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TRI NEWSLETTER

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We must cure tinnitus, we can cure tinnitus, and we will cure tinnitus

Four years ago, when the TRI was founded, we made a pledge to cure tinnitus. The ultimate goal is to silence the phantom sound, and hereby to improve the quality of life of our patients. That pledge still stands: we must cure tinnitus. The question is: can we?

About a month ago more than 250 researchers and clinicians gathered at the 4th TRI Meeting "Frontiers in Tinnitus Research" in Dallas. All participants witnessed an atmosphere of enthusiasm and confidence. There is no doubt anymore that tinnitus is a solvable problem. And if we can cure tinnitus, when will this happen? In spite of the fact that there is still no therapeutic breakthrough in sight, there are converging findings from neuroimaging and animal research identifying the neuronal correlates of tinnitus. Novel neuroscientific tools will permit to understand the pathophysiology better, and a better understanding will lead to better treatment approaches.

There are indeed promising results from new pharmacological trials and there are huge advances in clinical trial methodology. Moreover, specific auditory stimulation protocols show very encouraging results. In addition, different neurostimulation techniques are now available, either alone or in combination with other treatment approaches and cognitive behavioural techniques have been refined.

We should remember that reaching this goal as soon as possible requires the joint effort of explorative and verifying science. Great steps have to be taken, followed by strict verification of whether these steps are worthwhile of further more detailed research. And this is exactly what the TRI stands for. Think big, explore, but verify.

We have to acknowledge that we might still be at the very beginning of a bright tomorrow for tinnitus. By setting us in motion we made an important discovery: a cure for tinnitus is a realistic goal, which can be reached in the near future. The TRI meeting will have achieved its goal, if all the new ideas which popped up during presentations, talks, discussions and coffee breaks result in new research projects and new and better treatments for our tinnitus patients. The Dallas meeting will leave an imprint through our concerted effort to make the future come true.

Berthold Langguth Ana Belén Elgoyhen Dirk de Ridder Susanne Staudinger

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Image Source: www.photocase.de

New avenues for the treatment of tinnitus

Dirk de Ridder, Berthold Langguth, Ana Belén Elgoyhen
(adapted from „Best of ORL 2010“)

Ten to fifteen percent of the population is confronted with non-pulsatile tinnitus at some time in their life. Whereas many people can cope with their tinnitus, about 2 to 3% is severely distressed by it, leading to sleep disturbances, concentration problems, fatigue, and depression and sometimes leading even to suicide.

Even though tinnitus is difficult to treat, recent basic otological and neurological research, as well as new clinical trials, are increasing our understanding of this pathology, and are opening new avenues for developing new treatments. These treatments include new pharmacological targets, the use of novel and more specific auditory amplification methods, notched or tinnitus frequency specific music therapy, improved TRT and cognitive behavioral treatments, the use of virtual reality and the modulation of brain activity via non-invasive or invasive neuromodulation treatments.

Neuromodulation comes in different forms, from the non-invasive neurobiofeedback, transcranial direct current stimulation and transcranial magnetic stimulation, to the invasive brain implants. Traditionally, these techniques have targeted the auditory cortex. This makes sense, since it has been shown that the auditory cortex is involved in tinnitus^{5,7,16}, most likely in the intensity coding of the phantom percept¹⁴. However, the auditory cortex is but one of the areas involved in the generation of the phantom sound. Functional imaging studies have demonstrated that both the tinnitus sound percept and the tinnitus related distress are network properties of different, possibly overlapping networks^{11,15}. These networks differ between men and women and as a result of the tinnitus characteristics (pure tone versus noise-like tinnitus, left versus rightsided tinnitus, uni- versus bilateral tinnitus). Moreover, these networks change in time¹⁰.

Thus, tinnitus research is maturing, evolving from a pure ‘ear problem’ through an ‘auditory cortex problem’^{5,7,16}, into a ‘static network problem’¹² reaching a ‘dynamic multiple parallel network problem’^{10,15}. This implies that only targeting the auditory cortex with neuromodulation techniques^{1,6} is not going to be a long lasting successful approach. Neuromodulation targets will have to be based on the individual characteristics of the patient’s tinnitus profile and would have to include different brain areas comprising the different dynamic parallel networks. Recent TMS studies combining frontal and auditory cortex stimulation⁴ is but one example of application of these new insights.

As our understanding of the neural network correlates of tinnitus percept and tinnitus distress improve, new foreseeable neuromodulation targets can be proposed. These include the frontal cortex, the extended amygdalahippocampal area, the cingulate cortex, the insula, the parietal cortex and/or a combination of these areas. These approaches could critically improve tinnitus suppression rates within the near future.

However, one should not forget that the brain responds to the body. Thus, brain changes found in tinnitus reflect compensatory mechanisms often related to temporary or permanent, partial or complete, auditory deprivation⁹. Therefore, combining neuromodulation with auditory amplification might be necessary. Based on this concept neuromodulation would be used in an attempt to halt self-perpetuating tinnitus network loops, and auditory amplification in an attempt to normalize auditory input to the brain and to prevent tinnitus brain changes to reinstall, once neuromodulation effects wear off. Moreover, since neuromodulation effects altering perception are highly dependent on the brain state¹³, pharmacological⁸ and neuropsychological interventions might prepare the brain for this treatment approach. For example using TRT or cognitive behavioral treatment first, with or without pharmacological neuroplasticity enhancement, could improve the brain’s responsiveness to either neuromodulation or specific auditory stimulation.



Increasing the involvement of basic (oto)neuroscientists^{2,3} and functional neuroimaging specialists in improving our understanding of tinnitus is mandatory to develop pathophysiologically grounded treatments and to determine how to best combine the different aspects of this multimodal treatment approach. The tinnitus treatment of the future should therefore be based on basic (oto)neuroscience knowledge and requires truly multidisciplinary approaches, combining the expertise of functional imaging specialists, audiologists, ENT specialists, neurologists or neurosurgeons and psychologists.

1. De Ridder D, De Mulder G, Verstraeten E, Seidman M, Elisevich K, Sunaert S, et al: Auditory cortex stimulation for tinnitus. *Acta Neurochir Suppl* 97:451-462, 2007
2. Eggermont JJ, Roberts LE: The neuroscience of tinnitus. *Trends Neurosci* 27:676-682, 2004
3. Elgoyhen AB, Langguth B: Pharmacological approaches to the treatment of tinnitus. *Drug Discov Today*, 2009
4. Kleinjung T, Eichhammer P, Landgrebe M, Sand P, Hajak G, Steffens T, et al: Combined temporal and prefrontal transcranial magnetic stimulation for tinnitus treatment: a pilot study. *Otolaryngol Head Neck Surg* 138:497-501, 2008
5. Llinas RR, Ribary U, Jeanmonod D, Kronberg E, Mitra PP: Thalamocortical dysrhythmia: A neurological and neuropsychiatric syndrome characterized by magnetoencephalography. *Proc Natl Acad Sci U S A* 96:15222-15227, 1999
6. Londero A, Langguth B, De Ridder D, Bonfils P, Lefaucheur JP: Repetitive transcranial magnetic stimulation (rTMS): a new therapeutic approach in subjective tinnitus? *Neurophysiol Clin* 36:145-155, 2006
7. Muhlnickel W, Elbert T, Taub E, Flor H: Reorganization of auditory cortex in tinnitus. *Proc Natl Acad Sci U S A* 95:10340-10343, 1998
8. Nitsche MA, Lampe C, Antal A, Liebetanz D, Lang N, Tergau F, et al: Dopaminergic modulation of long-lasting direct current-induced cortical excitability changes in the human motor cortex. *Eur J Neurosci* 23:1651-1657, 2006
9. Norena AJ, Eggermont JJ: Enriched acoustic environment after noise trauma reduces hearing loss and prevents cortical map reorganization. *J Neurosci* 25:699-705, 2005
10. Schlee W, Hartmann T, Langguth B, Weisz N: Abnormal resting-state cortical coupling in chronic tinnitus. *BMC Neurosci* 10:11, 2009
11. Schlee W, Mueller N, Hartmann T, Keil J, Lorenz I, Weisz N: Mapping cortical hubs in tinnitus. *BMC Biol* 7:80, 2009
12. Schlee W, Weisz N, Bertrand O, Hartmann T, Elbert T: Using auditory steady state responses to outline the functional connectivity in the tinnitus brain. *PLoS ONE* 3:e3720, 2008
13. Silvanto J, Muggleton N, Walsh V: State-dependency in brain stimulation studies of perception and cognition. *Trends Cogn Sci* 12:447-454, 2008
14. van der Loo E, Gais S, Congedo M, Vanneste S, Plazier M, Menovsky T, et al: Tinnitus intensity dependent gamma oscillations of the contralateral auditory cortex. *PLoS ONE* 4:e7396, 2009
15. Vanneste S, Plazier M, der Loo EV, de Heyning PV, Congedo M, De Ridder D: The neural correlates of tinnitus-related distress. *Neuroimage*
16. Weisz N, Muller S, Schlee W, Dohrmann K, Hartmann T, Elbert T: The neural code of auditory phantom perception. *J Neurosci* 27:1479-1484, 2007





X International Tinnitus Seminar

March 16 to 19, 2011

Florianópolis - Santa Catarina - Brazil

Dear colleague,

Brazil has been elected to host the next International Tinnitus Seminar during the last 2008 meeting held in Sweden. It is the first time such an event takes place in Latin America.

We are pleased to announce the X International Tinnitus Seminar to be held in March 16 to 19, 2011 at the Resort of Costão do Santinho, situated in the paradisiacal island of Florianópolis, Santa Catarina, Brazil (www.its2011brazil.com.br)

The event will host the world's health community with a common interest in tinnitus. It will be a great opportunity to share and discuss related topics and a mind-opening experience to new ideas.

Along with an exciting scientific program we are also organising a unique cultural experience of the warm and friendly "Brazilian way".

Your invaluable presence will help us to make this an unforgettable event full of new knowledge and fun.

We look forward to welcoming you to Brazil in March 2011.

Prof Tanit Ganz Sanchez, MD, PhD

President of ITS 2011

Claudia Barros Coelho, MD, PhD

President of the Scientific Committee

News

Tinnitus Subtyping Project

The Tinnitus Subtyping Project has its own website now. Information about the subtyping project in general, about the participating centers etc is available on

<http://database.tinnitusresearch.org>

The 4th International TRI Tinnitus Conference - Frontiers in Tinnitus Research

We would like to thank all the participants in the Conference. We hope, you have enjoyed your visit to Dallas and that the Conference has given you new ideas and insight into the understanding of the enigmatic disease of tinnitus. The abstract book and recordings of the presentations are available for download now on the TRI website www.tinnitusresearch.org. Those who were prevented from attending the meeting may request the password from

info@tinnitusresearch.org

International Symposium on the 'Pathology of the Inner Ear'

The Kresge Hearing Research Institute is pleased to announce an International Symposium on the 'Pathology of the Inner Ear' taking place at the University of Michigan, October 14-15, 2010. Please, visit the web site for more information and registration:

<http://www.khri.med.umich.edu/ieps>



September 2010

Conventus Meeting of the Societas ORL Latina

When: September 1 – 4, 2010
Where: Acaya Golf Resort, Lecce, Italy
Contact: M.C.A. Events srl
Via G. Pellizza da Volpedo, 4
20149 Milan, Italy
Phone: 0039 02 34934404
Fax: 0039 02 34934397
E-Mail: info@mcaevents.org
Detailed Information: <http://www.conventus2010.org>

Eighteenth Annual Conference on Management of the Tinnitus Patient

When: September 16 - 18, 2010
Where: Iowa, IA, USA
Contact: Center for Conferences and Institutes
The University of Iowa
250 CEF
Iowa City, IA, 52242-5000
Phone: 001 800-551-9029
Fax: 001 319-335-4039
Detailed information: uihealthcare.com/depts/med/otolaryngology/conferences

Herbsttagung Arbeitsgemeinschaft Deutschsprachiger Audiologen und Neurootologen (ADANO)

When: September 16 – 19, 2010
Where: Zürich, Switzerland
Detailed information: <http://www.hno.org/adano/tagungen.htm>

IAPA 2010 - XV Anniversary Symposium in Audiological Medicine

When: September 19 – 22, 2010
Where: Krakow Poland
Phone: 004842636-35-18
Fax: 004842636-35-18
E-Mail: info@iapa2010.eu
Detailed Information: <http://www.iapa2010.eu>

International Symposium on Objective Measures in Auditory Implants

When: September 23 – 25, 2010
Where: St. Louis, MO, USA
Detailed information: <https://cme.wustl.edu/om2010/>

IAPA 2010 - XV International Symposium in Audiological Medicine

When: September 23 – 26, 2010
Where: Krakow Poland
Contact: Professor Mariola Sliwinska-Kowalska
Detailed Information: <http://iapa-online.org/symposia/future-symposia/#>



American Academy of Otolaryngology, Head and Neck Surgery Annual Meeting

When: September 26 – 29, 2010

Where: Boston, MA, USA

Detailed information: <http://www.entnet.org/ConferencesAndEvents/upcomingconferences.cfm>

October 2010

55th International Congress of Hearing Aid Acousticians

When: October 13 – 15, 2010

Where: Messe Hannover, Germany

Detailed information: <http://www.euha.org>

'Pathology of the Inner Ear' - An international Symposium

When: October 14 – 15, 2010

Where: University of Michigan, Ann Arbor, USA

Detailed information: www.khri.med.umich.edu/ieps

November 2010

ASHA 2009 Annual Convention

When: November 18 – 20, 2010

Where: Philadelphia, PA, USA

Detailed information: <http://www.asha.org/about/events/convention/>



I Epidemiology

Hearing impairment in F-111 maintenance workers: the study of health outcomes in aircraft maintenance personnel (SHOAMP) general health and medical study.

Am J Ind Med. 2010 Jun 30. [Epub ahead of print]

Guest M, Boggess M, Attia J, D'Este C, Brown A, Gibson R, Tavener M, Gardner I, Harrex W, Horsley K, Ross J; On behalf of the SHOAMP study team and Scientific Advisory Committee.

Faculty of Health, University of Newcastle, NSW, Australia.

BACKGROUND: We sought to examine hearing loss in a group from the Royal Australian Air Force who undertook fuel tank maintenance on F-111 aircraft, with exposure to formulations containing ototoxins, relative to two different comparison groups. **METHODS:** Using pure-tone audiometry, hearing thresholds were assessed in 614 exposed personnel, 513 technical-trade comparisons (different base, same job), and 403 non-technical comparisons (same base, different job). We calculated percentage loss of hearing (PLH) and used regression models to examine whether there was an association between PLH and F-111 fuel tank maintenance, adjusting for possible confounders. In addition, the difference between the observed hearing thresholds and the expected thresholds based on an otologically normal population (ISO-7029-2003) was determined. **RESULTS:** The PLH ranged from nil to 96 (median 1.5, quartiles 0.3, 5.5). A logistic regression model showed no statistically significant difference in PLH among the three exposure groups (exposed vs. non-technical controls 1.1: 95% CI 0.7, 2.0 and exposed vs. technical OR 0.9: 95% CI 0.6, 1.3). The model also highlighted a number of other risk factors for PLH including age, tinnitus, smoking, depression, and use of depression medications. However, at all eight frequencies measured, all populations had lower than expected hearing thresholds based on published ISO-7029 medians. **CONCLUSIONS:** Although there was no difference in PLH between the three exposure groups, the study did reveal a high degree of hearing loss between the 3 groups and a normal population. Am. J. Ind. Med. (c) 2010 Wiley-Liss, Inc.

Tinnitus and mobile phone use.

Occup Environ Med. 2010 Jun 23. [Epub ahead of print]

Hutter HP, Moshhammer H, Wallner P, Cartellieri M, Denk-Linnert DM, Katzinger M, Ehrenberger K, Kundi M.

Institute of Environmental Health, Medical University of Vienna, Vienna, Austria.

Objectives The mechanisms that produce tinnitus are not fully understood. While tinnitus can be associated with diseases and disorders of the ear, retrocochlear diseases and vascular pathologies, there are few known risk factors for tinnitus apart from these conditions. There is anecdotal evidence of a link between mobile phone use and tinnitus, but so far there have been no systematic investigations into this possible association. **Methods** 100 consecutive patients presenting with tinnitus were enrolled in an individually matched case-control study. For each case a control subject was randomly selected from visiting outpatients matched for sex and age. The patient's history was obtained and clinical examinations were conducted to exclude patients with known underlying causes of tinnitus. Mobile phone use was assessed based on the Interphone Study protocol. ORs were computed by conditional logistic regression with years of education and living in an urban area as covariates. **Results** Mobile phone use up to the index date (onset of tinnitus) on the same side as the tinnitus did not have significantly elevated ORs for regular use and intensity or for cumulative hours of use. The risk estimate was significantly elevated for prolonged use (≥ 4 years) of a mobile phone (OR 1.95; CI 1.00 to 3.80). **Conclusions** Mobile phone use should be included in future investigations as a potential risk factor for developing tinnitus.



The ten-year incidence of tinnitus among older adults.

Int J Audiol. 2010 Aug;49(8):580-5.

Nondahl DM, Cruickshanks KJ, Wiley TL, Klein BE, Klein R, Chappell R, Tweed TS.

*Department of Ophthalmology and Visual Sciences, University of Wisconsin, Madison, USA.

Abstract As part of a population-based study in Beaver Dam, Wisconsin, we estimated the 10-year cumulative incidence of tinnitus and its risk factors. Participants (n = 2922, aged 48-92 years) not reporting tinnitus at baseline (1993-1995) were followed for up to ten years. In addition to audiometric testing and anthropometric measures, data on tinnitus, health, and other history were obtained via questionnaire. Potential risk factors were assessed with discrete-time proportional hazards models. The 10-year cumulative incidence of tinnitus was 12.7%. The risk of developing tinnitus was significantly associated with: history of arthritis (hazard ratio (HR) = 1.37), history of head injury (HR = 1.76), history of ever smoking (HR = 1.40), and among women, hearing loss (HR = 2.59). Alcohol consumption (HR = 0.63 for ≥ 141 grams/week vs. <15 grams/week), age (among women, HR = 0.90 for each five-year increase in age), and among men, obesity (HR = 0.55), were associated with decreased risk. The risk of developing tinnitus was high for older adults, and associated with modifiable health and behavioral factors.

Prevalence and factors associated with tinnitus: a community-based study of Japanese elders.

J Epidemiol. 2010;20(4):271-6. Epub 2010 May 22.

Michikawa T, Nishiwaki Y, Kikuchi Y, Saito H, Mizutani K, Okamoto M, Takebayashi T.

Department of Preventive Medicine and Public Health, School of Medicine, Keio University, Tokyo, Japan.

BACKGROUND: The prevalence of tinnitus is reported to be high in older Western populations, and several risk factors have been suggested. However, community-based evidence on prevalence is limited and, to our knowledge, there is no such information from older non-Western populations. The purpose of this study was to determine the prevalence and factors associated with tinnitus in community-dwelling Japanese elders. **METHODS:** In this community-based cross-sectional study, 1320 residents of Kurabuchi Town aged 65 years or older (584 men and 736 women; participation proportion = 98.7%) were interviewed at home in 2006, and information on tinnitus and factors associated with tinnitus was collected. We estimated the prevalence of tinnitus by age group and sex and used a logistic regression model to investigate associated factors. **RESULTS:** The prevalence of tinnitus was 18.6% (men: 18.0%; women: 19.0%); there were no statistically significant differences by age group or sex. Hearing difficulty, depressive mood, prescribed medication, past/current history of coronary heart disease, and knee joint pain requiring medical consultation were associated with tinnitus. **CONCLUSIONS:** These findings suggest that tinnitus is common in Japanese aged over 65 years. Because the factors associated with tinnitus in this cross-sectional study are potentially modifiable, they should be thoroughly investigated in a longitudinal study.



II Pathophysiology

Can homeostatic plasticity in deafferented primary auditory cortex lead to travelling waves of excitation?

J Comput Neurosci. 2010 Jul 10. [Epub ahead of print]

Chrostowski M, Yang L, Wilson HR, Bruce IC, Becker S.

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Travelling waves of activity in neural circuits have been proposed as a mechanism underlying a variety of neurological disorders, including epileptic seizures, migraine auras and brain injury. The highly influential Wilson-Cowan cortical model describes the dynamics of a network of excitatory and inhibitory neurons. The Wilson-Cowan equations predict travelling waves of activity in rate-based models that have sufficiently reduced levels of lateral inhibition. Travelling waves of excitation may play a role in functional changes in the auditory cortex after hearing loss. We propose that down-regulation of lateral inhibition may be induced in deafferented cortex via homeostatic plasticity mechanisms. We use the Wilson-Cowan equations to construct a spiking model of the primary auditory cortex that includes a novel, mathematically formalized description of homeostatic plasticity. In our model, the homeostatic mechanisms respond to hearing loss by reducing inhibition and increasing excitation, producing conditions under which travelling waves of excitation can emerge. However, our model predicts that the presence of spontaneous activity prevents the development of long-range travelling waves of excitation. Rather, our simulations show short-duration excitatory waves that cancel each other out. We also describe changes in spontaneous firing, synchrony and tuning after simulated hearing loss. With the exception of shifts in characteristic frequency, changes after hearing loss were qualitatively the same as empirical findings. Finally, we discuss possible applications to tinnitus, the perception of sound without an external stimulus.

Tuning Out the Noise: Limbic-Auditory Interactions in Tinnitus.

Neuron. 2010 Jun 24;66(6):819-826.

Rauschecker JP, Leaver AM, Mühlau M.

Laboratory of Integrative Neuroscience and Cognition, Georgetown University Medical Center, Washington, DC 20057-1460, USA.

Tinnitus, the most common auditory disorder, affects about 40 million people in the United States alone, and its incidence is rising due to an aging population and increasing noise exposure. Although several approaches for the alleviation of tinnitus exist, there is as of yet no cure. The present article proposes a testable model for tinnitus that is grounded in recent findings from human imaging and focuses on brain areas in cortex, thalamus, and ventral striatum. Limbic and auditory brain areas are thought to interact at the thalamic level. While a tinnitus signal originates from lesion-induced plasticity of the auditory pathways, it can be tuned out by feedback connections from limbic regions, which block the tinnitus signal from reaching auditory cortex. If the limbic regions are compromised, this “noise-cancellation” mechanism breaks down, and chronic tinnitus results. Hopefully, this model will ultimately enable the development of effective treatment. Copyright © 2010 Elsevier Inc. All rights reserved.



The expression of mitogen-activated protein kinases and brain-derived neurotrophic factor in inferior colliculi after acoustic trauma.

Neurobiol Dis. 2010 Jun 18. [Epub ahead of print]

Meltser I, Canlon B

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Acoustic trauma is well known to cause peripheral damage with subsequent effects in the central auditory system. The inferior colliculus (IC) is a major auditory center for the integration of ascending and descending information and is involved in noise-induced tinnitus and central hyperactivity. Here we show that the early effects of acoustic trauma, that eventually result in permanent damage to auditory system, lead to a transient activation of BDNF and mitogen-activated protein kinases (MAPK) including extracellular signal-regulated kinase (ERK), c-jun N-terminal kinase (JNK), and p38 in the IC. In contrast, the early effects of acoustic trauma that result in a temporary damage produced a reversible activation only of p38. The transient activation of MAPK and BDNF in the IC after permanent acoustic trauma is attributed to the plastic changes triggered by a decreased signal input from the damaged periphery. The pattern of MAPK and BDNF activation in the IC is different from that previously described for the cochlea from this laboratory. The differences in the pattern of MAPK and BDNF expression in the IC highlight unique molecular mechanisms underlying temporary and permanent acoustic damage to the central auditory system. Copyright © 2010 Elsevier Inc. All rights reserved.

Assessing audiological, pathophysiological and psychological variables in tinnitus patients with or without hearing loss.

Eur Arch Otorhinolaryngol. 2010 Jun 25. [Epub ahead of print]

Martines F, Bentivegna D, Martines E, Sciacca V, Martinciglio G.

Sezione di Otorinolaringoiatria, Dipartimento di Neuroscienze Cliniche (DINeC), Università degli Studi di Palermo, Via del Vespro, 129, 90127, Palermo, Italy, francescomartines@unipa.it.

The aim of this work is to study the characteristics of tinnitus both in normal hearing subjects and in patients with hearing loss. The study considered tinnitus sufferers, ranging from 21 to 83 years of age, who were referred to the Audiology Section of Palermo University in the years 2006-2008. The following parameters were considered: age, sex, hearing threshold, tinnitus laterality, tinnitus duration, tinnitus measurements and subjective disturbance caused by tinnitus. The sample was divided into Group1 (G1), 115 subjects with normal hearing, and Group2 (G2), 197 subjects with hearing loss. Especially for G2, there was a predominance of males compared to females ($P = 0.011$); the highest percentage of tinnitus resulted in the decades 61-70 and >70 with a significant difference for G2 demonstrating that the hearing status and the elderly represent the principal tinnitus-related factors ($P < 0.0001$). The hearing impairment resulted in most cases of sensorineural hearing loss (SNHL) type and was limited to the high frequencies; the 72.1% of the patients with SNHL had a high-pitched tinnitus, while the 88.4% of the patients with a high-frequency SNHL had a high-pitched tinnitus ($P < 0.0001$). As to the subjective discomfort, the catastrophic category was the most representative among G1 with a significant difference between the two groups; no correlation was found between the level of tinnitus intensity and the tinnitus annoyance confirming the possibility that tinnitus discomfort is elicited by a certain degree of psychological distress as anxiety, depression, irritability and phobias.



[Tinnitus and depression]

[Article in Polish]

Otolaryngol Pol. 2009 Sep;63(7):20-3.

Zielińska-Bliźniewska H, Olszewski J.

Klinika Otolaryngologii i Onkologii Laryngologicznej, II Katedry Otolaryngologii UM Łodzi.

INTRODUCTION: The aim of the study was to assess the frequency of depression and its intensity in patients with diagnosed tinnitus and their correlation with selected audiological parameters. **MATERIAL AND METHODS:** 80 patients underwent the study, including 46 females (57.5%) and 34 males (42.5%) aged 20-84 suffering from tinnitus. The study methodology included: an interview, otorhinolaryngological examination, full audiological diagnostics and imaging test (CT or MR). Patients who qualified for the study completed a modified questionnaire according to the Beck Depression Inventory (BDI). **THE STUDY RESULTS:** The study found the depression level higher than the one in the general population and amounting to 45%, with 41.2% of the patients suffering from masked depression (a mean rating scale of 14-16), and 3.7% of the patients showing symptoms of moderate depression (27 points according to the rating scale). The own studies showed no statistically meaningful relation between intensification of depression in the studied patients and their age and sex as well as acoustic parameters such as frequency, tinnitus localization. However, a statistically variable relation was noted showing that the longer a patient suffered from tinnitus the more often depression occurred. **CONCLUSIONS:** The occurrence of depression among the studied patients with tinnitus is higher than in the Polish population. In the conducted studies dominated depression of mild intensity. It was affirmed that depression occurred more often in patients with tinnitus lasting longer than 5 years.

Polysomnographic and quantitative electroencephalographic correlates of subjective sleep complaints in chronic tinnitus.

J Sleep Res. 2010 Jun 16. [Epub ahead of print]

Hébert S, Fullum S, Carrier J.

Ecole d'orthophonie et d'audiologie, Centre de recherche en neuropsychologie et en cognition, Université de Montréal, Québec, Canada.

Summary Chronic tinnitus, or the perception of hearing sounds without the presence of external stimulation, is estimated at about 10-15% of the population, with highest prevalence after 50 years of age. Sleep complaints are among the most prominent complaints accompanying tinnitus, but objective data are rare. In this study, we examined prospectively the subjective and objective sleep parameters of this patient population in order to determine differences in sleep disturbances associated with chronic tinnitus compared to matched controls. Forty-four subjects (22 with tinnitus and 22 controls without tinnitus), unselected with respect to sleep complaints, participated in this study. The analysis involved 1-week sleep diaries, subjective sleep questionnaires and 1 night of polysomnographic (PSG) assessment. Compared to matched controls, the tinnitus group showed lower subjective sleep quality as measured with the Pittsburgh Sleep Quality Index (PSQI) and sleep diaries, but no significant difference in objective polysomnograph sleep parameters (i.e. sleep latency, efficiency). However, quantitative non-rapid eye movement sleep analysis revealed lower spectral power in the delta frequency band in the tinnitus group compared to controls, and this decrease was correlated with subjective sleep complaints (the lower the delta spectral power, the greater the complaints). This is the first report of an electrophysiological correlate of sleep difficulties supportive of subjective sleep complaints in the tinnitus population.



Quantitative analysis of cochlear active mechanisms in tinnitus subjects with normal hearing sensitivity: Time-frequency analysis of transient evoked otoacoustic emissions and contralateral suppression.

Auris Nasus Larynx. 2010 Jun 15. [Epub ahead of print]

Paglialonga A, Fiocchi S, Del Bo L, Ravazzani P, Tognola G.

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OBJECTIVE: The aim of this study was to analyze the fine structure of transient evoked otoacoustic emissions (TEOAEs) and contralateral suppression effects in tinnitus subjects with normal hearing in order to assess whether a minor cochlear or efferent dysfunction, possibly limited in narrow cochlear regions, might play a role in tinnitus. **METHODS:** TEOAEs were recorded, both in the absence and in the presence of contralateral acoustic stimulation, in 23 tinnitus patients with normal hearing sensitivity and in 31 non-tinnitus control subjects. The broad-band TEOAE recordings were analyzed by using an innovative algorithm and separated into a set of 33 narrow-band frequency components, that represent the different cochlear contributions to the whole TEOAE response. In each frequency component, three different parameters were analyzed and compared between tinnitus and non-tinnitus subjects, i.e., reproducibility, latency, and the suppression effects induced by contralateral acoustic stimulation. **RESULTS:** Significantly lower reproducibility was observed in the frequency components of the tinnitus subjects compared to the controls, whereas no significant differences in latency and in suppression effects were observed between tinnitus and non-tinnitus ears. **CONCLUSIONS:** The analysis of the fine structure of TEOAEs revealed that the tinnitus subjects involved in this study might, possibly, have a minor dysfunction of the cochlear active mechanisms that resulted in frequency components with lower reproducibility. Conversely, the analysis of suppression effects in the narrow-band frequency components of TEOAE indicated that the subjects involved showed no relevant damage to the efferent regulatory mechanisms that control the cochlear activity, neither through the cochlea as a whole, nor in limited cochlear regions. Copyright © 2010 Elsevier Ireland Ltd. All rights reserved.

Acoustic trauma evokes hyperactivity and changes in gene expression in guinea-pig auditory brainstem.

Eur J Neurosci. 2010 May;31(9):1616-28.

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Hearing loss from acoustic trauma is a risk factor for tinnitus. Animal models using acoustic trauma have demonstrated hyperactivity in central auditory pathways, which has been suggested as a substrate for tinnitus. We used a guinea-pig model of unilateral acoustic trauma. Within the same animals, measurements of peripheral hearing loss, spontaneous activity of single neurons in the inferior colliculus and gene expression in cochlear nucleus and inferior colliculus were combined, acutely and after recovery from acoustic trauma. Genes investigated related to inhibitory (GABA-A receptor subunit alpha 1; glycine receptor subunit alpha 1) and excitatory neurotransmission (glutamate decarboxylase 1; glutamate receptor AMPA subunit alpha 2; glutamate receptor NMDA subunit 1), regulation of transmitter release (member of RAB family of small GTPase; RAB3 GTPase activating protein subunit 1) and neuronal excitability (potassium channel subfamily K member 15). Acoustic trauma resulted in unilateral hearing loss and hyperactivity bilaterally in inferior colliculus. Changes in expression of different mRNAs were observed in ipsilateral cochlear nucleus and in ipsi- and contralateral inferior colliculus, immediately after acoustic trauma, and after 2 and 4 weeks' recovery. Gene expression was generally reduced immediately after trauma, followed by a return to near normal levels or over-expression as recovery time increased. Different mechanisms appear to underlie the spontaneous hyperactivity observed. There is



evidence of down-regulation of genes associated with neuronal inhibition in the contralateral inferior colliculus, whereas in ipsilateral cochlear nucleus, competing actions of inhibitory and excitatory systems seem to play a major role in determining overall excitability.

Comparison of salicylate- and quinine-induced tinnitus in rats: development, time course, and evaluation of audiologic correlates.

Otol Neurotol. 2010 Jul;31(5):823-31.

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BACKGROUND: Salicylate and quinine have been shown to reliably induce short-term tinnitus when administered at high doses. The present study compared salicylate and quinine-induced tinnitus in rats using the gap prepulse inhibition of acoustic startle (GPIAS). **METHODS:** Twenty-four rats were divided into 2 groups; the first group (n = 12) was injected with salicylate (300 mg kg d), whereas the second (n = 12) was treated with quinine orally at a dose of 200 mg kg d. Animals were treated daily for 4 consecutive days. All rats were tested for tinnitus and hearing loss before and 2, 24, 48, 72, and 96 hours after the first drug administration. Tinnitus was assessed using GPIAS; hearing function was measured with distortion product otoacoustic emissions (DPOAEs) and auditory brainstem response. **RESULTS:** Salicylate treatment induced transient tinnitus with a pitch near 16 kHz starting 2 hours posttreatment, persisting over the 4-day treatment period and disappearing 24 hours later. Animals in the quinine group showed GPIAS changes at a higher pitch (20 kHz); however, changes were more variable among animals, and the mean data were not statistically significant. Hearing function varied across treatments. In the salicylate group, high-level DPOAEs were slightly affected; most changes occurred 2 hours posttreatment. Low-level DPOAEs were affected at all frequencies with a progressive dose-dependent effect. In the quinine group, only high-level DPOAEs were affected, mainly at 16 kHz. **CONCLUSION:** The present study highlights the similarities and differences in the frequency and the time course of tinnitus and hypoacusis induced by salicylate and quinine. Transient tinnitus was reliably induced pharmacologically with salicylate, whereas hearing loss remained subclinical with only minor changes in DPOAEs.

A large cohort study of GJB2 mutations in Japanese hearing loss patients.

Clin Genet. 2010 Feb 23. [Epub ahead of print]

Tsukada K, Nishio S, Usami S; the Deafness Gene Study Consortium.

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Tsukada K, Nishio S, Usami S, and the Deafness Gene Study Consortium. A large cohort study of GJB2 mutations in Japanese hearing loss patients. GJB2 is the gene most frequently associated with hereditary hearing loss, and the GJB2 mutation spectrums vary among different ethnic groups. In this study, the mutation spectrum as well as clinical features of patients with GJB2 mutations as found in more than 1000 Japanese hearing loss families are summarized. The present results show that the frequency of GJB2 mutations in the Japanese population with hearing loss is 14.2% overall and 25.2% in patients with congenital hearing loss. c.235delC was the most frequent allele (49.8%), was associated with a more severe phenotype, and was mainly found in patients who were diagnosed by the age of 3. In contrast, the second most frequent was p.V37I (16.5%), which has a milder phenotype and was mainly found in patients diagnosed at a higher age. Additional clinical features in hearing loss patients with GJB2 mutations in this study were the near absence of tinnitus, vestibular dysfunction and inner ear malformations.



Tonotopic changes in GABA receptor expression in guinea pig inferior colliculus after partial unilateral hearing loss.

Brain Res. 2010 Jun 25;1342:24-32. Epub 2010 May 23.

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Immunohistochemistry was used to investigate the topographic distribution of the alpha1 subunit of the GABA receptor (GABRA1) in guinea pig inferior colliculus after treatments that caused a unilateral loss of peripheral neural sensitivity in the high-frequency regions of the cochlea. Both forms of treatment (direct mechanical lesion of the cochlea and acoustic overstimulation) resulted in a significant decrease in GABRA1 labeling in regions of the contralateral inferior colliculus in which high-frequency sound stimuli are represented. This localized region of reduced inhibitory receptor expression corresponds to the region in which hyperactivity of inferior colliculus neurons has been shown to develop after such treatments. The results strengthen the notion of a causal link between reduced GABRA1 expression and neural hyperactivity in central auditory nuclei and provide a possible mechanism for the development of phantom auditory sensations, or tinnitus. Copyright 2010 Elsevier B.V. All rights reserved.

Cochlear changes in presbycusis with tinnitus.

Am J Otolaryngol. 2010 Apr 29. [Epub ahead of print]

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OBJECTIVES: The pathophysiology of tinnitus is obscure and its treatment is therefore elusive. Significant progress in this field can only be achieved by determining the mechanisms of tinnitus generation, and thus, histopathologic findings of the cochlea in presbycusis with tinnitus become crucial. We revealed the histopathologic findings of the cochlea in subjects with presbycusis and tinnitus. **MATERIAL AND METHODS:** The subjects were divided into 2 groups, presbycusis with tinnitus (tinnitus) group and presbycusis without tinnitus (control) group, with each group comprising 8 temporal bones from 8 subjects. We quantitatively analyzed the number of spiral ganglion cells, loss of cochlear inner and outer hair cells, and areas of the stria vascularis and spiral ligament. **RESULTS:** There was a significantly greater loss of outer hair cells in the tinnitus group compared with the control group in the basal and upper middle turns. The stria vascularis was more atrophic in the tinnitus group compared with the control group in the basal turn. **CONCLUSIONS:** Tinnitus is more common in patients with presbycusis who have more severe degeneration of outer hair cells and stria vascularis. Copyright © 2010 Elsevier Inc. All rights reserved.

Effects of sodium salicylate on spontaneous and evoked spike rate in the dorsal cochlear nucleus.

Hear Res. 2010 Aug 1;267(1-2):54-60. Epub 2010 Apr 27.

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Spontaneous hyperactivity in the dorsal cochlear nucleus (DCN), particularly in fusiform cells, has been proposed as a neural generator of tinnitus. To determine if sodium salicylate, a reliable tinnitus inducer, could evoke hyperactivity in the DCN, we measured the spontaneous and depolarization-evoked spike rate in fusiform and cartwheel cells during salicylate superfusion. Five minute treatment with 1.4 mM



salicylate suppressed spontaneous and evoked firing in fusiform cells; this decrease partially recovered after salicylate washout. Less suppression and greater recovery occurred with 3 min treatment using 1.4 mM salicylate. In contrast, salicylate had no effect on the spontaneous or evoked firing of cartwheel cells indicating that salicylate's suppressive effects are specific to fusiform cells. To determine if salicylate's suppressive effects were a consequence of increased synaptic inhibition, spontaneous inhibitory postsynaptic currents (IPSC) were measured during salicylate treatment. Salicylate unexpectedly reduced IPSC thereby ruling out increased inhibition as a mechanism to explain the depressed firing rates in fusiform cells. The salicylate-induced suppression of fusiform spike rate apparently arises from unidentified changes in the cell's intrinsic excitability. Copyright © 2010 Elsevier B.V. All rights reserved.

Systematic screening for nonspecific autoantibodies in idiopathic sensorineural hearing loss: no association with steroid response.

Otol Neurotol. 2010 Jun;31(4):687-90.

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OBJECTIVE: An autoimmune pathogenesis has been suggested for idiopathic sensorineural hearing loss (iSHL). Specific tests have been developed to detect inner ear autoantibodies and have been shown to correlate with treatment outcome. However, the disease is rare, and specific tests are not easily available. We aimed to analyze the correlation between positive systemic autoimmune test results and steroid treatment outcome in patients with iSHL. **STUDY DESIGN:** Prospective, single-center, open trial. **SETTING:** All patients younger than 60 years seen in the ENT department from 1999 to 2007 and fulfilling the criteria for iSHL were tested for systemic autoimmunity. **PATIENTS:** Patients were classified into 2 groups, according to the presence or absence of autoimmunity. **INTERVENTION:** Clinical evaluation and audiologic tests. **MAIN OUTCOME MEASURES:** The outcomes of steroid treatment were compared between these 2 groups. **RESULTS:** Forty-nine patients were included; the mean age at iSHL onset was 36.1 years. Hearing loss was often bilateral (89.8%). Tinnitus and vertigo were present in 75.5% and 51%, respectively. On audiograms, disease severity was correlated with disease duration. Nine patients (18.4%) had positive autoimmune tests: anti-neutrophil cytoplasmic antibody (n = 1), antinuclear antibody (n = 3), rheumatoid factor (n = 3), and antiphospholipid (n = 2). Twenty-five courses of oral steroids were evaluated after 1 month: 52% of cases experienced some improvement. There were no differences in outcome associated with autoimmune status ($p = 0.85$). **CONCLUSION:** The results of this study suggest that positive autoimmune tests in patients with iSHL are not predictive of improvement after a 1-month steroid course. Therefore, systematic screening does not seem to be useful, and specific inner ear autoantibody tests need to be developed.



III Diagnostics

Late Auditory evoked potentials in individuals with tinnitus.

Braz J Otorhinolaryngol. 2010 Apr;76(2):263-70.

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Long latency auditory evoked potentials (LLAEP) alterations in individuals with tinnitus are suggestive of dysfunction in the central auditory pathways at a cortical level. AIM: To characterize the LLAEP in individuals with and without tinnitus exposed to occupational noise. METHOD: Cross-sectional contemporary cohort, prospective study. Sixty subjects exposed to occupational noise, ranging in age from 29 to 50 years underwent LLAEP assessment; 30 of them had tinnitus complaint and 30 did not have tinnitus. RESULTS: We observed significant statistical difference regarding the mean values of latencies of waves N1 ($p < 0.001$), P2 ($p = 0.002$) and P300 ($p = 0.039$) when we compared individuals with and without tinnitus. In individuals with tinnitus we also noticed a greater number of altered results concerning components N1 (60%) and P2 (66.7%), although only component P2 presented significant statistical difference ($p = 0.010$). For the LLAEP, the latency increase was the only type of alteration found ($p = 1.000$). We found a greater association between bilateral tinnitus and bilateral alteration for all components N1(73%), P2(73%) and P300(50%). CONCLUSION: It is relevant to study LLAEP in individuals with tinnitus exposed to high occupational sound pressure levels

Predictors of vestibular schwannoma growth and clinical implications.

Otol Neurotol. 2010 Jul;31(5):807-12.

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OBJECTIVE: Vestibular schwannomas exhibit variable and unpredictable patterns of growth. We evaluated the extent to which tumor growth influences the management of these benign tumors, and we explored symptom markers present at diagnosis that may be predictive of tumor growth. STUDY DESIGN: Retrospective case review. SETTING: Tertiary care hospital center. PATIENTS: One hundred eighty patients with unilateral vestibular schwannomas diagnosed between 1997 and 2007 who were initially managed conservatively by serial observation. INTERVENTION(S): Serial observation versus eventual microsurgical or radiosurgical treatment. MAIN OUTCOME MEASURE(S): Tumor growth, defined as a 1 mm/year or greater increase in tumor size. RESULTS: We observed that tumor growth was the most important predictor of a change in treatment strategy from serial observation to microsurgical or radiosurgical treatment. We further noted in multivariate analyses that larger tumor size at diagnosis was associated with higher odds of tumor growth, such that each 1-mm increment in tumor size at presentation increased the odds of growth by 20%. We also found that the symptom marker of tinnitus at diagnosis significantly increased the odds of tumor growth nearly 3-fold. CONCLUSION: Tumor growth plays a significant role in guiding the management of vestibular schwannomas. Assessment of tumor size at diagnosis and for the presence of tinnitus may allow for risk stratification of patients with newly diagnosed vestibular schwannomas and for a more rational application of the conservative management approach.



Hypersensitivity to sound in tinnitus patients: an analysis of a construct based on questionnaire and audiological data.

Int J Audiol. 2010 Jul;49(7):518-26.

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The purpose of this study was to analyse the Questionnaire on Hypersensitivity to Sound (GUF; Nelting & Finlayson, 2004) and to improve its validity based on the analysis of intercorrelations (single item level) with other methods of assessing hyperacusis (uncomfortable loudness level, individual loudness function, self-rated severity of hyperacusis). Subjects consisted of 91 inpatients with tinnitus and hyperacusis. The GUF showed a good reliability ($\alpha = .92$). The factorial structure of the questionnaire reported by Nelting et al (2002) was not completely supported by the evidence in this study. The total score and the single items showed small to moderate correlations with the other modes of measuring hyperacusis. Evidence for convergent and discriminant validity were found, but overall the results corroborate the conceptual heterogeneity of the construct hyperacusis and its dependency on the assessment method. Four items of the GUF with particularly low correlations were excluded from the questionnaire. The revised GUF total score showed slightly but not statistically significant higher convergent and discriminant validity.

Systematic screening for nonspecific autoantibodies in idiopathic sensorineural hearing loss: no association with steroid response.

Otol Neurotol. 2010 Jun;31(4):687-90.

Hervier B, Bordure P, Audrain M, Calais C, Masseau A, Hamidou M.

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OBJECTIVE: An autoimmune pathogenesis has been suggested for idiopathic sensorineural hearing loss (iSHL). Specific tests have been developed to detect inner ear autoantibodies and have been shown to correlate with treatment outcome. However, the disease is rare, and specific tests are not easily available. We aimed to analyze the correlation between positive systemic autoimmune test results and steroid treatment outcome in patients with iSHL. **STUDY DESIGN:** Prospective, single-center, open trial. **SETTING:** All patients younger than 60 years seen in the ENT department from 1999 to 2007 and fulfilling the criteria for iSHL were tested for systemic autoimmunity. **PATIENTS:** Patients were classified into 2 groups, according to the presence or absence of autoimmunity. **INTERVENTION:** Clinical evaluation and audiologic tests. **MAIN OUTCOME MEASURES:** The outcomes of steroid treatment were compared between these 2 groups. **RESULTS:** Forty-nine patients were included; the mean age at iSHL onset was 36.1 years. Hearing loss was often bilateral (89.8%). Tinnitus and vertigo were present in 75.5% and 51%, respectively. On audiograms, disease severity was correlated with disease duration. Nine patients (18.4%) had positive autoimmune tests: anti-neutrophil cytoplasmic antibody ($n = 1$), antinuclear antibody ($n = 3$), rheumatoid factor ($n = 3$), and antiphospholipid ($n = 2$). Twenty-five courses of oral steroids were evaluated after 1 month: 52% of cases experienced some improvement. There were no differences in outcome associated with autoimmune status ($p = 0.85$). **CONCLUSION:** The results of this study suggest that positive autoimmune tests in patients with iSHL are not predictive of improvement after a 1-month steroid course. Therefore, systematic screening does not seem to be useful, and specific inner ear autoantibody tests need to be developed.



IV Imaging

Neural correlates of human somatosensory integration in tinnitus.

Hear Res. 2010 Aug 1;267(1-2):78-88. Epub 2010 Apr 27.

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Possible neural correlates of somatosensory modulation of tinnitus were assessed. Functional magnetic resonance imaging (fMRI) was used to investigate differences in neural activity between subjects that can modulate their tinnitus by jaw protrusion and normal hearing controls. We measured responses to bilateral sound and responses to jaw protrusion. Additionally we studied multimodal integration of somatosensory jaw protrusion and sound. The auditory system responded to both sound and jaw protrusion. Jaw responses were enhanced in the cochlear nucleus (CN) and the inferior colliculus (IC) in tinnitus patients. The responses of the auditory brain areas to jaw protrusion presumably account for the modulation of tinnitus as described by the patients. The somatosensory system responded to jaw protrusion and not to sound. These responses occurred both in subjects with tinnitus and controls. Unexpectedly, the cerebellum responded to sound in normal hearing subjects, but not in tinnitus patients. Together, these results provide a neurophysiological basis for the effect of jaw protrusion on tinnitus. Copyright © 2010 Elsevier B.V. All rights reserved.

The neural correlates of tinnitus-related distress.

Neuroimage. 2010 Aug 15;52(2):470-80. Epub 2010 Apr 21.

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Tinnitus is an auditory phantom percept with a tone, hissing, or buzzing sound in the absence of any objective physical sound source. About 6% to 25% of the affected people report interference with their lives as tinnitus causes a considerable amount of distress. However, the underlying neurophysiological mechanism for the development of tinnitus-related distress remains not well understood. Hence we focus on the cortical and subcortical source differences in resting-state EEG between tinnitus patients with different grades of distress using continuous scalp EEG recordings and Low Resolution Electromagnetic Tomography (LORETA). Results show more synchronized alpha activity in the tinnitus patients with a serious amount of distress with peaks localized to various emotion-related areas. These areas include subcallosal anterior cingulate cortex, the insula, parahippocampal area and amygdala. In addition, less alpha synchronized activity was found in the posterior cingulate cortex, precuneus and DLPFC. A comparison between the tinnitus group with distress and the Nova Tech EEG (NTE) normative database demonstrated increased synchronized alpha and beta activity and less synchronized delta and theta activity in the dorsal anterior cingulate cortex in tinnitus patients with distress. It is interesting that the areas found show some overlap with the emotional component of the pain matrix and the distress related areas in asthmatic dyspnea. Unpleasantness of pain activates the anterior cingulate and prefrontal cortices, amygdala, and insula. As such, it might be that distress is related to alpha and beta activity in the dorsal anterior cingulate cortex, the amount of distress perceived to an alpha network consisting of the amygdala-anterior cingulate cortex-insula-parahippocampal area. Copyright (c) 2010 Elsevier Inc. All rights reserved.



V Pharmacotherapy

VI Auditive Stimulation

Acoustic Stimulation Treatments Against Tinnitus Could Be Most Effective when Tinnitus Pitch Is within the Stimulated Frequency Range.

Hear Res. 2010 Jul 6. [Epub ahead of print]

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Acoustic stimulation with hearing aids or noise devices is frequently used in tinnitus therapy. However, such behind-the-ear devices are limited in their high-frequency output with an upper cut-off frequency of approximately 5-6 kHz. Theoretical modeling suggests that acoustic stimulation treatments with these devices might be most effective when the tinnitus pitch is within the stimulated frequency range. To test this hypothesis, we conducted a pilot study with 15 subjects with chronic tinnitus. Eleven subjects received hearing aids and four subjects noise devices. Perceived tinnitus loudness was measured using a visual analog scale, and tinnitus-related distress was assessed using the Tinnitus Questionnaire. After six months of device usage, reductions of perceived tinnitus loudness were seen only in subjects with a tinnitus pitch of less than 6 kHz. When subjects were grouped by tinnitus pitch, the group of patients with a tinnitus pitch of less than 6 kHz (n=10 subjects) showed a significant reduction in perceived tinnitus loudness (from 73.4 +/- 6.1 before to 56.4 +/- 7.4 after treatment, p=0.012), whereas in subjects with a tinnitus pitch of 6 kHz or more (n=5 subjects) tinnitus loudness was slightly increased after six months of treatment (65.0 +/- 4.7 before and 70.6 +/- 5.9 after treatment), but the increase was not significant (p=0.063). Likewise, tinnitus-related distress was significantly decreased in the lowpitch group (from 31.6 +/- 4.3 to 20.9 +/- 4.8, p=0.0059), but not in the group with high-pitched tinnitus (30.2 +/- 3.3 before and 30.0 +/- 5.1 after treatment, p=1). Overall, reductions in tinnitus-related distress in our study were less pronounced than those reported for more comprehensive treatments. However, the differences we observed between the low- and the high-pitch group show that tinnitus pitch might influence the outcome of acoustic stimulation treatments when devices with a limited frequency range are used. Copyright © 2010 Elsevier B.V. All rights reserved.

Tinnitus and cochlear implants.

Auris Nasus Larynx. 2010 Jun 24. [Epub ahead of print]

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OBJECTIVE: Several published studies seem to confirm the clinical observation that cochlear implants (CI) have a suppressive effect on tinnitus in most CI users. The aim of this paper is to present our personal experiences on tinnitus improvement after cochlear implantation. **METHODS:** Before surgery, 51 post-lingually profoundly deaf adults, who underwent cochlear implantation between 2005 and 2007, filled out a questionnaire reporting tinnitus characteristics and the Italian version of the Tinnitus Handicap Inventory (THI-I). Moreover, they were asked to scale tinnitus loudness and annoyance. Six months after implant activation, patients repeated the same evaluations. Scores were statistically analysed by means of a Wilcoxon signed ranks test on the hypothesis that a CI could change the tinnitus magnitude and/or its annoyance. **RESULTS:** In our series of 36 patients, 36.10% reported total loudness suppression and another 41.6% reported a reduction. Annoyance scores reduced in 75% of patients. THI reduced in 72.2% of patients. **CONCLUSION:** Tinnitus reduction after CI may manifest as several mechanisms,



such as habituation, acoustic masking, direct electrical nerve stimulation and cortical reorganization. Nevertheless, it is our opinion that data on CI benefits on tinnitus should be interpreted with caution and it seems reasonable to admit that further data is still necessary before considering CI as a treatment of tinnitus especially in unilateral deafness. Copyright © 2010 Elsevier Ireland Ltd. All rights reserved.

Hearing aids as an adjunct to counseling: tinnitus patients who choose amplification do better than those that don't.

Int J Audiol. 2010 Aug;49(8):574-9.

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Hearing aids are commonly used for tinnitus management (Kochkin & Tyler, 2008) but there is limited evidence to support their use. The purpose of this study was to quantify the effectiveness of hearing aids and counseling as a tinnitus treatment option. This study is a retrospective analysis of tinnitus handicap questionnaire (THQ, Kuk et al, 1990) results from 58 tinnitus patients with hearing loss who received counseling, and (1) chose to follow recommendations of hearing aid fitting, or (2) chose not to have hearing aids. The groups (N = 29 each) had similar audiometric configuration, tinnitus duration, and age. It was hypothesized that the use of hearing aids would provide greater reduction in THQ scores than counseling alone. THQ scores were reduced 12 months following counseling but improvement in THQ only reached statistical significance for the group that received hearing aids ($p < 0.0001$). The hearing aid group had reduced; psychosocial handicap ($p < 0.0002$); and tinnitus-hearing handicap ($p < 0.0005$). It is concluded that patients with hearing loss and tinnitus should trial amplification.

Clinical prognostic factors for tinnitus retraining therapy with a sound generator in tinnitus patients.

J Med Dent Sci. 2010 Mar;57(1):45-53.

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OBJECTIVES: The purpose of the present study is to find out the clinical characteristics which determine candidates for tinnitus retraining therapy (TRT) with a sound generator (SG) as well as the prognosis of this treatment. **METHOD:** This study enrolled 270 serious tinnitus patients who visited this institute between January 2004 and December 2008 in the TRT program. The relationships among compliance, efficacy, clinical characteristics, and affinity for SG were evaluated retrospectively. **RESULTS:** The persistence rate at one month was 61.5%. The shorter duration and higher pitch of tinnitus were significant independent predictors of compliance. Six months after the initiation of TRT, 65.2% subjects demonstrated significant relief from tinnitus. The Kaplan-Meier method demonstrated that the overall efficacy rate at 18 months was 86.5%. The lower loudness of tinnitus, recognition of tinnitus attenuation by a sound generator, and patient's positive attitude toward TRT were significant variables for predicting favorable results. **CONCLUSION:** The patients with lower loudness of tinnitus were suitable for TRT with a SG.



Postoperative complications in patients with cochlear implants and impacts of nursing intervention.

Acta Otolaryngol. 2010 Jun;130(6):687-95.

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Department of Otorhinolaryngology/Head and Neck Surgery, Chinese People's Liberation Army General Hospital, Beijing, China.

CONCLUSION: This study shows that cochlear implantation is relatively safe surgery with few major complications and within acceptable limits. However, close follow-up observation and effective medical and nursing intervention could alleviate further complications and thus become key elements for promoting recovery of patients undergoing such surgery. **OBJECTIVES:** Cochlear implantation has become an effective method for curing patients disabled by profound hearing loss in China. However, full exploration of the associated complications remains to be completed. The objective of this study was thus to analyse the postoperative complications in patients with cochlear implants (CIs) in order to design improved measures for clinical and nursing interventions. **METHODS:** A retrospective study of 262 patients receiving CIs at the Department of Otorhinolaryngology/Head and Neck Surgery, Chinese People's Liberation Army General Hospital, Beijing, China from March 1997 to December 2006 was conducted. **RESULTS:** Among 262 patients, 4 cases (1.5%) had 1 or more major complications requiring substantial medical or nursing interventions, including 1 case of cerebrospinal fluid (CSF) otorrhoea accompanied by meningitis, 2 cases of facial nerve paresis and 1 case of perforation of tympanic membrane. Forty cases (15.3%) had some form of minor complication that settled spontaneously or easily with conventional treatments and nursing, of which dizziness and vomiting was the most frequent (4.2%), followed by CSF gusher without otorrhoea and/or induced meningitis (2.7%), tinnitus (1.9%) and facial nerve partially exposed without paralysis (1.5%). Eleven cases (4.2%) had some symptoms associated with installation of the cochlear device. Except for one patient who had no response after implantation because his auditory nerves were underdeveloped, all the patients who received appropriate treatment and nursing intervention had a favourable prognosis.

VII Brain Stimulation

Short-term Effects of Single rTMS Sessions on Auditory Evoked Activity in Chronic Tinnitus Patients.

J Neurophysiol. 2010 Jun 30. [Epub ahead of print]

Lorenz I, Müller N, Schlee W, Langguth B, Weisz N.

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Subjective tinnitus is the perception of a sound without any external source. Repetitive transcranial magnetic stimulation has been examined as a treatment tool for chronic tinnitus for several years trying to target hyperactivity / abnormal synchronization within the auditory cortex putatively underlying the auditory phantom percept. However, its exact impact on auditory cortical activity remains largely unknown. This study's objective was to systematically examine changes in auditory responses (N1, auditory steady state response) measured by means of magnetoencephalography after single sessions of stimulation with different transcranial magnetic stimulation paradigms. Subjects with chronic tinnitus (n=10) underwent five sessions of repetitive transcranial magnetic stimulation in which they received one of five different stimulation protocols (1Hz, individual alpha frequency, continuous theta burst stimulation, intermittent theta burst stimulation, and sham) in randomized order using a single-blind study design. Cortical steady state responses to 40 Hz amplitude-modulated tones were measured before and after each magnetic stimulation protocol. The results demonstrate a reduction of the cortical response to the auditory steady state stimulus after magnetic stimulation, whereas the N1 response was slightly enhanced or remained unchanged. Furthermore, the reduction of the auditory steady state response was driven by effects of intermittent theta burst stimulation, continuous theta burst stimulation, and



1Hz stimulation. Correspondingly, behavioral measures demonstrated the greatest reduction of tinnitus loudness after the respective rTMS protocols. The current study offers an interesting insight into the effects of repetitive transcranial magnetic stimulation on auditory cortical activity. The results of the study are discussed in context of the current limitations of transcranial magnetic stimulation for the treatment of chronic tinnitus.

Tinnitus modulation by deep brain stimulation in locus of caudate neurons (area LC).

Neuroscience. 2010 Jun 10. [Epub ahead of print]

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Tinnitus is an auditory disorder characterized by perception of internally generated phantom auditory sensations without corresponding mechanical stimuli arising from the body or external environment. Current auditory based treatment approaches, sometimes in conjunction with nonauditory based strategies, such as Tinnitus Retraining Therapy and Cognitive Behavioral Therapy, have been helpful in mitigating symptoms for the majority of patients. Yet there are over 1 million tinnitus sufferers who still endure troublesome chronic, continuous head noises that are debilitating and interfere with activities of daily living. Here we show that application of deep brain stimulation (DBS) therapy to a locus of caudate neurons (area LC) in the body of the nucleus, a subsite of the striatum that is not part of the classical auditory pathway, can decrease or increase tinnitus loudness perception. The DBS lead traversed through or was adjacent to area LC in six Parkinson's disease and essential tremor subjects with concomitant tinnitus who underwent implantation of the subthalamic or ventral intermediate nucleus. In five subjects where the DBS lead tip traversed area LC, tinnitus loudness in both ears was suppressed to a nadir of level 2 or lower on a 0-10 rating scale. In one subject where the DBS lead was outside area LC, tinnitus was not modulated. In three subjects with preoperative and postoperative audiograms, hearing thresholds were unchanged by area LC stimulation. Neuromodulation of area LC may be interrupting perceptual integration of phantom sensations generated in the central auditory system. This new, basal ganglia based approach to tinnitus modulation warrants further investigation and may be ultimately refined to treat patients with refractory symptoms. Copyright © 2010 IBRO. Published by Elsevier Ltd. All rights reserved.

[Feasibility of auditory cortical stimulation for the treatment of tinnitus. Three case reports.]

[Article in French]

Neurochirurgie. 2010 Apr 26. [Epub ahead of print]

Litré CF, Giersky F, Theret E, Leveque M, Peruzzi P, Rousseaux P.

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Tinnitus is a public health issue in France. Around 1 % of the population is affected and 30,000 people are handicapped in their daily life. The treatments available for disabling tinnitus have until now been disappointing. We report our experience on the treatment of these patients in neurosurgery. **PATIENT AND METHODS:** Between 2006 and 2008, transcranial magnetic stimulation (rTMS) was performed following several supraliminal and subliminal protocols in 16 patients whose mean age was 47 years (range, 35-71). All patients underwent anatomical and functional MRI of the auditory cortex before and 18h after rTMS, to straddle the primary and secondary auditory cortices. All patients underwent audiometric testing by an ENT physician. **RESULTS:** Nine patients responded with rTMS. After these investigations, two quadrapolar electrodes (Resume((R))), connected to a stimulating device implanted under the skin (Synergy((R)), from Medtronic), were extradurally implanted in three patients. The electrodes were placed between the primary and secondary auditory cortices. The mean follow-up was 25 months and significant improvement was found in these patients.



CONCLUSION: The feasibility of cortical stimulation in symptomatic treatment of tinnitus was demonstrated by this preparatory work. The intermediate- and long-term therapeutic effects remain to be evaluated. Copyright © 2010 Elsevier Masson SAS. All rights reserved.

Efficacy of repetitive transcranial magnetic stimulation for the treatment of refractory chronic tinnitus: A randomized, placebo controlled study.

Neuro Endocrinol Lett. 2010;31(2):238-49.

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OBJECTIVE: The pathophysiologic mechanisms of idiopathic tinnitus remain unclear. Low frequency rTMS applied over the auditory cortex has been proposed as a new and causally oriented treatment approach for pathological conditions with abnormal, increased cortical activity including tinnitus with increased activity in the auditory cortex. However available studies are characterized by a positive reports on the therapeutic effects of repetitive transcranial magnetic stimulation (rTMS) for treatment of tinnitus, there are few details about the duration of specific treatment effects. **DESIGN:** The design of the study was randomized, prospective, placebo-controlled. Right-handed patients were treated with either real or sham 1 Hz frequency rTMS over a period of two weeks. Fifty-two patients with chronic, treatment resistant tinnitus and stable medication were enrolled in the study after giving written informed consent and forty-two patients completed the study and were included in data analysis. **RESULTS:** The ability to reduce the symptoms of tinnitus appeared in both randomized groups immediately after the 1 Hz rTMS and sham stimulation phase. There was a significant reduction in both groups of the tinnitus total score on the Tinnitus Handicap Inventory (THI) (real rTMS $p=0.005$; sham rTMS $p=0.049$) and Tinnitus Questionnaire (TQ) total score (real rTMS $p=0.003$; sham rTMS $p=0.049$). On the THI evaluation scale, in the real rTMS a mild worsening was noted during week 6 in comparison with the state attained in week 2. During the subsequent course of the study a significant reduction of the total score persisted in the case of THI (real rTMS week 14 $p=0.033$ and borderline week 26 $p=0.058$). The reduction of symptoms as evaluated using the TQ was significant compared to baseline in the real rTMS group at week 2, 6 and 14 ($p=0.003$; $p=0.024$; $p=0.022$). The group treated with sham stimulation reached significant reduction of symptoms only at week 2 ($p=0.049$). A comparison of the difference in the recorded values of the total score during follow-up in relation to baseline expressed as a percentage demonstrates the difference in the effect of rTMS and sham stimulation as evaluated by both the basic scales. Graphical analysis of mean patterns of treatment response according to stimulation type shows a similarity between treatment response patterns evaluated by reduction of the total scores using THI and TQ. **CONCLUSIONS:** The principal finding of this study is that real 1 Hz rTMS treatment was capable of significantly reducing the total baseline score of basic scales that measure tinnitus severity. This result is important as it proves that significant reduction of symptoms can be achieved even in a group of patients with long-term symptoms resistant to pharmacological treatment.



VIII Behavioral Therapy

IX Somatic Tinnitus

Transcutaneous electrical nerve stimulation (TENS) of upper cervical nerve (C2) for the treatment of somatic tinnitus.

Exp Brain Res. 2010 Jul;204(2):283-7. Epub 2010 May 28.

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Somatic tinnitus has been defined as tinnitus temporally associated to a somatic disorder involving the head and neck. Several studies have demonstrated the interactions between the somatosensory and auditory system at the dorsal cochlear nucleus (DCN), inferior colliculus, and parietal association areas. The objective is to verify the effect of transcutaneous electrical nerve stimulation of the upper cervical nerve (C2) in the treatment of somatic tinnitus. As electrical stimulation of C2 increases activation of the DCN through the somatosensory pathway and enlarges the inhibitory role of the DCN on the central nervous system, C2 TENS can be considered for tinnitus modulation. A total of 240 patients in whom tinnitus is modulated by somatosensory events (e.g., tinnitus change with rotation, retro- and antifixion of neck) or modulated by pressure on head or face were included in this study. Both a real and a sham TENS treatment were applied for 30 min (10 min of 6 Hz, followed by 10 min of 40 Hz and 10 min of sham). Significant tinnitus suppression was found ($P < 0.001$). Only 17.9% ($N = 43$) of the patients with tinnitus responded to C2 TENS. They had an improvement of 42.92%, and six patients had a reduction of 100%.

Neural correlates of human somatosensory integration in tinnitus.

Hear Res. 2010 Aug 1;267(1-2):78-88. Epub 2010 Apr 27.

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Possible neural correlates of somatosensory modulation of tinnitus were assessed. Functional magnetic resonance imaging (fMRI) was used to investigate differences in neural activity between subjects that can modulate their tinnitus by jaw protrusion and normal hearing controls. We measured responses to bilateral sound and responses to jaw protrusion. Additionally we studied multimodal integration of somatosensory jaw protrusion and sound. The auditory system responded to both sound and jaw protrusion. Jaw responses were enhanced in the cochlear nucleus (CN) and the inferior colliculus (IC) in tinnitus patients. The responses of the auditory brain areas to jaw protrusion presumably account for the modulation of tinnitus as described by the patients. The somatosensory system responded to jaw protrusion and not to sound. These responses occurred both in subjects with tinnitus and controls. Unexpectedly, the cerebellum responded to sound in normal hearing subjects, but not in tinnitus patients. Together, these results provide a neurophysiological basis for the effect of jaw protrusion on tinnitus. Copyright © 2010 Elsevier B.V. All rights reserved.



X Surgical Treatment

Impact of Laser Eustachian Tuboplasty on Middle Ear Ventilation, Hearing, and Tinnitus in Chronic Tube Dysfunction.

Ear Hear. 2010 Jun 25. [Epub ahead of print]

Caffier PP, Sedlmaier B, Haupt H, Göktas O, Scherer H, Mazurek B.

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OBJECTIVES: Long-term Eustachian tube dysfunction (ETD) predisposes to various secondary middle ear diseases. Most surgical and prosthetical interventions on the Eustachian tube itself have proven to be ineffective, whereas middle ear surgeries treat the sequelae of ETD without major influence on the underlying tubal pathology. The purpose of our study was to evaluate the outcome of laser Eustachian tuboplasty (LETP) on tubal function and associated otological symptoms in topically anesthetized ETD patients with intact or perforated eardrums. **DESIGN:** In a prospective clinical investigation, outpatient LETP was carried out in 31 subjects with therapy-refractory chronic ETD. The study population comprised two groups: 16 patients with mesotympanic eardrum perforations diagnosed with noninflammatory chronic otitis media (COM) and 15 patients with intact eardrums including otitis media with effusion, adhesion processes, and dysfunctional pressure equalization. Clinical examination and data acquisition were performed 2 wks before LETP as well as 8 wks and 1 yr postoperatively. On COM patients, LETP was done at 10-wk intervals before the scheduled tympanoplasty. Assessment of clinical effectiveness was based on transnasal videoendoscopy, ear microscopy, tubal function tests (Valsalva maneuver and passive tubal opening), audio- and tympanometric measurements, and visual analog scales. Transnasal, fiber-guided laser surgery was performed in contact mode using a semiconductor diode laser ($\lambda = 830 \text{ nm}$, 4 W). We hypothesized that regulated laser ablation of hyperplastic mucosa at the epipharyngeal dorsal circumference of the tubal ostium could be effective in improving the associated symptoms such as dysfunctional pressure equalization, aural fullness, conductive hearing loss, and tinnitus. **RESULTS:** LETP resulted in persistent volume reduction of the posterior tubal circumference in all patients. Objective parameters revealed significant improvement of tubal function tests and middle ear ventilation in 62% of subjects after 8 wks (66% after 1 yr). Significant long-term reduction of conductive hearing loss was achieved in both patient groups. Besides, tinnitus loudness was significantly reduced in COM subjects after tympanoplasty. Visual analog scales showed very low values for intraoperative pain and discomfort and high scores for long-term overall patient satisfaction as well as improvement of the symptoms such as dysfunctional pressure equalization and aural fullness. Subjects with post-LETP Valsalva feasibility marked higher values for satisfaction and symptom improvement than patients without successful Valsalva maneuver. COM subjects scored higher in hearing improvement and satisfaction after LETP and successful tympanoplasty than patients with intact eardrums. **CONCLUSIONS:** Outpatient LETP seems to be a suitable, safe, easily applicable, and well-tolerated treatment option before (revision) tympanoplasties and in all investigated diseases developing from long-lasting pathologic middle ear ventilation. Minimally invasive shaping of the hyperplastic nasopharyngeal Eustachian tube under topical anesthesia seems to be effective in improving tubal function as well as the associated symptoms such as dysfunctional pressure equalization, aural fullness, and conductive hearing loss in otherwise therapy-refractory chronic ETD.



[Tragus cartilage tympanoplasty for treatment of adhesive otitis media.]

[Article in Chinese]

Nan Fang Yi Ke Da Xue Xue Bao. 2010 Jun;30(6):1382-4.

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OBJECTIVE: To evaluate the efficacy of cartilage tympanoplasty in the treatment of adhesive otitis media. **METHODS:** From June to October, 2008, 18 patients with adhesive otitis media (18 ears) were treated with tragus cartilage tympanoplasty. The air-bone gap changes and the self-perceived symptomatic improvement were evaluated at 1 month and 1 year after the operation. **RESULTS:** All the patients showed dry ear within 6 weeks after the operation. Tympanic membrane healing was achieved in 17 cases, and 1 case presented with a inferior-anterior fissure in the tympanic membrane. With the average preoperative air-bone gap (at 0.25, 0.5, 1.0, and 2.0 kHz) of 44.65 dB, the patients showed an obvious decrease of the air-bone gap by over 10 dB at 1 month after the operation and by over 25 dB at one year. Symptomatic improvements were achieved in these cases, including alleviated ear discomforts (3/15 cases), total tinnitus relief (1/11 cases), and alleviated tinnitus (10/11 cases). High-frequency tinnitus was noted in 1 case (1/7 cases), and the tympanic membrane appeared normal in 17 cases. **CONCLUSION:** Tympanic membrane reconstruction using the tragus cartilage can be feasible for treatment of secretory otitis media, but the surgical indications should be carefully controlled.

Tinnitus and cochlear implants.

Auris Nasus Larynx. 2010 Jun 24. [Epub ahead of print]

Bovo R, Ciorba A, Martini A.

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OBJECTIVE: Several published studies seem to confirm the clinical observation that cochlear implants (CI) have a suppressive effect on tinnitus in most CI users. The aim of this paper is to present our personal experiences on tinnitus improvement after cochlear implantation. **METHODS:** Before surgery, 51 post-lingually profoundly deaf adults, who underwent cochlear implantation between 2005 and 2007, filled out a questionnaire reporting tinnitus characteristics and the Italian version of the Tinnitus Handicap Inventory (THI-I). Moreover, they were asked to scale tinnitus loudness and annoyance. Six months after implant activation, patients repeated the same evaluations. Scores were statistically analysed by means of a Wilcoxon signed ranks test on the hypothesis that a CI could change the tinnitus magnitude and/or its annoyance. **RESULTS:** In our series of 36 patients, 36.10% reported total loudness suppression and another 41.6% reported a reduction. Annoyance scores reduced in 75% of patients. THI reduced in 72.2% of patients. **CONCLUSION:** Tinnitus reduction after CI may manifest as several mechanisms, such as habituation, acoustic masking, direct electrical nerve stimulation and cortical reorganization. Nevertheless, it is our opinion that data on CI benefits on tinnitus should be interpreted with caution and it seems reasonable to admit that further data is still necessary before considering CI as a treatment of tinnitus especially in unilateral deafness. Copyright © 2010 Elsevier Ireland Ltd. All rights reserved.



[Diagnosis and management of pulsatile tinnitus of venous origin]

[Article in Chinese]

Lin Chung Er Bi Yan Hou Tou Jing Wai Ke Za Zhi. 2010 Mar;24(6):267-9.

Zhang Y, Wang W, Dai C, Chen L.

Department of Otolaryngology, Eye, Ear, Nose and Thorat Hospital of Fudan University, Shanghai, 200031, China.

OBJECTIVE: To discuss the diagnosis and management of pulsatile tinnitus of venous origin. **METHOD:** A retrospective study was conducted on 12 patients who were diagnosed with pulsatile tinnitus of venous origin and treated with ligation of internal jugular veins. We reevaluated the evidences of identifying pulsatile tinnitus of venous origin and reviewed the short-term and long-term postoperative effects and complications. We also reviewed associated articles in this report. **RESULT:** Seven patients got relief of tinnitus in less than one week after the surgery, while the other 5 patients had no relief. Seven patients were inquired in this study and the other five lost to follow-up. According to the long review (from one to five years postoperatively), two patients who acquired immediate effect got relief of tinnitus, four including complained of no relief and the seventh aggravated into roaring. Three patients who got no immediate relief got no improvement at all. No one in our review complained of any complications. **CONCLUSION:** It's assumed that a history of pulsatile tinnitus, alleviation of tinnitus when pressing jugular veins, tinnitus changing with head position or posture and no occupying lesion in temporal CT scan or cranial MRI are inadequate in diagnosing pulsatile tinnitus of venous origin. Vascular imaging is also necessary to exclude other pathological changes like dura arteriovenous fistula, sigmoid diverticulum and so on. CT arteriography and venography are recommended preferentially. Ligation of internal jugular veins is controversial in patients who have no absence of transverse and sigmoid sinus and identified as pulsatile tinnitus of venous origin.

Predictors of vestibular schwannoma growth and clinical implications.

Otol Neurotol. 2010 Jul;31(5):807-12.

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OBJECTIVE: Vestibular schwannomas exhibit variable and unpredictable patterns of growth. We evaluated the extent to which tumor growth influences the management of these benign tumors, and we explored symptom markers present at diagnosis that may be predictive of tumor growth. **STUDY DESIGN:** Retrospective case review. **SETTING:** Tertiary care hospital center. **PATIENTS:** One hundred eighty patients with unilateral vestibular schwannomas diagnosed between 1997 and 2007 who were initially managed conservatively by serial observation. **INTERVENTION(S):** Serial observation versus eventual microsurgical or radiosurgical treatment. **MAIN OUTCOME MEASURE(S):** Tumor growth, defined as a 1 mm/year or greater increase in tumor size. **RESULTS:** We observed that tumor growth was the most important predictor of a change in treatment strategy from serial observation to microsurgical or radiosurgical treatment. We further noted in multivariate analyses that larger tumor size at diagnosis was associated with higher odds of tumor growth, such that each 1-mm increment in tumor size at presentation increased the odds of growth by 20%. We also found that the symptom marker of tinnitus at diagnosis significantly increased the odds of tumor growth nearly 3-fold. **CONCLUSION:** Tumor growth plays a significant role in guiding the management of vestibular schwannomas. Assessment of tumor size at diagnosis and for the presence of tinnitus may allow for risk stratification of patients with newly diagnosed vestibular schwannomas and for a more rational application of the conservative management approach.



XI Holistics

[Manual treatment of the cervical spinal column for tinnitus after acute hearing loss - a case report]

[Article in German]

Forsch Komplementmed. 2010;17(3):147-8. Epub 2010 Jun 16.

Oser A, Steinhäuser J.

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Tinnitus is one of the 20 most common reasons why patients aged 45-64 years consult a general practitioner in Germany. In the literature a correlation is claimed between disease patterns of the cervical spinal column and nuclei of cerebral nerves. In the case report presented here, a 30-year-old female patient with acute tinnitus after acute hearing loss was cured from her tinnitus after a single manual medical treatment at C0/C1, which supports the correlation claimed. If cervical spine diseases should therefore regularly be included in the differential diagnoses of acute tinnitus is a matter of further research. 2010 S. Karger AG, Basel.

XII Review

A triage guide for tinnitus.

J Fam Pract. 2010 Jul;59(7):389-93.

Henry JA, Zaugg TL, Myers PJ, Kendall CJ, Michaelides EM.

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Let patients know that they can learn to manage their reactions to tinnitus with methods that include stress reduction, therapeutic sound, and coping skills. Refer patients with tinnitus to an audiologist for a hearing evaluation, assessment of the tinnitus, and, if indicated, support in learning to manage reactions to tinnitus. Give patients with suicidal ideation or extreme anxiety or depression in response to tinnitus a same-day referral to a mental health professional. Provide an urgent referral to an otolaryngologist or emergency care if you suspect sudden sensorineural hearing loss or another urgent medical condition.

Tinnitus: current understanding and contemporary management.

Curr Opin Otolaryngol Head Neck Surg. 2010 Jul 9. [Epub ahead of print]

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PURPOSE OF REVIEW: Tinnitus is a debilitating condition that affects a broad range of patients. Despite thorough and extensive research, the cause of tinnitus has yet to be determined. Also, there has never been a single intervention identified that can consistently eliminate the symptoms of tinnitus. However, despite our inability to 'cure' tinnitus, there are many medical and behavioral strategies that may result in symptomatic relief. The purpose of this article is to review some of the previous information on tinnitus and to examine the recent research on the etiology and management of this condition.

RECENT FINDINGS: Recent research into the etiology of tinnitus has demonstrated that genetics plays less of a role than previously thought. Although many medications can cause some relief of tinnitus, a number of well designed studies have failed to identify a single cure.



For patients with severe tinnitus who have failed other treatments, such as dietary modification, herbs and nutrients, sound therapies (tinnitus retraining, Neuromonics, masking, and others), or centrally acting medications, transcranial magnetic stimulation has emerged as a viable treatment option. **SUMMARY:** Tinnitus is a common medical complaint and debilitating problem for some patients. It has a broad range of etiologies and even more potential treatments. This review is meant to inform the reader on the current options available to treat this condition.

Tuning Out the Noise: Limbic-Auditory Interactions in Tinnitus.

Neuron. 2010 Jun 24;66(6):819-826.

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Tinnitus, the most common auditory disorder, affects about 40 million people in the United States alone, and its incidence is rising due to an aging population and increasing noise exposure. Although several approaches for the alleviation of tinnitus exist, there is as of yet no cure. The present article proposes a testable model for tinnitus that is grounded in recent findings from human imaging and focuses on brain areas in cortex, thalamus, and ventral striatum. Limbic and auditory brain areas are thought to interact at the thalamic level. While a tinnitus signal originates from lesion-induced plasticity of the auditory pathways, it can be tuned out by feedback connections from limbic regions, which block the tinnitus signal from reaching auditory cortex. If the limbic regions are compromised, this “noise-cancellation” mechanism breaks down, and chronic tinnitus results. Hopefully, this model will ultimately enable the development of effective treatment. Copyright © 2010 Elsevier Inc. All rights reserved.

Medical management of Ménière’s disease: a 10-year case series and review of literature.

Eur Arch Otorhinolaryngol. 2010 May 8. [Epub ahead of print]

Martín González C, González FM, Trinidad A, Ibáñez A, Pinilla M, Martínez Ruiz-Coello A, Rodríguez Valiente A, López-Cortijo C.

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Ménière’s disease is frequent in our area. It is a disabling pathology that affects the patient’s quality of life. Its etiology and pathophysiology remain unclear and there are some therapeutic alternatives with controversial results. We present our series and treatment protocol for Ménière’s disease and discuss the current evidence regarding its medical treatment. In the last 10 years, 252 patients were diagnosed with Ménière’s disease based on their symptoms, and the results of tonal audiometry, videonystagmography and caloric stimulation tests. All cases received medical treatment according to our management protocol. Ménière’s disease is more frequent in women (54.76%); 83.73% of cases are unilateral. Among these, vertigo was observed in 93.7%, hearing loss in 88.1%, tinnitus in 86.1% and pathologic caloric stimulation tests in 71% (88.27% with a reduced vestibular response). A 5-year follow-up was performed in 89.6% of the patients. Subjective improvement as reported by patients was achieved in 94.4% of the cases. There is great controversy about the medical treatment of Ménière’s disease. We found no evidence for the most adequate medical treatment among the different alternatives described in literature. The patient’s acceptance and understanding of the disease is very important.



XIII Others

Initial UK experience of patient satisfaction with the Meniett(R) device for Ménière's disease treatment.

J Laryngol Otol. 2010 Jun 11:1-6. [Epub ahead of print]

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Objectives:To evaluate patient satisfaction and symptom improvement following treatment of Ménière's disease with the Meniett(R) device.**Methods:**Retrospective, questionnaire-based audit and analysis of unilateral Ménière's disease patients' records, following on from a previous study from our departments on intra-tympanic gentamicin for Ménière's disease, using the Vertigo Symptom Scale and Glasgow Benefit Inventory as outcome measures.**Results:**Of 33 consecutive patients treated with the Meniett(R) device for four to six weeks, 30 responded to the questionnaires (90.9 per cent). Respondents' mean Vertigo Symptom Scale score was 0.7 (range 0-2.1), and their mean Glasgow Benefit Inventory general subscale score was 24.1. Nineteen (63.3 per cent) patients felt that the device had alleviated their vertigo and tinnitus.**Conclusions:**This is the first UK study of the effectiveness of the Meniett(R) device in treating Ménière's disease. It shows that the Meniett(R) device is a well tolerated, useful and minimally invasive means of treating Ménière's disease after medical treatment has failed, and before more potentially cochleo- and vestibulo-toxic therapies and invasive procedures are utilised.

Hearing organ disorders in patients with systemic sclerosis.

Rheumatol Int. 2010 May 12. [Epub ahead of print]

Maciaszczyk K, Waszczykowska E, Pajor A, Bartkowiak-Dziankowska B, Durko T.

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In systemic sclerosis (SSc), there may develop hearing and balance disorders as a result of the immune-mediated vasculitis and fibrosis in the inner ear. The objective of the study was evaluation of the hearing organ function in patients with SSc with relationship to duration of the disease and Raynaud phenomenon and also to type and severity of the disease. Twenty unselected, consecutive patients with SSc diagnosed in compliance with the international diagnostic criteria of the American Rheumatism Association (1982), were enrolled into the study. The control group consisted of 26 otologically healthy persons matched to the SSc group for age and sex. Case history was recorded for all patients from questionnaire data. Otolaryngological examination and battery of audiological tests (pure tone audiometry, speech audiometry, impedance audiometry and auditory brainstem response-ABR) were performed. In the anamnesis 60% of patients reported vertigo, 55% headaches, 50% tinnitus, 40% hyperacusis, 40% hearing loss and 30% ear fullness. It was found that patients with SSc had significantly poorer mean hearing thresholds than the control group for 0.5, 1, 6 and 8 kHz. In ABR there were no differences between SSc and control groups although an increase of latency averages in the group of limited patients with SSc compared with the diffuse patients with SSc was observed. In eight patients (40%) sensorineural hearing loss, mostly bilateral and symmetrical was found. Furthermore, no relation was seen between hearing level and duration, type and severity of the disease. Ear involvement is frequent in systemic sclerosis and should be taken into consideration during diagnostic and therapeutic procedures.



XIV Case Reports

Delayed Progressive Extradural Pneumatocele due to Incomplete Sealing of Opened Mastoid Air Cell after Micro-Vascular Decompression.

J Korean Neurosurg Soc. 2010 Jun;47(6):477-9. Epub 2010 Jun 30.

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A case of delayed progressive extradural pneumatocele after microvascular decompression (MVD) is presented. A 60-year-old male underwent MVD for hemifacial spasm; the mastoid air cell was opened and sealed with bone wax during surgery. One month after surgery, the patient complained of tinnitus, and progressive extradural pneumatoceles without cerebrospinal fluid (CSF) leakage was observed. Revision surgery was performed and the opened mastoid air cell was completely sealed with muscle patch and glue. The patient's symptoms were resolved, with no recurrence of pneumatoceles at 6 month follow up. Progressive extradural pneumatocele without CSF leakage after posterior fossa surgery is a very rare complication. Previous reports and surgical management of this rare complication are discussed

[Otosyphilis]

[Article in Danish]

Ugeskr Laeger. 2010 Jul 12;172(28):2067-8.

Wanscher JH, Faber CE.

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We present a case in which a patient infected with human immunodeficiency virus (HIV) developed a sensorineural hearing loss and tinnitus due to inner-ear syphilis affection. The patient had normal otomicroscopy, tympanometry, ear, nose & throat examination, caloric test and intracranial magnetic resonance imaging. Relevant serological blood samples and lumbar puncture indicated syphilis in its secondary stage or the early latent phase. Audiometry demonstrated a considerable improvement and tinnitus decreased after ten days of treatment with antibiotics and prednisone.

Direct carotid-cavernous fistula presenting with minimal symptoms and rapid angiographic progression.

J Clin Neurosci. 2010 Jun 2. [Epub ahead of print]

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Most patients with direct carotid-cavernous fistulas (CCFs) present with dramatic symptoms including proptosis, chemosis, and diplopia. We report a patient with a direct/high-flow CCF whose only initial symptom was pulse-synchronous tinnitus. Following diagnostic angiography, she developed mild symptoms and dramatic angiographic changes over a period of 3days. Complete occlusion of the CCF and resolution of her symptoms were achieved by performing a stent-assisted coil embolization. Copyright © 2010.



Tinnitus in Fourth Nerve Palsy: An Indicator for an Intra-Axial Lesion.

J Neuroophthalmol. 2010 Jun 24. [Epub ahead of print]

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Department of Neurology (SYC, JSK), Seoul National University College of Medicine, Seoul National University Bundang Hospital; Eulji University College of Medicine (SYC); and Department of Otorhinolaryngology (JJS) and Ophthalmology (JMH), Seoul National University College of Medicine, Seoul National University Bundang Hospital, Seoul, Republic of Korea.

Accompanying neurological symptoms and signs are diagnostic hallmarks of fourth nerve palsy (4NP) from an intra-axial lesion. Due to the proximity of the trochlear nucleus and fascicles to the inferior colliculus (IC), auditory symptoms including tinnitus may occur with an intra-axial 4NP. A 53-year-old man with hypertension and diabetes developed right 4NP with a sudden worsening of tinnitus. MRI disclosed an infarction involving the trochlear fascicle and IC in the left dorsal midbrain. Tinnitus may be a symptom indicating an intra-axial lesion causing a 4NP.

Rituximab ameliorated severe hearing loss in Cogan's syndrome: a case report.

Orphanet J Rare Dis. 2010 Jun 16;5(1):18. [Epub ahead of print]

Orsoni JG, Lagana B, Rubino P, Zavota L, Bacciu S, Mora P.

BACKGROUND: Rituximab is a monoclonal antibody inducing depletion of B lymphocytes and presently approved for the treatment of non-Hodgkin's lymphoma and rheumatoid arthritis. Here is the first report of the use of this drug in a case of Cogan's syndrome (CS). **Case Presentation:** a 25-year-old Italian woman was referred with conjunctival hyperaemia, interstitial keratitis, moderate bilateral sensorineural hearing loss accompanied by tinnitus, dizziness, nausea and vertigo, poorly responsive to oral and topical steroidal therapy. Diagnosis of typical CS was made. The administration of a combined immunosuppressive treatment resolved ocular inflammation, dizziness, nausea, and vertigo but gave little results in controlling progressive hearing loss. A noticeable improvement in hearing function was documented by pure tone audiometry after infusion of Rituximab. **DISCUSSION:** in CS, hearing function is often the most difficult parameter to control with therapy. A positive effect of Rituximab on was observed in our case. The drug also allowed to significantly reduce the number of adjuvant immunosuppressive medications.

Mitochondrial neurogastrointestinal encephalomyopathy associated with progressive hearing loss.

J Laryngol Otol. 2010 Jun 15:1-3. [Epub ahead of print]

Hiraki N, Udaka T, Yamamoto H, Kadokawa Y, Ohkubo J, Suzuki H.

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Objective:We report a rare case of mitochondrial neurogastrointestinal encephalomyopathy with hearing loss.**Case report:**A 46-year-old woman presented with a three-year history of progressive, bilateral hearing loss and tinnitus. She had been suffering from unexplained abdominal pain and diarrhoea for 20 years. When first seen, her otoscopic findings were normal, and pure tone audiometry showed mild and moderate hearing loss in her right and left ears, respectively. She also had: bilateral ophthalmoparesis, neck and limb muscle weakness, and hypoactive deep tendon reflexes on neurological examination; diffuse leukoencephalopathy on magnetic resonance imaging of the brain; and markedly reduced leukocyte thymidine phosphorylase activity. On the basis of these findings, the patient was diagnosed with mitochondrial neurogastrointestinal encephalomyopathy.**Conclusion:**Mitochondrial neurogastrointestinal encephalomyopathy is an autosomal recessive disease caused by mutation of the thymidine phosphorylase gene, and is characterised by ophthalmoparesis, peripheral neuropathy, leukoencephalopathy, gastrointestinal symptoms and abnormal mitochondria in muscle cells.



Current advances in genetic research may reveal a higher prevalence of mitochondrial disorders than had previously been thought. Otolaryngologists should be aware of mitochondrial neurogastrointestinal encephalomyopathy and other rare genetic disorders when managing patients with progressive hearing loss.

Three-dimensional digital subtraction angiography for endovascular treatment of direct carotid-cavernous fistula -case report-

Neurol Med Chir (Tokyo). 2010;50(5):404-6.

Kohyama S, Ishihara S, Yamane F, Kanazawa R, Ishihara H, Suzuki M.

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A 63-year-old woman with a direct carotid-cavernous fistula (CCF), manifesting as sudden onset of severe headache and pulsatile tinnitus suffered during coronary angiography, was successfully treated with transarterial embolization based on the anatomical information obtained from volume-rendered three-dimensional digital subtraction angiography (3D DSA) images. 3D DSA is useful for understanding the configuration of such fistulas accurately and devising a therapeutic strategy for the endovascular treatment of direct CCFs.

Microvascular decompression in patient with atypical features of hemifacial spasm secondary to compression by a tortuous vertebrobasilar system: case report.

Neurosurgery. 2010 Jun;66(6):E1212; discussion E1212.

Perlmutter DH, Petraglia AL, Barbano R, Schwalb JM.

Department of Neurological Surgery, University of Rochester School of Medicine and Dentistry, Rochester, New York, USA.

OBJECTIVE: We report a case of hemifacial spasm in a patient who had associated hearing loss, numbness throughout the face, tinnitus, and vertigo, all of which occurred when turning his head to the left. To our knowledge, these symptoms have not occurred in this pattern and with a single trigger. **CLINICAL PRESENTATION:** A 45-year-old man presented with a 3-year history of right-sided hemifacial spasm initially treated with botulinum toxin. One month before presentation, he had an episode of acute hearing loss in the right ear when turning his head to the left, followed by multiple episodes of transient hearing loss in his right ear, numbness in his right face in all distributions of the trigeminal nerve, tinnitus, and vertigo. He was found to have decreased sensation in nerves V1 to V3 and House-Brackmann grade 3/6 weakness in his right face, despite not having botulinum toxin injections in more than a year. Magnetic resonance imaging/angiography showed an ectatic vertebrobasilar system causing compression of the fifth, seventh, and eighth cranial nerves. **INTERVENTION:** The patient underwent a retromastoid craniotomy and microvascular decompression. Postoperatively, he had complete resolution of his symptoms except for his facial weakness. The benefit has been long-lasting. **CONCLUSION:** Multiple, simultaneous cranial neuropathies from vascular compression are rare, but this case is an example of safe and effective treatment with microvascular decompression with durable results.

Pulsatile tinnitus as a first symptom of essential thrombocythemia.

Am J Otolaryngol. 2010 Apr 29. [Epub ahead of print]

Okazaki H, Doi T, Izumikawa M, Kaneda N, Ooka H, Fukui H, Tomoda K.

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Tinnitus is the sensation of sound inside the head and is a common symptom encountered daily by otorhinolaryngologists. Pulsatile tinnitus sufferers hear rhythmical noise at the same rate as a heartbeat and can present a diagnostic challenge. In this report, we present a 32-year-old patient with pulsatile



tinnitus that led to the diagnosis of essential thrombocythemia. The symptom of pulsatile tinnitus allowed an early diagnosis of essential thrombocythemia and a more favorable prognosis. The case demonstrates the importance of blood tests for all patients who present with pulsatile tinnitus of unknown origin. Copyright © 2010 Elsevier Inc. All rights reserved.

[Ménière's-like symptoms following meningioma]

[Article in Danish]

Ugeskr Laeger. 2010 Apr 12;172(15):1136-7.

Friis M, Klokke M, Fugleholm K.

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A 36-year-old woman who presented with a right sided hearing loss, tinnitus and attacks of dizziness was initially diagnosed with Ménière's disease. A meningioma was found along the posterior surface of the petrosal bone, centred partly on the external aperture of the vestibular aqueduct with no relation to the meatal canal. Removal of the meningeal tumour improved the hearing but Ménière's-like symptoms recurred after 18 months despite surgery. Ménière's-like symptoms could hypothetically be caused by changes of the endolymphatic duct or the vein of the vestibular aqueduct.



Clinical Trials

Source: clinicaltrials.gov (14th July 2010)

Telehealth Tinnitus Intervention for Patients With Traumatic Brain Injury (TBI)

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| Current status | not yet open for participant recruitment |
| Sponsors and collaborators | Department of Veterans Affairs |
| Information provided by | Department of Veterans Affairs |
| ClinicalTrials.gov Identifier | NCT01129141 |
| Purpose | This study will continue our efforts to develop tinnitus management protocols for Veterans. More specifically, this study will develop and evaluate an adaptation of Progressive Tinnitus Management (PTM) for use as a telehealth program for Veterans and military personnel who have experienced TBI. Adaptation of PTM as a home-based telehealth service has the potential of providing needed tinnitus services to Veterans with and without TBI for a relatively small cost and with minimal impact on individual VA hospitals. |
| Condition(s) | Tinnitus |
| Interventions | Procedure: Telehealth Tinnitus Intervention Procedure: Usual Care |
| Study type and design | Interventional; Allocation: Randomized Endpoint Classification: Efficacy Study Intervention Model: Parallel Assignment Masking: Double Open label Primary Purpose: Treatment |
| Official title | Telehealth Tinnitus Intervention for Patients With TBI |
| Arms | 1: Experimental - Telehealth Tinnitus Intervention (TTI) 2: Usual Care |
| Assigned Interventions | Procedure: Telehealth Tinnitus Intervention Telehealth Tinnitus Intervention (TTI) is a novel home-based telehealth program. TTI intervention involves a series of seven telephone appointments, conducted at approximately 1, 2, 3, 4, and 5 weeks, and 3 and 6 months after enrollment is finalized. Telephone counseling is provided by the Study Psychologist at weeks 1, 3, and 5, and by the Study Audiologist at weeks 2 and 4, and months 3 and 6. Procedure: Usual Care Usual Care/Wait List Control subjects will receive TTI after completing the 6-month questionnaires. Participants assigned to Usual Care will be instructed that they are allowed to receive any services for their tinnitus that are available to them, and that they will receive TTI following completion of the 3- and 6-month questionnaires. |
| Detailed Description | Traumatic brain injury (TBI) is strongly associated with tinnitus. Tinnitus management for Veterans and military members with TBI has become a critical concern. Our research has focused on developing effective, evidence-based methods of tinnitus management for Veterans. These efforts led to the development of Progressive Tinnitus |



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| | <p>Management (PTM). We are completing a pilot study to adapt PTM to meet the unique tinnitus management needs of Veterans and military members with TBI using a novel home-based telehealth program called Telehealth Tinnitus Intervention (TTI). Preliminary data analyses indicate that TTI is effective. The present study will modify the TTI program in accordance with pilot study findings and evaluate the modified TTI using a randomized clinical trial design.</p> <p>The 4-year study will be based at the VA National Center for Rehabilitative Auditory Research (NCRAR). TTI will be implemented and evaluated in a randomized clinical trial. Qualified candidates will be randomized to receive either immediate-TTI or usual care (wait-list control-WLC). All subjects will complete questionnaires at baseline and at 3, 6, 9, and 12 months post-baseline. The WLC group will receive TTI after completing the 6-month questionnaires. The primary outcome measure will be the Tinnitus Handicap Inventory (THI).</p> <p>TTI intervention involves a series of seven telephone appointments, conducted at approximately 1, 2, 3, 4, and 5 weeks, and 3 and 6 months after enrollment is finalized. Telephone counseling is provided by the Study Psychologist at weeks 1, 3, and 5, and by the Study Audiologist at weeks 2 and 4, and months 3 and 6.</p> <p>TTI has the potential of providing needed tinnitus services to Veterans and active military personnel across the country for a relatively small cost and with minimal impact on individual VA hospitals.</p> |
| Primary Outcomes | Tinnitus Handicap Inventory [Time Frame: Baseline, 3 months, 6 months, 9 months, 12 months] [Designated as safety issue: No] |
| Expected total Enrollment | 336 |
| Study Start | October 2010 |
| Expected study completion date | June 2014 |
| Expected primary completion date | June 2014 (Final data collection date for primary outcome measure) |
| Participants (age) | 18 Years and older |
| Gender | both |
| Accepts health volunteers | no |
| Eligibility Inclusion Criteria | <ol style="list-style-type: none"> 1. “clinically significant” tinnitus according to the initial score on the THS (minimum total score of 4 on section A; if score is 4-6, one item must be at least 3); 2. demonstrates understanding of the requirements of the study (based on adequate responses to the questions by the RC that assess capacity-to-consent); 3. has had a hearing test within the past 2 years (and was fitted with hearing aids if appropriate); and 4. motivated and capable of participating (including ability to communicate over the telephone in English). |



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| Exclusion Criteria | Callers who do not meet all of these criteria will be excluded from study participation. |
| Contact | Christine S Kaelin, MBA, (503) 220-8262 ext 57153; christine.kaelin@va.gov Emily Thielman, MS, (503) 220-8262 ext 51936; emily.thielman@va.gov |
| Locations | VA Medical Center, Portland, Oregon, United States, 97201 |
| Study chairs or principal investigators | James Henry, PhD, VA Medical Center, Portland |
| Responsible Party | Department of Veterans Affairs (Henry, James - Principal Investigator) |
| Study ID Numbers | C7452I |
| Last Updated | May 20, 2010 |
| Record first received | May 20, 2010 |
| ClinicalTrials.gov Identifier | NCT01129141 |
| Health Authority | United States: Federal Government |

Sub-chronic Neurostimulation Delivered in the Middle Ear for Tinnitus Suppression

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| Current status | not yet open for participant recruitment |
| Sponsors and collaborators | Shaare Zedek Medical Center |
| Information provided by | Shaare Zedek Medical Center |
| ClinicalTrials.gov Identifier | NCT01139554 |
| Purpose | <p>The objectives of this study are to evaluate the safety and efficacy of applying electrical stimulation on the Promontorium and the vicinity of the round window for the suppression of tinnitus in a sub-chronic stimulation regimen.</p> <p>In this study Electrical Promontory stimulation (EPS) will be applied using the NIMBUS multifunctional stimulator and it's monopolar 0.5mm electrodes which will be placed on the Promontorium and the anterior-inferior ridge of the round window niche.</p> |
| Condition(s) | Tinnitus |
| Intervention | Device: Nimbus Multifunctional Stimulator |
| Phase | 0 |
| Study type and design | <p>Interventional; Allocation: Non-Randomized Control: Uncontrolled Endpoint Classification: Safety/Efficacy Study Intervention Model: Single Group Assignment Masking: Open Label Primary Purpose: Treatment</p> |



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| Arms | Multifunctional Stimulator: Experimental |
| Assigned Interventions | Device: Nimbus Multifunctional Stimulator A Multifunctional Stimulator (Nimbus by Newmedic, Hemodia) for clinical use. The stimulator is also dedicated for Electrical Promontory Stimulation (EPS) |
| Primary Outcome Measures | Efficacy [Time Frame: 2 months] [Designated as safety issue: No] Study efficacy evaluations will be based on the analysis of pre and post procedure tinnitus severity characteristics (THI, MML, Pitch matching and VAS values). Safety [Time Frame: 2 months] [Designated as safety issue: Yes] Safety evaluations will be based on the observation for the reporting of any adverse events occurring during the study and up to the 30 days follow-up visit Occurrence of adverse events. |
| Expected total Enrollment | 20 |
| Study start | May 2010 |
| estimated study completion date | May 2011 |
| Estimated Primary Completion Date | May 2011 (Final data collection date for primary outcome measure) |
| Participants (age) | 18 Years to 60 Years |
| Gender | both |
| Accepts health volunteers | no |
| Inclusion Criteria | <ol style="list-style-type: none"> 1. Total score on the Handicap Inventory (THI) of at least 40. 2. Visual scale over 5. 3. Tinnitus origin is peripheral (related to long term noise exposure, or to a sudden exposure to a very loud noise etc.) 4. Tinnitus is on-going; present for more than 50% of the time over the past 6 months. 5. Unilateral tinnitus 6. Tinnitus prevalent at least 6 months. 7. Willingness to abstain from part taking in other, non-study procedures indicated to lessen tinnitus and/or its perception. 8. Willing and able to refrain from engaging in activities or work involving loud noise exposure. |
| Eligibility Exclusion Criteria | <ol style="list-style-type: none"> 1. Prior history of sudden hearing loss and/or fluctuating hearing levels. 2. Tinnitus prevalent more than 2 years. 3. History of frequent middle ear infections 4. Patient under immunosuppressant therapy 5. Auditory nerve damage. 6. Vestibular Schwannoma |



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| | <p>7. Cochlear implant.</p> <p>8. Pregnant or lactating.</p> <p>9. Developmental disability or cognitive impairment that would make it difficult for the subject to partake in the clinical study, including adequate comprehension of the informed consent form and ability to record the necessary measurements.</p> <p>10. Involvement in litigation and/or a worker's compensation claim and/or receiving disability benefits related to tinnitus and/or hearing loss.</p> <p>11. Not being physically or geographically capable of returning for scheduled follow-up visits.</p> <p>12. Any physical, psychological, or emotional disorder that would interfere with the planned surgical operations</p> <p>13. Mentally retarded, developmentally delayed or suffering from organic brain dysfunction.</p> |
| Contact | Ronen Perez, Dr., 972-2-6555360; perezro@inter.net.il Michael Vardi, 972-3-7684932 |
| Locations | Shaare Zedek Medical Center, Jerusalem, Israel |
| Responsible party | Shaare Zedek Medical Center, Jeruzalem (Dr. Ronen Perez) |
| Study ID Numbers | EST-01-IL |
| Last Updated | June 6, 2010 |
| Record first received | June 6, 2010 |
| ClinicalTrials.gov Identifier | NCT01139554 |
| Health Authority | Israel:Ethics Committee |

