary hearing loss and tinnitus. The purpose of the present study was to evaluate the gene expression profiles in the mouse cochlea with salicylate ototoxicity using DNA microarray.

Materials and methods: The subject mice were injected intraperitoneally with 400 mg/kg of sodium salicylate; an approximate 30 dB threshold shift that was observed by auditory brainstem response was achieved 3 h after an injection of sodium salicylate and the hearing threshold returned to within normal range at 3 days. Differential gene expression profiles at 3 h after salicylate injection in comparison to the normal cochlea were analyzed with DNA microarray technology.

Results: No ultrastructural changes in the mice cochlea were observed by TEM at 3 h after salicylate injection. Microarray revealed that 87 genes were up-regulated twofold or more in the mouse cochlea with salicylate ototoxicity in comparison to the normal cochlea. Among these genes, increased expression levels of 30 functional genes were confirmed by semi-quantitative RT-PCR.

Facial Palsy and Fallopian Canal Expansion Associated With Idiopathic Intracranial Hypertension.
Otol Neurotol. 2007 Apr 12; [Epub ahead of print]

Brackmann DE, Doherty JK
House Clinic and House Ear Institute, Los Angeles; and †University of California, San Diego, Division of Otolaryngology-Head & Neck Surgery, La Jolla, California, U.S.A.

Objective: Describe neurotologic findings associated with idiopathic intracranial hypertension (IIH).

Study design: Retrospective.

Setting: Tertiary referral center.

Patients: Case of IIH (>250 mm water) presenting with unilateral facial palsy and enlargement of the fallopian canal on computed tomography and magnetic resonance imaging.

Intervention(s): Oral acetazolamide, corticosteroids, and cerebrospinal fluid drainage.

Ain outcome measure(s): Intracranial pressure measurement, cranial nerve examination, audiometry, and symptom assessment.

Results: Audiometry revealed asymmetric sensorineural hearing loss. Enlargement of the fallopian canal with cerebrospinal fluid was evident on imaging studies. Partial resolution of IIH symptoms was achieved.

Conclusion: IIH is an enigmatic disease entity. Increased intracranial pressure usually presents with headache and pulsatile tinnitus and is occasionally associated with cranial neuropathies. Abducens palsy is most common, producing diplopia. Cranial nerve involvement is often asymmetric, producing false localizing signs. Facial paralysis is an uncommon sequela of IIH. Treatment of IIH consists of reducing intracranial pressure. Corticosteroids are recommended for treatment of facial paralysis.
The role of central nervous system plasticity in tinnitus.

Saunders JC
Department of Otolaryngology, Head and Neck Surgery, University of Pennsylvania, Philadelphia, PA 19104, USA. saunderj@mail.med.upenn.edu

Tinnitus is a vexing disorder of hearing characterized by sound sensations originating in the head without any external stimulation. The specific etiology of these sensations is uncertain but frequently associated with hearing loss. The „neurophysiological“ model of tinnitus has enhanced appreciation of central nervous system (CNS) contributions. The model assumes that plastic changes in the primary and non-primary auditory pathways contribute to tinnitus with the former perhaps sustaining them, and the latter contributing to perceived severity and emotionality. These plastic changes are triggered by peripheral injury, which results in new patterns of brain activity due to anatomic alterations in the connectivity of CNS neurons. These alterations may change the balance between excitatory and inhibitory brain processes, perhaps producing cascades of new neural activity flowing between brainstem and cortex in a self-sustaining manner that produces persistent perceptions of tinnitus. The bases of this model are explored with an attempt to distinguish phenomenological from mechanistic explanations.

Learning outcomes:
(1) Readers will learn that the variables associated with the behavioral experience of tinnitus are as complex as the biological variables. (2) Readers will understand what the concept of neuroplastic brain change means, and how it is associated with tinnitus. (3) Readers will learn that there may be no one brain location associated with tinnitus, and it may result from interactions between multiple brain areas. (4) Readers will learn how disinhibition, spontaneous activity, neural synchronization, and tonotopic reorganization may contribute to tinnitus.

Barotrauma and decompression illness of the inner ear: 46 cases during treatment and follow-up.

Klingmann C, Praetorius M, Baumann I, Plinkert PK
Department of Otolaryngology, Head and Neck Surgery, University of Heidelberg, Heidelberg, Germany. christoph_klingmann@med.uni-heidelberg.de

Introduction: Diving accidents affecting the inner ear are much more common than was once thought. Among the 319 patients treated in our clinic between January 2002 and November 2005, 46 cases involved 44 divers with symptoms of acute inner ear disorders. The objective of the present article is to investigate the symptoms of the acute disorders and assess any residual damage.

Study design: Retrospective case analysis.

Materials and methods: The medical records were used to study the cases of 18 divers treated for inner ear decompression illness on 20 occasions and 26 divers who had inner ear barotrauma. The symptoms of the disorder at the beginning of treatment, latency period before the first therapeutic measures, kind of initial therapy, symptoms after the accident, and hearing and balance functions at the last examination in our clinic were assessed. Divers with inner ear decompression illness were examined via means of transcranial or carotid Doppler ultrasonography for the presence of a vascular right-to-left (R/L) shunt.

Results: Of 18 divers with inner ear decompression illness, 17 reported vertigo as the main symptom. In one diver, the inner ear decompression illness was manifested bilaterally. The divers with inner ear decompression illness had been treated with hyperbaric oxygen therapy in 14 of 20 cases; the average latency period before the start of therapy was 40 hours (median, 10 h). In 15 (83%) of 18 patients, a large R/L shunt was detected, and in 14 (78%) of 18 patients, residual cochleovestibular damage was detected. Only 9 of 26 patients with inner ear barotrauma mentioned feeling dizzy, and in no patient was vertigo the main symptom. Twenty-one patients complained of tinnitus, whereas 20 complained of hearing loss. The hearing loss ranged from an unobtrusive difference of 10 dB between the ears up to
complete deafness. Three patients were subjected to tympanoscopy because of suspected rupture of the round window membrane. Of patients with inner ear barotrauma, 78% had residual cochleovestibular damage.

**Conclusion:** We describe for the first time a patient with bilateral manifestation of inner ear decompression illness. Inner ear decompression illness is frequently associated with a R/L shunt; therefore, after a diving accident, the patient's fitness to dive should be assessed via a specialist in diving medicine. Both decompression illness and barotrauma of the inner ear result in residual cochleovestibular damage in more than three of four patients.

**Illusory percepts from auditory adaptation.**

**Parra LC, Pearlmutter BA**
Biomedical Engineering Department, City College of New York, New York, NY 10031, USA. parra@ccny.cuny.edu

Phenomena resembling tinnitus and Zwicker phantom tone are seen to result from an auditory gain adaptation mechanism that attempts to make full use of a fixed-capacity channel. In the case of tinnitus, the gain adaptation enhances internal noise of a frequency band otherwise silent due to damage. This generates a percept of a phantom sound as a consequence of hearing loss. In the case of Zwicker tone, a frequency band is temporarily silent during the presentation of a notched broadband sound, resulting in a percept of a tone at the notched frequency. The model suggests a link between tinnitus and the Zwicker tone percept, in that it predicts different results for normal and tinnitus subjects due to a loss of instantaneous nonlinear compression. Listening experiments on 44 subjects show that tinnitus subjects (11 of 44) are significantly more likely to hear the Zwicker tone. This psychoacoustic experiment establishes the first empirical link between the Zwicker tone percept and tinnitus. Together with the modeling results, this supports the hypothesis that the phantom percept is a consequence of a central adaptation mechanism confronted with a degraded sensory apparatus.

**Primary afferent dendrite degeneration as a cause of tinnitus.**
J Neurosci Res. 2007 May 15;85(7):1489-1498.

**Bauer CA, Brozoski TJ, Myers K**
Division of Otolaryngology Head and Neck Surgery, Southern Illinois University School of Medicine, Springfield, Illinois 62794, USA. cbauer@siumed.edu

Chronic tinnitus affects millions of people, but the mechanisms responsible for the development of this abnormal sensory state remain poorly understood. This study examined the type and extent of cochlear damage that occurs after acoustic trauma sufficient to induce chronic tinnitus in rats. Tinnitus was evaluated by using a conditioned suppression method of behavioral testing. Cochlear damage was assessed 6 months after acoustic trauma. There was minimal loss of inner and outer hair cells in the exposed cochleas of subjects demonstrating evidence of tinnitus. However, a significant loss of large-diameter fibers in the osseous spiral lamina of exposed cochleas of trauma subjects was observed. The significance of this finding in the context of a model of tinnitus is discussed.
Psychological, neural, endocrine, and immune study of stress in tinnitus patients: any correlation between psychometric and biochemical measures?

Savastano M, Aita M, Barlani F
Department of Otolaryngology-Head and Neck Surgery, Padua University, Padua, Italy.

Objectives: The present study was carried out in tinnitus patients in order to study the psychological distress and the biochemical measures of this stressful condition. Psychological features were compared to immune and neuroendocrine parameters in order to verify in these subjects the possible presence of psychological and somatic responses to stress.

Methods: We studied 85 tinnitus patients who underwent hematochemical immune tests: lymphocyte subpopulations (CD3; CD4; CD3+CD4; CD8; CD19; CD16NK; CD3+CD16+CD56; and CD4/CD8), cortisol, adrenocorticotropic hormone, beta-endorphin, prolactin, and urinary catecholamine.

Results: Clinically, significant scores were obtained for hysteria, depression, paranoia, hypochondrias, and social introversion; and high scores were obtained for anxiety, depression, care for health, difficulty of treatment, low self-esteem, family and work difficulties, and social discomfort. There was a low to medium level of self-perception of stress. The less a subject felt stressed, the higher was his or her satisfaction level in the areas of psychological and physical functioning. The scores on the tests and the biochemical measures did not show a significant correlation, but there was a tendency to correlation for the lymphocytes CD19 and CD16NK and for adrenocorticotropic hormone.

Conclusions: The comparison between the psychometric and biochemical variables did not reveal any significant correlation among stress perception, daily satisfaction, and the biochemical parameters of stress.

Central neural activity in rats with tinnitus evaluated with manganese-enhanced magnetic resonance imaging (MEMRI).

Brozoski TJ, Ciobanu L, Bauer CA.
Division of Otolaryngology, Southern Illinois University School of Medicine, Springfield, IL 62794-9629, USA. tbrozoski@siumed.edu

The pathophysiology of tinnitus, the perception of sound in the absence of acoustic stimulation, is largely unknown, although several lines of research implicate long-term neuroplastic loss of inhibition. The evidence to date suggests that the neuroplastic alterations are likely to be found in multiple brain structures. The present study used manganese-enhanced magnetic resonance imaging (MEMRI) to assess the pattern of neural activity in the central auditory pathway of rats with psychophysical evidence of chronic acoustic-exposure-induced tinnitus. Manganese, an activity-dependent paramagnetic contrast agent, accumulates in active neurons through voltage-gated calcium channels, primarily at synapses, and serves as both a structural and functional indicator. Comparison images were obtained from normal subjects exposed to external tinnitus-like sound, and from tinnitus subjects treated with vigabatrin, a GABA agonist shown to eliminate the psychophysical evidence of tinnitus in rats. MEMRI indicated: (1) In rats with evidence of tinnitus, activity was generally elevated in the auditory brainstem, with significant elevation in the cerebellar paraflocculus, the posterior ventral cochlear nucleus, and the inferior colliculus; in general forebrain structures showed decreased activity, although MEMRI may be a less sensitive indicator of forebrain activity than brainstem activity; (2) in normal rats exposed to a tinnitus-like sound, a similar pattern of elevated brainstem activity and decreased forebrain activity was evident, with the notable exception of the paraflocculus, where artificial tinnitus had no effect and (3) vigabatrin, decreased brainstem activity to control levels, in rats with prior evidence of tinnitus, and decreased forebrain activity to below control levels. It was concluded that chronic tinnitus in rats is associated with focal activity elevation in the auditory brainstem and increased activity in the paraflocculus that may be unique to tinnitus.
Cannabinoid receptor down-regulation in the ventral cochlear nucleus in a salicylate model of tinnitus.

Hear Res. 2007 Jun;228(1-2):105-111. Epub 2007 Feb 16.

Zheng Y, Baek JH, Smith PF, Darlington CL
Department of Pharmacology and Toxicology, School of Medical Sciences, University of Otago, P.O. Box 913, Dunedin, New Zealand.

Cannabinoid CB1 receptors have not been systematically investigated in the brainstem cochlear nucleus, nor have they been investigated in relation to tinnitus. Using immunohistochemistry and cell counting, we showed that a large number of neurons in the rat cochlear nucleus possess cannabinoid CB1 receptors. Following salicylate injections that induced the behavioural manifestations of tinnitus, the number of principal neurons in the ventral cochlear nucleus expressing CB1 receptors significantly decreased, while the number of CB1-positive principal neurons in the dorsal cochlear nucleus did not change significantly. These results suggest that CB1 receptors in the cochlear nucleus may be important for auditory function and that a down-regulation of CB1 receptors in the ventral cochlear nucleus may be related to the development of tinnitus.

Acoustic shock.


McFerran DJ, Baguley DM
Department of Otolaryngology and Head and Neck Surgery, Essex County Hospital, Colchester, UK. donald.mcferran@essexrivers.nhs.uk

Acoustic shock is a recently recognised clinical entity: following an abrupt, intense and unanticipated acoustic stimulus, usually delivered by a telephone handset or headset, some individuals report a symptom cluster that includes otalgia, altered hearing, aural fullness, imbalance, tinnitus, dislike or even fear of loud noises, and anxiety and/or depression. Symptoms start shortly after the triggering acoustic incident and can be short-lived or can last for a considerable time. If persistent, the condition can lead to significant disability. Proposed mechanisms include involvement of the tensor tympani muscle, hyperexcitability of central auditory pathways, and a precursive state of raised anxiety or arousal. A formal treatment programme has not yet been proposed, but the potential utility of modern therapeutic techniques for tinnitus and hyperacusis are considered. Given the large number of UK residents working in telephone call centres, this condition is of considerable clinical importance.

Correlated neural activity as the driving force for functional changes in auditory cortex.


Eggermont JJ
Department of Physiology and Biophysics, University of Calgary, 2500 University Drive N.W., Calgary, Alberta, Canada T2N 1N4; Department of Psychology, University of Calgary, 2500 University Drive N.W., Calgary, Alberta, Canada T2N 1N4.

The functional role of neural synchrony is reflected in cortical tonotopic map reorganization and in the emergence of pathological phenomena such as tinnitus. First of all experimenter-centered and subject-centered views of neural activity will be contrasted; this argues against the use of stimulus-correction procedures and favors the use of a correction procedure based on neural activity without reference to stimulus timing. Within a cortical column neurons fired synchronously with on average about 6% of their spikes in a 1ms bin and occasionally showing 30% or more of such coincident spikes. For electrode separations exceeding 200mum the average peak correlation strength only occasionally reached 3%. The experimental evidence for coincidence of neural activity, neural correlation and neural synchrony shows that horizontal fibers activity can induce strong neural correlations.
Cortico-cortical connections for a large part connect cell groups with characteristic frequencies differing by more than one octave. Such neurons have generally non-overlapping receptive fields but still can have sizeable peak cross-correlations. Correlated neural activity and heterotopic neural interconnections are presented as the substrates for cortical reorganization; increased neural synchrony and tonotopic map reorganization go hand in hand. This links cortical reorganization with hypersynchrony that can be considered as an important driving force underlying tinnitus.

III Diagnostics

Comparison of FSE T2W and 3D FIESTA sequences in the evaluation of posterior fossa cranial nerves with MR cisternography.

Hatipoğlu HG, Durakoğlugil T, Cılız D, Yüksel E
From the Department of Radiology, Ankara Numune Research and Training Hospital, Ankara, Turkey.

Purpose: The aim of this study was to compare 3D fast imaging with steady state acquisition (3D FIESTA) to fast spin echo T2-weighted (FSE T2W) MRI sequences in the imaging of cisternal parts of cranial nerves V-XII.

Materials and methods: We retrospectively evaluated the temporal MRI sequences of 50 patients (F: M ratio, 27:23; mean age, 44.5 +/- 15.9 years) who were admitted to our hospital with vertigo, tinnitus, and hearing loss. In all, we evaluated 800 nerves. Two radiologists, working independently, divided the imaging findings into 3 groups: 0 (not visualized), 1 (partially visualized), and 2 (completely visualized).

RESULTS The rate of visualization of these cranial nerves with FSE T2W and 3D FIESTA sequences, respectively, (partially and completely visualized) were as follows: nerve V (100% and 100%); nerve VI (43% and 98%); nerve VII (100% and 100%); nerve VIII (100% and 100%); nerve IX-XI complex (67% and 100%); nerve XII (2% and 91%).

Conclusion: 3D FIESTA sequences are superior to FSE T2W sequences in the imaging of cisternal parts of the posterior fossa nerves. 3D FIESTA sequences may be used for obtaining high-resolution MR cisternography images.

Facial Palsy and Fallopian Canal Expansion Associated With Idiopathic Intracranial Hypertension.
Otol Neurotol. 2007 Apr 12; [Epub ahead of print]

Brackmann DE, Doherty JK
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Objective: Describe neurotologic findings associated with idiopathic intracranial hypertension (IIH).

Study design: Retrospective.

Setting: Tertiary referral center.

Patients: Case of IIH (>250 mm water) presenting with unilateral facial palsy and enlargement of the fallopian canal on computed tomography and magnetic resonance imaging.

Intervention(s): Oral acetazolamide, corticosteroids, and cerebrospinal fluid drainage.

Ain outcome measure(s): Intracranial pressure measurement, cranial nerve examination, audiometry, and symptom assessment.

Results: Audiometry revealed asymmetric sensorineural hearing loss. Enlargement of the fallopian canal with cerebrospinal fluid was evident on imaging studies. Partial resolution of IIH symptoms was achieved.

Conclusion: IIH is an enigmatic disease entity. Increased intracranial pressure usually presents with headache and pulsatile tinnitus and is occasionally associated with cranial neuropathies. Abducens palsy is most common, producing diplopia. Cranial nerve involvement is often asymmetric, producing false localizing signs. Facial paralysis is an uncommon sequela of IIH. Treatment of IIH consists of reducing intracranial pressure. Corticosteroids are recommended for treatment of facial paralysis.
Atypical clinical presentations of vestibular schwannomas.

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A significant number of patients with vestibular schwannomas present atypically, with none of the classical symptoms of unilateral sensorineural hearing loss, tinnitus, and/or dysequilibrium. The aim of this study is to highlight those patients with unusual clinical symptoms.

Study design: The clinical data of all patients who presented to the vestibular schwannoma clinic at Beaumont Hospital over the past 12 years was prospectively recorded in a computerized database. This paper reviews the atypical presenting symptoms.

Results: Three hundred ninety-eight patients were included in this study. A total of 3.7% of patients presented with atypical symptoms only.

Conclusion: A significant subgroup, 3.7% in our study, did not present with the audiovestibular symptoms classically associated with vestibular schwannoma. Clinician awareness of the atypical clinical symptoms may lead to earlier detection of these lesions.

Imaging of pulsatile tinnitus: a review of 74 patients.

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Objective: Our aim was to assess the effectiveness of imaging modalities in detecting the underlying pathologies in patients with pulsatile tinnitus.

Materials and methods: Seventy-four patients with pulsatile tinnitus were radiologically evaluated. All patients except two are evaluated on a thin-section bone algorithm computed tomography scan covering the temporal bone and skull base, 14 patients with or without contrast-enhanced brain computed tomography, 7 patients with magnetic resonance imaging and magnetic resonance angiography, 5 patients with digital subtraction angiography, and 12 patients with Doppler ultrasonography.

Results: The underlying pathology of tinnitus was detected in 50 patients (67.6%), and 24 patients were normal with radiologic studies. The most common cause was high jugular bulbus (21%) followed by atherosclerosis, dehiscent jugular bulbus, aneurysm of internal carotid artery, dural arteriovenous fistula, aberrant internal carotid artery, jugular diverticulum, and glomus tumor.

Conclusion: It was concluded that radiologic imaging methods are effective in detecting the underlying pathology of pulsatile tinnitus.

IV Imaging

Laterization of functional magnetic resonance imaging (fMRI) activation in the auditory pathway of patients with lateralized tinnitus.

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Introduction: Tinnitus is hypothesized to be an auditory phantom phenomenon resulting from spontaneous neuronal activity somewhere along the auditory pathway. We performed fMRI of the entire auditory pathway, including the inferior colliculus (IC), the medial geniculate body (MGB) and the auditory cortex.
(AC), in 42 patients with tinnitus and 10 healthy volunteers to assess lateralization of fMRI activation. **Methods:** Subjects were scanned on a 3T MRI scanner. A T2*-weighted EPI silent gap sequence was used during the stimulation paradigm, which consisted of a blocked design of 12 epochs in which music presented binaurally through headphones, which was switched on and off for periods of 50 s. Using SPM2 software, single subject and group statistical parametric maps were calculated. Lateralization of activation was assessed qualitatively and quantitatively. **Results:** Tinnitus was lateralized in 35 patients (83%, 13 right-sided and 22 left-sided). Significant signal change (P (corrected) < 0.05) was found bilaterally in the primary and secondary AC, the IC and the MGB. Signal change was symmetrical in patients with bilateral tinnitus. In patients with lateralized tinnitus, fMRI activation was lateralized towards the side of perceived tinnitus in the primary AC and IC in patients with right-sided tinnitus, and in the MGB in patients with left-sided tinnitus. In healthy volunteers, activation in the primary AC was left-lateralized. **Conclusion:** Our paradigm adequately visualized the auditory pathways in tinnitus patients. In lateralized tinnitus fMRI activation was also lateralized, supporting the hypothesis that tinnitus is an auditory phantom phenomenon.

**Evaluation of white matter structures in patients with tinnitus using diffusion tensor imaging.**

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Recent functional imaging studies have demonstrated that the sensation of tinnitus is associated with activity in cortical regions functionally linked to subserve the generation, perception and processing of the tinnitus stimulus. Previous functional imaging studies have focused primarily on the cortical centers. However, none of these examined the functional nature of associated white matter interconnecting these cortical centers. In this study, we investigate the integrity of white matter tracts interconnecting the auditory system to the parietal and frontal corticies in tinnitus patients using diffusion tensor imaging. Our preliminary results suggest the possible involvement of associated white matter structures in addition to processing cortical centers in tinnitus patients compared with healthy subjects.

**Imaging of pulsatile tinnitus: a review of 74 patients.**

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**Objective:** Our aim was to assess the effectiveness of imaging modalities in detecting the underlying pathologies in patients with pulsatile tinnitus. **Materials and methods:** Seventy-four patients with pulsatile tinnitus were radiologically evaluated. All patients except two were evaluated on a thin-section bone algorithm computed tomography scan covering the temporal bone and skull base, 14 patients with or without contrast-enhanced brain computed tomography, 7 patients with magnetic resonance imaging and magnetic resonance angiography, 5 patients with digital subtraction angiography, and 12 patients with Doppler ultrasonography. **Results:** The underlying pathology of tinnitus was detected in 50 patients (67.6%), and 24 patients were normal with radiologic studies. The most common cause was high jugular bulbus (21%) followed by atherosclerosis, dehiscent jugular bulbus, aneurysm of internal carotid artery, dural arteriovenous fistula, aberrant internal carotid artery, jugular diverticulum, and glomus tumor. **Conclusion:** It was concluded that radiologic imaging methods are effective in detecting the underlying pathology of pulsatile tinnitus.
V  Pharmacotherapy

Relief of idiopathic subjective tinnitus: is gabapentin effective?
Arch Otolaryngol Head Neck Surg. 2007

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Objective: To assess the therapeutic benefit of gabapentin (Neurontin) for subjective idiopathic troublesome tinnitus. DESIGN: An 8-week, double-blind, randomized clinical trial. Setting: Academic otolaryngology clinic in St Louis, Mo. Subjects: One hundred thirty-five subjects with severe idiopathic subjective tinnitus of 6 months' duration or longer. Intervention: Gabapentin, at a maintenance dosage of 900 to 3600 mg/d for 8 weeks, or lactose placebo. Main outcome measure: Change in the Tinnitus Handicap Inventory score from baseline to the study end point. Results: The overall change in the Tinnitus Handicap Inventory score for the entire cohort from baseline to week 8 was 11.2; the change among the 59 subjects randomized to the gabapentin arm was 11.3 and the change among the 56 subjects in the placebo arm was 11.0. The difference was 0.03 (95% confidence interval, -5.5 to 6.2; P = .91). Conclusion: Gabapentin is no more effective than placebo for the relief of idiopathic subjective tinnitus. Trial registration: clinicaltrials.gov Identifier: NCT00317850.

Effect of atorvastatin on progression of sensorineural hearing loss and tinnitus in the elderly: results of a prospective, randomized, double-blind clinical trial.

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Objective: To test whether the 3-hydroxy-3-methylglutaryl-coenzyme A reductase inhibitor atorvastatin can slow down the progression of presbycusis. Patients: Fifty patients 60- to 75-years-old with presbycusis and moderately elevated serum cholesterol. Intervention(s): In a double-blind design, patients were randomly assigned to treatment with either atorvastatin (40 mg/d orally) or placebo. Main outcome measure(s): Pure-tone audiometry and tinnitus evaluation at enrollment and after 7 and 13 months. RESULTS: Development of hearing thresholds after 7 and 13 months showed no significant differences between the groups. Tinnitus score continuously improved in the atorvastatin group (34.8 at 7 and 27.6 at 13 mo), whereas it slightly deteriorated in the placebo group (24.8 at 7 and 26.8 at 13 mo). The effect on tinnitus was a tendency without statistic significance (p = 0.0833). Conclusion: Atorvastatin had no effect on the development of hearing thresholds, but resulted in a trend toward a relief of tinnitus.
Objective: To assess the therapeutic benefit of gabapentin (Neurontin) for subjective idiopathic trouble-some tinnitus.

Design: An 8-week, double-blind, randomized clinical trial.

Setting: Academic otolaryngology clinic in St Louis, Mo.

Subjects: One hundred thirty-five subjects with severe idiopathic subjective tinnitus of 6 months' duration or longer.

Intervention: Gabapentin, at a maintenance dosage of 900 to 3600 mg/d for 8 weeks, or lactose placebo.

Main outcome measure: Change in the Tinnitus Handicap Inventory score from baseline to the study end point.

Results: The overall change in the Tinnitus Handicap Inventory score for the entire cohort from baseline to week 8 was 11.2; the change among the 59 subjects randomized to the gabapentin arm was 11.3 and the change among the 56 subjects in the placebo arm was 11.0. The difference was 0.03 (95% confidence interval, -5.5 to 6.2; P = .91).

Conclusion: Gabapentin is no more effective than placebo for the relief of idiopathic subjective tinnitus.

Trial registration: clinicaltrials.gov Identifier: NCT00317850.

Low dose transtympanic gentamicin treatment for intractable Meniere’s disease: a prospective study.

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Objective: To evaluate the effectiveness of low dose transtympanic gentamicin treatment in Meniere’s disease.

Material and method: Prospective study of 20 disable Meniere’s patients in Ramathibodi Hospital who received transtympanic gentamicin treatment for Meniere’s disease by fixed dose regimen of 12 injections during a period of 4 days. The study took place from March 1999 to December 2004. The hearing and equilibrium guidelines for reporting treatment results in Meniere’s disease of the American Academy of Otolaryngology and Head & Neck Surgery (1995) were used. The outcomes of treatment were evaluated at the 6th month. The multivariate repeated measures ANOVA was used for statistical comparisons.

Results: During the 5-year period, there were 20 patients, 9 men, and 11 women. The six-month outcomes of vertigo control, the functional level scale and tinnitus score were significantly improved by the treatment. Whereas, the mid frequency pure tone threshold average and the speech discrimination score were not significantly affected.

Conclusion: Fixed low dose transtympanic gentamicin treatment was found to be an effective treatment option for patients with disabling or intractable Meniere’s disease, with a low incidence of hearing deterioration. The use of this method appears to be practical and has been set as the standard protocol replacing the vestibular surgery in Ramathibodi Hospital.

[Botulinum toxin treatment in the head and neck region: current aspects, developments, and problems]
[Article in German]

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Some interesting developments, aspects, and problems concerning botulinum toxin treatment of disorders of the head and neck region have recently been reported. These new approaches are discussed in this review. They include applications into mimic muscles (prevention of scar formation, treatment of depressions), into laryngeal muscles, and into the upper esophagus. In addition, treatment of different forms of headache and tinnitus as well as applications in the autonomic nervous system are addressed.
Some of these options will shortly be put into clinical use, while others have to be checked further in clinical studies.

**Vigabatrin, a GABA transaminase inhibitor, reversibly eliminates tinnitus in an animal model.**

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Animal models have facilitated basic neuroscience research investigating the pathophysiology of tinnitus. It has been hypothesized that partial deafferentation produces a loss of tonic inhibition in the auditory system that may lead to inappropriate neuroplastic changes eventually expressed as tinnitus. The pathological down-regulation of gamma-aminobutyric acid (GABA) provides a potential mechanism for this loss of inhibition. Using an animal model previously demonstrated to be sensitive to treatments that either induce or attenuate tinnitus, the present study examined the effect of the specific GABA agonist vigabatrin on chronic tinnitus. It was hypothesized that vigabatrin would decrease the evidence of tinnitus by restoring central inhibitory function through increased GABA availability. Vigabatrin has been demonstrated to elevate central GABA levels (Mattson et al. 1995). Tinnitus was induced in rats using a single 1-h unilateral exposure to band-limited noise, which preserved normal hearing in one ear. Psychophysical evidence of tinnitus was obtained using a free-operant conditioned-suppression method: Rats lever-pressed for food pellets and were trained to discriminate between the presence and absence of sound by punishing lever pressing with a mild foot shock (0.5 mA; 1 s) at the conclusion of randomly introduced silent periods (60 s) inserted into background low-level noise. Additional random insertion of pure tone and noise periods of variable intensity enabled the derivation of psychophysical functions that reflected the presence of tinnitus with features similar to 20-kHz tones. Vigabatrin was chronically administered via drinking water at 30 and 81 mg kg⁻¹ day⁻¹, with each dose level tested over 2 weeks, followed by a 0-mg washout test. Vigabatrin completely and reversibly eliminated the psychophysical evidence of tinnitus at both doses. Although vigabatrin has serious negative side effects that have prevented its clinical use in the USA, it is nevertheless a potentially useful tool in unraveling tinnitus pathophysiology.

**Complementary ENT**: a systematic review of commonly used supplements.

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**Objective:** To assess the evidence surrounding the use of certain complementary supplements in otolaryngology. We specifically focussed on four commonly used supplements: spirulina, Ginkgo biloba, Vertigoheel(R) and nutritional supplements (cod liver oil, multivitamins and pineapple enzyme).

**Materials and methods:** A systematic review of the English and foreign language literature. Inclusion criteria: in vivo human studies.

**Exclusion criteria:** animal trials, in vitro studies and case reports. We also excluded other forms of ‘alternative medicine’ such as reflexology, acupuncture and other homeopathic remedies.

**Results:** Lack of common outcome measures prevented a formal meta-analysis. Three studies on the effects of spirulina in allergy, rhinitis and immunomodulation were found. One was a double-blind, placebo, randomised, controlled trial (RCT) of patients with allergic rhinitis, demonstrating positive effects in patients fed spirulina for 12 weeks. The other two studies, although non-randomised, also reported a positive role for spirulina in mucosal immunity. Regarding the use of Ginkgo biloba in tinnitus, a Cochrane review published in 2004 showed no evidence for this. The one double-blind, placebo-controlled trial that followed confirmed this finding. Regarding the use of Vertigoheel in vertigo, two double-blind RCTs and a meta-analysis were identified.
The first RCT suggested that Vertigoheel was equally effective in reducing the severity, duration and frequency of vertigo compared with betahistine. The second RCT suggested that Vertigoheel was a suitable alternative to G biloba in the treatment of atherosclerosis-related vertigo. A meta-analysis of only four clinical trials confirms that Vertigoheel was equally effective compared with betahistine, G biloba and dimenhydrinate. Regarding multivitamins and sinusitis, two small paediatric pilot studies reported a positive response for chronic sinusitis and otitis media following a course of multivitamins and cod liver oil. Regarding bromelain (pineapple enzyme) and sinusitis, one randomised, multicentre trial including 116 children compared bromelain monotherapy to bromelain with standard therapy and standard therapy alone, for the treatment of acute sinusitis. The bromelain monotherapy group showed a faster recovery compared with the other groups.

**Conclusion:** The positive effects of spirulina in allergic rhinitis and of Vertigoheel in vertigo are based on good levels of evidence, but larger trials are required. There is overwhelming evidence that G biloba may play no role in tinnitus. There is limited evidence for the use of multivitamins in sinus symptoms, and larger randomised trials are required.

[Comparative study on therapeutic effects of acupuncture, Chinese herbs and Western medicine on nervous tinnitus]
[Article in Chinese]

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**Objective:** To compare the clinical therapeutic effects of acupuncture at Jiaji (EX-B 2), Chinese herbs and western medicine on nervous tinnitus.

**Methods:** Ninety cases were randomly divided into 3 groups, 30 cases in each group. The acupuncture group were treated with acupuncture at cervical Jiaji (EX-B 2), 20 min each session, once a day, 10 sessions constituting one course; the Chinese herbs group with modified Buzhong Yiqi Decoction (decocted in water), one dose each day, 10 doses constituting one course; the western medicine group with bandazol, Dextran 40, Danshen tablet, and vitamin B12, 10 days constituting one course. After 3 courses, the therapeutic effects were evaluated with criteria of assessment for therapeutic effects.

**Results:** The effective rates in the 3 groups were 73.3%, 40.0% and 33.3%, respectively, with significant differences among the 3 groups (P < 0.05).

**Conclusion:** Acupuncture has obvious therapeutic effect on nervous tinnitus, and acupuncture at cervical Jiaji (EX-B 2) is an effective therapy for nervous tinnitus, and its therapeutic effect is better than those of Chinese herbs and western medicine.

**VI Auditive Stimulation**

**Tinnitus modifications after cochlear implantation.**
Eur Arch Otorhinolaryngol. 2007 Jun 9; [Epub ahead of print]

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Tinnitus can be defined as a phantom sensation in the absence of an external sound. In our study, we evaluated the effect of cochlear implant on tinnitus evolution. Among adult, postlingually deaf patients who underwent cochlear implantation at our clinic, we selected 20 subjects with pre-implantation tinnitus (group A) and 10 subjects without pre-implantation tinnitus (group B). Pre- and post-surgery tinnitus was assessed through two questionnaires: the first one dealing with tinnitus characteristics and psychosocial impact, and the second one represented by THI, an internationally validated score of evaluation of the effects of tinnitus on patient’s emotions and activities of daily living. None of the patients...
 belonging to group B developed tinnitus after surgery. As for group A, 40% of patients declared suppression of tinnitus, 30% attenuation of tinnitus after surgery, 25% reported tinnitus was unchanged and 5% reported worsening of tinnitus. In the nine patients with bilateral tinnitus (45%), after implantation tinnitus disappeared from both sides in four patients and attenuated bilaterally in four patients. A comparison between pre- and post-implantation THI scores showed decreased score in 65% of cases, unchanged score in 30% and increased score in 5%. The beneficial effect of cochlear implant on tinnitus, reported by a majority of patients, could be due to acoustic masking, to direct electrical stimulation of the acoustic nerve, and above all to a possible cochlear implantation dependent reorganization of the central auditory pathways and associative cerebral areas. In the light of these results, the authors propose (1) to include tinnitus in the selection criteria of which ear to implant; (2) to consider implantation eligibility for patients with bilateral severe hearing loss associated with severe tinnitus; and (3) to inform patients about the small risk of post-operative tinnitus worsening.

Neuromonics Tinnitus Treatment: third clinical trial.

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Objectives: The Neuromonics Tinnitus Treatment combines the use of a novel approach to acoustic stimulation with a structured program of counseling and support by a clinician specifically trained in tinnitus rehabilitation. The distinctive acoustic component has been designed to provide stimulation to auditory pathways deprived by hearing loss, engage positively with the limbic system, and allow intermittent, momentary tinnitus perception within a pleasant and relaxing stimulus, thereby facilitating desensitization to the tinnitus signal. The purposes of this study were (1) to demonstrate the efficacy of the treatment, when enhanced with various modifications since previously reported trials and (2) to test the relative clinical effectiveness of two variations of the approach. In the first, intermittent tinnitus perception was facilitated throughout treatment through the use of a stimulus in which intensity peaks allowed the patients’ tinnitus perception to be completely covered up, whereas in the intensity troughs their tinnitus was briefly discernible. In the second, subjects experienced little tinnitus perception while listening to the treatment for the first 2 mo, then experienced intermittent perception.

Design: Thirty-five subjects with a predominantly moderate to severe level of tinnitus-related distress before treatment were randomly allocated into one of two treatment groups, corresponding to the two stage-based variations of the Neuromonics Tinnitus Treatment. Participants were provided with a high-fidelity personal sound player with earphones and an acoustic stimulus that had been spectrally modified according to their individual audiometric profile. They were instructed to use the acoustic stimulus for at least 2 hr per day, particularly at those times when their tinnitus was usually disturbing. Each group had equal amounts of clinician time for education, monitoring, and support.

Results: At 2, 4, 6, and 12 mo after commencing treatment, both groups displayed clinically and statistically significant improvements in tinnitus distress, awareness, and minimum masking levels as well as loudness discomfort levels. Improvements increased with time over the first 6 mo of therapy, at which time 91% of all subjects across the two groups reported an improvement in tinnitus disturbance (as measured by the Tinnitus Reaction Questionnaire) of at least 40%, with a mean improvement of 65%. Also, 80% of subjects at 6 mo reported a level of tinnitus disturbance that was no longer clinically significant. There was some indication of a more consistent benefit over 12 mo for the group that was provided initially with a high level of tinnitus interaction; however, inter-group differences were not statistically significant. A relation between reported treatment usage (hours per day) and clinical outcomes was observed, suggesting that a „dosage effect” may apply with the stimulus provided.

Conclusions: This study found that the Neuromonics Tinnitus Treatment provides rapid and profound improvements to the severity of tinnitus symptoms and their effect on the subject’s quality of life. This was a consistent effect, provided by a treatment that subjects reported as being pleasant to use. Both of the stage-based variations of the treatment that were tested in this study were shown to be successful in achieving these outcomes.
Clinical evaluation of higher stimulation rates in the nucleus research platform 8 system.

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**Objective:** The effect on speech perception of using higher stimulation rates than the 14.4 kHz available in the Nucleus 24 cochlear implant system was investigated. The study used the Nucleus Research Platform 8 (RP8) system, comprising the CI24RE receiver-stimulator with the Contour electrode array, the L34SP body-worn research speech processor, and the Nucleus Programming Environment (NPE) fitting and Neural Response Telemetry (NRT) software. This system enabled clinical investigation of higher stimulation rates before an implementation in the Freedom cochlear implant system commercially released by Cochlear Limited.

**Design:** Use of higher stimulation rates in the ACE coding strategy was assessed in 15 adult subjects. An ABAB experimental design was used to control for order effects. Program A used a total stimulation rate of between 12 kHz and 14.4 kHz. This program was used for at least the first 3 mo after initial device activation. After evaluation with this program, each subject was provided with two different higher stimulation rate programs: one with a total stimulation rate of 24 kHz and the other with a total stimulation rate of 32 kHz. After a 6-week period of familiarization, each subject identified his/her preferred higher rate program (program B), and this was used for the evaluation. Subjects then repeated their use of program A for 3 wk, then program B for 3 wk, before the second evaluation with each. Speech perception was evaluated by using CNC open-set monosyllabic words presented in quiet and CUNY open-set sentences presented in noise. Preference for stimulation rate program was assessed via a subjective questionnaire. Threshold (T)- and Comfortable (C)-levels, as well as subjective reports of tinnitus, were monitored for each subject throughout the study to determine whether there were any changes that might be associated with the use of higher stimulation rates.

**Results:** No significant mean differences in speech perception results were found for the group between the two programs for tests in either quiet or noise. Analysis of individual subject data showed that five subjects had significant benefit from use of program B for tests administered in quiet and for tests administered in noise. However, only two of these subjects showed benefit in both test conditions. One subject showed significant benefit from use of program A when tested in quiet, whereas another showed benefit with this program in noise. Each subject’s preferred program varied. Five subjects reported a preference for program A, eight subjects reported a preference for program B and two reported no overall preference. Preference between the different stimulation rates provided within program B also varied, with 10 subjects preferring 24 kHz and five preferring 32 kHz total stimulation rates. A significant increase in T-levels from baseline measures was observed after three weeks of initial experience with program B, however there was no difference between the baseline levels and those obtained after five weeks of use. No significant change in C-levels was found over the monitoring period. No long-term changes in tinnitus that could be associated with the use of the higher stimulation rates were reported by any of the subjects.

**Conclusions:** The use of higher stimulation rates may provide benefit to some but not all cochlear implant recipients. It is important to optimize the stimulation rate for an individual to ensure maximal benefit. The absence of any changes in T- and C-levels or in tinnitus suggests that higher stimulation rates are safe for clinical use.

[Music therapy for tinnitus patients: an interdisciplinary pilot study of the Heidelberg Model]
[Article in German]

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**Background:** Chronic tinnitus, one of the most common disorders in ENT medicine, requires comprehensive and interdisciplinary treatment.

**Objective:** An innovative music therapy approach, developed at the German Center for Music Therapy Research in cooperation with the ENT clinic of the University of Heidelberg ("Heidelberg Model"), strives to integrate the tinnitus sound into a musically controllable acoustic process. The aim of the present study is to evaluate the effectiveness of this current treatment.

**Methods:** We carried out a prospective, two-armed (music therapy group vs control group) study with 20 patients (10 males, 10 females; mean age 51+/−7 years), suffering from decompensated chronic tinnitus (mean score in the Tinnitus Questionnaire TQ=46.8+/−9.6). The target variables involved TQ values, pre- and post-measurements, and follow-up after 3 and 6 months.

**Results:** Group comparison yields a highly statistically and clinically significant decrease in mean TQ-scores pre- and post in the music therapy group by 25 points or 52% on average as compared to 2 points (4%) in the control group (univariate ANOVA: (F(1,31)=14.19, P=0.001), effect size d=1.73). Logarithmic regression analysis reveals a fast onset and long lasting effect of music therapy (B=-8.9; F(1,125)=32.11, P=0.000).

**Discussion:** The effectiveness of this highly economic approach was proven as the innovative music therapy concept yields statistically and clinically significant results which remain stable throughout follow-up. Further investigations with larger sample sizes and using brain imaging should strengthen these findings.

**VII Brain Stimulation**

**Transcranial Magnetic Stimulation for the treatment of tinnitus: Effects on cortical excitability.**

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**Background:** Low frequency repetitive transcranial magnetic stimulation (rTMS) has been proposed as an innovative treatment for chronic tinnitus. The aim of the present study was to elucidate the underlying mechanism and to evaluate the relationship between clinical outcome and changes in cortical excitability. We investigated ten patients with chronic tinnitus who participated in a sham-controlled crossover treatment trial. Magnetic-resonance-imaging and positron-emission-tomography guided 1 Hz rTMS were performed over the auditory cortex on 5 consecutive days. Active and sham treatments were separated by one week. Parameters of cortical excitability (motor thresholds, intracortical inhibition, intracortical facilitation, cortical silent period) were measured serially before and after rTMS treatment by using single- and paired-pulse transcranial magnetic stimulation. Clinical improvement was assessed with a standardized tinnitus-questionnaire.

**Results:** We noted a significant interaction between treatment response and changes in motor cortex excitability during active rTMS. Specifically, clinical improvement was associated with an increase in intracortical inhibition, intracortical facilitation and a prolongation of the cortical silent period. These results indicate that intraindividual changes in cortical excitability may serve as a correlate of response to rTMS treatment.

**Conclusions:** The observed alterations of cortical excitability suggest that low frequency rTMS may evoke long-term-depression like effects resulting in an improvement of subcortical inhibitory function.

**Effects of repetitive transcranial magnetic stimulation on chronic tinnitus: a randomized, crossover, double blind, placebo controlled study.**


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Background: Chronic tinnitus is a disabling, almost untreatable, condition, usually accompanied by psychiatric distress. In patients with complex neuropsychiatric diseases, such as chronic pain, with which tinnitus shares pathophysiological similarities, placebo effects may be pronounced. Moreover, it may be difficult to distinguish actual repetitive transcranial magnetic stimulation (rTMS) induced clinical benefits beyond placebo effects in neuropsychiatric patients.

Methods: 16 patients with chronic tinnitus underwent a randomised, double blind, crossover, placebo controlled trial of 1 Hz rTMS (120% of motor threshold; 1200 stimuli/day for 5 days) of the left temporo-parietal region. Patients were screened for psychiatric comorbidity; additionally, anxiety and depression were monitored throughout the study. Moreover, an original placebo rTMS procedure produced the same activation of ipsilateral face muscles (a condition which may per se change the subjective rating of tinnitus) as the real rTMS. RESULTS: There were 8 out of 14 responders. Two patients dropped out for transient worsening of tinnitus. Active rTMS induced an overall significant, but transient, improvement (35% of the basal score) of subjective tinnitus perception that was independent of either tinnitus laterality or mood or anxiety changes. No correlations were found between response to rTMS and tinnitus duration, initial subjective score or patient age. When asked after the study was over, 71.4% of patients failed to identify the temporal sequence of the real or sham rTMS interventions.

Conclusion: The beneficial effects of rTMS on tinnitus are independent of mood changes. Moreover, they appear in the context of an original placebo stimulation designed to more closely replicate the somatic sensation of active stimulation. Because of the limited temporal duration of the clinical benefit, these neuromodulatory effects could be mediated by transient functional changes taking place in the neural circuits underlying tinnitus processing.

VIII Behavioral Therapy

Tinnitus retraining therapy: prognosis factors.

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Introduction: Tinnitus retraining therapy (TRT) is, nowadays, one of the most extended treatments for tinnitus control. The goal is the habituation to a nonsignificative signal, that is, tinnitus, first, eliminating its reaction and, second, minimizing its perception.

Purpose: The objective of this study is to identify the factors that could improve or reduce the efficacy of TRT.

Materials and methods: A prospective nonrandomized clinical assay (n = 137) was conducted. Three parameters were considered for tinnitus evaluation at 1-year follow-up: patient self-evaluation, visual analogue scale for intensity, and Tinnitus Handicap Inventory.

Results: Tinnitus retraining therapy group improved at 1-year follow-up, considering the 3 parameters. The most important factor of failure to TRT efficacy has been the refuse to instrumentation when it was required, according to TRT recommendations. Tinnitus Handicap Inventory score in this group did not show any improvement (P = .009). Highest scores of tinnitus intensity (visual analogue scale) and handicap (Tinnitus Handicap Inventory) before treatment as well as the most disabled diagnosis (sudden deafness and Meniere’s disease) had better response to TRT. Jastreboff’s treatment categories, longer presence of tinnitus, existence of hyperacusis or hearing loss, type of prosthesis used, duration of the treatment, and index of assistance to our follow-up program were not related to the effectiveness of TRT.

Conclusions: Tinnitus retraining therapy has demonstrated to be an effective treatment of tinnitus. More severe tinnitus are susceptible to get better response with this approach. Instrumentation, when recommended, is mandatory to obtain a higher relief of this symptom (EMB rating: B-2).
Randomized clinical trial: Group counseling based on tinnitus retraining therapy.

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The main component of tinnitus retraining therapy (TRT) is structured counseling. We conducted a randomized clinical trial to test the hypothesis that group educational counseling based on TRT principles would effectively treat veterans who have clinically significant tinnitus. Veterans with clinically significant tinnitus were randomized into one of three groups: educational counseling, traditional support, and no treatment. Subjects in the first two groups attended four 1.5 h group sessions each week. All subjects completed outcome questionnaires at baseline and at 1, 6, and 12 mo. A total of 269 subjects participated: 94 in the educational counseling group, 84 in the traditional support group, and 91 in the no-treatment group. Statistical analyses showed that educational counseling provided significantly more benefit than either traditional support or no treatment, as measured by the Tinnitus Severity Index. Results suggest that group educational counseling can significantly benefit many tinnitus patients and could be integral to a “progressive intervention” approach to tinnitus clinical management.

Results of TRT after eighteen months: our experience.

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The aim of this study was to evaluate the efficacy of TRT in patients suffering from tinnitus. The tinnitus disorder affects about 10-15% of the population and, in one person out of a hundred, it is a disabling disorder. TRT treatment is based on Jastreboff's neurophysiological model. TRT consists of two parts: counselling, and sound therapy by means of dedicated hearing aids and sound generators. It proved to be useful to reduce the symptoms related to tinnitus. Jastreboff's structured interviews were proposed to a sample of 51 patients with tinnitus belonging to the I-II-III-IV classes according to Jastreboff. These patients were treated for 18 months. Sixty-eight percent of patients reported a reduction in the symptoms related to tinnitus, such as sleep disturbance, problems in concentration, and inability to relax. A percentage (64.7%) of patients thought that their quality of life was improved. Patients who had suffered from tinnitus for less than one year achieved significantly better results than patients who had suffered for a longer period of time. TRT is an effective tool in the treatment of tinnitus.

Tinnitus rehabilitation: a mindfulness meditation cognitive behavioural therapy approach.
J Laryngol Otol. 2007 Apr 23;:1-7 [Epub ahead of print]

Sadlier M, Stephens SD, Kennedy V
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Background: Chronic tinnitus is a frequent symptom presentation in clinical practice. No drug treatment to date has shown itself to be effective. The aim of the present study was to investigate the effects of cognitive behavioural therapy and meditation in tinnitus sufferers.Methodology: Patients were selected from a dedicated tinnitus clinic in the Welsh Hearing Institute. A waiting list control design was used. Twenty-five chronic tinnitus sufferers were consecutively allocated to two groups, one receiving a cognitive behavioural therapy/meditation intervention of four one hour sessions with the other group waiting three months and subsequently treated in the same way, thereby acting as their own control. The main outcome was measured using the Hallam tinnitus questionnaire. A four to six month follow up was conducted.Results: These showed significant statistical reductions in tinnitus variables both in the active and also in the control group.
Post-therapy, no significant change was found after the waiting list period. The improvement was maintained at the four to six month period. Conclusion: The positive findings give support for the use of cognitive behavioural therapy/meditation for chronic tinnitus sufferers.

Ericksonian hypnosis in tinnitus therapy: effects of a 28-day inpatient multimodal treatment concept measured by Tinnitus-Questionnaire and Health Survey SF-36.

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For the first time, the therapeutic effects on subacute and chronic tinnitus of an inpatient multimodal treatment concept based on principles of Ericksonian hypnosis (EH) were examined by standardized criteria of the Tinnitus Questionnaire (TQ) and Health Survey (SF-36) within a controlled prospective, longitudinal study. A total of 393 patients were treated within an inpatient closed-group 28-day-setting based on a resource-oriented, hypnotherapeutic concept. The severity of tinnitus was assessed by TQ at times of admission, discharge and also at a 6- and 12-month follow-up. Health-related quality of life was evaluated before and after therapy using the SF-36. After therapy, a decrease in TQ score was seen in 90.5% of the patients with subacute tinnitus and in 88.3% of those with chronic tinnitus. Assessment of the TQ score at the end of therapy revealed highly significant improvements of 15.9/14.1 points in mean. Effect sizes in the treatment groups (0.94/0.80) were superior to those in the waiting-list controls (0.14/0.23). The TQ score remained stable in the follow-up controls. Significant improvement in health-related quality of life has been observed within the treatment groups depending on initial level of tinnitus severity I-IV according to TQ. Using a multimodal treatment concept with emphasis on resource-activating approaches of EH the annoyance of tinnitus can be significantly reduced while health-related quality of life is enhanced within a comparatively short treatment period of 28 days.

IX Somatic Tinnitus


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This, the first of two articles, addresses current concepts of aetiology, diagnosis and management of temporomandibular disorders (TMD). The aim is to direct the reader toward a more evidence-based approach; specific treatment regimes can be accessed elsewhere. The concept of these articles is to encourage the reader to think about the wider ramifications of TMD, with specific relevance to their management in general dental practice. This article addresses current controversial concepts, including occlusion, tinnitus, hearing, speech defects and bruxism. The second part addresses the need for imaging and explores treatment concepts. TMD management in general dental practice is widely regarded as being a contentious subject, with several differing and often diametrically opposed viewpoints being aired, not only in relation to aetiology and diagnosis but also in relation to treatment. This uncertainty often prompts the dentist to refer for secondary care. Another recurring issue is the lack of adequate remuneration in the general dental services for management of the patients, for example by splint therapy.

Clinical relevance: Sound, up-to-date knowledge in the treatment of TMD is essential.
Surgical Treatment

[Long-term results of endolymphatic sac drainage for Meniere disease]
[Article in Chinese]
Zhonghua Er Bi Yan Hou Tou Jing Wai Ke Za Zhi. 2007 Mar;42(3):173-176.

Yu YP, Yang SM, Han DY, Yang WY
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Objective: To investigate the efficacy of endolymphatic sac drainage for Meniere disease.
Methods: The efficacy of endolymphatic sac drainage for Meniere disease was retrospectively summed up in 26 patients in General Hospital of Chinese People’s Liberation Army from March 1987 to September 2004. Of 26 patients, there were eighteen patients followed up more than two years after surgery.

Results: According to Chinese Meniere disease’s diagnosis and curative effect standard evaluation criteria published in 1996, for vertigo symptom of these 18 patients, there were 9 cases (50%) with grade A (completely controlled), 8 cases (44.4%) with grade B (fundamentally controlled) and one case (5.6%) with grade D (not controlled). The vertigo fully controlled rate was only 50%, but the vertigo completely or fundamentally controlled rate reached 94.4%. Tinnitus of the patients after operation disappeared in 2 cases (11.1%), reduced in 9 case (50%) and unchanged in 7 cases (38.9%). Hearing post operation was improved in 6 cases (33.3%), unchanged obviously in 4 cases (22.2%) and decreased in 8 cases (44.5%).

Conclusions: Endolymphatic sac drainage was an effective and safe management as well as with less complication for intractable Meniere’s disease patients with residual hearing before operation.

Treatment of vestibular schwannomas. Why, when and how?

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Sporadic vestibular schwannoma (VS) causes unilateral hearing loss, tinnitus, vertigo and unsteadiness. In many cases, the tumour size may remain unchanged for many years following diagnosis, which is typically made by MRI. In the majority of cases the tumour is small, leaving the clinician and patient with the options of either serial scanning or active treatment by gamma knife radiosurgery (GKR) or microneurosurgery. Despite the vast number of published treatment reports, comparative studies are few, and evidence is no better than class III (May, 2006). The predominant clinical endpoints of VS treatment include tumour control, facial nerve function and hearing preservation. Less focus has been put on symptom relief and health-related quality of life (QOL). It is uncertain if treating a small tumour leaves the patient with a better chance of obtaining relief from future hearing loss, vertigo or tinnitus than by observing it without treatment. Recent data indicate that QOL is reduced in untreated VS patients, and may differ between patients who have been operated and patients treated with GKR. In the present paper we review the natural course and complaints of untreated VS patients, and the treatment alternatives and results. Furthermore, we review the literature concerning quality of life in patients with VS. Finally, we present our experience with a management strategy applied to more than 300 cases since 2001.

Microvascular decompression as a treatment for cranial nerve hyperactive dysfunction—a critical view.

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Neurovascular compression has been postulated as a probable mechanism for a large number of cranial nerve syndromes, with trigeminal neuralgia (TGN) as the prime example. Microvascular decompression (MVD) is often cited as the procedure of choice for treatment of medically refractory TGN. Arguments against these assumptions are: MRA studies indicate that vascular contact with the trigeminal nerve is present in most healthy individuals. Treatment results of MVD in multiple sclerosis patients with TGN are almost as good (at least in the short term) as in idiopathic cases. MVD is reported to provide pain relief even in TGN patients without visible neurovascular contact. In other syndromes of cranial nerve 'hyperactive dysfunction'—vertigo, tinnitus and neurogenic hypertension—the documentation is even weaker.

**Endonasal approach of salpingopharyngeus muscle for the treatment of ear click related to palatal tremor.**


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Palatal tremor (PT) is a rare disease associated with rhythmic movements of the soft palate. It can be separated into two distinct clinical entities: symptomatic and essential. Most patients with essential PT complain of the rhythmic ear clicks and in some cases tinnitus, but usually have an uneventful medical history. Symptomatic PT patients are often unaware of the palatal movements and have symptoms and signs of brainstem or cerebellar dysfunction. We describe the case of a 25-year-old patient who developed severe essential PT, with very distressing bilateral objective tinnitus, constantly perceived as ear clicks. Several oral medications were prescribed with poor results. No significant improvement was obtained with repetitive injections of botulinum toxin type A (BTX A) distributed in soft palate muscles. Because of the continuous tinnitus and its impact on the patient’s quality of life, chemical denervation of the salpingopharyngeus muscles, which is involved in the production of tinnitus, with BTX A was performed endonasally under endoscopic guidance. The result was very satisfactory. Tinnitus due to essential PT may be satisfactorily treated by endonasal injection of BTX into the salpingopharyngeus and palatopharyngeus muscles.

**XI Holistics**

[Comparative study on therapeutic effects of acupuncture, Chinese herbs and Western medicine on nervous tinnitus]

[Article in Chinese]


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**Objective:** To compare the clinical therapeutic effects of acupuncture at Jiaji (EX-B 2), Chinese herbs and western medicine on nervous tinnitus.

**Methods:** Ninety cases were randomly divided into 3 groups, 30 cases in each group. The acupuncture group were treated with acupuncture at cervical Jiaji (EX-B 2), 20 min each session, once a day, 10 sessions constituting one course; the Chinese herbs group with modified Buzhong Yiqi Decoction ( decocted in water), one dose each day, 10 doses constituting one course; the western medicine group with bandazol, Dextran 40, Danshen tablet, and vitamin B12, 10 days constituting one course. After 3 courses, the therapeutic effects were evaluated with criteria of assessment for therapeutic effects.

**Results:** The effective rates in the 3 groups were 73.3%, 40.0% and 33.3%, respectively, with significant differences among the 3 groups (P < 0.05).

**Conclusion:** Acupuncture has obvious therapeutic effect on nervous tinnitus, and acupuncture at cervical Jiaji (EX-B 2) is an effective therapy for nervous tinnitus, and its therapeutic effect is better than those of Chinese herbs and western medicine.
Phase-shift treatment for predominant tone tinnitus.

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Objectives: To independently evaluate phase-shift treatment for predominant tone tinnitus.

Study design: Prospective, single-blinded crossover study.

Methods: 61 subjects with predominant tone tinnitus participated in 2 weeks of control and 2 weeks of phase-shift treatment. Frequency and intensity matching, pre- and post-treatment tinnitus handicap inventory (THI) scores, and patient diaries were outcome measures.

Results: Initial volume comparisons show a strong relationship between treatment and decrease in tinnitus intensity, with 57% of patients achieving successful treatment. Thirty-seven percent decreased by one THI grade, 5% by two. Utilizing patient diaries, 42% of patients reported periods of complete residual inhibition (CRI) ranging from 1 hour to 7 days (average 2 days). No periods of CRI were reported in control weeks.

Conclusion: Phase-shift treatment significantly benefited the majority of our patients. These outcomes suggest that this device may be a valuable tool. Further long-term studies with home therapy are warranted.

XII  Review

[Tinnitus and diabetes]
[Article in czech]

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Tinnitus is the perception of sound in the absence of corresponding external sound(s). Tinnitus can be perceived in one or both ears or in the head. It is usually described as an unpleasant noise, but in some patients it takes the form of a ringing, buzzing, hissing, humming, or whistling sound, or as ticking, clicking, roaring, tunes, songs, or beeping. It is estimated that 1 out of every 5 people experience some degree of tinnitus. Tinnitus is not itself a disease but an unwelcome symptom. It can be accompanied by audiometric evidence of deafness which occurs in association with both conductive and sensorineural hearing loss resulting from a range of underlying causes, including ear infections, foreign objects or wax in the ear, and injury from loud noises. Tinnitus is also a side-effect of some metabolic disorders, medications, and may also result from an abnormally low level of serotonin or high level of insulin. As mentioned above, some foods are found by some people to make their tinnitus worse. The inner ear, like the brain, is totally lacking in energy reserves. Its metabolism depends directly on the supply of oxygen and glucose from the blood supply. Alterations in glucose metabolism therefore have great potential for disturbing the workings of the inner ear. Because tinnitus is often defined as a subjective phenomenon, it is difficult to measure using objective tests. Although there is no specific cure for tinnitus, those affected can learn techniques to successfully manage their tinnitus to the point where it is no longer a problem for them.

XIII  Others

Effectiveness of transmeatal low power laser irradiation for chronic tinnitus.
J Laryngol Otol. 2007 Jul 12:;1-5 [Epub ahead of print]

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Objective: To evaluate effectiveness of 5 mW laser irradiation in the treatment of chronic tinnitus.

Study Design: Prospective, randomised, double-blind study.

Methods: This investigation included 66 ears in 45 patients with chronic unilateral or bilateral tinnitus. A 5 mW laser with a wavelength of 650 nm, or placebo laser, was applied transmeatally for 15 minutes, once daily for a week. A questionnaire was administered which asked patients to score their symptoms on a five-point scale, before and two weeks after laser irradiation. A decrease of one scale point, regarding the loudness, duration and degree of annoyance of tinnitus, was accepted to represent an improvement.

Results: The loudness, duration and degree of annoyance of tinnitus were improved, respectively, in up to 48.8, 57.7 and 55.5 per cent of the patients in the active laser group. No significant improvement was observed in the placebo laser group.

Conclusion: Transmeatal, low power (5 mW) laser irradiation was found to be useful for the treatment of chronic tinnitus.

Meniere's disease: rare or underdiagnosed among Africans.

Eur Arch Otorhinolaryngol. 2007 Jul 4; [Epub ahead of print]

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Meniere’s disease can easily be misdiagnosed because several otological disorders mimic the disease. Conflicting reports on the incidence of this disease among the Africans had been documented. The goal of our study was to verify the prevalence and clinical features of Meniere’s disease in WA sub-region. A 10 year (1996-2005) retrospective study carried out in our hospital. The diagnostic criteria for the disease were outlined and Oyedeji’s social classification instrument was adapted for socio-economic stratification of patients. The method of treatment and prognostic out-come were discussed. Out of 11,463 patients seen within the period, 25 (16 females and 9 males) met the diagnostic criteria for Meniere’s disease. The age ranged from 27 to 75 years (mean = 47.2 SD13.2) and the most predominant age group was 41-50 years. Sixty-eight percent were of low socio-economic class and the rest high. About 84% had unilateral and 16% bilateral Meniere’s disease. All the patients presented with tinnitus, vertigo and audiologically confirmed sensorineural hearing loss. CT-scan and MRI were used to rule out some differentials, while caloric and recruitment tests were used to strengthen the diagnosis. Treatment regimen (conservative) outcome: 72% had good improvement, 8% fair, while 20% absconded from follow-up. The prevalence of Meniere’s disease in West African sub-region is 0.22%. This prevalence among Africans may not differ from the Caucasians. Under- or over-diagnosis of the disease previously must have been responsible for the contrasting results. Appropriate diagnostic tools are necessary for accurate diagnosis of the disease.

[Compensation tables for tinnitus as a physical defect in private accident insurance]

[Article in German]
Versicherungsmedizin. 2007 Jun 1;59(2):73-80.

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Until 2004, tinnitus was viewed as a psychic reaction according to the provisions of private accident insurance and therefore excluded from compensation. In two recent judgements of the Federal Supreme Court in Germany the assessment of tinnitus in private accident insurance has been newly defined. According to this jurisdiction, the compensation of tinnitus is possible, when a proven physical defect in the inner ear or the auditory pathway (hearing loss) can be established and has a causal connection to the accident. This leads to the question of how a quantitative assessment of tinnitus can be carried out. The compensation should be in accordance to the general terms and conditions of private accident insurance. A compensation table is proposed, which recognises the physical defect of tinnitus and is based on medical and scientific findings of the relation between hearing loss and tinnitus.
Does Subjective Tinnitus Cause Sexual Disturbance?
J Otolaryngol. 2007 Apr 1;36(2):77-82.
Bayar Muluk N, Murad Başar M, Oğuztürk O, Dikici O

Objective: Tinnitus can cause psychological problems, which can affect sexual performance. The aim of this study was to investigate sexual disturbance related to the psychological problems of patients with subjective tinnitus.

Materials and methods: The subjective tinnitus group with normal hearing levels consisted of 20 patients (10 male, 10 female) who were nonpsychiatric. The control group consisted of 20 healthy patients (10 male, 10 female) with normal hearing levels who did not have tinnitus and were nonpsychiatric. All subjects were married and had an active sexual life. Using a questionnaire, the subjective tinnitus loudness level score (STLL-Sc) was found. Using Zung Anxiety and Depression Scale, self-rating depression scale (SDS) was found in the study and control groups. Sexual function was assessed in all male subjects with the International Index of Erectile Functions (IIEF) and in all female subjects with the Female Sexual Function Index (FSFI).

Results: In females, the satisfaction subscore was slightly lower than normal limits in both the study and control groups. In males, the IIEF showed an insignificant, negative correlation with the STLL-Sc and the SDS and a positive correlation with tinnitus duration. In females, the FSFI showed an insignificant negative correlation with the STLL-Sc and a positive correlation with tinnitus duration and the SDS.

Conclusion: Sexual disturbance is seen in very quiet- and intermediate-level tinnitus sufferers in the early period of the disease. Over time, they become used to living with their tinnitus, and no loss in sexual performance is seen. In the future, we plan to investigate the sexual disturbance of patients with severe STLL-Scs.

Effectiveness of hyperbaric oxygen on sudden sensorineural hearing loss: prospective clinical research.
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The role of hyperbaric oxygen (HBO) treatment in sudden sensorineural hearing loss (SSNHL) is still controversial. In this study, 80 patients were treated for SSNHL. Fifty-five patients who received HBO and medical treatment and 25 patients who received medical treatment only were studied. There was a statistically significant difference between the HBO and medical treatment group and the medical treatment group for hearing gain and the degree of hearing loss after treatment (p<.05). In the HBO and medical treatment group, patients with tinnitus showed the highest hearing improvement. The patients who had tinnitus had a statistically significant difference for hearing gain in the HBO and medical treatment group (p<.05) but not in the medical treatment group (p>.05). In the HBO and medical treatment group, average hearing gain on each audiometric frequency was better than in the medical treatment group (p<.05).

Hyperbaric oxygen in the treatment of sudden deafness.
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Currently, the treatment of sudden deafness (SD) is based mainly on complete bed rest and the administration of corticosteroids. Hyperbaric oxygen therapy (HBOT) has previously been suggested as adjunctive treatment. We describe two cases of successful HBOT for SD. The first patient presented
with moderate mid-frequency hearing loss without accompanying symptoms, whereas the second pa-
tient had moderate low-frequency hearing loss with persistent tinnitus and a single episode of vertigo. HBOT in addition to conventional treatment soon after diagnosis resulted in full recovery of hearing in both patients. The pathogenesis of SD may involve a reduction in cochlear blood flow and perilymph oxygenation, making early HBOT a reasonable treatment modality for this condition.

### XIV Case Reports

**Subjective pulsatile tinnitus associated with extensive pneumatization of temporal bone.**

Eur Arch Otorhinolaryngol. 2007 Jul 24; [Epub ahead of print]

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Pulsatile tinnitus (PT), a rare otologic symptom, is frequently associated with identifiable and treatable causes. We report two cases of subjective PT due to extensive pneumatization of temporal bone around the internal carotid artery.

**Bilateral cochlear implantation in a patient with long-term deafness.**


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**Purpose of the study:** 1) To report the case of a 70-year-old patient with a history of auditory de-

**Case report:** A two-stages bilateral cochlear implantation was performed in a 70-year-old patient with long-term deafness without operative or post-operative problems with excellent functional result.

**Discussion:** Various studies have reported that in patients with long-term auditory deprivation, the results of cochlear implants are delayed and sometimes unsatisfactory when compared to patients with more recent post-lingual deafness. However they did not contraindicate the surgery. The positive results with the first implant (both for the tinnitus and the hearing loss) motivated the patient and medical team to proceed to bilateral implantation.

**Conclusion:** Patients with longstanding auditory deprivation can achieve good functional results even though at a slower rate. The use of bilateral cochlear implants accelerates and optimizes the final outcome.

**[Spontaneous temporomandibular joint herniation into the external auditory canal.]**

[Article in French]
Ann Otolaryngol Chir Cervicofac.2007 Jul 10; [Epub ahead of print]

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**Objectives:** We report a rare case of spontaneous temporomandibular joint herniation into the external auditory canal.
Material and methods: A 42-year-old woman consulted for recurrent right otalgia.

Results: The clinical examination revealed a white mass of the anterior wall of the bony external auditory canal, very close to the tympanic annulus, which was replaced by an invagination of the skin of the canal when the patient opened her mouth, consistent with temporomandibular joint herniation into the external auditory canal.

Conclusion: Inflammatory, malignant, and traumatic lesions are known as potential causes of temporomandibular joint herniation into the external auditory canal. Spontaneous herniations are much rare, and to the best of our knowledge this is the 15th case reported in the literature. This anomaly results from a patent foramen of Huschke. Main symptoms consist in otalgia and tinnitus. In half of the cases, they are minor and no treatment is necessary.

Unilateral sudden hearing loss as the first sign of chronic myeloid leukemia.
Eur Arch Otorhinolaryngol. 2007 Jul 4; [Epub ahead of print]

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Chronic myeloid leukemia (CML) is one of the etiologic causes of sudden hearing loss and vertigo. However, deafness in association with vestibular symptoms rarely occurs in CML as the first sign. In this article, a 50-year-old male with CML whose first signs and symptoms were unilateral sudden hearing loss and tinnitus in the right ear, vertigo and nausea was presented. Aetiopathogenetic mechanisms, clinical and radiological aspects and therapeutic options for CML with deafness and vertigo were discussed reviewing the literature.

[Acute Unilateral Total Deafness and Vestibular Findings after Gunshot Noise.]
[Article in German]
Laryngorhinootologie. 2007 Jun 26; [Epub ahead of print]

Hals-Nasen-Ohren-Klinik, Kopf- und Halschirurgie der Aristoteles-Universität, Thessaloniki, AHEPA-Hospital (Direktor: Prof. Dr. V. Vital).

Background: Acute acoustic trauma is usually acquired during military service after exposure to impulse or blast wave noise. The typical audiometric shape is a notch centered at about 4 kHz with some recovery above this frequency. This is the first case of an immediate induced unilateral total hearing loss in a young soldier following exposure to gunfire noise.

Case report: A 25-year-old right-hander army officer during military training, after realizing a series of five shots with a rifle (G3), he immediately experienced on the right ear otalgia, tinnitus and severe hearing loss, without imbalance or dizziness. The pure tone audiogram revealed a cophosis on the right ear without any residual remnants. In order to estimate the extent of the labyrinth damage, a caloric test and vestibular evoked myogenic potentials (VEMPs) were performed, which were both abnormal.

Conclusion: The possible mechanical and metabolic damage effects on the cochlea from the intense gunfire noise were discussed. As the caloric test showed directional preponderance and the VEMPs were totally abolished, it has been concluded that the saccule and to a lesser degree the posterior labyrinth have been also found affected. The importance of wearing hearing protectors such as ear plugs and ear muffs during exposure to intense noise was underlined.

Vertigo caused by a nasopharyngeal carcinoma.
Eur Arch Otorhinolaryngol. 2007 Jun 23; [Epub ahead of print]

Krause E, Hempel JM, Gürkov R
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A case of a 63 year-old woman with acute vertigo, hearing loss and tinnitus caused by a nasopharyngeal carcinoma is reported. Despite a long-standing unilateral Eustachian tube dysfunction, only the occurrence of vertigo attacks lead to the diagnosis in this patient. Inner ear-related symptoms are rare in nasopharyngeal carcinoma and the disease is uncommon in Europe. Skull base tumors are an important differential diagnosis of labyrinth dysfunction that can be detected by MRI. A complete diagnostic work-up is necessary in patients with unilateral tube dysfunction, to allow early detection of this disorder.

**Sensorineural Hearing Loss In A Patient With HLA-B27 Sclero-Uveitis.**

Br J Ophthalmol. 2007 May 30; [Epub ahead of print]

**Rao V, Gallagher M, Bhat P, Foster CS**
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**Background:** Audiovestibular disease exists in conjunction with several autoimmune disorders and while the exact inter-relation is not fully understood, their overlap warrants further investigation. We present a patient with HLA-B27-associated sclerouveitis and sensorineural hearing loss, and postulate a possible association between atypical Cogan’s syndrome and HLA-B27 autoimmunity.

**Brief Report:** A 52 year-old HLA-B27 positive Caucasian woman with a history of intermittent sclerouveitis, presented with a two-month history of redness and discomfort in both eyes associated with left sided hearing deficit and tinnitus. Review of systems revealed a prodrome of fever, chills, myalgia, night sweats and arthralgic symptoms with pain involving her lower back, upper limbs and knee joints. An audiogram performed had demonstrated a left-sided sensorineural deficit. The patient’s auditory symptoms had responded to oral corticosteroids which she was taking, at the time of presentation. Upon initial work-up and exam, Cogan’s syndrome was suspected and since the patient had responded to systemic corticosteroids, immunomodulatory therapy was considered. The patient was started on oral methotrexate and her ocular symptoms resolved.

**Conclusion:** While the association between HLA-B27 and Cogan’s syndrome has not been previously described, it may have profound clinical implications. Untreated autoimmune disease can result in significant morbidity and mortality. While the course and prognosis of HLA-B27 associated diseases are well delineated, their possible association with Cogan’s syndrome must alert physicians to the possibility of significant small vessel autoimmune disease and require prompt systemic immunomodulation.

**Cavernous hemangioma of the tympanic membrane and external ear canal.**


**Magliulo G, Parrotto D, Sardella B, Della Rocca C, Re M**
Department of Otorhinolaryngology, Audiology and Phoniatrics „G. Ferreri,” University La Sapienza, Rome, Italy. giuseppemagliuloorl@yahoo.it <giuseppemagliuloorl@yahoo.it>

**Objectives:** The aims of this study are to document the occurrence of a cavernous hemangioma of the tympanic membrane (TM) and external auditory canal (EAC) that invaded the middle ear spaces and to review the relevant literature.

**Methods:** The clinical presentation, imaging studies, operative report, and histologic findings of this new case of cavernous hemangioma are reviewed.

**Results:** A cavernous hemangioma of the TM and EAC involving the middle ear spaces was surgically excised without complications. The pulsatile tinnitus, which affected our patient at the same ear where the lesion was situated, disappeared after surgery. Our case represents the first documented cavernous hemangioma of the TM and EAC that invaded the middle ear spaces and the eighth case of cavernous hemangioma of the EAC/TM. Computed tomography is the method of choice in evaluating this lesion.
Conclusions: Hemangiomas of the EAC and/or TM are extremely rare entities amenable to surgical excision. With magnetic resonance imaging, there is difficulty in defining the exact location of the tumor and degree of soft tissue involvement.

Carcinomatous Meningitis Appearing as Acoustic Neuromas: Two Cases.
Strahlenther Onkol. 2007 May;183(5):279-283.

Astner ST, Nieder C, Stock K, Gaa J, Grosu AL
Department of Radiation Oncology, Technical University of Munich, Germany.

Background: For acoustic neuromas, stereotactic radiotherapy (radiosurgery or stereotactic fractionated radiotherapy) has been established as an important alternative to microsurgery. In most cases initial symptoms are slow progression of unilateral hearing loss, tinnitus or vertigo or acute hearing loss with vertigo. MRI scan shows a contrast-enhancing tumor within the inner auditory channel. If the patient undergoes primary radiotherapy, diagnosis is usually not verified histologically. Therefore, careful evaluation of the medical history is mandatory despite a typical appearance on the MRI scan. If medical history does not match with acoustic neuroma, further diagnostics are necessary to rule out infectious disease or carcinomatous meningitis.

Case report: Two patients with hearing loss, vertigo and the diagnosis of acoustic neuromas by MRI scan were referred for radiotherapy. In both cases the symptoms progressed very rapidly, not typical of acoustic neuromas, and in both patients repeated liquor puncture finally revealed carcinomatous meningitis. One patient died during therapy; in the second patient intrathecal chemotherapy and additional radiotherapy of the skull base led to partial remission continuing for several months.

Conclusion: Before primary radiotherapy of small intrameatal lesions diagnosis must be reassessed carefully. This is especially true for bilateral lesions suspicious for acoustic neuromas and rapid progression and persistence of clinical symptoms where carcinomatous meningitis has to be taken into account.

Assessment of objective pulsatile tinnitus in a patient with syringohydromyelia.

Steiger JR, Saccone PA, Watson KN
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jsteiger5@aol.com

We examined a 38-year-old male with syringohydromyelia and concomitant symptoms suggestive of intracranial hypertension including unilateral low-frequency sensorineural hearing loss and objective pulsatile tinnitus. The tinnitus was heard by the authors (through a hearing aid stethoscope tube), measured objectively (with a probe microphone), measured subjectively (as minimum masking levels and with fixed frequency Bekesy), and altered by changes in ear canal pressure (subjectively reported and measured objectively with a probe microphone). The audiologic symptoms were likely associated with elevated cerebrospinal fluid pressure that traveled to the cochlea through the cochlear aqueduct. The tinnitus may have originated from pulsations of central vascular structures that traveled through the cochlear aqueduct or the endolymphatic duct. Hearing loss likely resulted from tinnitus masking or a stiffening of the cochlear partition or stapes footplate.

Cochlear Implantation for Hearing Loss Associated With Bilateral Endolymphatic Sac Tumors in von Hippel-Lindau Disease.
Otol Neurotol. 2007 Apr 26; [Epub ahead of print]

Objective: Bilateral endolymphatic sac tumors (ELSTs) are associated with von Hippel-Lindau disease and often underlie significant audiovestibular morbidity, including hearing loss.

Patient: This 44-year-old female von Hippel-Lindau disease patient presented with tinnitus, vertigo, and binaural hearing loss. Magnetic resonance and computed tomography imaging demonstrated bilateral ELSTs, and audiometry confirmed bilateral hearing loss.

Intervention: The patient underwent staged resection of the ELSTs (left then right). After resection of the left ELST and during the same operation, a cochlear implant was placed.

Main outcome measures: Clinical, audiometric, and imaging data.

Results: Postoperatively, the patient had resolution of tinnitus and vertigo with a significant implant-aided improvement in hearing.

Conclusion: Because of their unique anatomic and biologic features, resection of bilateral tumors and cochlear implantation in deaf ELST patients is a potential option to improve hearing and quality of life.

A case of relapsing polychondritis with bilateral sensorineural hearing loss and perforation of the nasal septum at the onset.

Tsuda T, Nakajima A, Baba S, Tanohara K, Masuda I, Yamada T, Takagi K, Yamakawa T, Kamatani N, Hara M
Institute of Rheumatology, Aoyama Hospital, Tokyo Women’s Medical University, 2-7-13 Kita-Aoyama, Minato-ku, Tokyo 107-0061, Japan.

A 33-year-old woman suffered from epistaxis and perforation of the nasal septum. Based on a biopsy of nasal mucosa, Wegener’s granulomatosis was suspected initially. Her nasal symptoms improved spontaneously, but tinnitus, hearing loss, and dizziness appeared within 3 months. Laboratory analyses revealed no inflammation, and antineutrophil cytoplasmic antibodies were negative. Audiometry revealed bilateral sensorineural hearing loss. A second biopsy of the nasal septum showed an inflammatory change in the cartilage. Thus we diagnosed early-stage relapsing polychondritis.

Sudden sensorineural hearing loss in a patient with primary antiphospholipid syndrome.
J Laryngol Otol. 2007 Apr 10;:1-3 [Epub ahead of print]

Kang KT, Young YH
Department of Otolaryngology, National Taiwan University Hospital and National Taiwan University College of Medicine, Taipei, Taiwan.

Objective: Despite multiple systemic manifestations, sudden sensorineural hearing loss in a patient with antiphospholipid syndrome is rarely reported.

Patient: A 46-year-old man with primary antiphospholipid syndrome had a sudden onset of hearing loss and tinnitus in the right ear in December 2005, because he discontinued use of warfarin and acetylsalicylic acid for a few days.

Results: Audiometry revealed saucer-type sensorineural hearing loss with a pure tone average of 73 dB in the right ear, and flat-type hearing loss with a pure tone average of 25 dB in the left ear. Electronystagmography displayed multiple central signs and bilateral canal paresis, while a vestibular evoked myogenic potential test revealed bilateral delayed responses. After admission, the patient was re-treated with
warfarin and acetylsalicylic acid. Follow-up audiometry showed recovery of right-sided hearing, with a pure tone average of 12 dB, three days after presentation.

**Conclusion:** Consensus exists on the effectiveness of anticoagulant agents in aiding a favourable outcome of sudden sensorineural hearing loss in patients with antiphospholipid syndrome.

**Otosclerosis of the incus.**

**Escada PA, Capucho C, Chorão M, da Silva JF**
Departments of Otolaryngology, Egas Moniz University Hospital, Lisbon, Portugal. np46ab@mail.telepac.pt

**Objective:** To report a case of a patient with otosclerosis of the incus.

**Patients:** A 61-year-old woman with a progressive hearing loss on her left ear and a computed tomographic scan of the temporal bone revealing an expansible lesion of the incus.

**Interventions:** The ossicle was removed by using a transtympanomastoid approach; the ossicular chain was reconstructed using a titanium partial ossicular replacement prosthesis.

**Main outcome measure:** The diagnosis of the disease was obtained by means of histopathologic examination of the specimen.

**Results:** The patient obtained a good postoperative hearing result. The histopathologic examination of the specimen documented an otosclerosis of the incus.

**Conclusion:** Otosclerotic involvement of the middle ear ossicles, apart from footplate, was very rarely mentioned. Most subjects were incidentally diagnosed postmortem by means of examination of specimens from temporal bone collections. The diagnosis and treatment of a patient with otosclerosis of the incus is exceptional; however, otosclerosis should be considered in the differential diagnosis of expansible lesions of the ossicles.

**Management of tinnitus induced by brainstem and cerebellar infarction associated with complications of cerebello-pontine angle surgery.**
J Laryngol Otol. 2007 Apr;121(4):393-394.

**Brewis S, Baguley DM**
Department of Audiology, Addenbrooke’s Hospital, Cambridge, UK.

Following surgery in the USA in 1992 to remove a large right cerebello-pontine angle tumour, a 39-year-old woman developed severe brainstem and cerebellar infarction. This left her with severe visual impairment and ataxia. She became able to communicate by means of an adapted finger-spelling alphabet. She had total hearing loss in the right ear and a mild to moderately severe sensorineural hearing loss in the left ear, and severe tinnitus heard throughout the head. Additionally, she experienced hypersensitivity to sound above normal conversational levels, which evoked a synaesthetic feeling of coldness across her upper torso. Previous linear analogue hearing aid fitting had not been beneficial for either hearing or tinnitus. Careful fitting of a digital hearing aid, together with tinnitus counselling, inhibited the patient’s tinnitus to 25 per cent of its former intensity after a six month acclimatisation period, and improved communication.

**Cavernous hemangioma of the internal auditory canal.**

**Lenarz M, Durisin M, Kamenzetzi P, Becker H, Kreipe HH, Lenarz T**
Department of Otorhinolaryngology, Medical University of Hannover, Hannover, Germany. Lenarz.Minoo@MH-Hannover.des

Hemangiomas rarely occur in the internal auditory canal. These tumors originate from the capillary bed of the epineurium surrounding the nerve and can either compress or infiltrate the nerve.
Depending on location and the nerve of origin, these lesions can cause severe and progressive sensorineural hearing loss, tinnitus, facial nerve palsy, or vertigo even when they are relatively small. The presence of a small contrast-enhancing tumor in the internal auditory canal accompanied by severe sensorineural hearing loss and facial nerve palsy, should raise the suspicion of a hemangioma. Early recognition and surgical intervention in these benign tumors may improve the chance of preserving the functional integrity of the facial nerve and provides better results after nerve reconstruction. Due to their relative small size, the temporal bone CT-scan may show no evidence of pathological widening of the internal auditory canal or the typical intralesional calcifications at the time of presentation. MRI with Gadolinium is the imaging method of choice and a high index of clinical suspicion is necessary for the diagnosis of these tumors. In this paper we report about a 51-year-old male presented with right-sided sensory-neural deafness and facial nerve palsy, accompanied by severe tinnitus and ipsilateral loss of vestibular function due to a cavernous hemangioma in the internal auditory canal.
### Clinical Trials

**Source:** clinicaltrials.gov

#### Chronic Electrical Stimulation of the Auditory Cortex for Intractable Tinnitus (ACOUSCO)

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<thead>
<tr>
<th>Current status</th>
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<tr>
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<td>University Hospital, Bordeaux</td>
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<td>ClinicalTrials.gov Identifier</td>
<td>NCT00486577</td>
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<td>Condition(s)</td>
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<td>Interventions</td>
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<td>Phase</td>
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<td>Number of arms in study</td>
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<td>Official title:</td>
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| Further study details as provided by the University Hospital Bordeaux | Primary Outcome Measures: intensity of the tinnitus. The cut off efficacy is 35% improvement on the STI score [Time Frame: 6 months]  
Secondary Outcome Measures: Tinnitus Handicap Questionnair   
Multiple Activity Scale for Hyperacusis questionnaires for assessment of the patients and treatment outcome of tinnitus hyperacusis and loss of hearing subjective global improvement scale [Time Frame: 6 months]  
Further study details | Severe and chronic tinnitus – the perception of sound in one or both ears or in the head when non-external sound is present – can be disabling and difficult to treat. Physiopathology of tinnitus can be considered as similar to neuropathic pain. Neuropathic and central pain are treated since ten years by chronic electrical motor cortex stimulation. The hypothesis of this study is that it will be possible to treat severe tinnitus by this stimulation as neuropathic pains are treated by motor cortical stimulation.  
Principal Objective : to evaluate the efficacy of chronic electrical stimulation of the auditory cortex for intractable tinnitus  
Secondary Objective : to evaluate the tolerability and the safety of chronic electrical stimulation of the auditory cortex for intractable tinnitus |
<table>
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<td>Patient &gt;18 years of age and &lt; 70 years of age Permanent and chronic tinnitus during more than 2 years. A score over 19 at the STI (Quality of life index for tinnitus) Unilateral tinnitus</td>
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<td><strong>Exclusion criteria</strong></td>
<td>Deaf person Surgical or anesthetic contraindication History of psychiatric disorder or suicide Epilepsia</td>
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<tr>
<td><strong>Contact</strong></td>
<td>Please refer to this study by ClinicalTrials.gov identifier NCT00486577 Emmanuel CUNY, MD (33)556795577 <a href="mailto:emmanuel.cuny@chu-bordeaux.fr">emmanuel.cuny@chu-bordeaux.fr</a> René Dauman, MD (33)556794757 <a href="mailto:rene.dauman@chu-bordeaux.fr">rene.dauman@chu-bordeaux.fr</a></td>
</tr>
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<td><strong>Location</strong></td>
<td>University Hospital of Bordeaux - Pellegrin, Bordeaux, 33 076, France Emmanuel Cuny, MD (33)556795577 <a href="mailto:emmanuel.cuny@chu-bordeaux.fr">emmanuel.cuny@chu-bordeaux.fr</a> René Dauman, MD, Sub-Investigator</td>
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<tr>
<td><strong>Study chairs or principal investigators</strong></td>
<td>Emmanuel Cuny, MD, Principal Investigator University Hospital of Bordeaux</td>
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Phase out as a treatment for chronic untreatable tinnitus: a double blind crossover trial

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**Hypothesis**

This study examines the effect of the Phase Out treatment on chronic, incurable tinnitus in adult subjects in comparison with placebo sound. The expectation of this study is that Phase Out treatment is effective for a longer duration and results in increased residual inhibition than placebo sound.

**Condition(s)**

Tinnitus

**Interventions**

A subject will receive Phase Out treatment for thirty minutes three times a week for one week and placebo sound treatment on the same regime during another. One month interval is in between these two sets of treatment. If a treatment is started, the subject fills in a report mark on the Ä_tinnitus loudnessÄ and Ä_tinnitus annoyanceÄ in the tinnitus diary every evening till three weeks after the treatment session. One week after each week of therapy a subject receives the evaluating questionnaires and will send them back after filling in.

**Study type and design:** Randomised, placebo controlled, crossover, double blinded trial

**Official Title**

Phase out as a treatment for chronic untreatable tinnitus: a double blind crossover trial

**Primary outcome measures**

The major aim of this study is disappearance (report mark) of the tinnitus lasting many hours (time). Outcomes will be measured at weeks five and nine.

**Secondary outcome measures**

Besides the major aims, different questionnaires will be used to determine for which kind of tinnitus patients, this treatment is most effective:

1. Tinnitus Handicap Inventory (THI)
2. Tinnitus Reaction Questionnaire (TRQ)
3. Vital Exhaustion (VE) questionnaire
4. Hospital Anxiety and Depression Scale (HADS)
5. Short Form questionnaire (SF-36)
6. Eysenck Personality Questionnaire
7. Type D Personality Scale
8. Social Support Questionnaire (SSQ)
9. Tinnitus Coping Style Questionnaire (TCSQ)

Outcomes will be measured at weeks five and nine.

**Target number of participants**

60

**Anticipated study start**

01 May 2007

**Anticipated study end**

01 May 2009

**Ethics approval**

Approval pending from the Medical Ethical Committee of Groningen as of 12 April 2007

**Inclusion criteria**

1. Subjects greater than 18 years
2. Unilateral or bilateral tinnitus
3. Predominant tone tinnitus by history
4. Tinnitus for minimum of three months
| Exclusion criteria | 1. Acoustic neurinoma  
2. Aortic/outflow tract stenosis  
3. Pulsatile tinnitus  
4. Pregnancy  
5. Inability to correct use of test equipment: unable to cooperate during audiologic examination  
6. Known tinnitus etiology, which would demand other treatment  
7. Hearing loss greater than 60 decibel compared with standardised normal hearing on standard frequencies of a tone audiogram (250, 500, 1000, 2000, 4000 and 8000 hertz) |
|-------------------|---------------------------------------------------------------------------------------------------------|
| Sponsors details  | University Medical Centre Groningen (UMCG) (The Netherlands)  
Department of Ear, Nose and Throat Medicine, P.O. Box 30001, Groningen, Netherlands, 9700 RB |
| Contact           | **Dr K M Heijneman**  
Universitair Medisch Centrum Groningen, Afd. Keel-,Neus-, Oorheelkunde  
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k.m.heijneman@kno.umcg.nl |
| ISRCTN Register   | ISRCTN17631678 |