"Tinnitus: A Treatable Disease"

This has been the motto of this year’s TRI meeting which was hosted in Valencia, Spain, by Professor José Miguel Láinez, chair of the neurological department of Valencia and one of the founders of the Tinnitus Research Initiative (TRI). The special atmosphere of this Mediterranean city with its combination of a long historic tradition and a futuristic physiognomy, represented a unique venue.

The dream-like futuristic architecture of Santiago Calatrava’s city of arts and science represented an inspiring environment for the opening talk “The Dream to Cure Tinnitus” by Dirk De Ridder who gave those words a manifold meaning. Martin Luther-King had a dream similar like Walt Disney and Alice in the Wonderland and what has been a dream once, has come true later. But it is not only that dreams may help to overcome obstacles, which seem to be insurmountable. It is also that many scientific breakthroughs have appeared in dreams. The discovery of the benzene ring by Kekulé is just one of many examples. Finally the dream-state itself is proof of principle that a tinnitus cure is achievable: The vast majority of tinnitus patients have no tinnitus, when they dream. Thus a better understanding of the dream state itself may provide a hint in the search for efficient targets to cure tinnitus.

continue next page
Following the motto, the program of this year’s meeting was clinically oriented, starting with a session in which the need for multidisciplinary work was stressed. Collaboration of Audiologists, Otolologists, Neurotologists, Neurologists, Neurosurgeons, Psychiatrists and Psychotherapists is required for efficient diagnostic and therapeutic management. Further plenary talks focused on psychotherapy and sound therapy. Important progress has been made in these “traditional” treatments and they can be extremely useful in some patients, we also have to acknowledge their limitations.

In order to overcome these limitations, a deeper understanding of the involved mechanisms is needed. Advances in animal research, electrophysiology and neuroimaging enable an increasingly deeper understanding of the neuronal mechanisms underlying tinnitus. Recent basic scientific research has demonstrated the complexity of dynamic changes of brain structure and function after hearing loss. Most important is the differentiation between changes related to hearing loss and those related to the phantom perception. As an example, cortical tonotopic map changes, which have been considered as correlates of tinnitus in the past may be more dynamic than expected and rather reflect complex adaptive processes. Other concepts like spike timing dependent plasticity are increasingly recognized as relevant for tinnitus and its treatment. Importantly the advances in the understanding of the neuronal mechanisms are translated into innovative treatment approaches. Examples are the development of new pharmacologic compounds targeting potassium channels or combined electrical and auditory stimulation for inducing therapeutic neuroplastic changes in the auditory system.

In addition to basic science other approaches may prove beneficial to overcome current limitations. Analogous to evolutionary concepts underlying adaptation to new challenges, variability may be such an approach. TRI wants to stay a platform for the developing and testing of new ideas, being well aware that the vast majority of them might fail. By keeping on trying and learning from failures, we will make progress, analogous to what evolution does in nature. As Thomas Kuhn stated in his seminal book “The Structure of Scientific Revolutions”, also in science the fittest idea, the fittest concept, the fittest treatment will survive. Progress is based on failure, if we draw the right conclusions. Both basic and clinically oriented research will benefit from variability and creativity. As an example, large scale analysis of drug-target and side effect databases enables the identification of neuronal targets involved in the development of tinnitus as a side effect of drug treatment. Inversing this approach may provide guidance for identification of potential targets for treatment.

As important as the creativity and the open-mindedness, is the application of proper methodology and research structure in order not to reject an efficient approach because of false negative results and not to follow the wrong path fooled by false positive results. The relevance of epidemiological studies has been made clear, identifying the need for activities to prevent tinnitus and hearing loss, but also to demonstrate how emotional factors and tinnitus interact. There is good evidence for example that depression is not only a potential consequence of tinnitus, but also represents a risk factor for its development.

Various research sessions discussed progress in animal research, the interaction between the auditory system and the non-auditory system in tinnitus. In addition to changes in neuronal activity, synchronicity and connectivity, alterations in neuronal variability may be relevant under pathologial conditions. Neuroimaging becomes more and more successful in order to disentangle neuronal effects related to the various aspects and comorbidities of tinnitus. This knowledge can be directly implemented in brain stimulation approaches for modulating tinnitus-related brain activity. Similarly, advances in animal models offer increasing possibilities to develop and test new treatment approaches, being these pharmacological or specific stimulation approaches.
Let’s use the momentum built up in Valencia to foster our inspiration and motivation and to drive our efforts. These efforts will decide, whether the meeting was a success, and whether the dream of a cure for tinnitus will come true. We hope for new data, new ideas, new information and new treatment proposals till next year’s meeting, which will be held in Auckland, New Zealand, from March 10-13, 2014 under the motto “Beyond the Horizon”.

Ana Belén Elgoyhen    Dirk De Ridder    Berthold Langguth    Sylvia Domer-Mitschke
RESEARCH HIGHLIGHTS


Hearing aids with frequency transposition enable to bypass damaged hair cells in the cochlea and to transmit a large frequency spectrum of sounds to the brain. From a theoretical perspective this technology is promising for renormalizing tinnitus related neuroplastic changes in the auditory pathways. This pilot study demonstrates a convincing clinical tinnitus suppression with linear octave frequency transposition hearing aids and suggest the potential of this technology for tinnitus treatment.


Theoretical models of tinnitus generation suggest the involvement of increased central gain in the pathophysiology of tinnitus. The finding of increased auditory sensitivity in tinnitus subjects confirms the hypothesis of increased central gain.


By quantifying tinnitus related costs, this study demonstrates the high socioeconomic impact of tinnitus.


In this manuscript findings from several animal experimentns are reported which demonstrate a critical role of the cerebellum in tinnitus generation. These findings could be interpreted in the sense that tinnitus results from a prediction error in subjects with hearing loss (the cerebellum detects the mismatch between predicted auditory information and the incoming auditory signal).


By demonstrating the relevance of specific potassium channels in the dorsal cochlear nucleus for tinnitus generation, this study identifies a potential target for pharmacological treatment of tinnitus.


This study investigated the relationship between depressive symptoms and the course of disease after sudden sensorineural hearing loss and thus sheds light on the relevance of affective symptoms in the chronification of hearing loss and tinnitus.


This study demonstrates (1) that the tonotopic organisation of the auditory cortex can be investigated with fMRI and (2) confirms earlier data that tinnitus does not necessarily requires large scale tonotopic reorganisation.

This study systematically explores the hypothesis that changes in auditory evoked magnetic fields in tinnitus patients are frequency-specific. The authors found amplitude reductions in tinnitus patients in the region of hearing loss and conclude that these alterations reflect rather hearing loss than tinnitus.


This study highlights the potential and the limitation of structural MRI for the assessment of tonotopically organised subdivisions of the auditory cortex.


Based on EEG data from a large sample of tinnitus patients and controls individual components of brain activity were identified which reflect tinnitus distress and tinnitus loudness respectively. The connection between these networks was related to the perceived tinnitus distress any may thus represent a potential target for treatment.
**NEWS**

**Funding Opportunities**

The French Tinnitus-Patients-Organization, *France Acouphènes*, is willing to fund innovative research projects on Tinnitus and/or Hyperacusis. TRI will assist in the selection process and provide scientific advice for the funding decision.

The proposed research proposal should have a clinical focus and direct therapeutic implications. Proposals from French researchers and/or clinicians or in which French researchers and/or clinicians are co-investigators will be preferred.

The provided budget is 28.000,00 EUR and co-financing by other funders are eligible.

The Deadline for submissions is 15.11.2013

Application forms can be downloaded at [www.tinnitusresearch.org](http://www.tinnitusresearch.org)

**We’re looking forward to receiving your proposals on**

[exploratorygrants@tinnitusresearch.org](mailto:exploratorygrants@tinnitusresearch.org)
Upcoming Meetings

Meetings exclusively dedicated to Tinnitus are marked red

September 2013

117th American Academy of Otolaryngology, Head and Neck Surgery Annual Meeting & OTO EXPO
When: September 29 – October 02, 2013
Where: Vancouver, BC, CA
Detailed Information: http://www.entnet.org/

October 2013

Leicester Balance Course 2013
When: October 08 – 10, 2013
Where: Leicester Royal Infirmary, UK

9th Meeting of the British Society of Neuro-Otology
When: October 11, 2013
Where: National Hospital for Neurology and Neurosurgery, London, UK
Detailed Information: http://www.bsno.org.uk/9thMeeting.html

58th International Congress of Hearing Aid Acousticians EUHA
When: October 16 – 18, 2013
Where: Convention Center Nürnberg, Germany
Detailed Information: http://www.euha.org

CI 2013 Symposium - Emerging Issues in Cochlear Implantation
When: October 24 – 26, 2013
Where: Washington, DC, USA
Detailed Information: http://www.ci2013dc.com/

November 2013

The Ear Foundation - Implantable Devices 2013: The State of the Art
When: November 07, 2013
Where: National College for School Leadership, Nottingham UK
Detailed Information: http://www.earfoundation.org.uk/education/articles/709

28. Politzer Society Meeting
When: November 14 – 17, 2013
Where: Susesi Resort, Antalya, Turkey
Detailed Information: http://www.politzer2013.org
ASHA 2013 Annual Convention
When: November 14 – 16, 2013
Where: McCormick Place, Chicago, IL, USA
Detailed Information: http://www.asha.org/events/convention/

9th Asia Pacific Symposium on Cochlear Implant and Related Sciences (APSCI 2013)
When: November 26 – 29, 2013
Where: Hyderabad International Convention Centre, Hyderabad, India
Detailed Information: http://www.apsci2013.in/

166th Meeting of the Acoustical Society of America
When: December 02 – 06, 2013
Where: San Francisco, CA, USA
Detailed Information: http://acousticalsociety.org/meetings/san_francisco

ARO (The Association for Research in Otolaryngology) 37th MidWinter Meeting
When: February 22 – 26, 2014
Where: San Diego, CA, USA
Detailed Information: http://www.aro.org/mwm/mwm.html

Tinnitus & Hyperacusis Therapy Masterclass
When: March 03 – 07, 2014
Where: Birkbeck College, University of London, London, UK
Detailed Information: http://tinnitustherapy.org.uk/

41st Annual AAS Scientific and Technology Conference of the American Auditory Society
When: March 06 – 08, 2014
Where: Scottsdale, AZ, USA
Detailed Information: http://www.amauditorysoc.org/dates-and-location

TRI2014 – 8th International TRI Conference on Tinnitus 2014
Over the Horizon
When: March 10 – 13, 2014
Where: Auckland, New Zealand
ICA 2014 - XXXII International Congress of Audiology
When: March 23 – 27, 2014
Where: Sydney, Australia
Detailed Information: http://www.isa-audiology.org/

AudiologyNOW! 2014
When: March 26 – 29, 2014
Where: Orlando, FL, USA

XXXII World Congress of Audiology
When: May 03 – 07, 2014
Where: Brisbane Convention and Exhibition Center, Brisbane, Australia
Detailed Information: http://www.wca2014.com/

167th Meeting of the Acoustical Society of America (ASA)
When: May 05 – 09, 2014
Where: Providence, RI, USA
Detailed Information: http://acousticalsociety.org/meetings

ITS’14 – XI. International Tinnitus Seminar
When: May 21 – 24, 2014
Where: Langenbeck Virchow Haus, Berlin, Germany
Detailed Information: http://www.international-tinnitus-seminar-2014.com

HEAL 2014: Hearing Across the Lifespan
NHS and AHS Conferences in one single event
When: June 05 – 07, 2014
Where: Cernobbio (Lake Como), Italy
Detailed Information: http://www.heal2014.org
Twitter: @HEAL2014

OHBM 2014: 20th Annual Meeting of the Organization for Human Brain Mapping
When: June 08 – 14, 2014
Where: Hamburg, Germany
Detailed Information: http://www.humanbrainmapping.org
13\textsuperscript{th} International Conference on Cochlear Implants and Other Implantable Auditory Technologies

When:       June 18 – 21, 2014  
Where:      Gasteig Munchen GmbH, Germany  
Detailed Information:  http://www.ci2014muc.com

5\textsuperscript{th} International Conference on Auditory Cortex

When:       September 13 – 17, 2014  
Where:      Herrenkrug Parkhotel Magdeburg, Germany  
Detailed Information:  http://www.auditory-cortex.de/

59. Internationaler Hörgeräteakustiker-Kongress EUHA

When:       October 15 – 17, 2014  
Where:      Hannover, Germany  
Detailed Information:  http://www.euha.org/veranstaltungen/
Book Review

No review this time

Recently published literature (articles of authors who are collaborating with TRI are marked in blue)

0 Special Topic

No publications this time.

I Epidemiology

Sports officials’ hearing status: whistle use as a factor contributing to hearing trouble.

Flamme GA, Williams N.
Department of Speech Pathology & Audiology, Western Michigan University, Kalamazoo, Michigan, USA, greg.flamme@wmich.edu.

The objectives of this study were to examine the prevalence of hearing loss in a sample of sports officials and estimate the duration of whistle use required to reach a permissible 8-hr 100% noise dose. We conducted an online survey of 321 sports officials regarding their exposure to whistle noise and symptoms of hearing loss and tinnitus, and we assessed the acoustic characteristics of commercially available whistles. Male sports officials registered in Michigan had a greater prevalence of self-reported hearing trouble and tinnitus than observed in the general population of the midwestern United States. Sound levels produced by whistles range between 104 and 116 dBA, which corresponds to maximum unprotected exposure times of 90 to 5 sec, respectively. These findings suggest that whistle use may contribute to hearing loss among sports officials. Free full Text.


Macgregor AJ, Dougherty AL, Tang JJ, Galarneau MR.
Department of Medical Modeling, Simulation and Mission Support, Naval Health Research Center, San Diego, California.

OBJECTIVE: To examine the association between postconcussive symptoms and mild traumatic brain injury (MTBI) among combat veterans while adjusting for posttraumatic stress disorder (PTSD) and depression. PATIENTS: Military personnel with provider-diagnosed MTBI (n = 334) or nonhead injury (n = 658) were identified from the Expeditionary Medical Encounter Database. MAIN OUTCOME MEASURES: Post-Deployment Health Assessments and Re-Assessments were used to examine postconcussive symptoms and self-rated health. RESULTS: Personnel with MTBI were more likely to report headache (odds ratio [OR] = 3.37; 95% confidence interval [CI] = 2.19-5.17), back pain (OR = 1.79; 95% CI = 1.23-2.60), memory problems (OR = 1.86; 95% CI = 1.20-2.88), tinnitus (OR = 1.63; 95% CI = 1.10-2.41), and dizziness (OR = 2.13; 95% CI = 1.06-4.29) compared with those with non-head injuries. Among those with MTBI, self-reported decline in health was associated with memory problems (OR = 5.07; 95% CI = 2.56-10.02) and dizziness (OR = 10.60; 95% CI = 3.48-32.27). CONCLUSIONS: Mild traumatic brain injury is associated with reports of negative health consequences among combat veterans even when accounting for co-occurring psychological morbidity. The identification of postconcussive symptoms related to declines in a service member's self-rated health may be important in targeting and prioritizing clinical interventions.
Introduction: Hearing impairment is one of the most frequent chronic health issues. The incidence of hearing impairment and tinnitus increases with age. Aim: The aim of the authors was to determine the prevalence of hearing impairment and tinnitus in type 2 diabetic patients and to examine the possible associations between hearing impairment and/or tinnitus and increased HbA1c levels. Methods: 103 patients with type 2 diabetes (47 men, 56 women; age, 61.6±10.3 years, mean±SD; range, 33-88 years) evaluated at the 2nd Department of Medicine, Semmelweis University were enrolled in this study and the results were compared to those obtained from 589 type 2 diabetic (253 men, 336 women; age, 55.4±11.0 years, mean±SD; range, 26-97 years) and 15 622 non-diabetic patients (7002 men, 8620 women; age, 55.1±11.1 years, mean±SD; range, 26-98 years) who participated in a comprehensive health screening programme in Hungary. Hearing impairment was determined using the Interacoustics model AS608 screening audiometer in all patient groups. Tinnitus was evaluated with questionnaire. Results: It was found that hearing impairment and/or tinnitus occurred in a very high proportion of type 2 diabetic patients evaluated at the 2nd Department of Medicine, Semmelweis University (80% of cases) as compared to type 2 diabetic (34% of cases) and non-diabetic patients (14% of cases) enrolled in the national health screening programme. There was no significant correlation between increased HbA1c levels and hearing impairment or tinnitus in type 2 diabetic patients. Conclusion: These results suggest that the prevalence of hearing impairment and tinnitus is higher and develop at an earlier age in patients with type 2 diabetes. The results indicate a high prevalence of hearing impairment and tinnitus in type 2 diabetic patients. Orv. Hetil., 2013, 154, 363-368.

Ocena częsteości występowania szumów usznych u dzieci w Polsce
[The prevalence of tinnitus in children in Poland]
[Article in Polish]
Otolaryngologia Polska 2013. Article in press.

Raj-Koziak, D., Skarżyński, H., Kochanek, K., Fabijańska, A.

Aim: The objective of this study was to estimate the prevalence of the tinnitus in 7- and 12-year-old children in Poland. Material and methods: In this study 118,005, 7-year-old children and 23,339, 12-year-old children and their parents were asked about the presence of tinnitus by answering a questionnaire. 7-year-old children were asked by tester if they can hear noise in their ears or head. Results: The results showed that according to parents questionnaire answers tinnitus was present in group of 15,244 (12.9%) 7-year-old children and in group of 3886 (16.6%) 12-year-old children. Between 7-year-old children directly asked for tinnitus 29.3% (34,517) mentioned of having it. Group of 8060 (34.5%) 12-year-old children confirmed in questionnaire hearing tinnitus. Differences in the presence of tinnitus between 7- and 12-year-old children have proven to be statistically significant. Conclusions: Tinnitus is frequent complain among 7- and 12-year-old children. It is recommended to include to a questionnaire an inquiry about the presence of tinnitus during hearing screening tests performed recently more frequently at primary schools for early detection a diagnosis of tinnitus. © 2013.


Eskridge SL, Macera CA, Galarneau MR, Holbrook TL, Woodruff SI, Macgregor AJ, Morton DJ, Shaffer RA.

Naval Health Research Center, Department of Medical Modeling, Simulation, & Mission Support, 140 Sylvester Rd., San Diego, California, United States, 92106, 619-533-8427, 619-553-8551; susan.eskridge@med.navy.mil.

Assessment of acute mild traumatic brain injury (mTBI) symptoms after a combat blast could aid diagnosis and guide follow-up care. Our objective was to document acute mTBI symptoms following a combat blast and to examine associations between acute symptoms and mental health and service discharge outcomes. A retrospective cohort study was conducted with 1656 service personnel who experienced a combat blast-related mTBI in Iraq. Acute mTBI symptoms were ascertained from point-of-injury medical records. The associations between acute symptoms and posttraumatic stress disorder (PTSD), postconcussion syndrome (PCS), and type of service discharge were examined. Disability discharge occurred in 11%, while 36% had a non-disability discharge and 52% had no recorded discharge. A PTSD and PCS diagnosis was made in 19% and 15% of the sample, respectively. The most common acute mTBI symptoms were headache (62.8%), loss of consciousness (LOC) (34.5%), and tinnitus (33.2%). LOC was predictive of PTSD (odds ratio [OR] 1.54; 95% confidence interval [CI] 1.18, 2.00) and PCS (OR 2.08; 95% CI 1.56, 2.77), while altered mental status (OR 1.53; 95% CI 1.07, 2.17) and previous blast history (OR 1.83; 95% CI 1.15, 2.90) were also predictive of PCS. While no acute mTBI symptoms were associated with discharge outcomes, injury severity was associated with disability discharge. LOC after blast-related mTBI was associated with PTSD and PCS, and injury severity was predictive of disability discharge. The assessment of cognitive status immediately after a blast could assist in diagnosing mTBI and indicate a need for follow-up care.

Otologic manifestations from blast injuries among military personnel in Thailand.


Klamkam P, Jaruchinda P, Nivatwongs S, Muninnobpamasa T, Harnchumpol P, Nirattisai S, Mounthong G.

Department of Otolaryngology, Phramongkutklao Hospital, Bangkok, Thailand.

BACKGROUND: From November 2008 to October 2010, 565 military personnel sustained blast injury in Southernmost Thailand and 99 personnel, affected by multiple injuries, were transferred to Phramongkutklao Hospital. No data on the effect of blast injury to the ears among Thai military personnel have been reported. This study aims 1) to determine the prevalence of Sensorineural Hearing Loss (SNHL) and otologic manifestations from primary blast injury among military personnel, in Pattani, Yala and Narathiwat Provinces, and 2) to evaluate the impact of explosive devices and distance from explosion on SNHL under various conditions. MATERIALS AND METHODS: A cross-sectional study was conducted among 76 military personnel injured from blast injury in Southernmost Thailand. They were divided into three groups representing the bomb blast settings; open-space referred to an area without barrier, semi-open space referred to a room open on at least one side and closed space referred to a room enclosed with four walls and ceiling. RESULTS: The otologic manifestations from 76 patients were tinnitus, tympanic membrane perforation, bleeding and open wound. The prevalence of SNHL among patients in the open-, semi-open and closed space groups was 62.77%, 67.86% and 73.33%, respectively. The most common type of explosive was Improvised Explosive Devices (IEDs) 72 (94.74%). The average IED weighed 11.42kg and mean distance from explosion was 5.66m. CONCLUSION: Correlation among all three incident areas and two factors: impact of explosive devices and distance from explosion are risk factors of SNHL without significance. Copyright © 2013 Elsevier Inc. All rights reserved.
Information on prevalence and risk factors associated with self-reported hearing health among mass transit riders is extremely limited, even though evidence suggests mass transit may be a source of excessive exposure to noise. Data on mass transit ridership were collected from 756 study participants using a self-administered questionnaire. Hearing health was measured using two symptom items (tinnitus and temporary audiometric threshold shift), two subjective measures (self-rated hearing and hearing ability), and two medical-related questions (hearing testing and physician-diagnosed hearing loss). In logistic regression analyses that controlled for possible confounders, including demographic variables, occupational noise exposure, nonoccupational noise exposure (including MP3 player use) and use of hearing protection, frequent and lengthy mass transit (all forms) ridership (1,100 min or more per week vs. 350 min or less per week) was the strongest predictor of temporary threshold shift symptoms. Noise abatement strategies, such as engineering controls, and the promotion of hearing protection use should be encouraged to reduce the risk of adverse impacts on the hearing health of mass transit users.

Otologic assessment of blast and nonblast injury in returning middle east-deployed service members.

Shah A, Ayala M, Capra G, Fox D, Hoffer M.
Department of Otolaryngology, Naval Medical Center San Diego, San Diego, California.

OBJECTIVES/HYPOTHESIS: To determine if tympanic membrane perforation offers any protection from inner ear damage and determine the incidence and pattern of otologic blast injury in military personnel returning from deployment. STUDY DESIGN: Retrospective analysis of US service members injured in Operation Iraqi Freedom and Operation Enduring Freedom from October 2006 to October 2007. METHODS: One-hundred ten blast-injured patients were compared to 54 nonblast-injured patients returning from deployment. Data captured included audiogram results, presence of tympanic membrane perforation, demographic data, location and nature of injury, loss of consciousness, sleep disturbance, confusion, and symptoms of headache, dizziness, memory loss, and tinnitus. RESULTS: Of 110 blast-injured patients, 18 patients suffered tympanic membrane perforation (16%), of which nine patients suffered bilateral tympanic membrane perforation (8%). Blast patients suffered more hearing loss than controls as measured by pure-tone averages of varying speech reception frequencies and at 6,000 Hz. Of the blast patients who recorded an audiogram, nearly 24% suffered moderate to profound hearing loss. There was no statistically significant difference in hearing outcomes between blast-injured patients with tympanic membrane perforations and those without; however, when comparing patients with unilateral perforations with their contralateral ear, there was a difference in hearing thresholds at 6,000 Hz. There was a significantly increased risk of tinnitus, memory loss, headache, and dizziness between blast-injured patients compared to controls. CONCLUSIONS: Due to its violent nature, blast exposure causes greater neuro-otological manifestations and deserves prompt otologic evaluation. LEVEL OF EVIDENCE: 3b. Laryngoscope, 2013. Copyright © 2013 The American Laryngological, Rhinological and Otological Society, Inc.
The prevalence and characteristics of tinnitus in the youth population of the United States.

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Division of Neurotology and Skull Base Surgery, Department of Otolaryngology-Head and Neck Surgery, Department of Biomedical Engineering, University of California-Irvine, California, U.S.A.

OBJECTIVES/HYPOTHESIS: To evaluate the prevalence, characteristics, and associated risk factors of tinnitus in U.S. adolescents. STUDY DESIGN: Cross-sectional analyses of U.S. representative demographic and audiometric data, the National Health and Nutrition Examination Survey (NHANES) 2005 to 2008. METHODS: The study population consisted of 3,520 individuals aged 12 to 19 years with complete tinnitus-related data. Tinnitus was defined as the presence of ringing or buzzing in the ears lasting for at least 5 minutes during the preceding 12 months. In addition, we defined a chronic tinnitus subgroup as being bothered by tinnitus for more than 3 months. Demographic and other data regarding tinnitus, smoking, body mass index (BMI), anemia, hypertension, history of ear infections, tympanostomy tube placement, otoscopy, tympanometry and hearing thresholds, history of firearm use, and recreational and occupational exposure to noise were extracted and analyzed. RESULTS: Overall, tinnitus lasting 5 minutes or more in the preceding 12 months was reported by 7.5% of the 12- to 19-year-old population. This represents about 2.5 million adolescents in the United States. The prevalence of chronic tinnitus was 4.7%, corresponding to about 1.6 million adolescents in the United States. Multivariable-adjusted analysis revealed that both overall and chronic tinnitus were associated with female gender, low income, exposure to passive smoking, type A tympanogram, and occupational and recreational noise exposure. History of ≥3 ear infections and history of tympanostomy tube placement were associated only with overall tinnitus. CONCLUSIONS: Tinnitus afflicts a substantial portion of the youth population. Further investigation of the association between tinnitus and the identified risk factors is warranted. LEVEL OF EVIDENCE: N/A. Laryngoscope, 2013. Copyright © 2013 The American Laryngological, Rhinological and Otological Society, Inc.
Endogenous dynorphins, glutamate and N-Methyl-D-Aspartate (NMDA) receptors may participate in a stress-mediated type-I auditory neural exacerbation of tinnitus.


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Tinnitus is the phantom perception of sounds occurring in the absence of an external auditory stimulus. Tinnitus: 1] effects 50 million individuals, 2] often results from acoustic trauma and, 3] is very often exacerbated under stressful conditions. Tinnitus may result from lesions occurring at any location in the auditory system, but its mechanisms are poorly understood. Evidence is provided supporting an endogenous dynorphin-mediated potentiation of glutamate excitotoxicity at cochlear Type-I auditory dendrites that may well exacerbate chronic subjective neural-generated tinnitus during periods of heightened stress. The proposed mechanism is based on the following: 1] lateral efferent olivocochlear (LEOC) axon terminals contain endogenous dynorphin neuromodulators and are presynaptic to cochlear Type-I auditory dendrites that bear both κ-opioid and N-Methyl-D-aspartate (NMDA) receptors/binding sites; 2] the release of presynaptic LEOC dynorphins is likely to be triggered by sympathetic stress via the locus coeruleus; 3] sodium salicylate induces an acute excitotoxicity by potentiating glutamate neurotransmitter effects at cochlear NMDA receptors, resulting in a Type-I auditory neural-generated tinnitus; 4] dynorphins participate in central NMDA-receptor-mediated excitotoxic inflammation; and 5] κ-opioid receptor ligands also modulate Type-I auditory neural activity by potentiating glutamate at cochlear NMDA receptors. A stress-activated release of dynorphins into the cochlea could potentiate the already excitotoxic effects of glutamate, producing: 1] hyperacusis, together with an acute exacerbation of 2] chronic aberrant Type-I neural activity and 3] a worsening of the activity-dependent central auditory neural plasticity changes that must certainly generate the perception of tinnitus. Treatment options are discussed. Copyright © 2013. Published by Elsevier B.V.

The role of catastrophizing in recent onset tinnitus: Its nature and association with tinnitus distress and medical utilization.


* Department of Psychology, Division of Clinical Psychology and Psychotherapy, Philipps-University of Marburg, Marburg, Germany.

Objective: Persistent tinnitus affects 10 to 15% of adults. Little is understood about why only a small percentage of patients become severely affected. Catastrophic thinking has been suggested as one potentially relevant factor that might influence a patient's coping behavior, and thus tinnitus habituation. The current study investigates the concept of tinnitus catastrophizing and its relation with distress and medical utilization in recent onset tinnitus. Design: Participants were administered a survey assessing catastrophizing, tinnitus distress, medical utilization, coping, and mood disturbance. Regression analyses investigated the nature of tinnitus catastrophizing and its contributions to distress and health care utilization. Study sample: 278 subjects with tinnitus for less than six months were recruited from Ear-Nose-Throat units, through the internet, and newspaper articles. Results: Controlling for background variables, high subjective tinnitus loudness, low behavioral coping, and depressive symptoms were significantly associated with tinnitus catastrophizing. Furthermore, greater tinnitus catastrophizing was related to higher distress and more frequent medical visits. Conclusions: Tinnitus catastrophizing appears to be pivotal already at an early stage of tinnitus experience. Addressing catastrophizing by specific prevention and intervention
programs might reduce the development of distress and medical utilization in the long term. Longitudinal studies are required to clarify cause-effect relations.

**Tinnitus and Patterns of Hearing Loss.**
J Assoc Res Otolaryngol. 2013 Jan 18. [Epub ahead of print]

**Tan CM, Lecluyse W, McFerran D, Meddis R.**
Department of Psychology, University of Essex, Colchester, CO4 3SQ, UK.

Tinnitus is strongly linked with the presence of damaged hearing. However, it is not known why tinnitus afflicts only some, and not all, hearing-impaired listeners. One possibility is that tinnitus patients have specific inner ear damage that triggers tinnitus. In this study, differences in cochlear function inferred from psychophysical measures were measured between hearing-impaired listeners with tinnitus and hearing-impaired listeners without tinnitus. Despite having similar average hearing loss, tinnitus patients were observed to have better frequency selectivity and compression than those without tinnitus. The results suggest that the presence of subjective tinnitus may not be strongly associated to outer hair cell impairment, at least where hearing impairment is evident. The results also show a different average pattern of hearing impairment amongst the tinnitus patients, consistent with the suggestion that inner hair cell dysfunction with subsequent reduced auditory innervation is a possible trigger of tinnitus.

**Novel COCH mutation in a family with autosomal dominant late onset sensorineural hearing impairment and tinnitus.**

**Gallant E, Francey L, Fetting H, Kaur M, Hakonarson H, Clark D, Devoto M, Krantz ID.**
Division of Human Genetics, The Children's Hospital of Philadelphia, Philadelphia, PA, USA.

This report describes a three generation family with late onset bilateral sensorineural hearing impairment (BLSNHI) and tinnitus in which a novel mutation in the COCH gene was identified after a genome-wide linkage approach. The COCH gene is one of the few genes clinically examined when investigating the etiology of autosomal dominant late onset hearing impairment. Initially mutations in the COCH gene were only reported in exons 4 and 5, coding for the LCCL protein domain. More recently, additional mutations have been identified in exon 12, the only mutations identified outside of the LCCL domain. Currently clinical genetic testing for the COCH gene primarily focuses on identifying mutations in these three exons. In this study, we identify a novel mutation in the COCH gene in exon 11, which, like the exon 12 mutations, falls within the vWFA2 protein domain. This finding reinforces the need for clinical genetic screening of the COCH gene to be expanded beyond the current limited exon screening, as there is now more evidence to support that mutations in other areas of this gene are also causative of a similar form of late onset BLSNHI. Copyright © 2012 Elsevier Inc. All rights reserved.
The Auditory Sensitivity is Increased in Tinnitus Ears.
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Increased auditory sensitivity, also called hyperacusis, is a pervasive complaint of people with tinnitus. The high prevalence of hyperacusis in tinnitus subjects suggests that both symptoms have a common origin. It has been suggested that they may result from a maladjusted increase of central gain attributable to sensory deafferentation. More specifically, tinnitus and hyperacusis could result from an increase of spontaneous and stimulus-induced activity, respectively. One prediction of this hypothesis is that auditory sensitivity should be increased in tinnitus compared with non-tinnitus subjects. The purpose of this study was to test this prediction by examining the loudness functions in tinnitus ears (n = 124) compared with non-tinnitus human ears (n = 106). Because tinnitus is often accompanied by hearing loss and that hearing loss makes it difficult to disentangle hypersensitivity (hyperacusis) to loudness recruitment, tinnitus and non-tinnitus ears were carefully matched for hearing loss. Our results show that auditory sensitivity is enhanced in tinnitus subjects compared with non-tinnitus subjects, including subjects with normal audiograms. We interpreted these findings as compatible with a maladaptive central gain in tinnitus. Free full text.

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OBJECTIVE: Most studies of the association between tinnitus and depression have been cross-sectional, making it difficult to draw any conclusions about the directionality of the association. This study aimed to clarify whether tinnitus precedes the development of depressive symptoms in a general older population. METHODS: Residents of Kurabuchi Town, Gunma Prefecture, Japan (239 men, 296 women: ≥65years) without depressive symptoms were given health examinations in 2005-2006. Information on tinnitus was obtained via a questionnaire. Depressive symptoms were then assessed in a face-to-face home visit interviews carried out once in 2007 and once in 2008 according to the Geriatric Depression Scale 15-item version (GDS15). RESULTS: Among the men, the 2.5-year incidence of depressive symptoms (GDS15≥6) was higher in those with tinnitus than in those without (20.5% vs. 9.5%). In the multi-adjusted model, tinnitus was significantly associated with an increased risk of depressive symptoms (relative risk=2.07; 95% confidence interval=1.01-4.25). Among the women, no associations were found. CONCLUSION: In the present study, tinnitus was independently associated with the risk of depressive symptoms developing in men, but not in women. We believe primary care providers and public health staff should recognize tinnitus as a risk factor for depressive symptoms. Copyright © 2013. Published by Elsevier Inc.
The relationship between tinnitus pitch and hearing sensitivity.
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Tinnitus is the phantom perception of sounds. No single theory explaining the cause of tinnitus enjoys universal acceptance, however, it is usually associated with hearing loss. The aim of this study was to investigate the relationship between tinnitus pitch and audiometry, minimum masking levels (MML), tinnitus loudness, and distortion product otoacoustic emissions (DPOAE). This was a retrospective analysis of participant's records from the University of Auckland Hearing and Tinnitus Clinic database. The sample consisted of 192 participants with chronic tinnitus (more than 18 months) who had comprehensive tinnitus assessment from March 2008 to January 2011. There were 116 males (mean = 56.5 years, SD = 12.96) and 76 females (mean = 58.7 years, SD = 13.88). Seventy-six percent of participants had a tinnitus pitch $\geq$8 kHz. Tinnitus pitch was most often matched to frequencies at which hearing threshold was 40-60 (T50) dBHL. There was a weak but statistically significant positive correlation between tinnitus pitch and T50 ($r = 0.15$ at $p < 0.05$). No correlation was found between tinnitus pitch and DPOAEs, MML, audiometric edge and worst threshold. The strongest audiometric predictor for tinnitus pitch was the frequency at which threshold was approximately 50 dBHL. We postulate that this may be due to a change from primarily outer hair cell damage to lesions including inner hair cells at these levels of hearing loss.

The cerebellum as a novel tinnitus generator.

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The role of the cerebellum in auditory processing is largely unknown. Recently it was shown that rats with psychophysical evidence of tinnitus had significantly elevated neural activity in the paraflocculus of the cerebellum (PFL), as indicated by functional imaging. It was further shown that PFL activity was not elevated in normal rats listening to a tinnitus-like sound. This suggests that plastic changes in the PFL may underpin chronic tinnitus, i.e., it may serve as a tinnitus generator. Using a rat model of acoustic trauma-induced tinnitus, the role of the cerebellum was further examined in a series of experiments: The PFL was surgically ablated in animals with established tinnitus; the PFL was surgically ablated in animals before induction of tinnitus; the PFL was reversibly inactivated by chronic lidocaine infusion into the subarcuate fossa of animals with established tinnitus. It was found that PFL ablation eliminated established tinnitus without altering auditory discrimination. Similar to the ablation results, PFL inactivation with lidocaine reversibly eliminated existing tinnitus. In contrast however, PFL ablation before tinnitus induction attenuated, but did not completely eliminate, tinnitus. In a rat model of noise-induced chronic tinnitus, the cerebellar PFL may serve as a sufficient but non-obligatory generator of tinnitus.
Autoimmune sensorineural hearing loss: the otology-rheumatology interface.

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Autoimmune sensorineural hearing loss (SNHL) is a rare clinical entity characterized by a progressive fluctuating bilateral asymmetric SNHL that develops over several weeks to months. Vestibular symptoms, tinnitus and aural fullness are present in up to 50% of patients. Due to the lack of specific diagnostic tests, both clinical suspicion and responsiveness to corticosteroids are the pillars for the diagnosis of autoimmune SNHL. The evaluation of patients in whom this condition is suspected should include a detailed history and physical examination, an audiogram, an MRI and a limited laboratory workup to exclude secondary causes of hearing loss. The low frequency of this condition, the heterogeneity in the designs of the available studies and the absence of randomized trials comparing treatment responses and assessing long-term outcomes are some of the factors accounting for the limited evidence to guide the clinician in the approach to the diagnosis and treatment of autoimmune SNHL.

Anatomical anomalies of the vertebral and carotid arteries in patients with vertigo and hearing disorders.

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INTRODUCTION: The aim of this work was the analysis of the frequency and type of anatomical anomalies of the arteries to the cranium such as vertebral arteries and carotid arteries in patients with vertigo and hearing disorders. MATERIAL AND METHODS: Between 2007 and 2011, in the Department of Otolaryngology and Laryngological Oncology, the number of the patients diagnosed due to vertigo and hearing disorders amounted to 2,167. In CT-angiogram anatomical anomalies were confirmed in 29 of these patients. The studied group included 22 women aged 22-68 and 7 men aged 21-53. Each patient underwent a subjective and objective structured laryngological interview, audiological and otoneurological examinations, laboratory tests, USG and angio-CT of the arteries to the cranium. RESULTS: The most common anatomical anomaly of the arteries to the cranium was hypoplasia of the right vertebral artery in 58.7% of the cases, out of which 51.7% in women and 6.9% in men. Hypoplasia of the left vertebral artery was diagnosed in 24.7% of the studied group, 13.8% of women and 10.3% of men. Hypoplasia of the right internal carotid artery was found in 3.4% of the female patients while hypoplasia of the left internal carotid artery was identified in 6.8% of the studied cases, 3.4% of women and 3.4% of men. Hypoplasia of the right common carotid artery was confirmed in 3.4% of the male patients whereas critical stenosis of the left subclavian artery with the subclavian steal syndrome was found in 3.4% of the studied female patients. Tinnitus was reported in 88.2% of the patients with diagnosed right vertebral artery hypoplasia, and in 58.8% vertigo and in 52.9% hearing disorders were confirmed. Tinnitus was the most common complaint in the studied group, both in men and women. Less frequent complaints referred to vertigo (65.5% altogether) and hearing impairment (55.2% altogether). CONCLUSIONS: In the analyzed group, diagnosed anatomical anomalies were not indications for vascular surgery nor neurosurgery, therefore, the applied treatment was strictly conservative. Copyright © 2013 Polish Otorhinolaryngology - Head and Neck Surgery Society. Published by Elsevier Urban & Partner Sp. z o.o. All rights reserved.
Behavioral Evidence for Possible Simultaneous Induction of Hyperacusis and Tinnitus Following Intense Sound Exposure.
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Many human subjects suffering from chronic tinnitus also suffer from hyperacusis, a heightened perception of loudness at moderate to intense sound levels. While numerous studies suggest that animals develop chronic tinnitus following intense noise exposure, it is not yet clear whether sound exposure also induces chronic hyperacusis-like responses in animals. We addressed this question by examining the chronic effects of intense sound exposure on the acoustic startle response (ASR) and its suppression by background noise containing brief gaps. We compared startle amplitudes in intense tone-exposed (10 kHz, 115 dB SPL, 4 h) and age-matched controls at 2-28 weeks post-exposure. While both groups showed similar startle thresholds, exposed animals showed a hyperacusis-like augmentation of ASR at high stimulus levels. Addition of background noise had little effect on ASR in controls but had a strong suppressive effect on startle in exposed animals, indicating a sensitization to background noise. When the background noise contained a gap preceding the startle stimulus, ASR was suppressed in control animals, but exposed animals showed a marked weakening of gap-induced suppression of ASR. This weakening of gap-induced startle suppression is consistent with the interpretation that the gap may have been masked by tinnitus. The associated hyper-responsiveness to startle stimuli presented alone and the sensitization to background noise suggest that hyperacusis may have also been induced. The results indicate that noise exposure leads to increases in the gain of auditory responsiveness and may offer a model of the association of hyperacusis with tinnitus.

Differential auditory-oculomotor interactions in patients with right versus left sided subjective tinnitus: A saccade study.
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Subjective tinnitus (ST) is a frequent but poorly understood medical condition. Recent studies demonstrated abnormalities in several types of eye movements (smooth pursuit, optokinetic nystagmus, fixation and vergence) in ST patients. The present study investigates horizontal and vertical saccades in patients with tinnitus lateralized predominantly to the left or to the right side. Compared to left sided ST, tinnitus perceived on the right side impaired almost all the parameters of saccades (latency, amplitude, velocity, etc.) and noticeably the upward saccades. Relative to controls, saccades from both groups were more dysmetric and were characterized by increased saccade disconjugacy (i.e. poor binocular coordination). Although the precise mechanisms linking ST and saccadic control remain unexplained, these data suggest that ST can lead to detrimental auditory, visuomotor and perhaps vestibular interactions. © 2013 Lang, Vernet, Yang, Orssaud, Londero and Kapoula.
Salicylate Selectively Kills Cochlear Spiral Ganglion Neurons by Paradoxically Up-regulating Superoxide.

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Aspirin and its active ingredient salicylate are potent antioxidants that have been reported to be neuro- and otoprotective. However, when consumed in large quantities, these drugs can cause temporary hearing loss and tinnitus. Moreover, recent studies indicate that after several days of treatment, salicylate selectively destroys the spiral ganglion neurons and auditory nerve fibers that relay sounds from the sensory hair cells to the brain. Why salicylate selectively damages spiral ganglion neurons while sparing the hair cells and supports cells is unclear. Here we show that high dose of salicylate trigger an apoptotic response in spiral ganglion neurons characterized morphologically by soma shrinkage and nuclear condensation and fragmentation plus activation of extrinsic initiator caspase-8 and intrinsic initiator caspase-9 several days after the onset of drug treatment. Salicylate treatment triggered an upsurge in the toxic superoxide radical only in spiral ganglion neurons, but not in neighboring hair cells and support cells. Mn TMPyP pentachloride, a cell permeable scavenger of superoxide blocked the expression of superoxide staining in spiral ganglion neurons and almost completely blocked the damage to the nerve fibers and spiral ganglion neurons. NMDA receptor activation is known to increase neuronal superoxide levels. Since NMDA receptors are mainly found on spiral ganglion neurons and since salicylate enhances NMDA receptor currents, the selective killing of spiral ganglion neurons is likely a consequence of enhanced and sustained activation of NMDA receptors by salicylate.

The reduced cochlear output and the failure to adapt the central auditory response causes tinnitus in noise exposed rats.


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Tinnitus is proposed to be caused by decreased central input from the cochlea, followed by increased spontaneous and evoked subcortical activity that is interpreted as compensation for increased responsiveness of central auditory circuits. We compared equally noise exposed rats separated into groups with and without tinnitus for differences in brain responsiveness relative to the degree of deafferentation in the periphery. We analyzed (1) the number of CtBP2/RIBEYE-positive particles in ribbon synapses of the inner hair cell (IHC) as a measure for deafferentation; (2) the fine structure of the amplitudes of auditory brainstem responses (ABR) reflecting differences in sound responses following decreased auditory nerve activity and (3) the expression of the activity-regulated gene Arc in the auditory cortex (AC) to identify long-lasting central activity following sensory deprivation. Following moderate trauma, 30% of animals exhibited tinnitus, similar to the tinnitus prevalence among hearing impaired humans. Although both tinnitus and no-tinnitus animals exhibited a reduced ABR wave I amplitude (generated by primary auditory nerve fibers), IHCs ribbon loss and high-frequency hearing impairment was more severe in tinnitus animals, associated with significantly reduced amplitudes of the more centrally generated wave IV and V and less intense staining of Arc mRNA and protein in the AC. The observed severe IHCs ribbon loss, the minimal restoration of ABR wave size, and reduced cortical Arc expression suggest that tinnitus is linked to a failure to adapt central circuits to reduced cochlear input. Free PMC Article.
Pathogenic plasticity of Kv7.2/3 channel activity is essential for the induction of tinnitus.

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Tinnitus, the perception of phantom sound, is often a debilitating condition that affects many millions of people. Little is known, however, about the molecules that participate in the induction of tinnitus. In brain slices containing the dorsal cochlear nucleus, we reveal a tinnitus-specific increase in the spontaneous firing rate of principal neurons (hyperactivity). This hyperactivity is observed only in noise-exposed mice that develop tinnitus and only in the dorsal cochlear nucleus regions that are sensitive to high frequency sounds. We show that a reduction in Kv7.2/3 channel activity is essential for tinnitus induction and for the tinnitus-specific hyperactivity. This reduction is due to a shift in the voltage dependence of Kv7 channel activation to more positive voltages. Our in vivo studies demonstrate that a pharmacological manipulation that shifts the voltage dependence of Kv7 to more negative voltages prevents the development of tinnitus. Together, our studies provide an important link between the biophysical properties of the Kv7 channel and the generation of tinnitus. Moreover, our findings point to previously unknown biological targets for designing therapeutic drugs that may prevent the development of tinnitus in humans.

Investigation of temporal bone asymmetry in cases with unilateral tinnitus: morphometric and multicentric clinical study.

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The aim of this multicentric study was to compare the anatomical structures of temporal bone in patients with unilateral tinnitus with their healthy ears. We also aimed at evaluating whether age and gender-related asymmetrical changes occur in temporal bones or not. Fifty two ears of 26 patients who had unilateral tinnitus were included into the retrospective study. The patients who had subjective nonpulsatile tinnitus and who previously had temporal computed tomography according to their file records were accepted to study. Temporal CT scans and audiometric results of patients were examined retrospectively. Middle ear volume, diameter of internal acoustic meats and diameter of jugular bulb were evaluated by both anatomist and radiologist, interobserverly. Internal acoustic meats and jugular bulb were found larger in the ears that had tinnitus than healthy ears; however, there was no statistically significance. The stereological morphometrical study of temporal bone asymmetry in humans correlate with sex is of importance for both otolaryngologists and anatomists. These results will contribute to data on middle ear volume, internal acoustic meats and jugular bulb sizes.
The role of plasma melatonin and vitamins C and B12 in the development of idiopathic tinnitus in the elderly.

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BACKGROUND: To determine the correlation between plasma levels of melatonin, vitamin C and vitamin B12 and the presence of tinnitus among elderly subjects with unexplained subjective tinnitus. METHOD: Prospective involving apparently healthy elderly with subjective tinnitus and those without. Plasma levels of melatonin, vitamin C and vitamin B12 were determined using high performance liquid chromatography and correlation determined by comparing subjects with and without tinnitus. RESULT: There were 139 elderly subjects (78 females and 61 males), the mean (SD) range of the age was 66.9 years (0.77) 60-98 years. Of these 58.3% had tinnitus. The mean (SD) range of the plasma levels of melatonin was 11.2 pg/mL (4.2) 5.1 pg/mL - 30.2 pg/mL while that of Vitamin C was 0.7 µmol/L (0.1) 0.3 µmol/L - 1.2 µmol/L, and vitamin B12 was 43.0 pmol/L (3.1) 25.4 pmol/L - 71.6 pmol/L. Comparing the plasma levels of the markers between elderly with and those without tinnitus, the plasma levels of melatonin (p=0.01) and vitamin B12 (p=0.03) were significantly lower among the elderly with tinnitus compared to those without, while the difference in the plasma level of vitamin C (p=0.6) was not. CONCLUSION: Low plasma melatonin and vitamin B12 have significant correlation with the development of subjective idiopathic tinnitus among the elderly. This finding suggests the need for the trial of correction of these markers in the reversal or control of tinnitus. Free PMC Article.

Computational modeling of tinnitus development.

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Animal models and human neuroimaging studies have shown that tinnitus is generated through pathologically altered spontaneous activity of neurons in the central auditory system. Sensorineural hearing loss has been identified as an important trigger for the development of these aberrant patterns of neuronal activity, but the functional mechanisms that underlie this process have not yet been pinpointed. Using computational models, we have investigated which neuronal plasticity mechanisms could account for the development of neuronal correlates of tinnitus after hearing loss. We could show that a model based on the principle of activity stabilization through homeostatic plasticity can explain the development of neuronal hyperactivity as observed in animal studies. Moreover, the model's predictions of tinnitus frequencies from the audiograms of patients with noise-induced hearing loss and tonal tinnitus are close to the observed tinnitus pitch. The model thus proposes a specific mechanism for how plasticity in the central auditory system could lead to the development of tinnitus after cochlear damage. The model also predicts that central auditory structures may show increased response gain, which could explain why tinnitus and hyperacusis often occur together. Moreover, the homeostasis model is consistent with recent experimental findings from tinnitus patients with normal audiograms, and it explains why auditory deprivation through an earplug can lead to the occurrence of phantom sounds.
Spontaneous firing rate changes in cat primary auditory cortex following long-term exposure to non-traumatic noise: Tinnitus without hearing loss?

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Changes of neural activity in animal models have been correlated with tinnitus in humans. For instance, increased spontaneous firing rates (SFR), increased spontaneous neural synchrony, and cortical tonotopic map reorganization may underlie this phantom auditory percept. The aim of this study is to quantify the changes in SFR activity in the cat primary auditory cortex, following long-term exposure to different types of non-traumatic acoustic environments. For that purpose, four different groups of adult cats were exposed to moderate-level (~70dB SPL), behaviorally irrelevant sounds for several weeks to months, and their SFRs were compared with those in control cats. The sounds consisted of random multi-frequency tone pip ensembles with various bandwidths (2-4kHz, 4-20kHz, and a pair of third-octave bands centered at 4 and 16kHz), as well as a “factory noise”. Auditory brainstem response (ABR) thresholds, ABR wave 3 amplitudes at ~55 and 75dB SPL, and distortion product otoacoustic emission (DPOAE) amplitudes were unaffected by the exposure. However, we found that the SFR decreased within the exposure frequency range and increased outside the exposure range. This increased SFR for units with characteristic frequencies outside the exposure frequency range, which was slow to reverse after the exposure offset, suggests a mechanism for tinnitus in the absence of hearing loss.

Choline acetyltransferase activity in the hamster central auditory system and long-term effects of intense tone exposure.

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Acoustic trauma often leads to loss of hearing of environmental sounds, tinnitus, in which a monotonous sound not actually present is heard, and/or hyperacusis, in which there is an abnormal sensitivity to sound. Research on hamsters has documented physiological effects of exposure to intense tones, including increased spontaneous neural activity in the dorsal cochlear nucleus. Such physiological changes should be accompanied by chemical changes, and those chemical changes associated with chronic effects should be present at long times after the intense sound exposure. Using a microdissection mapping procedure combined with a radiometric microassay, we have measured activities of choline acetyltransferase (ChAT), the enzyme responsible for synthesis of the neurotransmitter acetylcholine, in the cochlear nucleus, superior olive, inferior colliculus, and auditory cortex of hamsters 5 months after exposure to an intense tone compared with control hamsters of the same age. In control hamsters, ChAT activities in auditory regions were never more than one-tenth of the ChAT activity in the facial nerve root, a bundle of myelinated cholinergic axons, in agreement with a modulatory rather than a dominant role of acetylcholine in hearing. Within auditory regions, relatively higher activities were found in granular regions of the cochlear nucleus, dorsal parts of the superior olive, and auditory cortex. In intense-tone-exposed hamsters, ChAT activities were significantly increased in the anteroventral cochlear nucleus granular region and the lateral superior olivary nucleus. This is consistent with some chronic upregulation of the cholinergic olivocochlear system influence on the cochlear nucleus after acoustic trauma. © 2013 Wiley Periodicals, Inc. Copyright © 2013 Wiley Periodicals, Inc.
Is the Degree of Discomfort Caused by Tinnitus in Normal-Hearing Individuals Correlated with Psychiatric Disorders?


Hospital de Base de Brasília, Brasília, Brazil.

Objective
To evaluate the annoyance of tinnitus in normal-hearing patients and to correlate it with outer hair cell function and with anxiety and depression disorders.

Study design
Case-control study.

Setting
Tertiary care medical center.

Subjects and Methods
Sixty-eight patients with tinnitus (study group) and a control group consisting of 46 subjects without tinnitus were studied. The subjects ranged in age from 20 to 45 years and had a hearing threshold of up to 25 dB in the frequency range of 500 to 8000 Hz. The subjects were submitted to otoacoustic emission (OAE) tests. Tinnitus annoyance was evaluated using the Tinnitus Handicap Inventory, and anxiety and depression were measured using the Beck Anxiety and Depression Inventories.

Results
In the study group, 67% of the transient-evoked OAE tests were altered, with the observation of significant differences for all frequencies tested. In addition, 65.2% of the distortion product-evoked OAE tests were altered at 3000, 6000, and 8000 Hz, and this difference was significant when compared with control. Anxiety (44.1%) and depression (33.3%) were significantly more frequent among patients with tinnitus. Tinnitus annoyance was not correlated with the OAE results or tinnitus duration but showed a correlation with the presence of anxiety and depression. In the study group, no difference in tinnitus annoyance, anxiety, or depression was observed between patients with normal and altered OAE tests.

Conclusion
This study showed altered OAE in patients with tinnitus and normal hearing. It also demonstrated a positive correlation between the annoyance of tinnitus and anxiety and depression in normal-hearing patients.

Analysis of mental disorders in tinnitus patients performed with Composite International Diagnostic Interview.

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PURPOSE: Known association between tinnitus and psychological distress prompted us to examine patients with chronic tinnitus by using the Composite International Diagnostic Interview (CIDI), which is a standardized and reliable method used for the diagnosis of mental disorders. METHODS: One hundred patients with chronic tinnitus admitted to the Tinnitus Center, Charité-Universitätsmedizin Berlin, were included in this study. Data were collected between February 2008 and February 2009. Besides CIDI, the Tinnitus Questionnaire according to Goebel and Hiller, the Hospital Anxiety Depression Scale, and the General Anxiety Disorder-7 were used. RESULTS: Using CIDI, we have identified one or more mental disorders in 46 tinnitus patients. In that group, we found persistent affective disorders (37 %), anxiety disorders (32 %), and somatoform disorders (27 %). Those patients who had affective or anxiety disorders were more distressed by tinnitus and were more anxious and more depressed than tinnitus patients without mental disorders. Psychological impairment positively correlated with tinnitus distress: Patients with decompensated tinnitus had significantly more affective and anxiety disorders than patients with compensated tinnitus. CONCLUSIONS: In the present study, we have detected a high rate (almost half of the cases) of psychological disorders occurring in patients with chronic tinnitus. The patients diagnosed with psychological disorders were predominantly affected by affective and anxiety disorders. Psychological disorders were associated with severity of tinnitus distress. Our findings imply a need for routine comprehensive screening of mental disorders in patients with chronic tinnitus.
Speech recognition index of workers with tinnitus exposed to environmental or occupational noise: a comparative study.

Soalheiro M, Rocha L, do Vale DF, Fontes V, Valente D, Teixeira LR.

INTRODUCTION: Tinnitus is considered the third worst symptom affecting humans. The aim of this article is to assess complaints by workers with tinnitus exposed to environmental and occupational noise.
Methodology: 495 workers went through an epidemiological survey at the Audiology Department of the Center for Studies on Workers’ Health and Human Ecology, from 2003 to 2007. The workers underwent tonal and vocal audiometry, preceded by a clinical and occupational history questionnaire. Two-factor ANOVA and Tukey were the statistical tests used. All the analysis set statistical significance at alpha=5%.
FINDINGS: There was a higher prevalence of occupational tinnitus (73.7%), a predominance of female domestic workers (65.4%) in cases of environmental exposure, and predominance of male construction workers (71.5%) for occupational exposure. There was a significant difference in workers with hearing loss, who showed a mean speech recognition index (SRI) of 85%, as compared to healthy workers with a mean SRI greater than 93.5%. Signs and symptoms, speech perception, and interference in sound localization with the type of noise exposure (environmental versus occupational) comparisons found no significant differences.
CONCLUSION: Studied group’s high prevalence of tinnitus, major difficulties in speech recognition with hearing loss and the presence of individuals with normal hearing with both types of exposure justify the importance of measures in health promotion, prevention, and hearing surveillance. The findings highlight the importance of valuing the patients’ own perception as the first indication of tinnitus and hearing loss in order to help develop appropriate public policies within the Unified National Health System (SUS). Free Article.

Psychiatric comorbidity and personality traits in patients with hyperacusis.
Int J Audiol. 2012 Dec 17. [Epub ahead of print]

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Objective: Hyperacusis, defined as unusual intolerance of ordinary environmental sounds, is a common problem. In spite of this, there is limited understanding of the underlying mechanisms. We hypothesized that individuals with hyperacusis would be prone to suffer from psychiatric disorders, related in particular to anxiety. Therefore, psychiatric morbidity and personality traits were investigated, along with different sociodemographic and clinical characteristics.
Design: Patients were assessed with a clinical interview related to symptoms of hyperacusis, the Mini-international neuropsychiatric interview (MINI), and the Swedish Universities scales of Personality (SSP) to study psychiatric disorders and personality traits.
Study sample: A group of 62 Swedish patients with hyperacusis between 18 and 61 years (mean 40.2, SD 12.2) was included. Results: Altogether 56% of the patients had at least one psychiatric disorder, and 47% had an anxiety disorder. Also, personality traits related to neuroticism were over-represented. A majority, 79%, suffered from comorbid tinnitus, and a similar proportion used measures to avoid noisy environments.
Conclusions: The over-representation of anxiety disorders and anxiety-related personality traits in patients with hyperacusis suggests common or cooperating mechanisms. Cognitive behavioural treatment strategies, proven efficient in treating anxiety, may be indicated and are suggested for further studies.
A psychometric validation of the Japanese versions of new questionnaires on tinnitus (THI-12, TRS, TRSw, TSS, and TSSw).

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Abstract

Conclusion: The Japanese version of the Tinnitus Handicap Inventory-12 (THI-12), Tinnitus Rating Scale (TRS), TRS 1-week version (TRSw), Tinnitus Severity Scale (TSS), and TSS 1-week version (TSSw), which were developed in this study, showed high reliability and validity, suggesting their usefulness in clinical practice. Based on the THI severity grades, we propose that the severity grades of THI-12 (draft) are categorized into four groups: 0-4 points, 5-9 points, 10-14 points, and 15-24 points.

Objectives: We developed Japanese versions of new questionnaires for evaluating the level of psychological distress and difficulty in activities of daily living due to tinnitus, and performed their psychometric validation to determine the reliability and validity. The THI-12 is an assessment consisting of 12 items, each of which is rated on a 3-point scale that was created by reducing the number of questions from the 25 items of the THI. The TRS, TRSw, TSS, and TSSw, which were self-evaluation questionnaires of tinnitus on an 11-grade integer Likert scale from 0 to 10 points, were used as additional instruments to assess tinnitus severity and distress.

Methods: The subjects were healthy adults, and patients with subjective tinnitus who were examined at the Otolaryngology Department of Keio University Hospital, Osaka City University Hospital, or Nagoya City University Hospital with a chief complaint of tinnitus between September 2010 and January 2011. In all, 38 healthy adult subjects and 113 patients with subjective tinnitus were included. We examined the reproducibility and the internal consistency for reliability. We also examined the relationship with the available scales (THI and Hospital Anxiety and Depression Scale, HADS) and group divergence for validity.

Results: The psychometric validation showed high reliability and validity of the THI-12, TRS, TRSw, TSS, and TSSw.

Imaging detection of endolymphatic sac tumor-associated hydrops.

J Neurosurg. 2013 Mar 8. [Epub ahead of print]

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Object To determine if physiologically based MRI sequences can be used to detect endolymphatic sac tumor (ELST)-associated hydrops, the authors performed contrast-enhanced delayed FLAIR imaging in consecutive ELST patients with clinical findings consistent with hydrops. Methods Consecutive patients with von Hippel-Lindau (VHL) disease and clinical findings of endolymphatic hydrops and ELSTs underwent contrast-enhanced delayed FLAIR MRI. Clinical, audiological, operative, and imaging findings were analyzed. Results Three patients (2 male, 1 female) with 4 ELSTs (1 patient had bilateral ELSTs) were identified who had clinical findings consistent with endolymphatic hydrops. Computed tomography and MRI evidence of an ELST was found in all patients. Their mean age at initial evaluation was 39.7 years (range 28-51 years). All patients demonstrated progressive sensorineural hearing loss that was associated with episodic vertigo and tinnitus. Contrast-enhanced delayed FLAIR MRI clearly demonstrated dilation of the membranous labyrinth consistent with hydrops in the affected ears but not the unaffected ears. Two patients underwent resection of the associated ELST that resulted in stabilization of progressive hearing loss, as well as amelioration of tinnitus and vertigo. Conclusions Contrast-enhanced delayed FLAIR MRI can be used to detect ELST-associated hydrops. Noninvasive MRI detection of hydrops can permit earlier detection of ELSTs in patients with VHL disease and provides direct insight into a mechanism that underlies ELST-associated audiovestibular morbidity.
Sigmoid sinus diverticulum and pulsatile tinnitus: analysis of CT scans from 15 cases.
Acta Radiol. 2013 Apr 2. [Epub ahead of print]


Department of Radiology.

Background Although the imaging features of sigmoid sinus diverticulum induced pulsatile tinnitus (PT) have been presented in some extent, detailed imaging findings still have not been systematically evaluated and precise diagnostic radiographic criteria has not been established.

Purpose To examine the computed tomography (CT) characteristics of sigmoid sinus diverticulum accompanied with PT.

Material and Methods Fifteen PT patients with sigmoid sinus diverticula proven by surgery were recruited after consenting. CT images of 15 patients were obtained and analyzed, including features of diverticula, brain venous systems, integrity of the sigmoid plate, and the degree of temporal bone pneumatization.

Results Sigmoid sinus diverticulum was located on the same side of PT in 15 patients. Diverticula originated at the superior curve of the sigmoid sinus in 11 patients and the descending segment of the sigmoid sinus in four patients. Sigmoid sinus diverticula focally eroded into the adjacent mastoid air cells in 12 patients and mastoid cortex in three patients. Among eight patients with unilateral dominant brain venous systems, the diverticula were seen on the dominant side in seven patients and non-dominant side in one patient. In contrast, the other seven patients showed co-dominant brain venous systems, with three presenting diverticula on the right side and four on the left. More notably, dehiscent sigmoid plate on the PT side was demonstrated in all patients. In addition, temporal bone hyper-pneumatization was found in nine patients, good and moderate pneumatization in three patients, respectively.

Conclusion Dehiscent sigmoid plate and extensive temporal bone pneumatization are two important imaging characteristics of the PT induced by sigmoid sinus diverticulum.

No cochlear dead regions detected in non-pulsatile tinnitus patients: An assessment with the threshold equalizing noise (sound pressure level) test.

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One of the hypotheses on the etiology of non-pulsatile tinnitus in normal or hearing impaired patients is the existence of sharp edged cochlear dead regions (DR) flanking normal functioning hair cells. The lack of inhibition of DR on the neighboring neurons may lead to hyperactivity. Currently the Threshold Equalizing Noise test (TEN test) is the reference test to clinically assess cochlear DR. To identify cochlear DR in patients with non-pulsatile tinnitus with and without hearing loss using the TEN (sound pressure level)-test. Data were obtained from adult patients with non-pulsatile tinnitus visiting the Tinnitus Clinic of the University Hospital Antwerp. The TEN (SPL)-test was performed to assess the presence of cochlear DR for test frequencies ranging from 0.5 to 8 kHz. A total of 55 ears of 33 subjects (15 male; 18 female) with non-pulsatile tinnitus were included in the study. Subjects were divided into subgroups based on the audiometric configuration of hearing loss: Flat configuration (N = 23), high-frequency gently sloping (N = 10) and high-frequency steeply sloping (N = 22). In forty-eight ears there was no evidence of cochlear DR. In seven ears the results were inconclusive. This occurred in patients with high-frequency steeply sloping audiogram configurations. The present study does not support the TEN (SPL) test as a reliable tool for the detection of cochlear DR in a tinnitus population.
Can the tinnitus spectrum identify tinnitus subgroups?

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The tinnitus spectrum is a psycho-acoustic metric of tinnitus. Previous work found a tight relation between the spectrum and the tone audiogram. This suggests that the spectrum and the audiogram provide essentially the same information, and the added value of the spectrum is limited. In order to test whether the spectrum shows tinnitus characteristics that cannot be inferred from the audiogram, we re-examined the relation between the tinnitus spectrum and the tone audiogram, in a group of 80 tinnitus patients. We defined three subgroups of patients, using the shape of their tinnitus spectrum: (1) patients with a spectrum, monotonously increasing with frequency (2) patients with a distinct peak in their spectrum, (3) all other patients. Patients in group 3 typically showed low frequency tinnitus spectra. In all three groups, the largest hearing loss was at high frequencies (>2 kHz). The mean audiograms of group 1 and 2 were remarkably similar; group 3 had an additional hearing loss for the lower frequencies (<2 kHz). The three groups did not differ with respect to age, sex, or tinnitus questionnaire outcomes. In subgroups 2 and 3, the shape of the spectrum clearly differed from that of the tone audiogram. In other words, the spectrum technique provided information that could not have been obtained by tone audiometry alone. Therefore, the spectrum measurement may develop into a technique that can differentiate between classes of tinnitus. This may eventually contribute to the effective management of tinnitus, as various classes of tinnitus may require different therapeutic interventions.


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Dural arteriovenous fistulae (DAVF) are cerebrovascular lesions with pathologic shunting into the venous system from arterial feeders. Digital subtraction angiography (DSA) has long been considered the gold standard for diagnosis, but advances in noninvasive imaging techniques now play a role in the diagnosis of these complex lesions. Herein, we describe the case of a patient with right-side pulsatile tinnitus and DAVF diagnosed using computed tomography angiography, magnetic resonance with arterial spin labeling, and DSA. Implications for imaging analysis of DAVFs and further research are discussed. Copyright © 2013 by the American Society of Neuroimaging.
Measuring subjective complaints of attention and performance failures - development and psychometric validation in tinnitus of the self-assessment scale APSA.
Health Qual Life Outcomes. 2013 May 29;11(1):86. [Epub ahead of print]

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BACKGROUND: There is a need for a validated self-assessment questionnaire for cognitive impairment in subjects reporting subjective tinnitus. The objective was to develop a patient-reported outcome measure.

METHODS: This was a prospective, non-interventional, multicultural study. The 30-item “Attention and Performance Self-Assessment Scale” (APSA) was linguistically validated in Germany, Mexico and USA and was analyzed for content and structure. The analysis included descriptive statistics of baseline data, item characteristics, test-retest reliability (intra-class correlation coefficients, ICC), definition of internal consistency (Cronbach's alpha), and explorative and confirmatory factor analysis to define the structure of the scale. Correlations with various tinnitus scales and subscales from the Hospital Anxiety and Depression Scale (HADS) were done to estimate convergent validity.

RESULTS: The data for 211 subjects aged 30 through 60 years, (mean 48.5 years, SD: 8.3) with mild to moderate tinnitus (mean Tinnitus Handicap Inventory-12 (THI-12) total score 11.2, SD: 5.3) were analyzed. The majority of subjects had sub-clinical scores for anxiety and depression (HADS below 11 points). Sequential principal factor analyses of the APSA resulted in a subscale which included 20 (APS20) of the original 30 items and two correlated subscales (AP-F1, AP-F2) defined by 9 items each. Both factor solutions were confirmed by confirmatory factor analysis. Test retest reliability of the APS20, AP-F1 and AP-F2 (ICC >= 0.87) and internal consistency (Cronbach's alpha >= 0.89) are high. APS20 correlated moderately high with HADS (depression: 0.54; anxiety: 0.62) and THI-12 total (0.52). In a few cases, AP-F2 correlated higher than AP-F1 with other scales (e.g. HADS-depression with AP-F1: only 0.46, but AP-F2: 0.59). CONCLUSIONS: APS20, AP-F1, and AP-F2 have good psychometrical properties. The scales will add value to the assessment of cognitive aspects of quality of life and mental health in the population with subjective tinnitus. The subscales AP-F1 and AP-F2 may be helpful for detecting specific cognitive failures and may be sensitive to different interventional effects. Free PMC Article.

Cochlear-facial dehiscence, a newly described entity.

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Dehiscence of the cochlear otic capsule has recently been described as a pathologic entity. We describe two cases of cochlear-facial dehiscence, which are the first reported: a 69 year-old male who complained of hearing loss, autophony, and pulsatile tinnitus, and a 41 year-old female who complained of left-sided hearing loss, pulsatile tinnitus, and vertigo. In both, CT showed bony dehiscence between the facial nerve and cochlea. Cochlear-facial dehiscence is another example of otic capsule dehiscence that produces symptoms of third window lesions. When patients present with third window lesion symptoms and the CT does not show superior canal dehiscence, cochlear-facial dehiscence should be considered. Copyright © 2013 The American Laryngological, Rhinological, and Otological Society, Inc.
Sudden unilateral hearing loss as first sign of cerebral sinus venous thrombosis? A 3-year retrospective analysis.


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INTRODUCTION: Recently, several studies and case reports have dealt with the topic of cerebral sinus venous thrombosis (CSVT) and focused on sudden hearing loss as an early and rare symptom, to diminish the delay in diagnosing this serious disease. MATERIALS AND METHODS: We conducted a retrospective analysis over 3 years and investigated MRIs of all inpatients who were treated for sudden sensorineural hearing loss. The aim of the study was to evaluate whether sudden hearing loss could be an early indicator, or the first sign, of CSVT. RESULTS: In total, 554 patients were included. Only 2 patients with CSVT could be identified. In both, sudden unilateral sensorineural hearing loss was not the only symptom. They also reported headache, and 1 patient also reported tinnitus and vertigo. CONCLUSION: In our opinion, sudden unilateral sensorineural hearing loss alone is not a reliable indicator of CSVT. In combination with headache or visual impairment, this rare vascular disease should be taken into account.

Acceptance of Tinnitus: Validation of the Tinnitus Acceptance Questionnaire.
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The concept of acceptance has recently received growing attention within tinnitus research due to the fact that tinnitus acceptance is one of the major targets of psychotherapeutic treatments. Accordingly, acceptance-based treatments will most likely be increasingly offered to tinnitus patients and assessments of acceptance-related behaviours will thus be needed. The current study investigated the factorial structure of the Tinnitus Acceptance Questionnaire (TAQ) and the role of tinnitus acceptance as mediating link between sound perception (i.e. subjective loudness of tinnitus) and tinnitus distress. In total, 424 patients with chronic tinnitus completed the TAQ and validated measures of tinnitus distress, anxiety, and depression online. Confirmatory factor analysis provided support to a good fit of the data to the hypothesised bifactor model (root-mean-square-error of approximation = .065; Comparative Fit Index = .974; Tucker-Lewis Index = .958; standardised root mean square residual = .032). In addition, mediation analysis, using a non-parametric joint coefficient approach, revealed that tinnitus-specific acceptance partially mediated the relation between subjective tinnitus loudness and tinnitus distress (path ab = 5.96; 95% CI: 4.49, 7.69). In a multiple mediator model, tinnitus acceptance had a significantly stronger indirect effect than anxiety. The results confirm the factorial structure of the TAQ and suggest the importance of a general acceptance factor that contributes important unique variance beyond that of the first-order factors activity engagement and tinnitus suppression. Tinnitus acceptance as measured with the TAQ is proposed to be a key construct in tinnitus research and should be further implemented into treatment concepts to reduce tinnitus distress.
Morphometric and volumetric MRI changes in idiopathic intracranial hypertension.
Cephalalgia. 2013 Apr 24. [Epub ahead of print]

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OBJECTIVE: We aimed at validating established imaging features of idiopathic intracranial hypertension (IIH) by using state-of-the-art MR imaging together with advanced post-processing techniques and correlated imaging findings to clinical scores. METHODS: Twenty-five IIH patients as well as age-, sex- and body mass index (BMI)-matched controls underwent high-resolution T1w and T2w MR imaging in a 1.5 T scanner, followed by assessment of optic nerve sheaths, pituitary gland, ventricles and Meckel's cave. Imaging findings were correlated with cerebrospinal fluid (CSF) opening pressures and clinical symptom scores of visual disturbances (visual field defects or enlarged blind spot), headache, tinnitus (pulsatile and non-pulsatile) and vertigo. CSF as well as ventricle volumes were determined by using an automated MRI volumetry algorithm. RESULTS: So-called ‘empty sella’ and optic nerve sheath distension were identified as reliable imaging signs in IIH. Posterior globe flattening turned out as a highly specific but not very sensitive sign. No abnormalities of the lateral ventricles were observed. These morphometric results could be confirmed using MR volumetry (VBM). Clinical symptoms did not correlate with an increase in lumbar opening pressure. CONCLUSIONS: Our study results indicate that lateral ventricle size is not affected in IIH. In contrast, abnormalities of the pituitary gland and optic nerve sheath were reliable diagnostic signs for IIH.

The influence of psychological factors on tinnitus severity.

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OBJECTIVE: Subjective tinnitus is a frequent symptom characterized by perception of sound in the absence of a corresponding external stimulus. Although many people learn to live with tinnitus, some find it severely debilitating. Why tinnitus is debilitating in some patients, but not in others, is still incompletely understood. We aimed to assess the influence of different aspects of psychological distress on perceived tinnitus severity. METHODS: Three hundred seventeen patients diagnosed with chronic subjective tinnitus at two university clinics completed the Tinnitus Handicap Inventory (THI), the Tinnitus Questionnaire (TQ) and the Symptom Check List-90-Revised. The influence of the different dimensions of psychological distress on perceived tinnitus severity was statistically evaluated. RESULTS: Both THI and TQ scores were significantly influenced by gender, site and the dimension "depression". In addition, TQ scores were significantly influenced by age and "somatization," whereas "hostility" had an impact on THI scores only. CONCLUSION: Psychological aspects as well as sociodemographic variables had a significant influence on both TQ scores. However, our results indicate, that these scales reflect emotional distress of tinnitus sufferers differently. This should be taken into consideration in the use of these scales as screening tools for assessment of tinnitus handicap. Copyright © 2013. Published by Elsevier Inc.
IV Imaging

Psychoacoustic tinnitus loudness and tinnitus-related distress show different associations with oscillatory brain activity.


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BACKGROUND: The phantom auditory perception of subjective tinnitus is associated with aberrant brain activity as evidenced by magneto- and electroencephalographic studies. We tested the hypotheses (1) that psychoacoustically measured tinnitus loudness is related to gamma oscillatory band power, and (2) that tinnitus loudness and tinnitus-related distress are related to distinct brain activity patterns as suggested by the distinction between loudness and distress experienced by tinnitus patients. Furthermore, we explored (3) how hearing impairment, minimum masking level, and (4) psychological comorbidities are related to spontaneous oscillatory brain activity in tinnitus patients. METHODS AND FINDINGS: Resting state oscillatory brain activity recorded electroencephalographically from 46 male tinnitus patients showed a positive correlation between gamma band oscillations and psychoacoustic tinnitus loudness determined with the reconstructed tinnitus sound, but not with the other psychoacoustic loudness measures that were used. Tinnitus-related distress did also correlate with delta band activity, but at electrode positions different from those associated with tinnitus loudness. Furthermore, highly distressed tinnitus patients exhibited a higher level of theta band activity. Moreover, mean hearing loss between 0.125 kHz and 16 kHz was associated with a decrease in gamma activity, whereas minimum masking levels correlated positively with delta band power. In contrast, psychological comorbidities did not express significant correlations with oscillatory brain activity. CONCLUSION: Different clinically relevant tinnitus characteristics show distinctive associations with spontaneous brain oscillatory power. Results support hypothesis (1), but exclusively for the tinnitus loudness derived from matching to the reconstructed tinnitus sound. This suggests to preferentially use the reconstructed tinnitus spectrum to determine psychoacoustic tinnitus loudness. Results also support hypothesis (2). Moreover, hearing loss and minimum masking level correlate with oscillatory power in distinctive frequency bands. The lack of an association between psychological comorbidities and oscillatory power may be attributed to the overall low level of mental health problems in the present sample. Free PMC Article.

Neural substrates predicting improvement of tinnitus after cochlear implantation in patients with single-sided deafness.


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Notwithstanding successful reduction of tinnitus after cochlear implantation (CI) in patients with single-sided deafness (SSD) in recent studies, neither the exact mechanism of suppression nor the predictors of the amount of improvement are fully understood yet. We collected quantitative electroencephalography (qEEG) data from nine SSD patients who underwent CI for tinnitus management. By correlating the degree of improvement in tinnitus intensity and tinnitus-related distress with preoperative source-localized qEEG findings and comparing qEEG findings of patients with marked improvement after CI with those with relatively slight improvement with regard to source-localized activity complimented by connectivity analysis, we attempted to find preoperative predictors of tinnitus improvement. Our results showed increased activities of the auditory cortex (AC), posterior cingulate cortex (PCC) and increased functional
connectivity between the AC and PCC as negative prognostic factors for the reduction of tinnitus intensity after CI in patients with SSD. Also, relatively increased activity of the right dorsolateral prefrontal cortex and decreased connectivity between distress-related areas such as the orbitofrontal cortex/parahippocampus and sensory-perception areas such as the AC/precuneus were found in patients with relatively slight improvement in tinnitus-related distress as compared with those with marked improvement. The current study suggests that preoperative cortical oscillations can be applied to predict post-CI tinnitus reduction in patients with SSD. Copyright © 2013. Published by Elsevier B.V.


Song JJ, De Ridder D, Schlee W, Van de Heyning P, Vanneste S.

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Recent findings regarding different characteristics according to the age of tinnitus onset prompted us to conduct a study on the differences in tinnitus-related neural correlates between late-onset tinnitus (LOT; mean onset age, 60.4 years) and early-onset tinnitus (EOT; mean onset age, 29.7 years) groups. Hence, we collected quantitative electroencephalography findings of 29 participants with LOT and 30 with EOT, and from 59 controls. We then compared the results between the 2 groups and between the tinnitus groups and age- and sex-matched control groups using resting state electroencephalography source-localized activity and connectivity analyses. Compared with the EOT and older control groups, the LOT group demonstrated increased localized activity and functional connectivity in components of previously described tinnitus distress networks, and the default mode and intrinsic alertness networks, such as the prefrontal cortices, dorsal anterior cingulate cortex, and insula. The current findings of intrinsic differences in tinnitus-related neural activity between the LOT and EOT groups might be applicable for planning individualized treatment modalities according to age of onset. Moreover, differences with regard to the age of tinnitus onset might be a milestone for future studies on onset-related differences in other similar pathologies, such as pain or depression. Copyright © 2013 Elsevier Inc. All rights reserved.


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Neuroimaging studies of tinnitus suggest the involvement of widespread neural networks for perceptual, attentional, memory, and emotional processes encompassing auditory, frontal, parietal, and limbic areas. Despite sparse findings for tinnitus duration and laterality, tinnitus distress has been shown to be related to changes in non-auditory cortical areas. The aim of this study was to correlate tinnitus characteristics with grey matter volume in two large samples of tinnitus patients. High-resolution brain images were obtained using a 1.5 T magnetic resonance imaging scanner and analysed by means of voxel-based morphometry. In sample one (n = 257), tinnitus distress correlated negatively with grey matter volume in bilateral auditory areas including the Heschl's gyrus and insula, that is, the higher the tinnitus distress the lower the grey matter volume. The effects of this correlation were small, but stable after correction for potential confounders such as age, gender, and audiometric parameters. This negative correlation was replicated in a second independent sample (n = 78). Our results support the notion that the role of the auditory cortex in tinnitus is not restricted to perceptual aspects. The distress observed was dependent on grey matter alterations in the auditory cortex, which could reflect reverberations between perceptual and distress networks.
Brain areas controlling heart rate variability in tinnitus and tinnitus-related distress.

Vanneste S, De Ridder D.

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BACKGROUND: Tinnitus is defined as an intrinsic sound perception that cannot be attributed to an external sound source. Distress in tinnitus patients is related to increased beta activity in the dorsal part of the anterior cingulate and the amount of distress correlates with network activity consisting of the amygdala-anterior cingulate cortex-insula-parahippocampus. Previous research also revealed that distress is associated to a higher sympathetic (OS) tone in tinnitus patients and tinnitus suppression to increased parasympathetic (PS) tone. METHODOLOGY: The aim of the present study is to investigate the relationship between tinnitus distress and the autonomic nervous system and find out which cortical areas are involved in the autonomic nervous system influences in tinnitus distress by the use of source localized resting state electroencephalogram (EEG) recordings and electrocardiogram (ECG). Twenty-one tinnitus patients were included in this study. CONCLUSIONS: The results indicate that the dorsal and subgenual anterior cingulate, as well as the left and right insula are important in the central control of heart rate variability in tinnitus patients. Whereas the sympathovagal balance is controlled by the subgenual and pregenual anterior cingulate cortex, the right insula controls sympathetic activity and the left insula the parasympathetic activity. The perceived distress in tinnitus patients seems to be sympathetically mediated.

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Impact of acoustic coordinated reset neuromodulation on effective connectivity in a neural network of phantom sound.

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Chronic subjective tinnitus is an auditory phantom phenomenon characterized by abnormal neuronal synchrony in the central auditory system. As recently shown in a proof of concept clinical trial, acoustic coordinated reset (CR) neuromodulation causes a significant relief of tinnitus symptoms combined with a significant decrease of pathological oscillatory activity in a network comprising auditory and non-auditory brain areas. The objective of the present study was to analyze whether CR therapy caused an alteration of the effective connectivity in a tinnitus related network of localized EEG brain sources. To determine which connections matter, in a first step, we considered a larger network of brain sources previously associated with tinnitus. To that network we applied a data-driven approach, combining empirical mode decomposition and partial directed coherence analysis, in patients with bilateral tinnitus before and after 12 weeks of CR therapy as well as in healthy controls. To increase the signal-to-noise ratio, we focused on the good responders, classified by a reliable-change-index (RCI). Prior to CR therapy and compared to the healthy controls, the good responders showed a significantly increased connectivity between the left primary cortex auditory cortex and the posterior cingulate cortex in the gamma and delta bands together with a significantly decreased effective connectivity between the right primary auditory cortex and the dorsolateral prefrontal cortex in the alpha band. Intriguingly, after 12 weeks of CR therapy most of the pathological interactions were gone, so that the connectivity patterns of good responders and healthy controls became statistically indistinguishable. In addition, we used dynamic causal modeling (DCM) to examine the types of interactions which were altered by CR therapy. Our DCM results show that CR therapy specifically counteracted the imbalance of excitation and inhibition. CR significantly weakened the excitatory connection between posterior cingulate cortex and primary auditory cortex and significantly strengthened inhibitory connections between auditory cortices and the dorsolateral prefrontal cortex.

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The overall impact of CR therapy on the entire tinnitus-related network showed up as a qualitative transformation of its spectral response, in terms of a drastic change of the shape of its averaged transfer function. Based on our findings we hypothesize that CR therapy restores a silence based cognitive auditory comparator function of the posterior cingulate cortex. Copyright © 2013 Elsevier Inc. All rights reserved.

**Developments in delivery of medications for inner ear disease.**
Expert Opin Drug Deliv. 2013 Apr 6. [Epub ahead of print]

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Introduction: Hearing loss, tinnitus and balance disturbance represent common diseases that have tremendous impact on quality of life. Despite the high incidence of inner ear disease in the general population, there are currently no dedicated pharmacologic interventions available to treat these problems. Areas covered: This review will focus on how treatment of inner ear disease is moving toward local delivery at the end organ level. The authors will discuss current practice, ongoing clinical trials and potential areas of development such as hair cell regeneration and neurotrophin therapy. Expert opinion: The inner ear is accessible through the middle ear via the oval and round windows allowing diffusion of drugs into the perilymph. With a better understanding of the physiology of the inner ear and the underlying molecular causes of inner ear disease there is great potential for the development of novel therapeutics that can be locally administered. At present, there is a rapid development of drugs to target diverse inner ear diseases that cause sensorineural hearing loss and balance dysfunction.

**Tinnitus and musical hallucinosis: The same but more.**

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While tinnitus can be interpreted as a simple or elementary form of auditory phantom perception, musical hallucinosis is a more complex auditory phantom phenomenon not only limited to sound perception, but also containing semantic and musical content. It most often occurs in association with hearing loss. To elucidate the relation between simple and complex auditory phantom percepts a source localized electroencephalography (EEG) study is performed. The analyses showed in both simple and complex auditory phantoms an increase in theta-gamma activity and coupling within the auditory cortex that could be associated with the thalamocortical dysrhythmia model. Furthermore increased beta activity within the dorsal anterior cingulate cortex and anterior insula is demonstrated, that might be related to auditory awareness, salience and its attribution to an external sound source. The difference between simple and complex auditory phantoms relies on differential alpha band activity within the auditory cortex and on beta activity in the dorsal anterior cingulate cortex and (para)hippocampal area. This could be related to memory based load dependency, while suppression within the primary visual cortex might be due the presence of a continuous auditory cortex activation inducing an inhibitory signal to the visual system. Complex auditory phantoms further activate the right inferior frontal area (right sided Broca homolog) and right superior temporal pole that might be associated with the musical content. In summary, this study showed for the first time that simple and complex auditory phantoms might share a common neural substrate but differ as complex auditory phantoms are associated with activation in brain areas related to music and language processing. Copyright © 2013. Published by Elsevier Inc.
Mapping tonotopy in human auditory cortex.

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Tonotopy is arguably the most prominent organizational principle in the auditory pathway. Nevertheless, the layout of tonotopic maps in humans is still debated. We present neuroimaging data that robustly identify multiple tonotopic maps in the bilateral auditory cortex. In contrast with some earlier publications, tonotopic gradients were not found to be collinearly aligned along Heschl's gyrus; instead, two tonotopic maps ran diagonally across the anterior and posterior banks of Heschl's gyrus, set at a pronounced angle. On the basis of the direction of the tonotopic gradient, distinct subdivisions of the auditory cortex could be clearly demarcated that suggest homologies with the tonotopic organization in other primates. Finally, we applied our method to tinnitus patients to show that - contradictory to some pathophysiological models - tinnitus does not necessarily involve large-scale tonotopic reorganization. Overall, we expect that tonotopic mapping techniques will significantly enhance our ability to study the hierarchical functional organization of distinct auditory processing centers in the healthy and diseased human brain.

Brain activity and perception of gaze-modulated tinnitus.

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We studied the correspondence between brain activity and tinnitus in subjects with gaze-modulated tinnitus. These subjects are able to modulate their tinnitus by peripheral gaze of the eyes. This is a rare form of tinnitus that primarily occurs in subjects that underwent acoustic schwannoma surgery. The voluntary control of the tinnitus allows for a controlled experiment to study the perceptual characteristics of tinnitus and the corresponding brain activity as assessed by functional MRI. Eighteen subjects with gaze-modulated tinnitus participated in the study. The effect of gaze on tinnitus was diverse. Most commonly, the largest effect on tinnitus was observed for horizontal gaze toward the surgery side. When the loudness of tinnitus changed, it was usually an increase. In addition, changes of the pitch and apparent bandwidth of the tinnitus were reported. Peripheral gaze corresponded to increase of activity in the cochlear nucleus and inferior colliculus, a decrease of activity in the medial geniculate body, and a reduction of deactivation in the auditory cortex. The inhibition of the medial geniculate body in the thalamus contrasts with the excitation that is typically observed in response to external sound stimuli. It suggests that abnormal functioning of the thalamus plays a role in tinnitus.
'Is tinnitus accompanied by hemifacial spasm in normal-hearing patients also a type of hyperactive neurovascular compression syndrome? : A magnetoencephalography study.
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BACKGROUND: Traditionally, tinnitus accompanied by hemifacial spasm has been considered a type of hyperactive neurovascular compression syndrome that is similar to hemifacial spasm alone because of the anatomically close relationship between the facial nerve and cochlear nerve as well as the hyperactive clinical nature. METHODS: Participants were 29 subjects who presented with hemifacial spasm and neuroradiological evidence of vascular compression of the cranial (facial/cochlear) nerve. We used magnetoencephalography (MEG) to estimate the activity of the cochlear nerve in patients with and without tinnitus on the ipsilateral side. We compared the difference in the latency and the ratio of the equivalent current dipole (ECD) strength between the ipsilateral and contralateral sides of the spasm and tinnitus. RESULTS: Cochlear nerve activity in patients with tinnitus was increased with a shorter latency (p = 0.016) and stronger ECD strength (p = 0.028) compared with patients without tinnitus. CONCLUSION: The MEG results from normal-hearing patients who had tinnitus accompanied by hemifacial spasm suggest that the hyperactivity of the auditory central nervous system may be a crucial pathophysiological factor in the generation of tinnitus in these patients. The neurovascular compression that causes sensory input from the pathologic facial nerve activity may contribute to this hyperactivity of the central auditory nervous system. Free PMC Article.

Auditory evoked magnetic fields in individuals with tinnitus.
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Some forms of tinnitus are likely to be perceptual consequences of altered neural activity in the central auditory system triggered by damage to the auditory periphery. Animal studies report changes in the evoked responses after noise exposure or ototoxic drugs in inferior colliculus and auditory cortex. However, human electrophysiological evidence is rather equivocal: increased, reduced or no difference in N1/N1m evoked amplitudes and latencies in tinnitus participants have been reported. The present study used magnetoencephalography to seek evidence for altered evoked responses in people with tinnitus compared to controls (hearing loss matched and normal hearing) in four different stimulus categories (a control tone, a tone corresponding to the audiometric edge, to the dominant tinnitus pitch and a tone within the area of hearing loss). Results revealed that amplitudes of the evoked responses differed depending on the tone category. N1m amplitude to the dominant tinnitus pitch and the frequency within the area of hearing loss were reduced compared to the other two categories. Given that tinnitus pitch is typically within the area of hearing loss, the differences in the evoked responses pattern in tinnitus participants seem to be related more to the hearing loss than to the presence of tinnitus. Copyright © 2013 The Authors. Published by Elsevier B.V. All rights reserved.
Assessment of tonotopically organised subdivisions in human auditory cortex using volumetric and surface-based cortical alignments.
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Although orderly representations of sound frequency in the brain play a guiding role in the investigation of auditory processing, a rigorous statistical evaluation of cortical tonotopic maps has so far hardly been attempted. In this report, the group-level significance of local tonotopic gradients was assessed using mass-multivariate statistics. The existence of multiple fields on the superior surface of the temporal lobe in both hemispheres was shown. These fields were distinguishable on the basis of tonotopic gradient direction and may likely be identified with the human homologues of the core areas AI and R in primates. Moreover, an objective comparison was made between the usage of volumetric and surface-based registration methods. Although the surface-based method resulted in a better registration across subjects of the grey matter segment as a whole, the alignment of functional subdivisions within the cortical sheet did not appear to improve over volumetric methods. This suggests that the variable relationship between the structural and the functional characteristics of auditory cortex is a limiting factor that cannot be overcome by morphology-based registration techniques alone. Finally, to illustrate how the proposed approach may be used in clinical practice, the method was used to test for focal differences regarding the tonotopic arrangements in healthy controls and tinnitus patients. No significant differences were observed, suggesting that tinnitus does not necessarily require tonotopic reorganisation to occur. Hum Brain Mapp, 2013. © 2013 Wiley Periodicals, Inc. Copyright © 2013 Wiley Periodicals, Inc.

Pinpointing a Highly Specific Pathological Functional Connection That Turns Phantom Sound into Distress.
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It has been suggested that an auditory phantom percept is the result of multiple, parallel but overlapping networks. One of those networks encodes tinnitus loudness and is electrophysiologically separable from a nonspecific distress network. The present study investigates how these networks anatomic ally overlap, what networks are involved, and how and when these networks interact. Electroencephalography data of 317 tinnitus patients and 256 healthy subjects were analyzed, using independent component analysis. Results demonstrate that tinnitus is characterized by at least 2 major brain networks, each consisting of multiple independent components. One network reflects tinnitus distress, while another network reflects the loudness of the tinnitus. The component coherence analysis shows that the independent components that make up the distress and loudness networks communicate within their respective network at several discrete frequencies in parallel. The distress and loudness networks do not intercommunicate for patients without distress, but do when patients are distressed by their tinnitus. The obtained data demonstrate that the components that build up these 2 separable networks communicate at discrete frequencies within the network, and only between the distress and loudness networks in those patients in whom the symptoms are also clinically linked.

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Although hyperacusis, a hyperresponsiveness to non-noxious auditory stimuli, is a sound-evoked symptom, possible resting-state pathologic oscillations in hyperacusis brain have never been explored. By comparing 17 tinnitus participants with hyperacusis (T+H+) and 17 without hyperacusis (T+H-), we aimed to explore characteristic resting-state cortical activity of hyperacusis. The T+H+ and T+H- groups, strictly matched for all tinnitus sound characteristics to exclude tinnitus-related cortical changes, were compared using resting-state electroencephalography source-localized activity complemented by functional connectivity analyses. Correlation analysis revealed that hyperacusis questionnaire score was positively correlated with the orbitofrontal cortex (OFC) beta power, the right auditory cortex (AC) alpha1 power, and the dorsal anterior cingulate cortex (dACC) beta1 power. Compared to the T+H- group, the T+H+ group demonstrated increased beta power in the dACC and OFC, and increased alpha power in the right AC. Region of interest analyses including 17 normal controls further confirmed that these differences originated solely from relatively increased power of the T+H+ group, not from a relative power decrease of the T+H- group. Also, the T+H+ group showed increased connectivity between the OFC/dACC and the AC as compared to the T+H- group. The beta power increase in the OFC/dACC may indicate increased resting-state vigilance in tinnitus patients with hyperacusis. In addition, increased alpha power in the AC may reflect an adaptive top-down inhibition against sound stimuli probably mediated by the increased beta power of the OFC. The OFC/dACC, also frequently found to be activated in analogous diseases such as allodynia/hyperalgesia, may compose a hyperresponsiveness network.

V Pharmacotherapy

The Effect of Intratympanic Methylprednisolone and Gentamicin Injection on Meniere's Disease.


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ObjectivesTo compare the efficacy of intratympanic injections of methylprednisolone (ITMP) and intratympanic injections of gentamicin (ITG) to control the symptoms of Ménière's disease and to evaluate their effect on hearing level.Study DesignA historical cohort study.SettingTertiary referral center.Subjects and MethodsEighty-nine patients affected by Ménière's disease were included in this study, of whom 47 were treated with ITG and 42 were treated with ITMP. Two periods of follow-up were considered: 0 to 6 months and 6 to 12 months after the intratympanic injections (ITI). Mean outcome measurements consisted of control of vertigo attacks, tinnitus, and aural fullness; pure-tone average (PTA); and speech discrimination score (SDS).ResultsThe 2 groups had the same number of vertigo spells per month before ITI (P = .883). Six to 12 months after ITI, 82.9% of the ITG group and 48.1% of the ITMP group achieved complete control of vertigo (P = .004). There was better control of tinnitus and aural fullness with ITG than with ITMP (P ≤ .002). The 2 groups had a statistically significant difference in hearing level before ITI (P ≤ .001). This difference was no longer present 6 to 12 months after ITI (P > .05).ConclusionIntratympanic injections of gentamicin are more efficient than ITMP in controlling the symptoms of Ménière's disease. The 2 groups ended up without a difference in hearing level after ITI. According to these findings, administrating ITMP to control Ménière's disease seems to be less beneficial than ITG.
Drug delivery to the ear.

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Drug delivery to the ear is used to treat conditions of the middle and inner ear such as acute and chronic otitis media, Ménière’s disease, sensorineural hearing loss and tinnitus. Drugs used include antibiotics, antifungals, steroids, local anesthetics and neuroprotective agents. A literature review was conducted searching Medline (1966-2012), Embase (1988-2012), the Cochrane Library and Ovid (1966-2012), using search terms ‘drug delivery’, ‘middle ear’, ‘inner ear’ and ‘transtympanic’. There are numerous methods of drug delivery to the middle ear, which can be categorized as topical, systemic (intravenous), transtympanic and via the Eustachian tube. Localized treatments to the ear have the advantages of targeted drug delivery allowing higher therapeutic doses and minimizing systemic side effects. The ideal scenario would be a carrier system that could cross the intact tympanic membrane loaded with drugs or biochemical agents for the treatment of middle and inner ear conditions.

Intracranial dural arteriovenous fistulas: natural history and rationale for treatment with stereotactic radiosurgery.

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Dural arteriovenous fistulas (DAVs) are abnormal arteriovenous communications within the dura. The symptoms depend on their location and the pattern of the venous drainage. Patients with cavernous sinus DAVFs often present with ocular manifestations such as exophthalmos, chemosis and diplopia. Patients with transverse or sigmoid sinus DAVFs frequently experience headache and tinnitus on the affected side. DAVFs with anterograde sinus or cortical venous drainage (CVD) have been clinically regarded as benign, whereas DAVFs with retrograde CVD are considered aggressive in behavior. Similar to other cerebral arteriovenous malformations, DAVFs can hemorrhage, with an estimated annual risk of approximately 1.8%. The recommended therapeutic intervention for a DAVF is dependent on the anticipated natural history of the lesion. Management options include surgical resection, embolization and radiosurgery. Radiosurgical treatment has been used for DAVFs in various locations including the anterior cranial fossa, cavernous sinus, transverse/sigmoid sinus, superior sagittal sinus and tentorium. We present an update on 321 DAVF patients treated at the Taipei Veterans General Hospital using Gamma Knife radiosurgery. The prescribed mean margin dose was 17.2 Gy. In our series, 98% of patients had a stable or improved clinical condition after radiosurgery. Stereotactic radiosurgery using the Gamma Knife is a safe and effective alternative for the treatment of DAVFs. Copyright © 2013 S. Karger AG, Basel.
Tinnitus.

[No authors listed]

Around 10% of people experience subjective tinnitus (the perception of sound, only audible to the patient, in the absence of an external auditory stimulus).(1-3) It may be associated with hearing loss, anxiety, depression, sleep disturbance, concentration problems or reduced quality of life; for around 0.5% it is extremely disturbing.(1-4) Risk factors include aging, significant noise exposure, drug therapy (e.g. aminoglycosides, NSAIDs, diuretics), or disorders of the outer, middle or inner ear or auditory nerve (e.g. ear wax, infections, vestibular schwannoma, otosclerosis).(1,2,4) It may be due to excessive spontaneous activity in the auditory system and brain; if the signal (normally suppressed by the subconscious) becomes noticed it becomes more intrusive and annoying in a vicious cycle.(5) Here, we discuss symptomatic drug and non-drug treatments for subjective tinnitus in adults. We do not cover treatment of underlying causes of tinnitus.

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Tinnitus is a frequent condition without consistently effective remediation. Mr V. was a 64 year old man with Behcet’s disease, a generalized systemic relapsing vasculitis. Tinnitus appeared in 1998 and he had been both aware and distressed by his tinnitus 80% of his awake time. After his last colonoscopic examination, he mentioned a transient interruption of his tinnitus. Mr V. only received propofol, an anesthetic drug that selectively down-regulates glutamatergic synaptic transmission. Amantadine, another glutamate antagonist, was later prescribed and durably suppressed tinnitus. Systematically inquiry about post-anesthesia effects on tinnitus may help decide if amantadine may be tried on an individual basis. © The Author(s) 2013.

Effectiveness of Systemic High-Dose Dexamethasone Therapy for Idiopathic Sudden Sensorineural Hearing Loss.
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Objective: To evaluate the effectiveness of systemic high-dose dexamethasone therapy for sudden sensorineural hearing loss in comparison to the previous treatment regimen at our clinic with systemic prednisone 100 mg daily for 7 days analyzed in a previous study. Methods: We conducted a retrospective review of an electronic patient data base of 79 patients with idiopathic sudden sensorineural hearing loss. The standard treatment was orally applied dexamethasone (1st to 3rd day: 40 mg daily, 4th to 6th day: 10 mg daily) in an ambulant setting. The primary endpoint was change in hearing threshold from the initial audiogram to an audiogram at least 4 weeks later. Factors that were analyzed included patient's age, interval between onset of symptoms and start of treatment, presence or absence of dizziness and tinnitus, the audiogram pattern, severity of hearing loss and hearing in the opposite ear. Hearing gain was expressed either as absolute or relative hearing gain. Functionally relevant recovery of hearing was defined as the final pure-tone average (PTA) of 30 dB or less (or the same as the PTA of the opposite ear ± 10 dB). Furthermore, we calculated the percentage of patients with complete, partial and no recovery as defined in the recently published Clinical Practice Guideline of the American Academy of Otolaryngology - Head and Neck Surgery Foundation. We then compared our results with the previous treatment regimen carried out at our clinic. Results: The average initial PTA hearing loss in the affected ear compared to baseline PTA
of the unaffected ear was 51.5 ± 20.9 dB (mean ± SD). The mean absolute hearing gain was 44.4 ± 18.1 dB. The mean relative hearing gain was 86 ± 19%. Of the total, 87% had functionally relevant recovery of hearing. All of our patients showed partial (24%) or complete recovery (76%). No difference in recovery rate could be detected between patients with start of therapy within 24 h and patients with beginning of therapy within 7 days. We found a correlation between the severity of hearing loss and functionally relevant recovery. A mild hearing loss was noted in 34% of patients, with an average relative hearing gain of 89% and a functionally relevant recovery in 96% of them; the 9% of patients with initial deafness showed a mean relative hearing gain of 69% and a functionally relevant recovery in 43%. The audiogram pattern with low- or high-frequency hearing loss showed the best recovery rate; the poorest recovery rate was found in patients with initial deafness. Con-clusion: Application of high-dose orally applied dexamethasone seems to improve the recovery outcomes in comparison to prednisone 100 mg p.o. for 7 days. Copyright © 2013 S. Karger AG, Basel.

**Ginkgo biloba for tinnitus.**

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**BACKGROUND:** This is an update of a Cochrane review first published in The Cochrane Library in Issue 2, 2004 and previously updated in 2007 and 2009. Tinnitus can be described as the perception of sound in the absence of external acoustic stimulation. At present no specific therapy for tinnitus is acknowledged to be satisfactory in all patients. There are a number of reports in the literature suggesting that Ginkgo biloba may be effective in the management of tinnitus. However, there also appears to be a strong placebo effect in tinnitus management. **OBJECTIVES:** To assess the effect of Ginkgo biloba in patients who are troubled by tinnitus. **SEARCH METHODS:** We searched the Cochrane Ear, Nose and Throat Disorders Group Trials Register; the Cochrane Central Register of Controlled Trials (CENTRAL); PubMed; EMBASE; AMED; Web of Science; BIOSIS Previews; Cambridge Scientific Abstracts; ICTR and additional sources for published and unpublished trials. The date of the most recent search was 12 March 2012. **SELECTION CRITERIA:** Adults (18 years and over) complaining of tinnitus or adults with a primary complaint of cerebral insufficiency, where tinnitus forms part of the syndrome. **DATA COLLECTION AND ANALYSIS:** Both original authors independently extracted data and assessed trials for quality. For the 2012 update two authors determined trial eligibility, extracted data, analysed data and updated the contents of the review. **MAIN RESULTS:** Four trials with a total of 1543 participants were included in the review; we assessed all the included studies as having a low risk of bias. Three trials (1143 participants) included patients with a primary complaint of tinnitus and one (400 participants) included patients with mild to moderate dementia, some of whom had tinnitus. There was no evidence that Gingko biloba was effective in patients with a primary complaint of tinnitus. In the study of patients with dementia, mean baseline levels of tinnitus were low (1.7 to 2.5 on a 10-point subjective symptom rating scale). A small but statistically significant reduction of 1.5 and 0.7 points was seen in patients taking Gingko biloba with vascular dementia and Alzheimer's disease respectively. The practical clinical significance of this is unclear. The incidence of side effects was low. **AUTHORS' CONCLUSIONS:** The limited evidence does not demonstrate that Ginkgo biloba is effective for tinnitus when this is the primary complaint. Update of Cochrane Database Syst Rev. 2004;(2):CD003852.
Effects of C-phycocyanin and Spirulina on Salicylate-Induced Tinnitus, Expression of NMDA Receptor and Inflammatory Genes.

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Effects of C-phycocyanin (C-PC), the active component of Spirulina platensis water extract on the expressions of N-methyl D-aspartate receptor subunit 2B (NR2B), tumor necrosis factor-α (TNF-α), interleukin-1β (IL-1β), and cyclooxygenase type 2 (COX-2) genes in the cochlea and inferior colliculus (IC) of mice were evaluated after tinnitus was induced by intraperitoneal injection of salicylate. The results showed that 4-day salicylate treatment (unlike 4-day saline treatment) caused a significant increase in NR2B, TNF-α, and IL-1β mRNAs expression in the cochlea and IC. On the other hand, dietary supplementation with C-PC or Spirulina platensis water extract significantly reduced the salicylate-induced tinnitus and down-regulated the mRNAs expression of NR2B, TNF-α, IL-1β mRNAs, and COX-2 genes in the cochlea and IC of mice. The changes of protein expression levels were generally correlated with those of mRNAs expression levels in the IC for above genes. Free PMC Article.

Clinical Investigation on the Beneficial Effects of the Chinese Medicinal Herb Gushen Pian on Sensorineural Deafness and Tinnitus.

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The objective is to study the therapeutic effects of Gushen Pian on sensorineural deafness according to the Phase II clinical trial protocol, as approved for novel traditional Chinese medicines by Ministry of Health of PRC. This is a double blind study in which 120 patients were allocated randomly into treatment and control groups and an open treatment group (40 cases in each group). Patients in the treatment groups were administrated with Gushen Pian and controls received placebo. Routine examination of blood and urine, hepatic and renal function tests and pure tone audiometry were performed before and after treatment. Clinical symptoms and therapeutic outcomes were compared and evaluated. For double-blind treatment group, the total effective rate of deafness was 42.2 % and total relieved rate of deafness was 4.6 %; for double-blind control group, the total effective rate of deafness was 18.7 % and total relieved rate of deafness was 0 %; for simple treatment group, the total effective rate of deafness was 58.7 % and total relieved rate of deafness was 6.3 %. For double-blind treatment group, the total effective rate of tinnitus was 89.2 % and total relieved rate of tinnitus was 59.5 %; for double-blind control group, the total effective rate of tinnitus was 30.8 % and total relieved rate of tinnitus was 5.1 %; for simple treatment group, the total effective rate of tinnitus was 74.3 % and total relieved rate of tinnitus was 57.1 %. The double-blind treatment showed statistically significant differences from control group. The medication could effectively alleviate aural fullness, dizziness, lassitude of loins and knees, dysphoria with feverish sensation in chest, insomnia, and fatigue, etc. No adverse effect was reported during treatment; no abnormal results were reported in blood, urine, faces, heart function, liver function and kidney function examination. Gushen Pian had beneficial effect on deafness and tinnitus and could effectively alleviate aural fullness, insomnia, etc., without any adverse effects.
Intratympanic treatment for tinnitus: A review.

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Since the 1940s, various attempts have been made to treat peripheral tinnitus by way of intratympanic injection. This administration procedure requires only low concentrations of medication, thanks to the highly targeted delivery to the site of action and comes with minimal systemic exposure. While different compounds have been tested for their effects on tinnitus by intratympanic injection, there has been no breakthrough so far. Accordingly, the clinical use of intratympanic tinnitus treatments has remained limited to date. A more widespread adoption of this approach will require the development of specific medications for peripheral tinnitus, as well as proof of safety and efficacy, which would be determined from randomized controlled clinical trials.

Curculigo orchioides Protects Cisplatin-Induced Cell Damage.

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Cisplatin is commonly used as a chemotherapeutic agent against many human cancers. However, it generates reactive oxygen species (ROS) and has serious dose-limiting side effects, including ototoxicity. The roots of Curculigo orchioides (C. orchioides) have been used to treat auditory diseases such as tinnitus and hearing loss in Chinese traditional medicine. In the present study, we investigated the protective effects of an ethanol extract obtained from C. orchioides rhizome (COR) on cisplatin-induced cell damage in auditory cells (HEI-OC1). COR (2.5-25 μg/ml) inhibited cisplatin-induced HEI-OC1 cell damage in a dose-dependent manner. To investigate the protective mechanism of COR on cisplatin cytotoxicity in HEI-OC1 cells, we measured the effects of COR on ROS generation and lipid peroxidation in cisplatin-treated cells as well as its scavenging activities against superoxide radicals, hydroxyl radicals, hydrogen peroxide, and DPPH radicals. COR (1-25 μg/ml) had scavenging activities against superoxide radicals, hydroxyl radicals, hydrogen peroxide, and DPPH radicals, as well as reduced lipid peroxidation. In in vivo experiments, COR was shown to reduce cochlear and peripheral auditory function impairments through cisplatin-induced auditory damage in mice. These results indicate that COR protects from cisplatin-induced auditory damage by inhibiting lipid peroxidation and scavenging activities against free radicals.

Suppression of noise-induced hyperactivity in the dorsal cochlear nucleus following application of the cholinergic agonist, carbachol.
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Increased spontaneous firing (hyperactivity) is induced in fusiform cells of the dorsal cochlear nucleus (DCN) following intense sound exposure and is implicated as a possible neural correlate of noise-induced tinnitus. Previous studies have shown that in normal hearing animals, fusiform cell activity can be modulated by activation of parallel fibers, which represent the axons of granule cells. The modulation consists of a transient excitation followed by a more prolonged period of inhibition, presumably reflecting direct excitatory inputs to fusiform cells and an indirect inhibitory input to fusiform cells from the granule cell-cartwheel cell system. We hypothesized that since granule cells can be activated by cholinergic inputs, it might be possible to suppress tinnitus-related hyperactivity of fusiform cells using the cholinergic agonist, carbachol. To test
this hypothesis, we recorded multiunit spontaneous activity in the fusiform soma layer (FSL) of the DCN in control and tone-exposed hamsters (10kHz, 115dB SPL, 4h) before and after application of carbachol to the DCN surface. In both exposed and control animals, 100μM carbachol had a transient excitatory effect on spontaneous activity followed by a rapid weakening of activity to near or below normal levels. In exposed animals, the weakening of activity was powerful enough to completely abolish the hyperactivity induced by intense sound exposure. This suppressive effect was partially reversed by application of atropine and was not associated with significant changes in neural best frequencies (BF) or BF thresholds. These findings demonstrate that noise-induced hyperactivity can be pharmacologically controlled and raise the possibility that attenuation of tinnitus may be achievable by using an agonist of the cholinergic system. Copyright © 2013. Published by Elsevier B.V.

Pathogenic plasticity of Kv7.2/3 channel activity is essential for the induction of tinnitus.

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Tinnitus, the perception of phantom sound, is often a debilitating condition that affects many millions of people. Little is known, however, about the molecules that participate in the induction of tinnitus. In brain slices containing the dorsal cochlear nucleus, we reveal a tinnitus-specific increase in the spontaneous firing rate of principal neurons (hyperactivity). This hyperactivity is observed only in noise-exposed mice that develop tinnitus and only in the dorsal cochlear nucleus regions that are sensitive to high frequency sounds. We show that a reduction in Kv7.2/3 channel activity is essential for tinnitus induction and for the tinnitus-specific hyperactivity. This reduction is due to a shift in the voltage dependence of Kv7 channel activation to more positive voltages. Our in vivo studies demonstrate that a pharmacological manipulation that shifts the voltage dependence of Kv7 to more negative voltages prevents the development of tinnitus. Together, our studies provide an important link between the biophysical properties of the Kv7 channel and the generation of tinnitus. Moreover, our findings point to previously unknown biological targets for designing therapeutic drugs that may prevent the development of tinnitus in humans.

[An efficacy comparison of betahistin, trimetazidine and ginkgo biloba extract in patients with tinnitus]
[Article in Turkish]

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OBJECTIVES: This study aims to investigate the efficacy of trimetazidine, betahistine and ginkgo biloba extract in the treatment of tinnitus. PATIENTS AND METHODS: Complete clinical data of 90 patients (48 males, 42 females; mean age 52.3±15.1 years; range 20 to 61 years) who received betahistine, trimetazidine and ginkgo biloba extract for three months were retrospectively analyzed. The patients were divided into three groups including 30 in each group according to treatments received. Pre-treatment and post-treatment scores of tinnitus disability questionnaire were compared statistically. RESULTS: There was no statistically significant difference between pre-treatment scores of tinnitus disability questionnaire among all three groups (p>0.05), while there was a statistically significant difference among the groups following treatment (p=0.019, p<0.05). After a-three-month treatment, a decrease of 19.7±15.5 units in trimetazidine group, 12.2±12.7 units in betahistine group, and 3.80±5.9 units in ginkgo biloba extract group were found to be statistically significant, compared to the mean pretreatment tinnitus disability questionnaire scores (p=0.002, p<0.01). CONCLUSION: Our study results suggest that trimetazidine, betahistin and
ginkgo biloba extract reduce tinnitus symptoms. However, symptomatic relief can be mostly achieved with trimetazidine treatment.

**Intratympanic dexamethasone injection for refractory tinnitus: Prospective placebo-controlled study.**

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**OBJECTIVES/HYPOTHESIS:** The purpose of this study is to investigate the effectiveness of intratympanic dexamethasone injections (ITDI) for refractory tinnitus. **STUDY DESIGN:** A prospective, placebo-controlled, randomized, double-blind study. **METHODS:** Thirty patients with refractory tinnitus who were diagnosed in the Department of Otolaryngology, Ajou University Hospital, Suwon, Republic of Korea, between 2006 and 2007 were enrolled and then were assigned into two groups of ITDI (15 patients) or saline (15 patients) by permuted block randomization. Intratympanic injections were double-blind performed four times within 2 weeks. After 4 weeks, we analyzed the improvement and aggravation rates of tinnitus using the following parameters: questionnaires, tinnitus handicap index (THI), loudness matching test, frequency, and duration of tinnitus. **RESULTS:** The effectiveness rates of ITDI for refractory tinnitus reported in the tinnitus questionnaires, in the THI, and in the loudness matching test were all 33.3% in the steroid group, and 26.7%, 40.0%, and 26.7% in the saline group, respectively. However, there were no statistically significant differences in both groups. To analyze the therapeutic effect of ITDI on tinnitus under 6 months of its development, the improvement rates reported in the tinnitus questionnaires, in the THI, and in the loudness matching test were all 28.5% in the steroid group, and 40.0%, 40.0%, and 30.0% in the saline group, respectively. There were also no statistically significant differences in both groups. **CONCLUSIONS:** ITDI may not be effective for refractory tinnitus. The indication of ITDI for tinnitus needs to be limited to specific cases. **LEVEL OF EVIDENCE:** 1b. Laryngoscope, 2013. Copyright © 2013 The American Laryngological, Rhinological and Otological Society, Inc.

**Zinc to Treat Tinnitus in the Elderly: A Randomized Placebo Controlled Crossover Trial.**
Otol Neurotol. 2013 Apr 17. [Epub ahead of print]

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**OBJECTIVE:** Several reports suggest that zinc, which is involved in several neural transmissions systems throughout the auditory pathway, might help some tinnitus patients. However, previous studies used inadequate experimental designs. Therefore, we tested the effectiveness of zinc to reduce tinnitus. **STUDY DESIGN:** Randomized, prospective double-blind placebo-controlled design. **SETTING:** Tertiary referral center. **PATIENTS:** Tinnitus subjects older than 60 years, who are more likely to have a zinc deficiency. **INTERVENTION(S):** In Phase 1, 58 subjects were randomized to receive 50 mg of zinc per day for 4 months, and 58 subjects received a placebo. After a 1-month washout period, the 2 groups were crossed over to receive the alternative regime (Phase 2). **MAIN OUTCOME MEASURE:** Difference scores between before and after measures of the Tinnitus Handicap Questionnaire. Changes on the difference scores 20 or greater were considered as a statistically significant and, therefore, clinically meaningful improvement for THQ. **RESULTS:** Five percent (5 of 93 patients) had an improvement of 20 points or greater in THQ scores after zinc treatment, whereas 2% (2 of 94 patients) had an improvement of 20 or greater in THQ scores after placebo. The difference between 2 proportions is 5/93 - 2/94 = 0.03, the estimate of relative improvement is (5/93) / (2/94) = 2.53, with 95% confidence interval from 0.5 to 12.7. From chi-square independent test, there was no significant evidence that patients treated by zinc improved better than those treated by placebo (X2 (1) = 1.4, p > 0.05). The observed power in THQ for zinc is 0.16, and that for placebo is 0.06. **CONCLUSION:** Zinc is not an effective treatment for tinnitus in this subgroup of patients.
Auditive Stimulation


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Over the last three years of hearing aid dispensing, it was observed that among 74 subjects fitted with a linear octave frequency transposition (LOFT) hearing aid, 60 reported partial or complete tinnitus suppression during day and night, an effect still lasting after several months or years of daily use. We report in more details on 38 subjects from whom we obtained quantified measures of tinnitus suppression through visual analog scaling and several additional psychoacoustic and audiometric measures. The long-term suppression seems independent of subject age, and of duration and subjective localization of tinnitus. A small but significant correlation was found with audiogram losses but not with high frequency loss slope. Long-term tinnitus suppression was observed for different etiologies, but with a low success rate for sudden deafness. It should be noted that a majority of subjects (23) had a history of noise exposure. Tinnitus suppression started after a few days of LOFT hearing aid use and reached a maximum after a few weeks of daily use. For nine subjects different amounts of frequency shifting were tried and found more or less successful for long-term tinnitus suppression, no correlation was found with tinnitus pitch. When the use of the LOFT hearing aid was stopped tinnitus reappeared within a day, and after re-using the LOFT aid it disappeared again within a day. For about one third of the 38 subjects a classical amplification or a non linear frequency compression aid was also tried, and no such tinnitus suppression was observed. Besides improvements in audiometric sensitivity to high frequencies and in speech discrimination scores, LOFT can be considered as a remarkable opportunity to suppress tinnitus over a long time scale. From a pathophysiological viewpoint these observations seem to fit with a possible re-attribution of activity to previously deprived cerebral areas corresponding to high frequency coding. Free PMC Article.

[Examination of signals for tinnitus sound therapy : Effects of signal dynamics on sound acceptance and tinnitus masking.]
[Article in German]
HNO. 2012 Dec 29. [Epub ahead of print]

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BACKGROUND: In terms of sound acceptance and tinnitus-masking efficacy, tinnitus sound therapy appears to be more effective using dynamic natural sounds than static noise signals. The aim of this study was to systematically determine the effects of physical dynamics parameters on tinnitus masking and sound acceptance. MATERIALS AND METHODS: Based on a dynamic model, noise signals with different dynamic properties were synthesized and used to investigate minimal masking levels (MMLs) and spontaneous sound acceptance in six tinnitus patients. RESULTS: High signal dynamics resulted in high MMLs and low sound acceptance. In some instances, low signal dynamics gave rise to slightly lower MMLs than white noise. Despite unfavourable MMLs, natural dynamic sounds were better accepted than synthesized sounds with comparable dynamics. CONCLUSIONS: The higher spontaneous acceptance of natural sounds as compared to white noise appears not to be due solely to physical sound properties, but rather to result primarily from psychological factors. It may be possible to improve sound acceptance in tinnitus sound therapy by using signals with low amounts of dynamics and implementing the use of natural sounds.
Neural substrates predicting improvement of tinnitus after cochlear implantation in patients with single-sided deafness.


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Notwithstanding successful reduction of tinnitus after cochlear implantation (CI) in patients with single-sided deafness (SSD) in recent studies, neither the exact mechanism of suppression nor the predictors of the amount of improvement are fully understood yet. We collected quantitative electroencephalography (qEEG) data from nine SSD patients who underwent CI for tinnitus management. By correlating the degree of improvement in tinnitus intensity and tinnitus-related distress with preoperative source-localized qEEG findings and comparing qEEG findings of patients with marked improvement after CI with those with relatively slight improvement with regard to source-localized activity complimented by connectivity analysis, we attempted to find preoperative predictors of tinnitus improvement. Our results showed increased activities of the auditory cortex (AC), posterior cingulate cortex (PCC) and increased functional connectivity between the AC and PCC as negative prognostic factors for the reduction of tinnitus intensity after CI in patients with SSD. Also, relatively increased activity of the right dorsolateral prefrontal cortex and decreased connectivity between distress-related areas such as the orbitofrontal cortex/parahippocampus and sensory-perception areas such as the AC/precuneus were found in patients with relatively slight improvement in tinnitus-related distress as compared with those with marked improvement. The current study suggests that preoperative cortical oscillations can be applied to predict post-CI tinnitus reduction in patients with SSD. Copyright © 2013. Published by Elsevier B.V.

Impact of acoustic coordinated reset neuromodulation on effective connectivity in a neural network of phantom sound.


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Chronic subjective tinnitus is an auditory phantom phenomenon characterized by abnormal neuronal synchrony in the central auditory system. As recently shown in a proof of concept clinical trial, acoustic coordinated reset (CR) neuromodulation causes a significant relief of tinnitus symptoms combined with a significant decrease of pathological oscillatory activity in a network comprising auditory and non-auditory brain areas. The objective of the present study was to analyze whether CR therapy caused an alteration of the effective connectivity in a tinnitus related network of localized EEG brain sources. To determine which connections matter, in a first step, we considered a larger network of brain sources previously associated with tinnitus. To that network we applied a data-driven approach, combining empirical mode decomposition and partial directed coherence analysis, in patients with bilateral tinnitus before and after 12 weeks of CR therapy as well as in healthy controls. To increase the signal-to-noise ratio, we focused on the good responders, classified by a reliable-change-index (RCI). Prior to CR therapy and compared to the healthy controls, the good responders showed a significantly increased connectivity between the left primary cortex auditory cortex and the posterior cingulate cortex in the gamma and delta bands together with a significantly decreased effective connectivity between the right primary auditory cortex and the dorsolateral prefrontal cortex in the alpha band. Intriguingly, after 12 weeks of CR therapy most of the pathological interactions were gone, so that the connectivity patterns of good responders and healthy controls became statistically indistinguishable. In addition, we used dynamic causal modeling (DCM) to examine the types of interactions which were altered by CR therapy. Our DCM results show that CR
therapy specifically counteracted the imbalance of excitation and inhibition. CR significantly weakened the excitatory connection between posterior cingulate cortex and primary auditory cortex and significantly strengthened inhibitory connections between auditory cortices and the dorsolateral prefrontal cortex. The overall impact of CR therapy on the entire tinnitus-related network showed up as a qualitative transformation of its spectral response, in terms of a drastic change of the shape of its averaged transfer function. Based on our findings we hypothesize that CR therapy restores a silence based cognitive auditory comparator function of the posterior cingulate cortex. Copyright © 2013 Elsevier Inc. All rights reserved.

Cochlear implants in adults over 60: a study of communicative benefits and the impact on quality of life.
Cochlear Implants Int. 2013 Mar 18. [Epub ahead of print]


OBJECTIVES: Quantifying the improvement in quality of life (QoL) of cochlear implant (CI) patients over 60, its relation to audiometric benefits and the subjective impact on specific areas of life. METHODS: An observational retrospective study was conducted on 26 individuals (17 male and 9 female) older than 60, all implanted in our unit between 1 January 1999 and 31 January 2009. And 10 patients (5 male and 5 female) aged between 40 and 60 were the control group. A full postoperative audiological evaluation was completed. Sociodemographic characteristics and history of hearing loss were collected. To evaluate QoL benefits, the Glasgow Benefit Inventory test and the Specific Questionnaire were filled in. RESULTS: Patients in the test and control groups had similar preoperative speech recognition levels. Preoperative audiometric thresholds were significantly worse in patients from 40 to 60 years of age although they scored better in speech recognition after implantation. Patients experienced significant improvement in their QoL in all areas, especially in general health, while they experienced a smaller improvement in social interaction. Age, duration of deafness, and years wearing the processor were statistically related to QoL regardless of audiometric benefit. Unilateral CI users and patients without tinnitus obtain better QoL although no statistical relation was found. CONCLUSIONS: Cochlear implantation improves QoL of patients over 60 by the mere fact of having been implanted, regardless of poorer audiological benefits. Older patients, with long-term deafness experience a greater improvement in QoL after implantation. The results of this study should aid other centers when counseling patients on the expected, daily functional benefits of cochlear implantation.

The cochlear implant as a tinnitus treatment.

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INTRODUCTION AND OBJECTIVES: Tinnitus is a symptom of high prevalence in patients with cochlear pathology. We studied the evolution of tinnitus in patients undergoing unilateral cochlear implantation for treatment of profound hearing loss. METHODS: This was a longitudinal, retrospective study of patients that underwent unilateral cochlear implantation and who had bilateral tinnitus. Tinnitus was assessed quantitatively and qualitatively before surgery and at 6 and 12 months after surgery. RESULTS: We evaluated 20 patients that underwent unilateral cochlear implantation with a Nucleus® CI24RE Contour Advance™ electrode device. During the periods in which the device was in operation, improvement or disappearance of tinnitus was evidenced in the ipsilateral ear in 65% of patients, and in the contralateral ear in 50%. In periods in which the device was disconnected, improvement or disappearance of tinnitus was found in the ipsilateral ear in 50% of patients, and in the ear contralateral to the implant in 45% of the patients. In 10% of the patients, a new tinnitus appeared in the ipsilateral ear. CONCLUSIONS: The patients with profound hearing loss and bilateral tinnitus treated with unilateral cochlear implantation improved in a high percentage of cases, in the ipsilateral ear and in the contralateral ear. Copyright © 2012 Elsevier España, S.L. All rights reserved. Free Article.
Hearing Preservation after Cochlear Implantation: UNICAMP Outcomes.

de Carvalho GM, Guimaraes AC, Duarte AS, Muranaka EB, Soki MN, Martins RS, Bianchini WA, Paschoal JR, Castilho AM.

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Background. Electric-acoustic stimulation (EAS) is an excellent choice for people with residual hearing in low frequencies but not high frequencies and who derive insufficient benefit from hearing aids. For EAS to be effective, subjects' residual hearing must be preserved during cochlear implant (CI) surgery. Methods. We implanted 6 subjects with a CI. We used a special surgical technique and an electrode designed to be atraumatic. Subjects' rates of residual hearing preservation were measured 3 times postoperatively, lastly after at least a year of implant experience. Subjects' aided speech perception was tested pre- and postoperatively with a sentence test in quiet. Subjects' subjective responses assessed after a year of EAS or CI experience. Results. 4 subjects had total or partial residual hearing preservation; 2 subjects had total residual hearing loss. All subjects' hearing and speech perception benefited from cochlear implantation. CI diminished or eliminated tinnitus in all 4 subjects who had it preoperatively. 5 subjects reported great satisfaction with their new device. Conclusions. When we have more experience with our surgical technique we are confident we will be able to report increased rates of residual hearing preservation. Hopefully, our study will raise the profile of EAS in Brazil and Latin/South America.

Cochlear implantation for unilateral deafness with and without tinnitus: A case series.
Laryngoscope. 2013 Apr 2. doi: 10.1002/lary.23764. [Epub ahead of print]

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OBJECTIVES/HYPOTHESIS: To investigate cochlear implantation (CI) in patients with unilateral deafness with and without tinnitus. STUDY DESIGN: Prospective case series of patients undergoing cochlear implantation for unilateral deafness and tinnitus in a tertiary academic unit. METHODS: Nine postlingually deafened subjects with unilateral hearing loss, with and without tinnitus ipsilaterally, and functional hearing in the contralateral ear were implanted with a standard electrode. Speech perception in noise was tested using the Bamford-Kowal-Bench presented at 65 dB SPL. The Speech, Spatial, and Qualities (SSQ) of Hearing Scale was used to evaluate the subjective perception of hearing outcomes, and the Tinnitus Reaction Questionnaire assessed the effect on tinnitus. RESULTS: All patients were implanted with the Med-El Flex soft electrode, Innsbruck, Austria. They are regularly wearing the speech processor and find it beneficial in improving their ability to hear, particularly in noise. Decrease of tinnitus perception and an improvement of sound localization sounds were also reported by these patients. CONCLUSION: In our case series, CI was successful for all nine patients, with improvement of speech recognition in noise, self-perceived improvement of hearing, and for tinnitus control. Several factors such as deafness duration, age of deafness onset, the presence of residual hearing, patient motivation, and the rehabilitation intensity need to be further investigated in order to understand their impact on performance after implantation. LEVEL OF EVIDENCE: 4. Laryngoscope, 2012. Copyright © 2012 The American Laryngological, Rhinological and Otological Society, Inc.
Recent technological advances in sound-based approaches to tinnitus treatment: A review of efficacy considered against putative physiological mechanisms.
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The past decade has seen an escalating enthusiasm to comprehend chronic tinnitus from the perspective of both scientific understanding and clinical management. At the same time, there is a significant interest and commercial investment in providing targeted and individualized approaches to care, which incorporate novel sound-based technologies, with standard audiological and psychological strategies. Commercially produced sound-based devices for the tinnitus market include Co-ordinated Reset Neuromodulation®, Neuromonics®, Serenade®, and Widex® Zen. Additionally, experimental interventions such as those based on frequency-discrimination training are of current interest. Many of these interventions overtly claim to target the underlying neurological causes of tinnitus. Here, we briefly summarize current perspectives on the pathophysiology of tinnitus and evaluate claims made by the device supporters from a critical point of view. We provide an opinion on how future research in the field of individualized sound-based interventions might best provide a reliable evidence-base in this growing area of translational medicine.

Rationale for the tinnitus retraining therapy trial.
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The Tinnitus Retraining Therapy Trial (TRTT) is a National Institutes of Health-sponsored, multi-centered, placebo-controlled, randomized trial evaluating the efficacy of tinnitus retraining therapy (TRT) and its component parts, directive counseling and sound therapy, as treatments for subjective debilitating tinnitus in the military. The TRTT will enroll 228 individuals at an allocation ratio of 1:1:1 to: (1) directive counseling and sound therapy using conventional sound generators; (2) directive counseling and placebo sound generators; or (3) standard of care as administered in the military. Study centers include a Study Chair’s Office, a Data Coordinating Center, and six Military Clinical Centers with treatment and data collection standardized across all clinics. The primary outcome is change in Tinnitus Questionnaire (TQ) score assessed longitudinally at 3, 6, 12, and 18-month follow-up visits. Secondary outcomes include: Change in TQ sub-scales, Tinnitus Handicap Inventory, Tinnitus Functional Index, and TRT interview visual analog scale; audiometric and psychoacoustic measures; and change in quality of life. The TRTT will evaluate TRT efficacy by comparing TRT (directive counseling and conventional sound generators) with standard of care; directive counseling by comparing directive counseling plus placebo sound generators versus standard of care; and sound therapy by comparing conventional versus placebo sound generators. We hypothesize that full TRT will be more efficacious than standard of care, directive counseling and placebo sound generators more efficacious than standard of care, and conventional more efficacious than placebo sound generators in habituating the tinnitus awareness, annoyance, and impact on the study participant’s life.
The use of fractal tones in tinnitus patient management.

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A variety of noises have been employed for decades in an effort to facilitate habituation, mask, or suppress tinnitus. Many of these sounds have reportedly provided benefit, but success has not been universal. More recently, musical stimuli have been added as a sound therapy component. The potential advantages of using such stimuli, in particular fractal tones, in combination with amplification are discussed in this paper.

On the necessity of full length electrical cochlear stimulation to suppress severe tinnitus in single-sided deafness.

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BACKGROUND: Cochlear implantation (CI) has proven in long term prospective trials to reduce significantly incapacitating tinnitus in single sided deafness (SSD). Discussion arises whether electrical stimulation near the round window (RW) is also able to reduce tinnitus. AIM: to assess whether electrical stimulation of the basal first 4 intracochlear electrodes of a CI could sufficiently reduce tinnitus and to compare these results with stimulation with all CI electrodes. MATERIAL AND METHODS: 7 patients who met the criteria of severe tinnitus due to SSD were implanted with a Med-El Sonata Ti100 with a FlexSoftTM or Flex24TM electrode. After 4 weeks only the basal electrode pair (E12) nearest to the RW was activated. Each week the following pair was activated until the 4th pair. Thereafter all electrodes were activated. Tinnitus was assessed before CI surgery and before each electrode pair was activated. When all electrodes were fitted, evaluation was done after 1, 3 and 6 months. Tinnitus was assessed with Visual Analogue Scale (VAS) for loudness, psychoacoustic tinnitus loudness comparison at 1 kHz and Tinnitus Questionnaire (TQ) for the effect on quality of life. To evaluate the natural evolution, a tightly matched control group with severe tinnitus due to SSD was followed prospectively. RESULTS: All the tinnitus outcome measures remained unchanged with 1, 2, 3 or 4 activated electrode pairs. With complete CI activation, the tinnitus decreased significantly comparable with earlier reports. Pre-implantation the tinnitus loudness was 8.2/10 on the VAS and was reduced to 4.1/10 6 months postimplantation. Psychometrically the loudness level went from 21.7 dB SL (SD: 16.02) to 7.5 dB SL (SD: 5.24) and the TQ from 60/84 to 39/84. The non-implanted group had no decrease of the tinnitus, the average VAS remained stable at 8.9/10 throughout the follow-up period of 6 months. CONCLUSION: with the current stimulation parameters electrical stimulation in the first 8e10 mm of the basal part of the scala tympani is insufficient to reduce tinnitus. However, stimulation over the complete CI length yields immediate tinnitus reduction confirming earlier results.

Tinnitus in a single-sided deaf ear reduces speech reception in the nontinnitus ear.

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BACKGROUND: The influence of tinnitus on speech reception is under debate. A few previous studies addressed this issue and compared speech reception in groups with and without tinnitus, with tinnitus arising in both ears or in the same test ear. Recently, we demonstrated that loudness of tinnitus in single-
sided deafness (SSD) could be reduced dramatically by implanting and activating a cochlear implant (CI).

PURPOSE: The aim of the study was to evaluate whether changing the level of tinnitus in the SSD ear by disenabling or enabling the CI changes the speech reception in noise in the non-tinnitus ear. METHODS AND PATIENTS: Fifteen CI users (MED-EL multichannel) with SSD and incapacitating tinnitus participated. They had an initial score of 6 or greater out of 10 on the Visual Analogue Scale (VAS) and an average total score of 58.05 (standard deviation [SD], 13.68) on the Tinnitus Questionnaire. The outcome measure, speech reception threshold (SRT) in noise using an adaptive procedure was measured in the nontinnitus ear using insert earphones. The measurements were performed with a high tinnitus level and a low tinnitus level in the SSD ear, realized by switching the CI off or on. Tinnitus loudness was assessed on a VAS, and tinnitus loudness was also matched using an audiometer. RESULTS: Speech reception in noise is significantly worse in case of high tinnitus loudness. The mean difference in SRT in the nontinnitus ear between the 2 conditions (SRTCI off-SRTCI on) of the 15 subjects was 1.98 dB SNR (SD, 3.01 dB SNR). The mean tinnitus loudness on the VAS was 7.2 (SD, 2.6) in the CI-off condition. In the CI-on condition, the mean VAS score significantly declined to 3.4 (SD, 2.5). Also, the tinnitus loudness match improved from 22 dB SL (SD, 14.4 dB SL) to 10 dB SL (SD, 10.1 dB SL) in the CI-on condition. CONCLUSION: Unilateral tinnitus can significantly decrease speech reception in noise in the nontinnitus ear.

Desynchronization boost by non-uniform coordinated reset stimulation in ensembles of pulse-coupled neurons.

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Several brain diseases are characterized by abnormal neuronal synchronization. Desynchronization of abnormal neural synchrony is theoretically compelling because of the complex dynamical mechanisms involved. We here present a novel type of coordinated reset (CR) stimulation. CR means to deliver phase resetting stimuli at different neuronal sub-populations sequentially, i.e., at times equidistantly distributed in a stimulation cycle. This uniform timing pattern seems to be intuitive and actually applies to the neural network models used for the study of CR so far. CR resets the population to an unstable cluster state from where it passes through a desynchronized transient, eventually resynchronizing if left unperturbed. In contrast, we show that the optimal stimulation times are non-uniform. Using the model of weakly pulse-coupled neurons with phase response curves, we provide an approach that enables to determine optimal stimulation timing patterns that substantially maximize the desynchronized transient time following the application of CR stimulation. This approach includes an optimization search for clusters in a low-dimensional pulse coupled map. As a consequence, model-specific non-uniformly spaced cluster states cause considerably longer desynchronization transients. Intriguingly, such a desynchronization boost with non-uniform CR stimulation can already be achieved by only slight modifications of the uniform CR timing pattern. Our results suggest that the non-uniformness of the stimulation times can be a medically valuable parameter in the calibration procedure for CR stimulation, where the latter has successfully been used in clinical and pre-clinical studies for the treatment of Parkinson's disease and tinnitus. Free Article.
Would an endosteal CI-electrode make sense? Comparison of the auditory nerve excitability from different stimulation sites using ESRT measurements and mathematical models.
Eur Arch Otorhinolaryngol. 2013 May 9. [Epub ahead of print]


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Regarding potential endosteal cochlear implant electrodes, the primary goal of this paper is to compare different intra- and extra-cochlear stimulation sites in terms of current strengths needed for stimulating the auditory nerve. Our study was performed during routine cochlear implantation using needle electrodes for electric stimulation and by visually recording electrically elicited stapedius reflexes (ESRT) as a measure for the stimulus transfer. Of course this rather simple setup only allows rough estimations, which, however, may provide further arguments whether or not to proceed with the concept of an endosteal electrode. In addition, a mathematical model is being developed. In a pilot study, intra-operative electric stimuli were applied via a needle electrode commonly used for the promontory stimulation test. Thus, stapedius reflex thresholds (ESRTs), electrically elicited via the needle from different points inside and outside the cochlea served as indicators for the suitability of different electrode positions towards the modiolus. Tests were performed on 11 CI-recipients. In addition, the extension of electrical fields from different stimulation sites is simulated in a mathematical cochlea model. In most patients ESRT measurements could be performed and evaluated. Thus an "endosteal" stimulation seems possible, although the current intensities must be higher than at intraluminal stimulation sites. Moreover, our model calculations confirm that the extension of electric fields is less favourable with increasing distance from the electrode to the ganglion nerve cells. In terms of hearing, the concept of an endosteal electrode should only be promoted, if its superiority for hearing preservation can be proven, e.g. in animal experiments. However, for other indications like the electric suppression of tinnitus, further research seems advisable. Levels of evidence: N/A.

Intervention for restricted dynamic range and reduced sound tolerance: Clinical trial using a Tinnitus Retraining Therapy protocol for hyperacusis.

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Hyperacusis is the intolerance to sound levels that normally are judged acceptable to others. The presence of hyperacusis (diagnosed or undiagnosed) can be an important reason that some persons reject their hearing aids. Tinnitus Retraining Therapy (TRT), a treatment approach for debilitating tinnitus and hyperacusis, routinely gives rise to increased loudness discomfort levels (LDLs) and improved sound tolerance. TRT involves both counseling and the daily exposure to soft sound from bilateral noise generator devices (NGs). We implemented a randomized, double-blind, placebo-controlled clinical trial to assess the efficacy of TRT as an intervention for reduced sound tolerance in hearing-aid eligible persons with hyperacusis and/or restricted dynamic ranges. Subjects were assigned to one of four treatment groups (2x2): Devices: NGs or placebo NGs and Counseling: Yes or No. They were evaluated at least monthly on a variety of audiometric tests, including LDLs, the Contour Test for Loudness for tones and speech, and word recognition measured at each session's comfortable and loud levels. Eighty percentage of the participants who received full treatment benefited significantly; whereas the other treatment groups demonstrated ≤ 45% treatment efficacy. Treatment dynamics and examples of improved word recognition post-treatment will be described. [Work supported by NIH R01 DC04678.].
Acoustic correlates of tinnitus-like sounds.
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Although many people describe their tinnitus using complex terms (such as a tea-kettle, crickets, and roaring), past studies of tinnitus have focused using pure tones and noises as stimuli. Therefore, this study was developed to begin to address the usefulness of using complex, dynamic sounds in the assessment of tinnitus. In a previous study, a free-classification task was used to ascertain the perceptual dimensions of tinnitus-like sounds in normally hearing listeners. Sounds were representative of those commonly used to describe tinnitus (e.g., ringing, tonal, noisy, pulsing, and clicking sounds). Listeners placed icons associated with each sound on a grid and placed similar sounds in clusters. Multi-dimensional scaling conducted on the classification data revealed three different perceptual dimensions. This study evaluated the acoustics of the stimuli to determine the nature of the perceptual dimensions. These analyses estimated a variety of temporal and spectral stimulus properties (e.g., autocorrelation statistics, spectral statistics, envelope characteristics, etc.). The acoustic characteristics were then correlated with the ordering along the three perceptual dimensions. Results suggest a noisy versus tonal dimension, an envelope-based dimension stimulus (choppy versus smooth), and a dimension related to dynamic stimulus characteristics.

VII Brain Stimulation

Comparing immediate transient tinnitus suppression using tACS and tDCS: a placebo-controlled study.
Exp Brain Res. 2013 Jan 12. [Epub ahead of print]
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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. Two forms of low-intensity cranial electrical stimulation exist for clinical and research purposes: transcranial direct current stimulation (tDCS) and transcranial alternating current stimulation (tACS). In a recent study, it was demonstrated that a single session of tDCS over the dorsolateral prefrontal cortex (DLPFC) (anode over right DLPFC) yields a transient improvement in subjects with chronic tinnitus and that repeated sessions can possibly be used as a treatment. In the present study, the effect of a single-session individual alpha-modulated tACS and tDCS applied at the DLPFC bilaterally is compared with tinnitus loudness and tinnitus annoyance. A total of fifty tinnitus patients were selected and randomly assigned to the tACS or tDCS treatment. Our main result was that bifrontal tDCS modulates tinnitus annoyance and tinnitus loudness, whereas individual alpha-modulated tACS does not yield a similar result. This study provides additional insights into the role of DLPFC in tinnitus modulation as well as the intersection between tinnitus and affective/attentional processing.
rTMS Induced Tinnitus Relief Is Related to an Increase in Auditory Cortical Alpha Activity.

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Chronic tinnitus, the continuous perception of a phantom sound, is a highly prevalent audiological symptom. A promising approach for the treatment of tinnitus is repetitive transcranial magnetic stimulation (rTMS) as this directly affects tinnitus-related brain activity. Several studies indeed show tinnitus relief after rTMS, however effects are moderate and vary strongly across patients. This may be due to a lack of knowledge regarding how rTMS affects oscillatory activity in tinnitus sufferers and which modulations are associated with tinnitus relief. In the present study we examined the effects of five different stimulation protocols (including sham) by measuring tinnitus loudness and tinnitus-related brain activity with Magnetoencephalography before and after rTMS. Changes in oscillatory activity were analysed for the stimulated auditory cortex as well as for the entire brain regarding certain frequency bands of interest (delta, theta, alpha, gamma). In line with the literature the effects of rTMS on tinnitus loudness varied strongly across patients. This variability was also reflected in the rTMS effects on oscillatory activity. Importantly, strong reductions in tinnitus loudness were associated with increases in alpha power in the stimulated auditory cortex, while an unspecific decrease in gamma and alpha power, particularly in left frontal regions, was linked to an increase in tinnitus loudness. The identification of alpha power increase as main correlate for tinnitus reduction sheds further light on the pathophysiology of tinnitus. This will hopefully stimulate the development of more effective therapy approaches. Free Article.

The effect of rTMS on auditory processing in adults with chronic, bilateral tinnitus: A placebo-controlled pilot study.

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BACKGROUND: On the basis that tinnitus may result from neural hyperactivity in the auditory cortex, researchers have investigated the use of low frequency (1 Hz) repetitive transcranial magnetic stimulation (rTMS) as a potential modulator of this hyperactivity. While these investigations show promise, investigations to date have neglected to consider the possible effect of 1 Hz rTMS on other functions of the auditory cortex of these individuals, such as auditory processing. OBJECTIVE/HYPOTHESIS: This placebo-controlled pilot study aimed to determine whether 1 Hz rTMS applied to the primary auditory cortex (PAC), specifically Brodmann Area 41 (BA41), of adults with chronic, bilateral tinnitus would influence their auditory processing abilities. METHODS: Eight participants with bilateral, chronic tinnitus were randomized to receive a 10-day course of neuronavigationally guided active rTMS (n = 4) or placebo rTMS (n = 4) treatment applied to a focal region of the left PAC (BA41). Participants' auditory processing was measured using Time Compressed Reverberant Speech and three-pair Dichotic Digits (DD). Their tinnitus was measured using the Tinnitus Handicap Inventory (THI) and a psychoacoustic measure of tinnitus perception. All outcome measures were administered at baseline (1 week prior to rTMS), 1 week, 1, 2 and 3 months post-rTMS. RESULTS: All four participants in the active rTMS (A) group, and none of the participants in the sham (placebo) rTMS (S) group, showed improved auditory processing scores at multiple assessment points post-stimulation, with the group differences in median normalized gain scores reaching significance at the 5% level from 1 week or 1 month post-stimulation onwards. Three of the four participants in the active rTMS (A) group, and none of the participants in the sham rTMS (S) group, showed improved tinnitus scores at multiple assessment points post-stimulation, with some of the group differences in median normalized gain scores reaching significance at the 5% level. CONCLUSIONS: The results of this preliminary study suggest that 1 Hz rTMS applied to the PAC (BA41) has the capacity to improve both auditory processing and tinnitus perception in some adults with chronic, bilateral tinnitus. Copyright © 2013 Elsevier Inc. All rights reserved.
Combined rTMS to the auditory cortex and prefrontal cortex for tinnitus control in patients with depression: a pilot study.

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Conclusion: The study showed that combined repetitive transcranial magnetic stimulation (rTMS) on the auditory cortex and prefrontal cortex has more benefit than rTMS on the auditory cortex alone for tinnitus control in patients with depression. Further studies for the most optimal combination of stimulation on both areas are needed.

Objective: Recent studies suggest that the neuronal network changes of chronic tinnitus are beyond the auditory pathway. There is increasing evidences for the application of rTMS on multiple brain cortices in addition to the auditory cortex for the treatment of tinnitus. Sequential rTMS was performed on the auditory cortex alone as well as the auditory cortex combined with prefrontal cortex in patients with both chronic tinnitus and depression.

Methods: Patients who presented with chronic tinnitus of more than 1 year were enrolled in the present study (seven males, four females; mean age 54 years). To select the site for the rTMS, PET CT was performed. Patients received the first rTMS on the primary auditory cortex for 5 days and on the primary auditory cortex and prefrontal cortex in the second application after tinnitus relapse. The Tinnitus Handicap Inventory (THI), visual analog scale (VAS), and Beck Depression Inventory (BDI) were evaluated before and after rTMS.

Results: The mean THI score of the eight patients with depression changed from 77.5 ± 15 to 61.8 ± 20.1 after the second rTMS. There was statistical significance only for the second rTMS. The VAS score changed from 8.6 ± 1.6 to 6.3 ± 1.8 after the first rTMS and from 7.6 ± 2.4 to 4.6 ± 2.7 after the second rTMS, showing statistically significant changes both times. The THI changes after the second rTMS were greater than after the first rTMS, and the changes in VAS score showed a similar pattern. The changes in BDI score, which indicates the severity of depression, showed a variable pattern after rTMS. Patients with mild depression (10 ≤ BDI score <16, n = 4) showed significant improvement of THI with the second combined rTMS (ΔTHI = 24.5) as compared with the first rTMS on the auditory area (ΔTHI = 6). In contrast, combined rTMS did not show any better improvement on THI (ΔTHI = 6.5) than the first rTMS on the auditory cortex (ΔTHI = 7) in patients without depression (BDI <10, n = 3) and patients with moderate to severe depression (BDI ≥16, n = 4).

Repetitive transcranial magnetic stimulation as a treatment for chronic tinnitus: a critical review

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OBJECTIVE: Because chronic tinnitus is a condition that negatively impacts the quality of life for millions of people worldwide, a safe and effective treatment for tinnitus has been sought for decades. However, a true "cure" for the most common causes of tinnitus remains elusive. Repetitive transcranial magnetic stimulation (rTMS), a noninvasive procedure, has shown potential for reducing patients' perception or severity of tinnitus. This article provides background information about rTMS and reviews studies that investigated rTMS as a treatment for chronic tinnitus.

DATA SOURCES: PubMed and Medline databases (National Center for Biotechnology Information, U.S. National Library of Medicine) were searched for the terms repetitive transcranial magnetic stimulation, tinnitus, TMS, and rTMS in articles published from 1980 to 2012.

STUDY SELECTION: Articles included in this review were selected to represent a sampling of rTMS methodologies that have been used with tinnitus patients.

DATA EXTRACTION: Data extraction included sample size, TMS stimulation frequency, TMS stimulation intensity, number of pulses administered per session, number of TMS sessions, and method of tinnitus assessment.

Data Synthesis: Because of the heterogeneity of the studies reviewed, most of which had small populations of subjects, it was not appropriate to perform a meta-analysis. A systematic review of the literature was conducted to summarize and critique published research results.

CONCLUSION: Although optimism for the clinical use of rTMS
as an effective treatment for tinnitus remains high among many researchers, clinicians, and patients, several key questions and procedural issues remain unresolved. Suggestions for improving rTMS research protocols are described and discussed. (C) 2013 Otology & Neurotology, Inc.

**Impact of acoustic coordinated reset neuromodulation on effective connectivity in a neural network of phantom sound.**


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Chronic subjective tinnitus is an auditory phantom phenomenon characterized by abnormal neuronal synchrony in the central auditory system. As recently shown in a proof of concept clinical trial, acoustic coordinated reset (CR) neuromodulation causes a significant relief of tinnitus symptoms combined with a significant decrease of pathological oscillatory activity in a network comprising auditory and non-auditory brain areas. The objective of the present study was to analyze whether CR therapy caused an alteration of the effective connectivity in a tinnitus related network of localized EEG brain sources. To determine which connections matter, in a first step, we considered a larger network of brain sources previously associated with tinnitus. To that network we applied a data-driven approach, combining empirical mode decomposition and partial directed coherence analysis, in patients with bilateral tinnitus before and after 12 weeks of CR therapy as well as in healthy controls. To increase the signal-to-noise ratio, we focused on the good responders, classified by a reliable-change-index (RCI). Prior to CR therapy and compared to the healthy controls, the good responders showed a significantly increased connectivity between the left primary cortex auditory cortex and the posterior cingulate cortex in the gamma and delta bands together with a significantly decreased effective connectivity between the right primary auditory cortex and the dorsolateral prefrontal cortex in the alpha band. Intriguingly, after 12 weeks of CR therapy most of the pathological interactions were gone, so that the connectivity patterns of good responders and healthy controls became statistically indistinguishable. In addition, we used dynamic causal modeling (DCM) to examine the types of interactions which were altered by CR therapy. Our DCM results show that CR therapy specifically counteracted the imbalance of excitation and inhibition. CR significantly weakened the excitatory connection between posterior cingulate cortex and primary auditory cortex and significantly strengthened inhibitory connections between auditory cortices and the dorsolateral prefrontal cortex. The overall impact of CR therapy on the entire tinnitus-related network showed up as a qualitative transformation of its spectral response, in terms of a drastic change of the shape of its averaged transfer function. Based on our findings we hypothesize that CR therapy restores a silence based cognitive auditory comparator function of the posterior cingulate cortex. Copyright © 2013 Elsevier Inc. All rights reserved.
The Effects of Neurofeedback on Oscillatory Processes Related to Tinnitus.
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Although widely used, no proof exists for the feasibility of neurofeedback for reinstating the disordered excitatory-inhibitory balance, marked by a decrease in auditory alpha power, in tinnitus patients. The current study scrutinizes the ability of neurofeedback to focally increase alpha power in auditory areas in comparison to the more common rTMS. Resting-state MEG was measured before and after neurofeedback (n = 8) and rTMS (n = 9) intervention respectively. Source level power and functional connectivity were analyzed with a focus on the alpha band. Only neurofeedback produced a significant decrease in tinnitus symptoms and-more important for the context of the study-a spatially circumscribed increase in alpha power in right auditory regions. Connectivity analysis revealed higher outgoing connectivity in a region ultimately neighboring the area in which power increases were observed. Neurofeedback decreases tinnitus symptoms and increases alpha power in a spatially circumscribed manner. In addition, compared to a more established brain stimulation-based intervention, neurofeedback is a promising approach to renormalize the excitatory-inhibitory imbalance putatively underlying tinnitus. This study is the first to demonstrate the feasibility of focally enhancing alpha activity in tinnitus patients by means of neurofeedback.

Cortico-cortical modulation induced by 1-Hz repetitive transcranial magnetic stimulation of the temporal cortex.


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BACKGROUND AND PURPOSE: Repetitive transcranial magnetic stimulation (rTMS) has potential as a noninvasive neuromodulation treatment method for various neuropsychiatric disorders, and repeated sessions of rTMS are more likely to enhance the therapeutic efficacy. This study investigated neurophysiologic and spatiodynamic changes induced by repeated 1-Hz rTMS of the temporal cortex using transcranial magnetic stimulation (TMS) indices and fluorodeoxyglucose positron emission tomography (FDG-PET). METHODS: Twenty-seven healthy subjects underwent daily 1-Hz active or sham rTMS of the right temporal cortex for 5 consecutive days. TMS indices of motor cortical excitability were measured in both hemispheres daily before and after each rTMS session, and 2 weeks after the last stimulation. FDG-PET was performed at baseline and after the 5 days of rTMS sessions. RESULTS: All subjects tolerated all of the sessions well, with only three of them (11.1%) reporting mild transient side effects (i.e., headache, tinnitus, or local irritation). One-Hz rTMS decreased motor evoked potential amplitudes and delayed cortical silent periods in the stimulated hemisphere. Statistical parametric mapping of FDG-PET data revealed a focal reduction of glucose metabolism in the stimulated temporal area and an increase in the bilateral precentral, ipsilateral superior and middle frontal, prefrontal and cingulate gyri. CONCLUSIONS: Repeated rTMS sessions for 5 consecutive days were tolerated in all subjects, with only occasional minor side effects. Focal 1-Hz rTMS of the temporal cortex induces cortico-cortical modulation with widespread functional changes in brain neural networks via long-range neural connections. Free PMC Article.
Low-frequency repetitive transcranial magnetic stimulation to the temporoparietal junction for tinnitus: four-week stimulation trial.
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IMPORTANCE: This research examines the impact of 4 weeks of repetitive transcranial magnetic stimulation (rTMS) stimulation to the temporoparietal junction and compares the results of this longer duration of treatment with a similar stimulus protocol of only 2 weeks’ duration. OBJECTIVE: To examine the effectiveness and safety of 4 weeks of low-frequency rTMS to the left temporoparietal junction in a cohort of patients with bothersome tinnitus. DESIGN: Crossover, double-blind, randomized controlled trial. SETTING: Outpatient academic medical center. PARTICIPANTS: The study population comprised 14 adults aged between 22 and 59 years with subjective, unilateral or bilateral, nonpulsatile tinnitus of 6 months' duration or greater and a score of 34 or greater on the Tinnitus Handicap Inventory (THI). INTERVENTIONS: Low-frequency (1 Hz) 110% motor threshold rTMS or sham to the left temporoparietal junction for 4 weeks. MAIN OUTCOME AND MEASURE: The difference of the change in the THI score between active rTMS and sham rTMS. RESULTS: Active treatment was associated with a median reduction in THI score of 10 (range, -20 to +4) points, and sham treatment was associated with a median reduction of 6 (range, -24 to +12) points. The median difference in THI score between the change associated with active and sham rTMS was 4 (95% CI, -9 to 10; and range, -32 to +14) points. CONCLUSIONS AND RELEVANCE: Daily low-frequency active rTMS to the left temporoparietal junction area for 4 weeks was no more effective than sham for patients with chronic bothersome tinnitus. Possible explanations for this negative study include the failure of rTMS to stimulate deeper parts of auditory cortex within the sylvian fissure and more widespread cortical network changes not amenable to localized rTMS effects. TRIAL REGISTRATION: clinicaltrials.gov Identifier: NCT00567892.

VIII Behavioral Therapy

The role of catastrophizing in recent onset tinnitus: Its nature and association with tinnitus distress and medical utilization.
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Objective: Persistent tinnitus affects 10 to 15% of adults. Little is understood about why only a small percentage of patients become severely affected. Catastrophic thinking has been suggested as one potentially relevant factor that might influence a patient's coping behavior, and thus tinnitus habituation. The current study investigates the concept of tinnitus catastrophizing and its relation with distress and medical utilization in recent onset tinnitus. Design: Participants were administered a survey assessing catastrophizing, tinnitus distress, medical utilization, coping, and mood disturbance. Regression analyses investigated the nature of tinnitus catastrophizing and its contributions to distress and health care utilization. Study sample: 278 subjects with tinnitus for less than six months were recruited from Ear-Nose-Throat units, through the internet, and newspaper articles. Results: Controlling for background variables, high subjective tinnitus loudness, low behavioral coping, and depressive symptoms were significantly associated with tinnitus catastrophizing. Furthermore, greater tinnitus catastrophizing was related to higher distress and more frequent medical visits. Conclusions: Tinnitus catastrophizing appears to be pivotal already at an early stage of tinnitus experience. Addressing catastrophizing by specific prevention and intervention programs might reduce the development of distress and medical utilization in the long term. Longitudinal studies are required to clarify cause-effect relations.
Standardized tinnitus-specific individual cognitive-behavioral therapy: A controlled outcome study with 286 tinnitus patients.


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BACKGROUND: Pharmacological treatment of tinnitus cannot be considered well established. Thus, reducing tinnitus severity through behavioral therapy is emerging as a key goal. METHODS: A total of 286 patients suffering from persistent and stable tinnitus for four months or longer participated in this controlled clinical multicenter study. The study investigated the efficacy and safety of a standardized treatment involving individual cognitive-behavioral therapy (CBT). Controls were 120 patients waiting to be treated. Therapy was standardized using manualized procedures within the setting of a specifically designed disease management program. The primary outcome measure was the tinnitus change score using an 8-point numeric verbal rating scale. Secondary outcome measures were tinnitus severity as determined by the tinnitus questionnaire score as well as the tinnitus loudness score and the tinnitus annoyance score using 6- and 8-point numeric verbal rating scales, respectively. Following a significant multivariate rank test, these four validated outcome measures were tested in the order given. RESULTS: The primary outcome measure, tinnitus change score, showed an efficacy of treatment with an odds ratio of 3.4 (95% confidence interval, 2.6-4.5). Of the treated patients, 84% showed a tinnitus change score improvement, but only 22% of controls did. The secondary outcome measures of tinnitus questionnaire score, loudness score, and annoyance score improved in the treatment group significantly more than in the control group. In the therapy group, the tinnitus questionnaire score was reduced by 50% from a median of 27 to 13.5; in the control group, no change in median tinnitus questionnaire score was observed. The multivariate endpoint of the primary and secondary outcome measures differed significantly (P < 0.0001) between treatment and control groups. The same was true when univariate scores were considered. CONCLUSIONS: A structured tinnitus-specific CBT using standardized tinnitus-specific interventions can be an effective individual therapy for the treatment of patients suffering from tinnitus for at least 4 months. The trial was registered at the ClinicalTrials.gov registry (ID: NCT 00719940). Copyright © 2012. Published by Elsevier B.V.

Learning from tinnitus patients' narratives-A case study in the psychodynamic approach.


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Tinnitus is assumed to be the perception of sound that results exclusively from activity within the nervous system without any external stimulation. Approximately 1-2% of the population regard their tinnitus as a serious threat towards their quality of life. The way the patients describe their suffering varies, sometimes also depending on the interest and insight of the clinician to whom they turn to for help. The lack of insightful narratives of someone who is severely annoyed by the presence of a constant tinnitus sound may lead to limited and biased models of tinnitus suffering. In the present case study the participating patient, a woman aged 70, shared her experience of being victimized by tinnitus with the clinician/researcher during a number of psychotherapeutic sessions. The psychodynamic, narrative approach, made it possible for the client to articulate the unique and specific meaning that she experienced as being part of her suffering. In her words, tinnitus became a tolerable symptom that she managed to work through within psychotherapeutic alliance. Free full text.
Internet-Based Cognitive Behaviour Therapy for Tinnitus Patients Delivered in a Regular Clinical Setting: Outcome and Analysis of Treatment Dropout.

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Cognitive behaviour therapy (CBT) can reduce tinnitus distress but is not available for most patients. Therapist guided, internet-based CBT (ICBT) increase availability and has been shown to be effective. However, the initial positive results need to be replicated in larger samples, and treatment dropout has not been thoroughly studied. Moreover, it has not been evaluated if a low-intensity version of ICBT without therapist contact could be an alternative for patients who do not need or are able to manage the full ICBT-program. This study evaluated two parallel interventions delivered in regular care: ICBT for tinnitus distress (n = 293) and a low-intensity version of ICBT (n = 81) for patients with lower levels of tinnitus distress. We also explored predictors of dropout from ICBT and if dropout influences outcome. Tinnitus Reaction Questionnaire (Wilson, Henry, Bowen, & Haralambous, 1991) was used as the primary outcome. Secondary outcomes were measures of depression, anxiety, sleep, and sound sensitivity. Significant reductions following ICBT were found on all measures after treatment and also at a three-month follow-up. Patients receiving low-intensity ICBT showed a significant reduction in distress, even when they had low levels of distress initially. Treatment dropout was preceded by an increase in days spent at each treatment step but not by an increased distress. Early dropout was related to worse outcome. ICBT can be used in a regular clinical setting to reduce tinnitus distress. Early dropouts may need additional management. For help-seeking patients with lower distress, a low-intensity version of ICBT can be used.

Rationale for the tinnitus retraining therapy trial.


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The Tinnitus Retraining Therapy Trial (TRTT) is a National Institutes of Health-sponsored, multi-centered, placebo-controlled, randomized trial evaluating the efficacy of tinnitus retraining therapy (TRT) and its component parts, directive counseling and sound therapy, as treatments for subjective debilitating tinnitus in the military. The TRTT will enroll 228 individuals at an allocation ratio of 1:1:1 to: (1) directive counseling and sound therapy using conventional sound generators; (2) directive counseling and placebo sound generators; or (3) standard of care as administered in the military. Study centers include a Study Chair's Office, a Data Coordinating Center, and six Military Clinical Centers with treatment and data collection standardized across all clinics. The primary outcome is change in Tinnitus Questionnaire (TQ) score assessed longitudinally at 3, 6, 12, and 18-month follow-up visits. Secondary outcomes include: Change in TQ sub-scales, Tinnitus Handicap Inventory, Tinnitus Functional Index, and TRT interview visual analog scale; audiometric and psychoacoustic measures; and change in quality of life. The TRTT will evaluate TRT efficacy by comparing TRT (directive counseling and conventional sound generators) with standard of care; directive counseling by comparing directive counseling plus placebo sound generators versus standard of care; and sound therapy by comparing conventional versus placebo sound generators. We hypothesize that full TRT will be more efficacious than standard of care, directive counseling and placebo sound generators more efficacious than standard of care, and conventional more efficacious than placebo sound generators in habituating the tinnitus awareness, annoyance, and impact on the study participant's life.
Dynamic reconfiguration of human brain functional networks through neurofeedback.

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Recent fMRI studies demonstrated that functional connectivity is altered following cognitive tasks (e.g., learning) or due to various neurological disorders. We tested whether real-time fMRI-based neurofeedback can be a tool to voluntarily reconfigure brain network interactions. To disentangle learning-related from regulation-related effects, we first trained participants to voluntarily regulate activity in the auditory cortex (training phase) and subsequently asked participants to exert learned voluntary self-regulation in the absence of feedback (transfer phase without learning). Using independent component analysis (ICA), we found network reconfigurations (increases in functional network connectivity) during the neurofeedback training phase between the auditory target region and (1) the auditory pathway; (2) visual regions related to visual feedback processing; (3) insula related to introspection and self-regulation and (4) working memory and high-level visual attention areas related to cognitive effort. Interestingly, the auditory target region was identified as the hub of the reconfigured functional networks without a-priori assumptions. During the transfer phase, we again found specific functional connectivity reconfiguration between auditory and attention network confirming the specific effect of self-regulation on functional connectivity. Functional connectivity to working memory related networks was no longer altered consistent with the absent demand on working memory. We demonstrate that neurofeedback learning is mediated by widespread changes in functional connectivity. In contrast, applying learned self-regulation involves more limited and specific network changes in an auditory setup intended as a model for tinnitus. Hence, neurofeedback training might be used to promote recovery from neurological disorders that are linked to abnormal patterns of brain connectivity. Copyright © 2013 Elsevier Inc. All rights reserved.

Costs of suppressing emotional sound and countereffects of a mindfulness induction: an experimental analog of tinnitus impact.

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Tinnitus is the experience of sounds without an appropriate external auditory source. These auditory sensations are intertwined with emotional and attentional processing. Drawing on theories of mental control, we predicted that suppressing an affectively negative sound mimicking the psychoacoustic features of tinnitus would result in decreased persistence in a mentally challenging task (mental arithmetic) that required participants to ignore the same sound, but that receiving a mindfulness exercise would reduce this effect. Normal hearing participants (N=119) were instructed to suppress an affectively negative sound under cognitive load or were given no such instructions. Next, participants received either a mindfulness induction or an attention control task. Finally, all participants worked with mental arithmetic while exposed to the same sound. The length of time participants could persist in the second task served as the dependent variable. As hypothesized, results indicated that an auditory suppression rationale reduced time of persistence relative to no such rationale, and that a mindfulness induction counteracted this detrimental effect. The study may offer new insights into the mechanisms involved in the development of tinnitus interference. Implications are also discussed in the broader context of attention control strategies and the effects of emotional sound on task performance. The ironic processes of mental control may have an analog in the experience of sounds. Free PMC Article.
Intervention for restricted dynamic range and reduced sound tolerance: Clinical trial using a Tinnitus Retraining Therapy protocol for hyperacusis.

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Hyperacusis is the intolerance to sound levels that normally are judged acceptable to others. The presence of hyperacusis (diagnosed or undiagnosed) can be an important reason that some persons reject their hearing aids. Tinnitus Retraining Therapy (TRT), a treatment approach for debilitating tinnitus and hyperacusis, routinely gives rise to increased loudness discomfort levels (LDLs) and improved sound tolerance. TRT involves both counseling and the daily exposure to soft sound from bilateral noise generator devices (NGs). We implemented a randomized, double-blind, placebo-controlled clinical trial to assess the efficacy of TRT as an intervention for reduced sound tolerance in hearing-aid eligible persons with hyperacusis and/or restricted dynamic ranges. Subjects were assigned to one of four treatment groups (2x2): Devices: NGs or placebo NGs and Counseling: Yes or No. They were evaluated at least monthly on a variety of audiometric tests, including LDLs, the Contour Test for Loudness for tones and speech, and word recognition measured at each session's comfortable and loud levels. Eighty percentage of the participants who received full treatment benefited significantly; whereas the other treatment groups demonstrated ≤ 45% treatment efficacy. Treatment dynamics and examples of improved word recognition post-treatment will be described. [Work supported by NIH R01 DC04678.].

Inspiration from Bertram Scharf's work.

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In 1990, Bertram Scharf and I discussed about me doing a post doc in his laboratory. The opportunity to work with Bertram did not materialize, but his work in loudness, efferents, and attention has been a continuing inspiration not only for my own research but also for auditory perception, physiology, and audio engineering in general. For example, a Google Scholar search of "Bertram Scharf" on November 8, 2012, produced 1517 citations for his top 10 papers, with 6 on loudness and critical bands, 2 on efferents, and 2 on attention. Here I highlight two recent projects that have been inspired by Scharf's work. The first project showed significant loudness adaptation in patients with auditory neuropathy, particularly those with otoferlin deficits. This result directly supports Scharf's proposition that simple loudness adaptation is due to a sensory process, which in this case can be pinned down to transmitter release and replenishment in the hair cell and nerve synapse. The second project extended Scharf's theoretical work in efferents and attention to improving feedback control in cochlear implant users and tinnitus sufferers. This line of work could improve cochlear implant speech perception in noise and reduce internal gain to alleviate tinnitus.
The concept of acceptance has recently received growing attention within tinnitus research due to the fact that tinnitus acceptance is one of the major targets of psychotherapeutic treatments. Accordingly, acceptance-based treatments will most likely be increasingly offered to tinnitus patients and assessments of acceptance-related behaviours will thus be needed. The current study investigated the factorial structure of the Tinnitus Acceptance Questionnaire (TAQ) and the role of tinnitus acceptance as mediating link between sound perception (i.e. subjective loudness of tinnitus) and tinnitus distress. In total, 424 patients with chronic tinnitus completed the TAQ and validated measures of tinnitus distress, anxiety, and depression online. Confirmatory factor analysis provided support to a good fit of the data to the hypothesised bifactor model (root-mean-square-error of approximation = .065; Comparative Fit Index = .974; Tucker-Lewis Index = .958; standardised root mean square residual = .032). In addition, mediation analysis, using a non-parametric joint coefficient approach, revealed that tinnitus-specific acceptance partially mediated the relation between subjective tinnitus loudness and tinnitus distress (path ab = 5.96; 95% CI: 4.49, 7.69). In a multiple mediator model, tinnitus acceptance had a significantly stronger indirect effect than anxiety. The results confirm the factorial structure of the TAQ and suggest the importance of a general acceptance factor that contributes important unique variance beyond that of the first-order factors activity engagement and tinnitus suppression. Tinnitus acceptance as measured with the TAQ is proposed to be a key construct in tinnitus research and should be further implemented into treatment concepts to reduce tinnitus distress.

A systematic review of internet-based self-help therapeutic interventions to improve distress and disease-control among adults with chronic health conditions.

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The evidence base of internet-based self-help interventions has been rapidly growing for mental health conditions over the past decade. However, to date a systematic review of the application of this technology to chronic health conditions has not been reported. The objective of the present review was to therefore critically appraise the research on the efficacy of internet self-help interventions for distress and disease outcomes in adults with physical health complaints. Electronic searches were conducted in Embase, CINAHL, MEDLINE and PsychINFO, and reference lists were examined. Twenty four studies met inclusion criteria, covering 8 health conditions. Across health conditions, consistent evidence was obtained that online therapeutic interventions were efficacious in improving disease-symptoms and control, with the exception of diabetes. Mixed evidence was obtained for distress outcomes: 3 health conditions demonstrated consistent benefit (irritable bowel syndrome, tinnitus, and one heterogeneous chronic illness population); one condition obtained moderate support (chronic pain); while results were not promising for diabetes. The limited research conducted among epilepsy, cancer, and chronic fatigue precluded conclusions from being drawn. Few studies met all methodological quality criteria. This review demonstrates that internet-based self-help interventions hold guarded promise in the amelioration of distress and disease-control, and further research implications are discussed. Crown Copyright © 2013. Published by Elsevier Ltd. All rights reserved.
The influence of psychological factors on tinnitus severity.

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OBJECTIVE: Subjective tinnitus is a frequent symptom characterized by perception of sound in the absence of a corresponding external stimulus. Although many people learn to live with tinnitus, some find it severely debilitating. Why tinnitus is debilitating in some patients, but not in others, is still incompletely understood. We aimed to assess the influence of different aspects of psychological distress on perceived tinnitus severity.

METHODS: Three hundred seventeen patients diagnosed with chronic subjective tinnitus at two university clinics completed the Tinnitus Handicap Inventory (THI), the Tinnitus Questionnaire (TQ) and the Symptom Check List-90-Revised. The influence of the different dimensions of psychological distress on perceived tinnitus severity was statistically evaluated.

RESULTS: Both THI and TQ scores were significantly influenced by gender, site and the dimension "depression". In addition, TQ scores were significantly influenced by age and "somatization," whereas "hostility" had an impact on THI scores only.

CONCLUSION: Psychological aspects as well as sociodemographic variables had a significant influence on both TQ scores. However, our results indicate, that these scales reflect emotional distress of tinnitus sufferers differently. This should be taken into consideration in the use of these scales as screening tools for assessment of tinnitus handicap. Copyright © 2013. Published by Elsevier Inc.

IX Somatic Tinnitus

[Efficacy of myofascial trigger point deactivation for tinnitus control].
[Article in Portuguese]

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Chronic pain in areas surrounding the ear may influence tinnitus. OBJECTIVE: To investigate the efficacy of myofascial trigger point deactivation for the relief of tinnitus.

METHOD: A double-blind randomized clinical trial enrolled 71 patients with tinnitus and myofascial pain syndrome. The experimental group (n = 37) underwent 10 sessions of myofascial trigger point deactivation and the control group (n = 34), 10 sessions with sham deactivation.

RESULTS: Treatment of the experimental group was effective for tinnitus relief (p < 0.001). Pain and tinnitus relieves were associated (p = 0.013), so were the ear with worst tinnitus and the side of the body with more pain (p < 0.001). The presence of temporary tinnitus modulation (increase or decrease) upon initial muscle palpation was frequent in both groups, but its temporary decrease was related to the persistent relief at the end of treatment (p = 0.002). CONCLUSION: Besides medical and audiological investigation, patients with tinnitus should also be checked for: 1) presence of myofascial pain surrounding the ear; 2) laterality between both symptoms; 3) initial decrease of tinnitus during muscle palpation. Treating this specific subgroup of tinnitus patients with myofascial trigger point release may provide better results than others described so far. Free full text.
Self-reported aural symptoms, headache and temporomandibular disorders in Japanese young adults.
BMC Musculoskelet Disord. 2013 Feb 6;14(1):58. [Epub ahead of print]


BACKGROUND: To investigate the associations of aural symptoms, headache and depression with the presence of temporomandibular disorder (TMD) symptoms in a young adult population in Japan. METHODS: A personal interview survey was conducted on first-year university students (n = 1,930) regarding symptoms of TMD, aural problems, headache, shoulder pain and depression. Logistic regression was applied to assess the associations of these problems with the presence of TMD symptoms after controlling for age and gender. RESULTS: Among the 1,930 students, 543 students exhibited TMD symptoms and were classified into 7 groups: clicking only (Group I, n = 319), pain in the TMJ only (Group II, n = 21), difficulty in mouth opening only (Group III, n = 18), clicking and pain (Group IV, n = 29), clicking and difficulty in mouth opening (Group V, n = 48), difficulty in mouth opening and pain (Group VI, n = 11), and combination of three symptoms (Group VII, n = 97). The control group (n = 1,387) were subjects without any TMD symptoms. After adjusting for age and gender, a strong association was observed between TMD symptoms (Group II and IV) and tinnitus (OR = 12.1 and 13.2, respectively). TMD symptoms (Group I, II and III) were also associated with vertigo and headache. Otalgia and depression were significantly associated with the presence of clicking only. CONCLUSIONS: TMD symptoms were significantly correlated to aural symptoms and headache. A functional evaluation of the stomatognathic system should be considered in subjects with unexplained aural symptoms and headache. Free Article.

Anterior and medial angulations of the styloid process in subjects with TMD: clinical and radiographic findings.

Mazzetto MO, Andrade KM, Magri LV, Rodrigues CA, Watanabe PC.

This study investigated the existence of association between the angulation of the styloid process on the anterior and medial directions with the intensity of temporomandibular dysfunction (TMD) symptoms. Fifty patients (8 men and 42 women) aged 25 to 70 years, with relevant TMD symptoms were evaluated. Clinical examinations were performed to determine the severity of TMD symptoms (orofacial pain, headache, tinnitus and dizziness) based on the RDC/TMD criteria and the visual analogue scale (VAS), and digital radiographic images of the styloid process were obtained: lateral cephalometric skull radiograph (analysis of anterior angulation) and posteroanterior skull radiograph (reverse Towne’s projection) (analysis of medial angulation). The anterior angulation average of the styloid process was 20.89° while the medial angulation average was 19.1° in the right side and 19.04° in the left side. There was no statistically significant difference among the patient groups (severe, moderate and mild symptoms) associating the TMD symptoms and the anterior or medial angulation of the styloid process (p>0.05). There was no correlation between the intensity of the TMD symptoms and the measurements of anterior and medial angulation of the styloid process using either lateral cephalometric or posteroanterior radiographs (reverse Towne's projection). Free Article.
X Surgical Treatment

Intracranial dural arteriovenous fistulas: natural history and rationale for treatment with stereotactic radiosurgery.
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Dural arteriovenous fistulas (DAVFs) are abnormal arteriovenous communications within the dura. The symptoms depend on their location and the pattern of the venous drainage. Patients with cavernous sinus DAVFs often present with ocular manifestations such as exophthalmos, chemosis and diplopia. Patients with transverse or sigmoid sinus DAVFs frequently experience headache and tinnitus on the affected side. DAVFs with anterograde sinus or cortical venous drainage (CVD) have been clinically regarded as benign, whereas DAVFs with retrograde CVD are considered aggressive in behavior. Similar to other cerebral arteriovenous malformations, DAVFs can hemorrhage, with an estimated annual risk of approximately 1.8%. The recommended therapeutic intervention for a DAVF is dependent on the anticipated natural history of the lesion. Management options include surgical resection, embolization and radiosurgery. Radiosurgical treatment has been used for DAVFs in various locations including the anterior cranial fossa, cavernous sinus, transverse/sigmoid sinus, superior sagittal sinus and tentorium. We present an update on 321 DAVF patients treated at the Taipei Veterans General Hospital using Gamma Knife radiosurgery. The prescribed mean margin dose was 17.2 Gy. In our series, 98% of patients had a stable or improved clinical condition after radiosurgery. Stereotactic radiosurgery using the Gamma Knife is a safe and effective alternative for the treatment of DAVFs. Copyright © 2013 S. Karger AG, Basel.

Treatment outcomes of intracranial dural arteriovenous fistulas of the transverse and sigmoid sinuses from a single institute in Asia.
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Intracranial dural arteriovenous fistulas (DAVFs) of the transverse and sigmoid sinuses (TSS) are rare in Asian populations. This study sought to evaluate the treatment outcomes of intracranial TSS DAVFs at a single Asian institute. Between 1989 and 2007, 122 patients presented to the Seoul National University Hospital with intracranial DAVFs; we performed a retrospective analysis of the 38 patients (31.1%) with TSS DAVFs. The common clinical presentations were headache (44.7%), tinnitus (39.5%), and intracranial hemorrhage (26.3%), and 71.1% had Borden type II or III lesions. Two patients were conservatively managed, two underwent surgery, and 34 were treated endovascularly with transarterial embolization (TAE), transvenous embolization (TVE), or both. The complete occlusion rate immediately after treatment was 50%. Of the 31 patients (81.6%) who underwent follow-up angiography, initial complete occlusion was achieved in 51.6%, and, at the last follow-up, the complete occlusion rate was 64.5%, with the surgery and TVE groups achieving 100% occlusion. The clinical cure rate was 34.2%, and 86.8% of patients had a favorable clinical outcome. However, all patients in both the surgery and TVE groups achieved a favorable clinical outcome. Four (26.7%) of 15 lesions with initially partial embolization showed delayed occlusion. Five patients (13.2%) exhibited clinical or angiographic signs of recurrence, and five patients had permanent complications. TSS DAVFs were less common than cavernous sinus DAVFs, unlike in Western countries, but the angiographic and clinical characteristics of TSS DAVFs were similar to those in Western countries. TSS DAVFs were successfully managed with different modalities, but both surgery and TVE were superior to conservative management or TAE. Copyright © 2012 Elsevier Ltd. All rights reserved.
Intracranial dural arteriovenous fistulas: natural history and rationale for treatment with stereotactic radiosurgery.

Pan DH, Wu HM, Kuo YH, Chung WY, Lee CC, Guo WY.

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Dural arteriovenous fistulas (DAVFs) are abnormal arteriovenous communications within the dura. The symptoms depend on their location and the pattern of the venous drainage. Patients with cavernous sinus DAVFs often present with ocular manifestations such as exophthalmos, chemosis and diplopia. Patients with transverse or sigmoid sinus DAVFs frequently experience headache and tinnitus on the affected side. DAVFs with anterograde sinus or cortical venous drainage (CVD) have been clinically regarded as benign, whereas DAVFs with retrograde CVD are considered aggressive in behavior. Similar to other cerebral arteriovenous malformations, DAVFs can hemorrhage, with an estimated annual risk of approximately 1.8%.

The recommended therapeutic intervention for a DAVF is dependent on the anticipated natural history of the lesion. Management options include surgical resection, embolization and radiosurgery. Radiosurgical treatment has been used for DAVFs in various locations including the anterior cranial fossa, cavernous sinus, transverse/sigmoid sinus, superior sagittal sinus and tentorium. We present an update on 321 DAVF patients treated at the Taipei Veterans General Hospital using Gamma Knife radiosurgery. The prescribed mean margin dose was 17.2 Gy. In our series, 98% of patients had a stable or improved clinical condition after radiosurgery. Stereotactic radiosurgery using the Gamma Knife is a safe and effective alternative for the treatment of DAVFs. Copyright © 2013 S. Karger AG, Basel.

Surgical treatment of hemifacial spasm with zone-4 offending vessel.
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BACKGROUND: Increasing evidence shows that vascular compression on any of the four zones of facial nerve may cause hemifacial spasms. Vascular compression on zone 4 (the cisternal portion) of the nerve is quite common, but only a very small percentage of such compression will elicit hemifacial spasm, because zone 4 is less susceptible than zone 3 (the root exit zone). Therefore, it seems difficult for the neurosurgeons to distinguish the real culprit vessels in zone 4. Here, our experience in treating vascular compression located in zone 4 of the facial nerve is reported. METHODS: Twelve patients of HFS due to compression of zone 4 were treated with microvascular decompression (MVD) surgery with the aid of combined monitoring of abnormal muscle response (AMR) and Z-L response (ZLR). RESULTS: All of the 12 patients had a zone 4 compression. In addition, there were vascular compressions on zone 3 (the root exit zone) and/or zone 2 (the attached segment) in six cases. AMR was absent in two cases, unstable in one case, and persisted after vascular decompression in another one case. ZLR was stable before decompression of zone 4 and disappeared after decompression in all cases. After MVD surgery, 11 patients were cured and one patient achieved good resolution of spasm. One patient had postoperative transient tinnitus. CONCLUSIONS: The neurosurgeon should not ignore vascular compression at zone 4, especially when compressions at zones 2 and 3 co-exist. With the aid of AMR and ZLR, we are able to judge whether offending vessels exist at zone 4.
Surgery is the most effective method of improving hearing in patients with otosclerosis. The level of improvement depends on the stage of the disease and the chosen surgical method. THE AIM OF THIS STUDY: is to present hearing results in patients treated surgically by means of different types of prostheses and methods of vestibule sealing. MATERIAL AND METHODS: 230 cases (160 men, 70 women) between the age of 21 and 64 (median 36 years) treated for the first time in the Department of Otolaryngology of Medical University in Gdańsk underwent epidemiologic and clinical analysis. The researches took into account the level of hearing improvement based on the reduced air-bone reserve for frequencies 0.5, 1.0, 2.0 i 4.0 kHz in groups with where prostheses type 1 and 2 were used. RESULTS: 230 stapedotomies were performed. In 110 patients prosthesis type 1 was used (PTFE) and in 120 type 2 (piston PTFE with platinum tape). Each vestibule was sealed with homogenic fat tissue or fibrin sponge. After 6 weeks from the operation the air-bone reserve was reduced by 5 to 30 dB, the reserve existed after one year from the operation in some patients. 35% of the patients presented with vertigo after the operation and 5% with tinnitus. CONCLUSIONS: Stapedotomy is a method of hearing improvement in patients with otosclerosis. Best results are achieved when prosthesis type 2 is used and homogenic fat tissue serves to seal the vestibule. Broad opening of the vestibule may be the cause for vertigo and lack of hearing improvement occurrence. Copyright © 2012 Polish Otolaryngology Society. Published by Elsevier Urban & Partner Sp. z.o.o. All rights reserved.


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From the Departments of Neurology (M.S.), Clinical Neurosciences (T.B.), and Neurosurgery (J.C.T.), University Hospital Munich, Campus Grosshadern, Munich; and the German Clinic of Diagnostics (S.v.S.-B.), Wiesbaden, Germany.

A 55-year-old man reported having recurrent spontaneous attacks of rotatory vertigo lasting 1-5 seconds and occurring up to 10 times daily and often associated with attacks of right ear tinnitus for more than 3 years. Caloric testing showed a right peripheral vestibular deficit. Cervical vestibular myogenic potentials showed impaired function of the right saccule. An audiogram was normal. MRI (figure, A and B) showed that the eighth nerve was in contact with the anterior inferior cerebellar artery. Vestibular paroxysmia was diagnosed.(1,2) Carbamazepine resolved the symptoms but the patient discontinued it due to side effects. The symptoms recurred, and surgery was performed. Intraoperatively, compression of the eighth nerve was found (figure, C and D). He has has had no further symptoms and takes no medication. These findings support the view that vascular compression of the root entry zone of the eighth cranial nerve can cause vestibular paroxysmia.
Effect of previous botulinum neurotoxin treatment on microvascular decompression for hemifacial spasm.

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Object The objective of this study was to investigate the clinical characteristics, intraoperative findings, complications, and outcomes after the first microvascular decompression (MVD) in patients with and without previous botulinum neurotoxin treatment for hemifacial spasm (HFS). Methods The authors analyzed 246 MVDs performed at the University of Pittsburgh Medical Center between January 1, 2000, and December 31, 2007. One hundred and seventy-six patients with HFS underwent botulinum neurotoxin injection treatment prior to first MVD (Group I), and 70 patients underwent their first MVD without previous botulinum neurotoxin treatment (Group II). Clinical outcome data were obtained immediately after the operation, at discharge, and at follow-up. Follow-up data were collected from 177 patients with a minimum follow-up period of 9 months (mean 54.48 ± 27.84 months). Results In 246 patients, 89.4% experienced immediate postoperative relief of spasm, 91.1% experienced relief at discharge, and 92.7% experienced relief at follow-up. There was no significant difference in outcomes and complications between Group I and Group II (p > 0.05). Preoperatively, patients in Group I had higher rates of facial weakness, tinnitus, tonus, and platysmal involvement as compared with Group II (p < 0.05). The posterior inferior cerebellar artery and vertebral artery were intraoperatively identified as the offending vessels in cases of vasculature compression in a significantly greater number of patients in Group II compared with Group I (p = 0.008 and p = 0.005, respectively, for each vessel). The lateral spread response (LSR) disappeared in 60.48% of the patients in Group I as compared with 74.19% in Group II (p > 0.05). No significant differences in complications were noted between the 2 groups. Conclusions Microvascular decompression is an effective and safe procedure for patients with HFS previously treated using botulinum neurotoxin. Intraoperative monitoring with LSR is an effective tool for evaluating adequate decompression.

Surgery for Ménière's disease.

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BACKGROUND: This is an update of a Cochrane review first published in The Cochrane Library in Issue 1, 2010. Ménière's disease is characterised by three major symptoms: vertigo, deafness, and tinnitus or aural fullness, all of which are discontinuous and variable in intensity. A number of surgical modalities, of varying levels of invasiveness, have been developed to reduce the symptoms of Ménière's disease, but it is not clear whether or not these are effective. OBJECTIVES: To assess the effectiveness of surgical options for the treatment of Ménière's disease. All surgical interventions used in the treatment of Ménière's disease, either to alter the natural history of the disease or to abolish vestibular function, were considered for this review. SEARCH METHODS: We searched the Cochrane Ear, Nose and Throat Disorders Group Trials Register; the Cochrane Central Register of Controlled Trials (CENTRAL); PubMed; EMBASE; CINAHL; Web of Science; BIOSIS Previews; Cambridge Scientific Abstracts; ITRP and additional sources for published and unpublished trials. The date of the most recent search was 7 November 2012. SELECTION CRITERIA: Randomised or quasi-randomised controlled studies of a surgical modality versus a placebo therapy in Ménière's disease. DATA COLLECTION AND ANALYSIS: Two authors independently assessed trial quality and extracted data. We contacted study authors for further information. MAIN RESULTS: The only surgical intervention which has been evaluated in randomised controlled trials and met the inclusion criteria was endolymphatic sac surgery. We identified two randomised trials, involving a total of 59 patients; one comparing endolymphatic sac surgery with ventilation tubes and one with simple mastoidectomy. Neither study reported any beneficial effect of surgery either in comparison to placebo surgery or grommet...
Disappeared Pulsatile Tinnitus Related to Petrous Segment Stenosis of the ICA after Relief of the Stenosis by Stenting.

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Pulsatile tinnitus may result from turbulent flow within the internal carotid artery (ICA). Atherosclerotic carotid stenosis is a rare but well-known cause of pulsatile tinnitus. The classical treatment was endarterectomy or ligation for proximal ICA disease or stenting for distal ICA lesions. Endovascular techniques offer new ways to treat atherosclerotic vascular stenosis lesions. We describe two cases of pulsatile tinnitus caused by stenosis within the petrous segment of the ICA and treated by stent-assisted angioplasty.

Outcome of translabyrinthine surgery for vestibular schwannoma in neurofibromatosis type 2.
Br J Neurosurg. 2013 Mar 8. [Epub ahead of print]

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Objectives. To analyse the long-term outcome of translabyrinthine surgery for vestibular schwannoma (VS) in neurofibromatosis type 2 (NF2). Research type. Retrospective cohort study. Setting. Two tertiary referral NF2 units. Patients. One hundred and forty eight translabyrinthine operations for patients with VS were performed. Preoperative stereotactic radiotherapy had been performed on 12(9.4%) patients. Results. Mean tumour size was 3.1 cm. Total tumour excision was achieved in 66% of cases, capsular remnants were left in 24% of cases, and subtotal excision was achieved in 5% and partial removal was achieved in 5%. The radiological residual/recurrence rate was 13.9%. The perioperative mortality was 1.6%. At 2 years postoperatively, facial function was expressed in terms of House-Brackmann score (HB): HB 1 in 53.4%, HB 1/2 in 61.3%, HB 1-3 in 83.2% and HB 4-6 in 16.8%. All nine patients who underwent surgery following failed stereotactic radiotherapy had HB 3 function or better. Among 9.5% of the cases, 14 facial nerves were lost during surgery and repaired using direct anastomosis or grafting. There was no tinnitus present preoperatively in 27% of the cases, and 22% of patients developed tinnitus postoperatively. In patients with preoperative tinnitus, 61% remained the same, 17% got it resolved and only in 21% it worsened. The preoperative hydrocephalus rate was 26%, and among 15% of the cases five ventriculo-peritoneal (VP) shunts were performed. The cerebrospinal fluid leak rate was 2.5%. Fifty-six patients underwent auditory brainstem implantation (ABI) and two patients had cochlear implant (CI) sleepers inserted. Conclusions. The management of patients with NF2 presents the clinician with a formidable challenge with many patients still presenting themselves late with the neurological compromise and a large tumour load. There is still an argument for the management by observation until the neurological compromise dictates interventional treatment particularly with the option of hearing rehabilitation with ABI or CI. The translabyrinthine approach provides a very satisfactory means of reducing the overall tumour volume.
Visual and Neurological Outcomes Following Endovascular Stenting for Pseudotumor Cerebri Associated With Transverse Sinus Stenosis.
Radvany MG, Solomon D, Nijjar S, Subramanian PS, Miller NR, Rigamonti D, Blitz A, Gailloud P, Moghekar A.

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BACKGROUND:: Pseudotumor cerebri (PTC) is characterized by raised intracranial pressure (ICP) without an identifiable mass, evidence of hydrocephalus, or abnormal cerebrospinal fluid content. In the past, most cases of PTC appeared to have no identifiable etiology, and thus, they were classified as “idiopathic intracranial hypertension” (IIH). Recently, however, a subset of patients with presumed IIH has been found to have evidence of cerebral dural sinus stenoses, particularly involving one or both transverse sinuses (TS). The belief that the stenoses are the cause, rather than an effect of the increased ICP, has led investigators to recommend stenting of the stenosed sinus for the treatment of the condition. We describe detailed visual and neurological outcomes after stenting for PTC associated with hemodynamically significant dural sinus stenosis.

METHODS:: All patients with PTC had initial neurological, neuro-ophthalmological, and imaging assessments. Regardless of the findings, all were treated with medical therapy. If medical therapy failed and TS stenosis was detected on contrast-enhanced magnetic resonance or computed tomographic venography, catheter cerebral angiography with venous manometry was performed. If a mean pressure gradient (MPG) of 4 mm Hg or greater was present, unilateral transverse sinus stenting was performed.

RESULTS:: Twelve patients with PTC and TS stenosis associated with an MPG of >4 mm Hg who failed medical therapy were identified. TS stenting significantly decreased the pressure gradient in all cases. Unilateral stenting was sufficient to reduce pressure gradients even when the stenosis was bilateral. At a mean follow-up of 16 months (range, 9-36 months), tinnitus had improved in all patients, and 10 of 12 patients had improvement in visual function. Seven patients had significant improvement in headaches.

CONCLUSION:: In this small series of patients with PTC associated with TS stenosis, endovascular stent placement was generally effective in treating visual dysfunction and tinnitus, although not headaches. The optimum gradient and vascular characteristics amenable for selection of patients for stenting needs further research.

Outcome of management of otosclerosis by stapedotomy compared to stapedectomy in a jordanian population.
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OBJECTIVE: To study the success results rates and complications of stapedotomy compared to stapedectomy in the operative management of otosclerosis. METHODS: This is a retrospective study of 50 patients who were treated surgically for otosclerosis. The medical records of these patients were reviewed for the type of operation performed, complications and the serial pure tune audiometries pre- and postoperatively for at least one year. Patients with conductive hearing loss not due to otosclerosis were excluded from this study. The medical records of equal number of patients (25 patients with stapedotomy and 25 patients with stapedectomy) were analyzed for hearing improvement or loss, postoperative nausea, vomiting, vertigo, nystagmus, perilymph fistula, reparative granuloma, labyrinthitis, tinnitus and perforation of the tympanic membrane. All operations were performed by the senior consultan-otologists of our department. Stapes superstructures were removed by crural scissors and stapes footplate was perforated by microdrill. RESULTS: Out of 25 patients with stapedotomy, 22 (88%) developed complete closure (≤10 dB) of the air-bone gap on pure tune audiometry; in two patients (8%), the air-bone gap improved to less
20 dB, and recurrent conductive hearing loss (due piston slipping) in one patient (4%). On the other hand, in patients with stapedectomy, only 16 patients (64%) developed complete closure of the air-bone gap (≤10 dB) on pure tune audiometry, and in four patients (16%) the air-bone gap improved to less 20 dB, while recurrent conductive hearing loss occured in three patients (12%), one patient developed complete sensorineural hearing loss (4%), there was one case of fluctuating hearing loss due to reparative granuloma (4%), perilymph fistula was reported in one case (4%) and no cases of facial palsy or perforation of the tympanic membrane were recorded. CONCLUSION: The results of this study clearly show that stapedotomy gives better hearing results and fewer complications than stapedectomy. Free PMC Article.

Improving outcomes in patients with vestibular schwannomas: microsurgery versus radiosurgery.
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Vestibular schwannomas (VSs) account for 6% of all intracranial tumors. Historically, VSs have been treated with microsurgery (MS); however, stereotactic radiosurgery (SRS) has emerged as a viable alternative. This review seeks to compare the tumor control rates, functional outcomes, and costs associated with these two modalities. A focused review of the published literature (1966-2012) was conducted comparing outcomes between MS and SRS in those with VS. Outcomes of interest included hearing preservation, facial nerve preservation, tumor control, and cost-effectiveness. Three level 2 studies, eight level 3 studies, and several level 4 studies were reviewed and assessed. Evidence from level 2 studies show that SRS (40-68%) results in higher rates of serviceable hearing compared to MS (0-5%), and higher rates of facial nerve preservation are likewise seen after SRS (98-100%) compared to MS (66-83%) in patients with tumors <3 cm in size. Complications vary as expected by treatment modality, with CSF leak, tinnitus, and trigeminal symptoms being among the most common complications following MS. Hydrocephalus, tinnitus, and trigeminal symptoms were reported in a small percentage of patients after SRS. Tumor control is comparable between MS and SRS for tumors <3cm in size. Total costs for MS can reach over two times higher than for SRS, although long-term follow-up data is needed. SRS has been shown to be efficacious and have a lower morbidity in most patients with tumors that are <3cm. SRS can be considered as the primary modality of choice for treatment of most VS that are <3cm.

Effect of stapedotomy on pre-operative tinnitus and its psychosomatic burden.
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OBJECTIVE: According to the literature, between 40 and 90% of otosclerosis patients suffering from hearing loss also suffer from tinnitus on the affected side. For a lot of these patients tinnitus represents a handicap that is just as debilitating as the hearing loss itself. The main goal of the surgical treatment of otosclerosis is a significant improvement in hearing loss, but frequent reports of reduced tinnitus after surgery suggest that this can be a positive side effect. METHODS: All patients who underwent stapedotomy were initially included in the study. Retrospectively, the tinnitus questionnaire as compiled by Goebel and Hiller was sent to the patients, and 34 patients (37 ears) replied. The pre- and postoperative cases of tinnitus were divided into compensated and non-compensated tinnitus. In addition the following tinnitus-related factors were evaluated: emotional, cognitive and mental burden; intrusiveness of the tinnitus; hearing problems; somatic ailments; and sleep disturbances. RESULTS: Over 80% of the patients surveyed suffered from tinnitus pre-operation. The tinnitus disappeared or improved in over 60% of the cases after stapedotomy. In addition, the related factors surveyed also improved appreciably post surgery and reached a significant
level in patients with compensated tinnitus. CONCLUSION: Besides a significant improvement in hearing loss the intensity and the psychosomatic burden of a pre-operative tinnitus can be reduced by stapedotomy. Copyright © 2013 Elsevier Ireland Ltd. All rights reserved.

**Persistent stapedial arteries in human: from phylogeny to surgical consequences.**
Surg Radiol Anat. 2013 May 3. [Epub ahead of print]

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The stapedial artery is an embryonic artery which disappears during the tenth week in utero, in human species. During its short life, this artery shapes the stapes and transforms the middle meningeal artery from the internal carotid artery to a branch of the external carotid system. Nevertheless, a persistent stapedial artery is seen in 0.2-4.8 per thousand of human adults. This persistence is usually asymptomatic but can sometimes cause pulsatile tinnitus or conductive hearing loss. Despite the risk of facial palsy, hearing loss and even hemiplegia argued by several authors, some surgeons have succeeded in coagulation without side effects. Reviewing the literature, we seek to enlighten the actual knowledge about the persistent stapedial artery to evaluate the risk to coagulate it. Embryologic studies explain the four types of persistent stapedial arteries: the hyoido-stapedial artery, the pharyngo-stapedial artery, the pharyngo-hyo-stapedial artery and aberrant internal carotid with persistent stapedial artery. Phylogenetic studies show that the stapedial artery persists in adulthood in many vertebrates. Its disappearance is therefore either a random effect or an adaptative convergence. This adaptation could be partially linked to the negative allometry of the stapes. Practically, the risk to coagulate a stapedial artery seems limited thanks to anastomoses, for example with the stylomastoid artery. The risk of hemiplegia reported is in fact an extrapolation of variation in rats’ embryos. A persistent stapedial artery can therefore reasonably be coagulated, with special attention to the facial nerve, because the facial canal is always dehiscent where the artery penetrates.

**Controversial issues of optimal surgical timing and patient selection in the treatment planning of otosclerosis.**
Eur Arch Otorhinolaryngol. 2013 Apr 30. [Epub ahead of print]

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The aim of this study was to analyze the impact of clinical factors on the outcomes of otosclerosis surgery and support patients' access to evidence-based information in pre-operative counseling to optimize their choices. A total of 109 ears in 93 patients undergoing stapes surgery in a tertiary referral center were included. Variables with a potential impact on hearing outcomes were recorded, with an emphasis on factors that were readily available pre-operatively. Hearing success was defined as a post-operative air-bone gap ≤10 dB. Logistic regression analysis was used to determine the factors independently contributing to the prediction of hearing success. The mean follow-up period was 18.0 months. Univariate and multivariate analyses indicated that none of the pre-operative factors (piston type, age, sex, affected side, tinnitus, vertigo, and pre-operative hearing thresholds) affected hearing success significantly (all p > 0.05). In conclusion, self-crimping Nitinol piston provides comparable hearing outcomes with conventional manual-cramping prostheses. However, Nitinol piston offers a technical simplification of a surgical procedure and an easier surgical choice for patients. In addition, age is not a detriment to hearing gain and instead might result in better use of hearing aids in older adults, thus facilitating social hearing recovery. Finally, hearing success does not depend on the extent of pre-operative hearing loss. Hence, patients with poor cochlear function should not be considered poor candidates for surgery. The predictive model has established recommendations for otologists for better case selection, and factors that are readily available pre-operatively may inform patients more explicitly about expected post-operative audometric results.
Classic and reversal steps stapedotomy performed with CO2 laser: a comparative analysis.
Eur Arch Otorhinolaryngol. 2013 Apr 24. [Epub ahead of print]

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The objective of this paper is to evaluate and compare hearing outcomes, intraoperative and postoperative complications and tinnitus characteristics, with particular regard to the effects of stapes surgery on the course of tinnitus. Two groups were evaluated: one group of patients were treated with classical stapedotomy and the second group was composed of patients who underwent reversal technique. Eighty-four patients aged between 22 and 62 years with otosclerosis were divided into two groups: group 1 (n = 49, 17 male, mean age 38, patients treated with classic stapedotomy) and group 2 (n = 35, 13 male, mean age 40, patients treated with reversal stapedotomy). Classical and reversal stapedotomy techniques were performed using CO2 laser; self-crimping titanium piston prosthesis were positioned in patients treated with reversal stapedotomy and classical stapedotomy. Preoperative and postoperative audiometric evaluation using pure tone audiometry (air-bone gap (ABG), bone-conduction thresholds and air-conduction thresholds). Tinnitus handicap inventory (THI) scale and intraoperative/postoperative complications were assessed in both groups. Wilcoxon's test and Friedman's test followed by post hoc analysis were used. There were no statistically significant differences in ABG, air conduction, bone conduction, and THI score variations after surgery between the two groups. Complications in both groups were not significant, and different.

In conclusion, reversal and classic stapedotomies performed with CO2 laser can be considered efficient, safe and reliable techniques considering the hearing outcomes and complications recorded.

Pulsatile Tinnitus due to a Tortuous Siphon-Like Internal Carotid Artery Successfully Treated by Arterial Remodeling.

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A patient is described with a right-sided tortuous siphon-like extracranial internal carotid artery leading to highly distressing ipsilateral heart beat synchronous pulsatile tinnitus, scoring 9/10 measuring loudness. Dilating the balloon during the occlusion test in or distal to the siphon-like anomaly reduces the arterial pulsations. Subsequently, surgery is performed using Teflon as an external construct to straighten the siphon-like anomaly. Postoperatively, the pulsations improve to 5/10 in a standing position and disappear during a reclined position. By adding a hearing aid, the pulsations are almost completely gone during a standing position (1/10) and remain absent in a reclined position. Free PMC Article.

Intralabyrinthine schwannomas: a case series with discussion of the diagnosis and management.

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OBJECTIVE: By extracting cases of intralabyrinthine schwannomas (ILS) from the sum of all vestibular schwannomas, we aim to identify and analyze unique features of its presentation. This allows us to refine the management protocol of this rare condition. DESIGN: This is a retrospective study of all patients seen in the Department of Otorhinolaryngology-Head and Neck Surgery, Rouen University Hospital, with either ILS or ILS with intracanalicular extension (ILS-IAC) between 2001 and 2011. A literature search was performed and results combined to draw conclusions on management strategies. METHOD: Three patients with
ILS and 6 patients with ILS-IAC were identified. We retrieved data on age, sex, symptoms, audiometry, imaging, and management. Pure tone audiometry and speech discrimination score were assessed and hearing classification recorded. Facial nerve function and vestibular function were documented throughout. The diagnostic and surveillance imaging (MRI with or without CT) were reviewed. 

RESULTS: The average age at presentation was 62.8 years and the sex ratio was (male: female) 4:5. An ipsilateral hearing loss was observed in all patients. Eight of 9 patients had tinnitus at presentation, 2 had rotatory vertigo, and 1 patient had a facial palsy and hemifacial spasm. In 2 cases, the labyrinthine extension was initially missed. The patient presenting with a large tumor and facial palsy was operated on without delay. The others underwent MRI surveillance, with 4 requiring surgery at a later stage. No postoperative facial palsies were encountered other than the one that had been present preoperatively. 

CONCLUSION: Frequency of ILS is underestimated because of poor diagnostic criteria. These tumors have often been described as having features, which resemble Ménière's disease, which is not found in our series. In the absence of tumor progression or disabling symptoms, their management is surveillance/medical, and when surgery is considered, facial paralysis and recurrence rates seem low. The treatment of IAC-ILS differs from that of ILS.

XI Holistic

Complementary and integrative treatments: tinnitus.

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This article discusses the use of an integrative approach to treating tinnitus. The authors begin with a discussion of their approach to tinnitus patients, followed by a detailed look at the physiology of tinnitus and several theories of its mechanism. The many viable options for tinnitus relief are discussed, including sound therapies, Western medical approaches, and herbal and traditional medicines that can be used as integrative and complementary treatments. It concludes with a reminder that a variety of treatment options are available to tinnitus patients to help them take control of their symptoms. Copyright © 2013 Elsevier Inc. All rights reserved.

A case discussion on presbyacusis.

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Presbyacusis is one among the many socio-medical problems, which is considered as a hidden disability. The hearing impairment in elderly people is described as presbyacusis. Hearing problem among elderly people is a major issue and a person with hearing loss may be unable to hear doorbells and alarms, to respond while talking with anyone, etc. All this can make them feel frustrated, lonely, and depressed. It is the third most common chronic condition after arthritis and hypertensive diseases among elders. Hearing loss can be improved by using the hearing aids. Hearing aids work well for some while for others; it may not be a perfect solution due to many reasons such as some people do not buy aids that meet their needs, incorrect amplification adjustments, low custom design, etc. In classics of Ayurveda this ailment has been described as karnabaadhiriya under the heading of ear diseases. Karnapurana (Instillation of medicated oil into the external auditory canal) is one of the major treatments for ear diseases explained in classics. Clinical observation has shown its effectiveness in the management of presbyacusis. A case report of 75-year-old male who presented with complaints of reduced hearing and tinnitus in both ears has been presented here. Free PMC Article.
Drug delivery to the ear.

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Drug delivery to the ear is used to treat conditions of the middle and inner ear such as acute and chronic otitis media, Ménière’s disease, sensorineural hearing loss and tinnitus. Drugs used include antibiotics, antifungals, steroids, local anesthetics and neuroprotective agents. A literature review was conducted searching Medline (1966-2012), Embase (1988-2012), the Cochrane Library and Ovid (1966-2012), using search terms ‘drug delivery’, ‘middle ear’, ‘inner ear’ and ‘transtympanic’. There are numerous methods of drug delivery to the middle ear, which can be categorized as topical, systemic (intravenous), transtympanic and via the Eustachian tube. Localized treatments to the ear have the advantages of targeted drug delivery allowing higher therapeutic doses and minimizing systemic side effects. The ideal scenario would be a carrier system that could cross the intact tympanic membrane loaded with drugs or biochemical agents for the treatment of middle and inner ear conditions.

Randomized trial of four noise-induced hearing loss and tinnitus prevention interventions for children.

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Abstract Objective: To evaluate the effectiveness of four NIHL prevention interventions at improving knowledge, attitudes, and intended behaviors regarding sound exposure and appropriate use of hearing protective strategies in children. Design: A randomized trial of the four interventions with a non-intervention comparison group. Questionnaires were completed prior to, immediately after, and three months after each intervention. Study: Interventions included: (1) A classroom presentation by older-peer educators, (2) A classroom presentation by health professionals, (3) Exploration of a museum exhibition, and (4). Exploration of an internet-based virtual museum. A comparison group received no intervention. Study sample: Fifty-three fourth grade classrooms (1120 students) participated in the study. Results: All interventions produced significant improvements but the number of improvements decreased over time. In terms of effectiveness, the classroom programs were more effective than the internet-based virtual exhibit, which was more effective than the visit to the museum exhibition. Self-reported exposures indicated that as many as 94.5% of participants were at risk for NIHL. Conclusions: Interpersonal, interactive educational interventions such as the classroom program are more effective and have longer impact than self-directed learning experiences for NIHL and tinnitus prevention, however each may have an important role in promoting hearing health in elementary school students.
Post-traumatic stress disorder (PTSD) is associated with both (1) 'ill-defined' or 'medically unexplained' somatic syndromes, e.g. unexplained dizziness, tinnitus and blurry vision, and syndromes that can be classified as somatoform disorders (DSM-IV-TR); and (2) a range of medical conditions, with a preponderance of cardiovascular, respiratory, musculoskeletal, neurological, and gastrointestinal disorders, diabetes, chronic pain, sleep disorders and other immune-mediated disorders in various studies. Frequently reported medical co-morbidities with PTSD across various studies include cardiovascular disease, especially hypertension, and immune-mediated disorders. PTSD is associated with limbic instability and alterations in both the hypothalamic-pituitary-adrenal and sympatho-adrenal medullary axes, which affect neuroendocrine and immune functions, have central nervous system effects resulting in pseudo-neurological symptoms and disorders of sleep-wake regulation, and result in autonomic nervous system dysregulation. Hypervigilance, a central feature of PTSD, can lead to 'local sleep' or regional arousal states, when the patient is partially asleep and partially awake, and manifests as complex motor and/or verbal behaviours in a partially conscious state. The few studies of the effects of standard PTSD treatments (medications, CBT) on PTSD-associated somatic syndromes report a reduction in the severity of ill-defined and autonomically mediated somatic symptoms, self-reported physical health problems, and some chronic pain syndromes.

Tinnitus.

[No authors listed]

Around 10% of people experience subjective tinnitus (the perception of sound, only audible to the patient, in the absence of an external auditory stimulus).(1-3) It may be associated with hearing loss, anxiety, depression, sleep disturbance, concentration problems or reduced quality of life; for around 0.5% it is extremely disturbing.(1-4) Risk factors include aging, significant noise exposure, drug therapy (e.g. aminoglycosides, NSAIDs, diuretics), or disorders of the outer, middle or inner ear or auditory nerve (e.g. ear wax, infections, vestibular schwannoma, otosclerosis).(1,2,4) It may be due to excessive spontaneous activity in the auditory system and brain; if the signal (normally suppressed by the subconscious) becomes noticed it becomes more intrusive and annoying in a vicious cycle.(5) Here, we discuss symptomatic drug and non-drug treatments for subjective tinnitus in adults. We do not cover treatment of underlying causes of tinnitus.

Homeostatic mechanisms and treatment of tinnitus.
Restor Neurol Neurosci. 2013 Feb 22. [Epub ahead of print]

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Tinnitus is a potentially debilitating phantom percepts affecting up to ten percent of the general population. After decades of efforts, we still lack an effective treatment for tinnitus, partly because of the heterogeneity of its etiology. Recent studies revealed potential central mechanisms underlying the most common form of tinnitus, which is caused by hearing loss. Here we review recent evidence that homeostatic down-regulation of phasic and tonic inhibition is a mechanism underlying hearing loss-induced tinnitus and propose novel strategies of sensory training and targets of pharmacological intervention to reverse the homeostatic changes induced by the hearing loss for treatment of tinnitus.
Medically unexplained symptoms and somatisation in ENT.
J Laryngol Otol. 2013 Apr 10:1-6. [Epub ahead of print]

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Background: Somatisation has been described as the perception of a physiological event influenced by emotion. Method: A review of the medical literature was carried out using the following Medical Subject Headings: somatisation (which identified 357 articles), medically unexplained symptoms (749 articles), unexplained or idiopathic dizziness (142 articles), tinnitus (360 articles), catarrh (1068 articles) and globus pharyngeus (3114 articles). Results: Up to 40 per cent of out-patient attendances have medically unexplainable symptoms. In ENT clinics, this includes patients with dizziness, tinnitus, ‘pseudo’ eustachian tube dysfunction, being ‘unable to hear’, catarrh and postnasal drip, atypical facial pain, globus pharyngeus, and functional dysphonia. Medical explanations of these symptoms often differ from patients’ perceptions. Demonstrating normal test results and providing reassurance have little effect on patients’ doubts and anxieties. Consultations that recognise the symptoms and their impact, and offer a tangible and involving explanation are more likely to satisfy and empower patients. Conclusion: The treatment of medically unexplained symptoms has changed in recent years; there is now more emphasis on psychological factors due to an association with anxiety and depression.

Recent technological advances in sound-based approaches to tinnitus treatment: A review of efficacy considered against putative physiological mechanisms.

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The past decade has seen an escalating enthusiasm to comprehend chronic tinnitus from the perspective of both scientific understanding and clinical management. At the same time, there is a significant interest and commercial investment in providing targeted and individualized approaches to care, which incorporate novel sound-based technologies, with standard audiological and psychological strategies. Commercially produced sound-based devices for the tinnitus market include Co-ordinated Reset Neuromodulation®, Neuromonics®, Serenade®, and Widex® Zen. Additionally, experimental interventions such as those based on frequency-discrimination training are of current interest. Many of these interventions overtly claim to target the underlying neurological causes of tinnitus. Here, we briefly summarize current perspectives on the pathophysiology of tinnitus and evaluate claims made by the device supporters from a critical point of view. We provide an opinion on how future research in the field of individualized sound-based interventions might best provide a reliable evidence-base in this growing area of translational medicine.
Complementary and integrative treatments: tinnitus.

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This article discusses the use of an integrative approach to treating tinnitus. The authors begin with a discussion of their approach to tinnitus patients, followed by a detailed look at the physiology of tinnitus and several theories of its mechanism. The many viable options for tinnitus relief are discussed, including sound therapies, Western medical approaches, and herbal and traditional medicines that can be used as integrative and complementary treatments. It concludes with a reminder that a variety of treatment options are available to tinnitus patients to help them take control of their symptoms. Copyright © 2013 Elsevier Inc. All rights reserved.

Chronic tinnitus: an interdisciplinary challenge.

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BACKGROUND: Tinnitus is defined as the perception of sound in the absence of a corresponding external acoustic stimulus. It is a common problem that markedly impairs the quality of life of about 1% of the general population. METHODS: We selectively reviewed the pertinent literature to provide an overview of the current treatment options for chronic tinnitus. RESULTS: Cognitive behavioral therapy is effective and is the best studied of all currently available treatments. All patients should have a therapeutic interview for counseling. Auditory stimulation can also lessen tinnitus: It is used in tinnitus maskers and hearing aids, as well as in tinnitus retraining therapy. An improved understanding of the neural mechanisms of tinnitus has led to the development of innovative techniques of neuromodulation and neurostimulation, but these are still experimental. Drugs are indicated only for the treatment of tinnitus-associated symptoms such as depression, sleep disturbances, and anxiety. CONCLUSION: There are many ways to treat chronic tinnitus, and new treatments are now being developed. As tinnitus has many causes and can be associated with many different comorbid disturbances, multidisciplinary diagnostic evaluation and treatment are important. For many tinnitus patients, long-term therapeutic success depends on the maintenance of a therapeutic relationship with the treating physician, so that the physician and the patient can work together to give careful consideration to each newly proposed diagnostic test or treatment step. Free PMC Article.

Inner ear disorders.

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OBJECTIVES: To present a framework for the diagnosis and treatment of inner ear disorders, with an emphasis on problems common to neuro-rehabilitation. INTRODUCTION: Disorders of the inner ear can cause hearing loss, tinnitus, vertigo and imbalance. Hearing loss can be conductive, sensorineural, or mixed; conductive hearing loss arises from the ear canal or middle ear, while sensorineural hearing loss arises from the inner ear or auditory nerve. Vertigo is a hallucination of motion, and is the cardinal symptom of vestibular system disease. It should be differentiated from other causes of dizziness: gait imbalance, disequilibrium, lightheadedness (pre-syncope). Vertigo can be caused by problems in the
inner ear or central nervous system. METHODS: The diagnosis of inner ear disorders begins with a targeted physical examination. The initial work-up of hearing loss is made by audiometry, and vertigo by electronystagmography (ENG). Supplemental tests and MRI are obtained when clinically indicated. RESULTS: The clinical pattern and duration of vertigo are the most important clinical features in the diagnosis. Common inner ear causes of vertigo include: vestibular neuritis (sudden, unilateral vestibular loss), Meniere’s disease (episodic vertigo), benign paroxysmal positional vertigo (BPPV), and bilateral vestibular loss. Common central nervous system causes of vertigo include: post concussion syndrome, cervical vertigo, vestibular migraine, cerebrovascular disease, and acoustic neuroma. CONCLUSION: A basic knowledge of vestibular physiology, coupled with an understanding of common vestibular syndromes, will lead to correct diagnosis and treatment in most cases.

An integrative model of auditory phantom perception: Tinnitus as a unified percept of interacting separable subnetworks.

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Tinnitus is a considered to be an auditory phantom phenomenon, a persistent conscious percept of a salient memory trace, externally attributed, in the absence of a sound source. It is perceived as a phenomenological unified coherent percept, binding multiple separable clinical characteristics, such as its loudness, the sidedness, the type (pure tone, noise), the associated distress and so on. A theoretical pathophysiological framework capable of explaining all these aspects in one model is highly needed. The model must incorporate both the deafferentation based neurophysiological models and the dysfunctional noise canceling model, and propose a ‘tinnitus core’ subnetwork. The tinnitus core can be defined as the minimal set of brain areas that needs to be jointly activated (=subnetwork) for tinnitus to be consciously perceived, devoid of its affective components. The brain areas involved in the other separable characteristics of tinnitus can be retrieved by studies on spontaneous resting state magnetic and electrical activity in people with tinnitus, evaluated for the specific aspect investigated and controlled for other factors. By combining these functional imaging studies with neuromodulation techniques some of the correlations are turned into causal relationships. Thereof, a heuristic pathophysiological framework is constructed, integrating the tinnitus perceptual core with the other tinnitus related aspects. This phenomenological unified percept of tinnitus can be considered an emergent property of multiple, parallel, dynamically changing and partially overlapping subnetworks, each with a specific spontaneous oscillatory pattern and functional connectivity signature. Communication between these different subnetworks is proposed to occur at hubs, brain areas that are involved in multiple subnetworks simultaneously. These hubs can take part in each separable subnetwork at different frequencies. Communication between the subnetworks is proposed to occur at discrete oscillatory frequencies. As such, the brain uses multiple nonspecific networks in parallel, each with their own oscillatory signature, that adapt to the context to construct a unified percept possibly by synchronized activation integrated at hubs at discrete oscillatory frequencies. Copyright © 2013 Elsevier Ltd. All rights reserved.
The internal representation of vowel spectra investigated using behavioral response-triggered averaging.

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Listeners presented with noise were asked to press a key whenever they heard the vowels [a] or [i:]. The noise had a random spectrum, with levels in 60 frequency bins changing every 0.5 s. Reverse correlation was used to average the spectrum of the noise prior to each key press, thus estimating the features of the vowels for which the participants were listening. The formant frequencies of these reverse-correlated vowels were similar to those of their respective whispered vowels. The success of this response-triggered technique suggests that it may prove useful for estimating other internal representations, including perceptual phenomena like tinnitus.

Tinnitus: A Cost Study.
Ear & Hearing 2013;34;508–514

Maes IH, Cima RF, Vlaeyen JW, Anteunis LJ, Joore MA.

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OBJECTIVES: The aim of this study was to examine the costs of tinnitus in The Netherlands from a health care and a societal perspective. Furthermore, the impact of disease characteristics and demographic characteristics on these costs were examined. METHODS: A bottom-up cost of illness study was performed, using the baseline data on a cost questionnaire of a randomized controlled trial investigating the (cost) effectiveness of an integral multidisciplinary treatment for tinnitus versus care as usual. Mean yearly costs were multiplied by the prevalence figure of tinnitus for the adult general population to estimate the total cost of illness of tinnitus to society. Because cost data usually are not normally distributed, a nonparametric bootstrap resampling procedure with 1000 simulations was performed to determine statistical uncertainty of the cost estimates per category. Several questionnaires measuring disease and demographic characteristics were administered. The impact of disease characteristics and demographics on costs was investigated using a multivariate regression analysis. RESULTS: Total mean societal cost of illness was €6.8 billion (95% confidence interval: €3.9 billion-€10.8 billion). The larger part of total cost of illness was not related to health care. Total mean health care costs were €1.9 billion (95% confidence interval: €1.4 billion-€2.5 billion). Significant predictors of both health care costs and societal costs were tinnitus severity, age, shorter duration of tinnitus, and more severe depression. CONCLUSION: The economical burden of tinnitus to society is substantial, and severity of tinnitus is an important predictor of the costs made by patients.
Trans-canal laser irradiation reduces tinnitus perception of salicylate treated rat.

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The aim of this study was to find out the effect of Low-level laser therapy (LLLT) on salicylate-induced tinnitus in the rat model. Fourteen Sprague Dawley rats (8 weeks; 240-280gm) were divided into 2 groups (study group, control group). Rats of both groups were treated with 400mg/kg/day of sodium salicylate for 8 consecutive days. Tinnitus was monitored using GPIAS (Gap Prepulse Inhibition of Acoustic Startle) 2hours after first salicylate treatment, and every 24hours during 9 days of treatment. Rats in laser group were irradiated to each ear with wavelength of 830nm diode laser (165mW/cm2) for 30minutes daily for 8 days. During salicylate treatment, rats of study group irradiated with low level laser showed significantly higher GPIAS values throughout the experiment. Therapeutic effect of LLLT is demonstrated in animal tinnitus model by means of GPIAS. Further experimental studies are needed to find possible mechanisms and better methods to improve LLLT efficacy. Copyright © 2013. Published by Elsevier Ireland Ltd.

Review of an 11-year Experience in Retrosigmoid Approach for Treatment of Acoustic Neuromas.

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This study reviews surgery on acoustic neuromas by the second author using retrosigmoid approach from January 2000 to June 2010 in the state of Sarawak. There was a total of 32 patients in this study. The commonest presenting symptom was hearing loss (81.3%), followed by headache and tinnitus (each 37.5%), ataxia (34.4%) and facial numbness (21.9%). Twenty-seven patients (84.4%) had large tumor (≥ 3cm) while 5 patients (15.6%) had medium size tumor (1.5-2.9cm). The mean tumor size was 3.6 cm. Facial nerve outcome was good to moderate in 93.7% (House and Brackmann Grade I-IV). The most common complications were CSF leak with 3 patients(9.4%) and facial numbness with 2 patients(6.3%). All either resolved with treatment or improved. There was no mortality. Excision of acoustic neuromas using retrosigmoid approach could achieve acceptable facial nerve outcome with a low incidence of morbidity without mortality.

Telemedicine in tinnitus: feasibility, advantages, limitations, and perspectives.

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Given the important patient needs for support and treatment, telemedicine-defined by medical approaches supported by the new technologies of information-could provide interesting alternative in tinnitus treatment. By analyzing the published tools and approaches which could be used in the context of telemedicine for tinnitus by health professionals or self-administrated by patients, this review summarizes, presents, and describes the principal telemedicine approaches available presently or in the near future to help assess or treat tinnitus or to offer support to tinnitus sufferers. Several pieces of evidence strongly support the feasibility of telemedicine approaches for tinnitus. Telemedicine can be used to help tinnitus sufferers at several points in the therapeutic process: for early screening, initial evaluation, and diagnosis; for optimizing therapeutic tools, particularly behavioural therapies and virtual reality-enhanced behavioral
therapies; for long-term monitoring of patients and provision of online support. Several limitations are, however, discussed in order to optimize the safe development of such approaches. Cost effective and easy to implement, telemedicine is likely to represent an important part of the future of tinnitus therapies and should be progressively integrated by otolaryngologists.

**Noise and health in vulnerable groups: A review.**

van Kamp I, Davies H.


Vulnerable or susceptible groups are mentioned in most reviews and documents regarding noise and health. But only a few studies address this issue in a concrete and focused way. Groups at risk most often mentioned in the literature are children, the elderly, the chronically ill and people with a hearing impairment. The other categories encountered are those of sensitive persons, shiftworkers, people with mental illness (e.g., schizophrenia or autism), people suffering from tinnitus, and fetuses and neonates. The mechanism for this vulnerability has not been clearly described and relevant research has seldom focused on the health effects of noise in these groups in an integrated manner. This paper summarizes the outcomes and major conclusions of a systematic, qualitative review of studies over the past 5 years. This review was prepared for the 10th Conference on Noise as a Public Health Problem (ICBEN, 2011). Evidence is reviewed describing effects, groups assumed to be at risk, and mechanisms pertaining to noise sensitivity and learned helplessness. [Free Article](#).

**The effectiveness of transmeatal low-power laser stimulation in treating tinnitus.**
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Ngao CF, Tan TS, Narayanan P, Raman R.

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The aim of this study is to examine the effectiveness of transmeatal low-power laser stimulation (TLLS) in treating tinnitus. This is a prospective, double-blinded, randomized, placebo-controlled trial. Patients with persistent subjective tinnitus as their main symptom were recruited into the study from the outpatient clinics. The recruited patients were randomized into the experimental group or TLLS+ group (patients in this group were prescribed to use TLLS at 5 mW at 650 nM wavelength for 20 min daily and oral beta-histine 24 mg twice per day for a total of 10 weeks) and the control group or TLLS- group (patients in this group were prescribed with a placebo device to use and oral beta-histine 24 mg twice per day for 10 weeks). All patients were required to answer two sets of questionnaires: the Tinnitus handicap inventory (THI) and visual analogue scales (VAS) symptoms rating scales, before starting the treatment and at the end of the 10-week treatment period. The total score of the THI questionnaire was further graded into five grades, grade 1 being mild and grade 5 being catastrophic. Wilcoxon-signed ranks test and Mann-Whitney test were used to compare and analyze the THI and VAS scores before and after treatment for each group. Changes with p value of <0.05 were considered as statistically significant. Chi square test was used to analyze the change of parameters in categorical forms (to compare between TLLS+ and TLLS-). Changes with p value of <0.05 were considered as statistically significant. Forty-three patients successfully and diligently completed their treatment. It was noted that using any condition of the device, TLLS+ or TLLS-, patient's tinnitus symptoms improved in terms of THI scores (TLLS+, p value = 0.038; TLLS-, p value = 0.001) or VAS scores with a change of at least one grade (TLLS+, p value = 0.007; TLLS-, p value = 0.002) at p value <0.05 significant level. In contrast when TLLS+ group was compared with TLLS- group, no statistically significant result was obtained. In term of VAS scores, there seems to be no statistically significant improvement in patients' annoyance, sleep disruption, depression, concentration and tinnitus loudness and pitch heard between the two groups. Transmeatal low-power laser stimulation did not demonstrate significant efficacy as a therapeutic measure in treating tinnitus.
XIV Case Reports

Teaching NeuroImages: Subdural hematoma with pseudo-intracranial hypertension.
Tan XL, Xiao B, Yang QD, Huang Q, Xiao L, Tang BS.

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A 40-year-old woman presented with worsening headache accompanied by vomiting, anorexia, and tinnitus. The headaches were initially orthostatic. MRI showed chronic progressive subdural hematomas (SDH) with significant mass effect, diffuse pachymeningeal enhancement, and pituitary enhancement/enlargement (figure, A and B), indicating intracranial hypotension due to spontaneous spinal CSF leak, which was confirmed by CT myelography (figure, C). CSF leak is an important cause of SDH,(1) which, by clinical and radiologic manifestations, may give the false impression that the patient has intracranial hypertension but without papilledema or hydrocephalus, termed pseudo-intracranial hypertension. This recognition is crucial because both conservative measures to decrease intracranial pressure and evacuation of the SDH are harmful.(1,2). Free full Text.

Tinnitus related to eyelid blinking.
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Tinnitus can be generated by various causes, including vascular or myogenic factors and sensorineural auditory structures. Tinnitus due to repetitive contraction of the paraauditory muscles is a rare condition. We present a case of bilateral tinnitus concomitant with eyelid blinking. Otoscopy revealed normal tympanic membranes; however, inward movement of the tympanic membrane was visible whenever the patient blinked. Long-time-based tympanometry measuring static compliance revealed a cogwheel or saw-toothed pattern associated with movement of the tympanic membrane related to eyelid blinking. The patient was managed with pharmacological treatment combined with assurance and was relatively well controlled. Copyright © 2012 Elsevier Ireland Ltd. All rights reserved.

Where there’s smoke there’s fire--ear candling in a 4-year-old girl.
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It is estimated that one-third of the United States population subscribes to alternative medical therapies (Eisenberg et al, NEJM 1993;328:246-252). Ear candles are popular products promoted by alternative health practitioners, and sold by health shops and even over the Internet. They have been promoted for ear and sinus discomfort, rhinitis, sinusitis, glue ear, colds, flu, migraine, tinnitus, but particularly for removal of ear wax (cerumen). In this case report, a 4-year-old girl in New Zealand presents with otitis media and during the course of the ear examination white deposits were noticed on her eardrum; this was confirmed as being caused by ear candling.
Cochlear implantation has become a standard therapy for children with bilateral profound hearing loss, resulting in substantial and sustainable benefits for the development of expressive and receptive and expressive language skills and cognition. During the last few years, audiologic and otologic criteria for cochlear implantation have been expanded. Recently, patients with profound single-sided deafness with or without tinnitus have received cochlear implants despite normal to near-normal hearing on the contralateral side. This indication, however, has thus far been restricted to adult patients. Although it is known that unilateral hearing has an impact on social-emotional development in children, otologic surgeons have been reluctant to treat children with single-sided deafness with a cochlear implant. We report here on a case of successful cochlear implantation in an 8-year-old boy with acute single-sided deafness due to a lateral skull-base fracture, after an MRI showed signs of imminent fibrosis of the inner ear with possible prevention of cochlear implantation at a later stage. There was normal hearing in the contralateral ear. The child showed rapid development of speech discrimination in the implanted ear, improvements in sound localization and speech perception in noise, and a high degree of patient satisfaction. This experience may encourage using this therapeutic approach in children with chronic profound single-sided deafness.

Hearing loss with positional changes due to spontaneous intracranial hypotension improved with treatment; a case report.

Yamada S, Yasui K, Hasegawa Y.
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A 51-year-old woman was admitted to our hospital because of the right ear fullness and orthostatic headache. Based on the findings of low cerebrospinal fluid (CSF) pressure and detected images of CSF leakage by MRI myelography and radionuclide cisternography, she was diagnosed as having spontaneous intracranial hypotension (SIH). Audiograms in the supine and sitting positions showed a marked hearing loss of low-frequencies and its exacerbation after the sitting. After she was treated with bed rest, hydration and epidural blood patch, hearing loss with positional changes gradually improved. In conclusion, non-invasive examinations with audiogram in the supine and sitting positions could be useful in the diagnosis of SIH and the evaluation of therapeutic efficacy of hearing loss.

Ear Nose Throat J. 2012 Dec;91(12):E7-9.

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We describe the case of a 36-year-old woman with a history of vitiligo who presented with an insidious onset of neurologic, vestibular, ocular, and auditory symptoms. She had recently noted the onset of vertigo, tinnitus, and hypersensitivity to sound. Findings on audiology were within normal limits, although the patient reported some auditory discomfort during the testing. The patient had a history of bilateral uveitis and peripheral neurologic symptoms. She was diagnosed with Vogt-Koyanagi-Harada (VKH) syndrome and started on corticosteroid therapy. Her neurologic, vestibular, ocular, and auditory symptoms resolved. VKH syndrome is an uncommon cause of vertigo and hearing loss, but it should be considered in the differential diagnosis of patients with autoimmunity-related inner ear symptoms.
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Faculty of Medicine, Paris Descartes University, Paris, France; Sainte-Anne Hospital (CMME), Paris, France; Center of Psychiatry and Neuroscience, Sainte-Anne Hospital, Inserm U894, Paris, France.  
Tinnitus is a frequent condition without consistently effective remediation. Mr V. was a 64 year old man with Behcet's disease, a generalized systemic relapsing vasculitis. Tinnitus appeared in 1998 and he had been both aware and distressed by his tinnitus 80% of his awake time. After his last colonoscopic examination, he mentioned a transient interruption of his tinnitus. Mr V. only received propofol, an anesthetic drug that selectively down-regulates glutamatergic synaptic transmission. Amantadine, another glutamate antagonist, was later prescribed and durably suppressed tinnitus. Systematically inquiry about post-anesthesia effects on tinnitus may help decide if amantadine may be tried on an individual basis. © The Author(s) 2013.

Monolateral type I proatlantal artery with bilateral absence of vertebral arteries: description of a case and review of the literature.  
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We report a case of a patient with right type I proatlantal intersegmental artery associated with right fetal posterior cerebral artery and absence of both vertebral arteries and of the left posterior communicating artery. We also describe the clinical relevance of these findings for this patient. A 56-year-old woman with vertigo and tinnitus underwent contrast enhanced Magnetic Resonance Angiography (MRA) of the supra-aortic arteries using a 1.5 Tesla scanner. Maximum intensity projection and volume rendering reconstructions were obtained. MRA demonstrated the persistence of an anastomotic artery between the right internal carotid artery and basilar artery, passing through the foramen magnum, suggesting a type I proatlantal intersegmental artery. The examination also showed the absence of both vertebral arteries and the presence of a right fetal-type posterior cerebral artery. To our knowledge, this is the first report of a type I proatlantal intersegmental artery associated with an omolateral fetal-type posterior cerebral artery and the absence of both vertebral arteries and of the left posterior communicating artery. This condition requires a watchful monitoring of the patient and has to be considered in case of surgical procedures of the carotid arteries.
Endolymphatic sac tumour: case report and literature review.

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Objective: To increase awareness of the presentation, diagnostic difficulties and management of endolymphatic sac tumours. Case reports: A 79-year-old man with a 6-month history of unilateral hearing loss, tinnitus and vertigo, who was suspected to have an endolymphatic sac tumour on imaging, underwent successful transmastoid-translabyrinthine resection. A 53-year-old man with unilateral hearing loss and pulsatile tinnitus underwent subtotal resection of a suspected paraganglioma, which was identified histologically. Due to interval growth, gamma knife radiosurgery was performed followed by subtotal petrosectomy, at which juncture an endolymphatic sac tumour was reported. Methods: A review of the world literature was carried out using Medline, which identified less than 150 reported cases of endolymphatic sac tumour. Conclusion: Endolymphatic sac tumours are rare lesions of the petrous temporal bone. Although benign, they can be locally destructive. At present, there is no consensus regarding the management and long-term follow up of these tumours. Surgical resection is usually favoured, although treatment with radiotherapy and gamma knife surgery has also been reported.

Transitory stapedial myoclonus in a patient with benign fasciculation syndrome.

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Department of Neurological, Neuropsychological, Morphological and Movement Sciences, Section of Clinical Neurology, Merano, Italy.

Objective: We report a previously undescribed association between transitory stapedial myoclonus, objective tinnitus and benign fasciculation syndrome. Method: Case report and review of the world literature regarding stapedial myoclonus. Results: A 30-year-old man with a diagnosis of benign fasciculation syndrome abruptly developed severe, low-pitched tinnitus on the right side. Otoscopic examination revealed rhythmic movement of the tympanic membrane, which was synchronous with the tinnitus. No palatal spasm was noted on nasopharyngeal examination. Brain magnetic resonance imaging and pure tone audiometry were unremarkable. Based on these findings, a diagnosis of objective tinnitus due to stapedial myoclonus was made. The objective tinnitus spontaneously disappeared within 48 hours of its appearance, but in the following days the patient suffered frequent, brief episodes of objective tinnitus lasting only a few seconds. Conclusion: The occurrence of stapedial myoclonus in this patient indicated the presence of an underlying motor unit hyper-excitability. This case suggests that, in some patients, stapedial myoclonus may represent the clinical expression of diffuse motor unit hyper-excitability.
Large bilateral internal auditory meatus associated with bilateral superior semicircular canal dehiscence.

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Superior semicircular canal dehiscence and an abnormally wide internal auditory meatus are clinical entities characterized by vestibular and cochlear symptoms. These symptoms are induced by hypersensitivity of labyrinthine receptors secondary to a bone defect of the otic capsule. We report the case of a 41-year-old man with congenital right-sided hearing loss who presented with bilateral superior semicircular canal dehiscence that was associated with wide, bulbous internal auditory meatus and a loss of the bony wall separating the lateral end of the meatus from the cochlea. The patient was experiencing vestibular and cochlear symptoms in the right ear and disabling tinnitus in the left ear. However, he refused all treatment and was lost to follow-up.

Recurrent facial hemiparesis due to dolichoectatic vertebrobasilar artery: an unusual and ignored cause.
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Dolichoectatic arteries are elongated tortuous aneurysms of intracranial arteries most commonly of vertebrobasilar tree presenting with ischaemic, haemorrhagic, thromboembolic lesions or with cranial nerve compression. The clinical presentation includes tic douloureux, neuralgia, tinnitus, vertigo, motor or sensory deficits, ataxia, dementia, Parkinsonism, hydrocephalus, headache, migraine, aneurysm, neoplasm, stroke/transient ischaemic attacks, leukoencephalopathy, central sleep apnoea and cerebellar dysfunctions. We present a case of recurrent facial nerve palsy secondary to vertebrobasilar dolichoectasia, an interesting and rare condition.

A schwannoma of the greater petrosal nerve located within the petrous apex and treated with stereotactic radiotherapy.
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A 26-year-old female experienced progressive left sided pulsatile tinnitus and conductive hearing loss for two years, which following an extensive clinical workup, was diagnosed as a left greater petrosal nerve schwannoma located within the petrous apex of the temporal bone. Between neurosurgical management and radiation therapy, multiple therapeutic options were presented to the patient, who ultimately chose stereotactic radiotherapy as an alternative to surgical resection due to the potential morbidity associated with surgery. The patient received three fractions of 600cGy without subsequent worsening of her symptoms, new onset neurologic symptoms or radiation induced side effects reported at a 3, 6 and 12month clinic visits. A follow-up MRI at 6 and 12months post radiation administration demonstrated no further tumor growth. Published by Elsevier Inc.
Bilateral carotid artery dissection in a severe preeclamptic setting: An unusual cause of postpartum headache.

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A 30-year-old woman with severe preeclampsia presented at 27 weeks of amenorrhea with left headache, neck pain, blurred vision and numbness of left hemiface that resolved spontaneously within 2 hours. A week later, hypertension remained poorly controlled despite combination of nicardipine and labetalol intravenous therapy; an urgent caesarean section was eventually performed due to onset of HELLP syndrome. At day 5 postpartum, the patient had a Horner syndrome with right ipsilateral disabling tinnitus. A CT-angiography of supra-aortic trunks was performed urgently; it showed a bilateral carotid arterial dissection without stroke, which was subsequently confirmed by MRI angiography. The patient was transferred in neurovascular intensive care unit. Anticoagulant therapy was implemented to prevent cerebral and retinal ischemic lesions. Symptoms resolved quickly and the patient was discharged at day 7 postpartum. MR-angiography performed 4 months later showed a full resolution of the bilateral carotid dissection. Anticoagulant therapy was therefore discontinued. Copyright © 2013. Published by Elsevier SAS.

Occipital artery anastomosis to vertebral artery causing pulsatile tinnitus.

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Pulsatile tinnitus can result from various vascular etiologies that cause transmission of pulsatile turbulent flow into the inner ear. Less commonly, non-vascular sources cause increased blood flow and transmission of sound perceived as tinnitus. Thorough clinical examination leads to appropriate imaging evaluation and therapeutic planning. Most pulsatile tinnitus results from expected mechanisms, such as dural arteriovenous fistula, jugular bulb dehiscence, or paraganglioma; however, the literature contains reports of numerous rare causes, particularly variant anatomic morphologies. We present the case of a novel cause of pulsatile tinnitus in which collateral vascular flow compensated for decreased normal intracranial cerebral arterial supply and might have caused catastrophic consequences if intervened upon after assumptions based on an incomplete evaluation.

Intratympanic aberrant and hypoplastic carotid artery.

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Intratympanically aberrant internal carotid artery (ICA) is a rarely seen vascular abnormality. We present here the combination of aberration and prominent hypoplasia of the ICA in a case. Intratympanic aberrant ICA, which is rarely cited as a cause of tinnitus and hearing loss, should be known as a reason to be kept in mind as it may lead to life-threatening complications. Generally, it has been defined upon massive bleeding during myringotomy, ear surgery or biopsy procedure. In this article, the audiological and radiological studies confirmed with CT and MR angiography conducted on an aberrant and hypoplastic internal carotid artery that was identified under the manubrium mallei in a 28-year-old, young male patient who presented with complaints about hearing loss and fullness in the left ear were presented along with a literature review. Copyright © 2013 Elsevier Inc. All rights reserved.
Endovascular Treatment of an Iatrogenic Vertebrojugular Fistula With a Balloon-Expandable Covered Stent: Case Report and Review of the Literature.


We report a case of a fistula between the vertebral artery and the internal jugular vein that occurred after the erroneous placement of a central venous catheter. The patient was presented with tinnitus. Endovascular treatment with a balloon expandable covered stent placed into the vertebral artery was performed. One year follow-up showed satisfactory exclusion of the fistula, patency of the stented vertebral artery, and resolution of the symptoms. Only few other similar cases are reported in the literature with the use of different types of stents.

Glomus jugulare: a rare cause of facial nerve palsy.

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Department of Ophthalmology and.

ABSTRACT Purpose: To report a case of an unusual presentation of a glomus jugulare tumour. Design: Case report. Results: Glomus jugulare is a very rare brain tumour that usually presents with tinnitus, hearing loss, dysphagia and hoarseness. We report a case where this extremely rare diagnosis presented quite differently, with ipsilateral proptosis and subsequent facial nerve palsy. Furthermore, the sibling of the presented case had also been diagnosed with the same tumour. Conclusions: There have only been a few case reports in the literature describing facial nerve palsy in the context of a glomus jugulare tumour. This case highlights that although paragangliomas are exceedingly rare causes of facial palsy, they should be included in the differential diagnosis.

Anterior jugular phlebectasia and tinnitus: A case report.
Ear Nose Throat J. 2013 Mar;92(3):E24-5.

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Abnormal dilation of a normal anterior jugular vein is a rare anomaly and usually presents as a neck lump. To the best of our knowledge, this is the first report in the literature of such a case in which the patient presented with severe tinnitus. Excision of the dilated portion of the anterior jugular vein in our patient alleviated the severe tinnitus.
A single microvascular decompression surgery cures a patient with trigeminal neuralgia, hemifacial spasm, tinnitus, hypertension, and paroxysmal supraventricular tachycardia caused by the compression of a vertebral artery.


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This report presents a 72-year-old woman with posterior cranial fossa neurovascular compression syndrome that included paroxysmal supraventricular tachycardia. The patient underwent surgical exploration of the posterior cranial fossa, and a gross left vertebral artery was identified as the offending vessel. The neurovascular conflicts were associated with the cranial nerves V, VII, VIII, IX, and X. The patient experienced significant postoperative relief. Probably this is the first report of a single microvascular decompression, having cured such a high number of syndromes, including paroxysmal supraventricular tachycardia. Free Article.

Lipochoristoma of the internal auditory canal.


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PROBLEM: Approximately 90% of tumours of cerebellopontine angle and internal auditory canal are vestibular schwannomas (acoustic neuromas) and meningiomas. Lipochoristomas are rare benign masses that represent only 0.15% of cases. METHODOLOGY: We report the case of a 39-year-old man who consulted us for right-sided hearing loss and tinnitus. RESULTS: Tonal audiometry showed a downsloping right sensorineural hearing loss in frequencies above 2000 Hz. Magnetic resonance imaging (MRI) revealed a heterogeneous lesion in the right internal auditory canal with areas of hyperintensity on noncontrast T1-weighted MRI and suppression of much of the signal of the lesion with persistence of some areas of enhancement on T1-weighted fat-suppressed images. CONCLUSION: Correct imaging diagnosis through MRI (high signal intensity on noncontrast T1-weighted images together with a missing signal in fat suppression sequences) is essential in order to avoid unnecessary surgery or radiation therapy, which are not recommended in the treatment of these lesions.

Essential palatal tremor treated with botulinum toxin.

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Palatal tremor is a rare movement disorder characterized by rhythmic movement of the soft palate. There are two subtypes: essential and symptomatic palatal tremor. Essential palatal tremor is characterized by tinnitus and an absence of other neurological deficits. Different treatment options have been used to treat palatal tremor, with varying success rates. Here we describe a patient with essential palatal tremor and who was treated with botulinum toxin injections. Crown Copyright © 2013. Published by Elsevier Inc. All rights reserved.
Pulsatile tinnitus caused by a dilated mastoid emissary vein.

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Although pulsatile tinnitus can be audible, objective demonstration of this heartbeat-synchronous sound has rarely been successful. We report a rare case of pulsatile tinnitus in a 44-yr-old female patient, which was induced by a large mastoid emissary vein (MEV) and objectively documented by Doppler sonography of the left posterior auricular region. The tinnitus was intermittent and the patient could adapt to the tinnitus without intervention on the mastoid emissary vein. These findings suggest that a single large MEV can cause pulsatile tinnitus in the absence of other vascular abnormalities, and imaging studies of the posterior fossa and Doppler ultrasonography can aid the diagnosis in such cases. Free Article.

Internal carotid dissection caused by an elongated styloid process (Eagle syndrome).

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Eagle syndrome (symptoms associated with an elongated styloid process (SP)) is commonly divided into two presentations. First, the so-called classic Eagle syndrome where patients can present with unilateral sore throat, dysphagia, tinnitus, unilateral facial and neck pain and otalgia. Second, there is the vascular or stylocarotid form of Eagle syndrome in which the elongated SP is in contact with the extracranial internal carotid artery. We describe two cases of internal carotid artery dissection associated with an elongated SP. One is a patient with ischaemic stroke and another with transient ischaemic attacks caused by an elongated SP. A surgical resection of the SP was performed on the former patient. Both patients were treated with anticoagulation and recovered well. A literature search only revealed two prior descriptions of carotid dissection in the context of an elongated SP.


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Dural arteriovenous fistulae (DAVF) are cerebrovascular lesions with pathologic shunting into the venous system from arterial feeders. Digital subtraction angiography (DSA) has long been considered the gold standard for diagnosis, but advances in noninvasive imaging techniques now play a role in the diagnosis of these complex lesions. Herein, we describe the case of a patient with right-side pulsatile tinnitus and DAVF diagnosed using computed tomography angiography, magnetic resonance with arterial spin labeling, and DSA. Implications for imaging analysis of DAVFs and further research are discussed. Copyright © 2013 by the American Society of Neuroimaging.
Cochlear-facial dehiscence, a newly described entity.

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Dehiscence of the cochlear otic capsule has recently been described as a pathologic entity. We describe two cases of cochlear-facial dehiscence, which are the first reported: a 69 year-old male who complained of hearing loss, autophony, and pulsatile tinnitus, and a 41 year-old female who complained of left-sided hearing loss, pulsatile tinnitus, and vertigo. In both, CT showed bony dehiscence between the facial nerve and cochlea. Cochlear-facial dehiscence is another example of otic capsule dehiscence that produces symptoms of third window lesions. When patients present with third window lesion symptoms and the CT does not show superior canal dehiscence, cochlear-facial dehiscence should be considered. Copyright © 2013 The American Laryngological, Rhinological, and Otological Society, Inc.

Transitory stapedial myoclonus in a patient with benign fasciculation syndrome.

Brigo F, Storti M, Lochner P, Nardone R.

Department of Neurological, Neuropsychological, Morphological and Movement Sciences, Section of Clinical Neurology, Merano, Italy.

Objective: We report a previously undescribed association between transitory stapedial myoclonus, objective tinnitus and benign fasciculation syndrome. Method: Case report and review of the world literature regarding stapedial myoclonus. Results: A 30-year-old man with a diagnosis of benign fasciculation syndrome abruptly developed severe, low-pitched tinnitus on the right side. Otoscopic examination revealed rhythmic movement of the tympanic membrane, which was synchronous with the tinnitus. No palatal spasm was noted on nasopharyngeal examination. Brain magnetic resonance imaging and pure tone audiometry were unremarkable. Based on these findings, a diagnosis of objective tinnitus due to stapedial myoclonus was made. The objective tinnitus spontaneously disappeared within 48 hours of its appearance, but in the following days the patient suffered frequent, brief episodes of objective tinnitus lasting only a few seconds. Conclusion: The occurrence of stapedial myoclonus in this patient indicated the presence of an underlying motor unit hyper-excitability. This case suggests that, in some patients, stapedial myoclonus may represent the clinical expression of diffuse motor unit hyper-excitability.

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Tumor necrosis factor antagonists (anti-TNFa) are an established therapeutic option for several autoimmune and inflammatory bowel diseases. Despite their clinical effectiveness, neurological adverse events have been reported and literature data suggest a potential role of anti-TNFa in the induction of demyelination of the CNS. We present four patients treated with anti-TNFa who developed symptoms suggestive of CNS demyelination. The first patient, a 17-year-old male who received etanercept for psoriatic arthritis for eight months, presented with dysesthesias up to T4 level. The second patient, a 30-year-old male treated with adalimumab for three years due to ankylosing spondylitis, presented with right unilateral tinnitus. The third case, a 47-year-old female, received etanercept for four years because of psoriatic arthritis and developed persistent headache and left-sided face and head numbness. Finally, the fourth patient, a 57-years-old female treated with etanercept for six years due to ankylosing spondylitis, presented with difficulty in speech, swallowing, and ptosis of the right corner of the mouth. In all cases, brain MRI showed lesions suggestive of demyelination, while positive oligoclonal bands were detected in the CSF. Anti-TNFa treatments were discontinued and patients showed clinical improvement with pulsed intravenous corticosteroid therapy. CNS demyelination following anti-TNFa treatment represents a relatively rare but potential serious complication. Close follow-up and MRI monitoring of these patients is mandatory to elucidate whether the clinical manifestations represent adverse events occurring during anti-TNFa therapy or a first demyelinating episode.

Tornwald's cyst in clinical practice.

Szkiełkowska A, Slusarczyk A, Pietrasik K, Skarżyński H.

AIM: Tornwald’s cyst is a recess in the midline of the nasopharynx, which is produced by persistent notochord remnants. The aim of the study was to present difficulties in diagnostic procedures in patients with Tornwald’s cyst suspicion. MATERIAL AND METHOD: Authors present 2 cases of patients being treated for Tornwald’s cyst in the Audiology and Phoniatrics Clinic of Institute of Physiology and Pathology of Hearing in Warsaw. RESULTS: Discussed patients complained fullness in ears, hearing disorders, tinnitus, dysphagia, occipital headaches and balance problem. Both patients underwent ENT examination with endoscopic examination of nasopharynx and hearing assessment tests(pure tone audiometry, impedance audiometry). Magnetic resonance imaging and computer tomography were also performed. Surgery of nasopharyngeal cyst and tympanotomy with drainage of middle ear were performed in one patient. Second patient was treated with TRT therapy for her tinnitus. CONCLUSION: Tornwald's cyst should be remembered as an uncommon cause of hearing problems, tinnitus, fullness in ears, dysphagia, occipital headaches and balance problem. Magnetic resonance imaging seems to be the most specific method in Tornwald's cyst diagnosis. Copyright © 2013 Polish Otorhinolaryngology - Head and Neck Surgery Society. Published by Elsevier Urban & Partner Sp. z.o.o. All rights reserved.
Long delayed traumatic carotid-cavernous sinus fistula.
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Traumatic carotid-cavernous sinus fistula (TCCF) is a rare but significant vascular abnormality in the skull base found after craniomaxillofacial trauma. Although the direct type is usually caused by trauma, the onset of symptoms in TCCF may present several weeks after injury. We present the case of a patient who sustained a blunt head injury from falling down and was hospitalized with skull base fracture associated with zygomatic complex fractures on the right side. After surgery, the recovery was uneventful and the patient was discharged without any problems. On the eighth week postoperatively, the patient returned to hospital presenting tinnitus, bruit on the right orbital area, diplopia, eye pain, and headache. The patient also had severe limitation of ocular movement on lateral gaze. After having brain angio-CT, which showed a dilated superior ophthalmic vein, the diagnosis of CCF with cranial nerve VI was confirmed. The fistula was occluded successfully by using coils. After the procedure, tinnitus, bruit, and headache were reduced immediately. On following up 4 months after coiling, cranial nerve VI palsy and related symptoms-diplopia and limit of ocular movement-were improved significantly. Although TCCFs usually manifest symptoms early after trauma, in this case, the patient presented clinical signs 8 weeks post-injury, while the longest time that was acknowledged in another previously released article was 6 weeks. According to this case, we recommend a careful follow-up until 2 months for patients with skull base fracture in order to rule out the risk of CCF.

Primary paraganglioma in the facial nerve canal.
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OBJECTIVE: To describe primary paraganglioma in the facial nerve canal and discuss the characteristics of facial nerve paraganglioma in contrast with other tumors. CASE REPORT: A 23-year-old man developed gradually progressive right facial palsy as the initial symptom. One year later, he exhibited hearing loss without tinnitus in his right ear. CT demonstrated an enlarged facial nerve canal with irregular bony erosion of the circumference. MRI showed a well-enhanced heterogeneous mass with hypo-intensity spots inside it. During surgery, a blood-rich tumor was observed along the facial nerve: however, extensive bleeding interfered with tumor removal. The surgical specimen demonstrated paraganglioma. The tumor was completely removed in the second surgery in combination with arterial embolization. Facial nerve function was reconstructed with a free muscle flap more than one year following resection. CONCLUSION: Because paraganglioma is a blood-rich tumor, it is important to perform angiography and embolization. If preoperative facial nerve palsy is demonstrated, careful management of facial nerve function is needed. Paraganglioma must be considered in the differential diagnosis of a facial nerve tumor. Copyright © 2013 Elsevier Ireland Ltd. All rights reserved.
The dentato-rubro-olivary tract: clinical dimension of this anatomical pathway.

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Symptomatic palatal tremor is potentially the result of a lesion in the triangle of Guillain-Mollaret (1931) and is associated with hypertrophic olivary degeneration (HOD) which has characteristic MR findings. The triangle is defined by dentate efferents ascending through the superior cerebellar peduncle and crossing in the decussation of the brachium conjunctivum inferior to the red nucleus, to finally reach the inferior olivary nucleus (ION) via the central tegmental tract. The triangle is completed by ION decussating efferents terminating on the original dentate nucleus via the inferior cerebellar peduncle.

We can demonstrate the anatomy of this anatomical triangle using a clinical case of palatal tremor presenting with bilateral subjective pulsatile tinnitus along with the pathognomonic MR findings previously described. The hyperintense T2 signal in these patients may be permanent, but the hypertrophied olive normally regresses after 4 years. The temporal relationship between the evolution of the histopathology and the development of the palatal tremor remains unknown as does the natural history of the tremor. Botox injection at the level of tensor and levator veli palatini insertion have been used to treat patients with disabling tremor synchronous tinnitus. A lesion involving the triangle can have a quite varied clinical expression. Free PMC Article.

EMG-guided salpingopharyngeus Botox injection for palatal myoclonus.

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Palatal myoclonus (PM) is a rare neurological disorder characterized by involuntary movements of the soft palate musculature causing objective clicking tinnitus. Two forms are recognized as distinct clinical entities, with poorly understood pathogenesis: essential and symptomatic PM. The intrusive nature of the tinnitus prompts patients to seek medical advice. Conventional medical treatments with anxiolytics, antidepressants, and anticonvulsants have limited efficacy in these patients. In this case report, electromyography-guided injection of botulinum toxin type A (Botox; Allergan, Irvine, CA, USA) to the involved salpingopharyngeus and tensor veli palatini yielded satisfactory results with minimal temporary adverse effects.

Unilateral Papilledema in Pseudotumor Cerebri.
Semin Ophthalmol. 2013 Apr 29. [Epub ahead of print]

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Abstract Purpose: To report a case of a 25-year-old girl with pseudotumor cerebri who presented with unilateral swollen optic disk. Methods: A 25-year-old obese patient admitted to our ophthalmic department complaining of headaches, tinnitus, and transient visual obscurations for the last three months. Upon ophthalmic examination, the left optic nerve was swollen with a few hemorrhages compared to the normal-appearing right optic nerve. Following lumbar puncture with opening pressure of 350 mmHg, a diagnosis of pseudotumor cerebri was made and treatment with acetazolamide was started. Results: Three months later there were no episodes of visual obscurations and headache improved. Conclusion: Although rare, unilateral swollen disk could be a sign of unilateral papilledema due to increased intracranial pressure.
Non Surgical Treatment of Eagle's Syndrome - A Case Report -.

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Eagle's syndrome is a disease without a clear lesion that is associated with repeated episodes of pharyngalgia, odynophagia, the sensation of a foreign body in the pharynx, tinnitus, and otalgia in which patients displaying these types of symptoms must be given a differential diagnosis. It is known to be characterized by styloid process elongation or increasing compression to adjacent anatomical structures through stylohyoid ligament calcification. In serious cases, continuous pressure to the carotid artery can lead to a stroke. Diagnosis is confirmed through clinical symptoms, radiological findings, and physical examinations. The most common type of treatment consists of a surgical excision of elongated styloid process. Nonetheless, this study presents a case of treating Eagle's syndrome with conservative management. Free PMC Article.

A Case of Isolated Susac Occlusive Retinal Vasculitis.
J Neuroophthalmol. 2013 Apr 22. [Epub ahead of print]

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Susac syndrome is characterized by encephalopathy, sensorineural hearing loss, and branch retinal artery occlusion. Additional ocular findings include arteriolar wall hyperfluorescence and Gass plaques. We present a 51-year-old Caucasian woman with ophthalmologic findings indicative of Susac syndrome in the setting of tinnitus and migraine with aura.

Middle ear myoclonus: two informative cases and a systematic discussion of myogenic tinnitus.

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BACKGROUND: THE TERM MIDDLE EAR MYOCLONUS (MEM) HAS BEEN INVOocked TO EXPLAIN SYMPTOMS OF TINNITUS PRESUMABLY CAUSED BY THE DYSFUNCTIONAL MOVEMENT OF EITHER OF THE TWO MUSCLES THAT INSERT IN THE MIDDLE EAR: tensor tympani and stapedius. MEM has been characterized through heterogeneous case reports in the otolaryngology literature, where clinical presentation is variable, phenomenology is scarcely described, the pathogenic muscle is usually not specified, natural history is unknown, and the presumptive definitive treatment, tensor tympani or stapedius tendon lysis, is inconsistently effective. It is not surprising that no unique acoustogenic mechanism or pathophysiologic process has been identified to explain MEM, one of several descriptive diagnoses associated with the complicated disorders of myogenic tinnitus. METHODS: Here, we explore MEM from the neurologist's perspective. Following the detailed descriptions of two informative cases from our clinic, we systematically evaluate the different mechanisms and movement disorder phenomena that could lead to a diagnosis of MEM. RESULTS: From a functional neuroanatomic perspective, we explain how tensor tympani MEM is best explained as a form of peritubal myogenic tinnitus, similar to the related disorder of essential palatal tremor. From a pathogenic perspective, we discuss how MEM symptomatology may reflect different mechanical and neurologic processes. We emphasize the diagnostic imperative to recognize when myogenic tinnitus is consistent with a psychogenic origin. DISCUSSION: Both individual patient care and further elucidation of MEM will rely on more detailed clinical characterization as well as multidisciplinary input from neurology, otolaryngology, and dentistry. Free PMC Article.
Sigmoid sinus dehiscence resurfacing as treatment for pulsatile tinnitus.

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Aim: To report a case of sigmoid sinus dehiscence presenting with pulsatile tinnitus and treated successfully with resurfacing. Case report: This patient presented with pulsatile tinnitus due to sigmoid sinus dehiscence. This was successfully treated using only soft tissue resurfacing. Conclusion: Sigmoid sinus dehiscence is a rare but treatable cause of pulsatile tinnitus. It can occur in the absence of a diverticulum, and is not necessarily limited to the transverse sigmoid junction. When resurfacing, care must be taken not to significantly alter the extraluminal diameter of the sigmoid in a dominant sinus, as this raises the risk of post-operative hydrocephalus.

XV Specific Forms of Tinnitus

The Effect of Intratympanic Methylprednisolone and Gentamicin Injection on Meniere's Disease.

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Objectives: To compare the efficacy of intratympanic injections of methylprednisolone (ITMP) and intratympanic injections of gentamicin (ITG) to control the symptoms of Ménière's disease and to evaluate their effect on hearing level.

Study Design: A historical cohort study.

Setting: Tertiary referral center.

Subjects and Methods: Eighty-nine patients affected by Ménière's disease were included in this study, of whom 47 were treated with ITG and 42 were treated with ITMP. Two periods of follow-up were considered: 0 to 6 months and 6 to 12 months after the intratympanic injections (ITI).

Mean outcome measurements consisted of control of vertigo attacks, tinnitus, and aural fullness; pure-tone average (PTA); and speech discrimination score (SDS).

Results: The 2 groups had the same number of vertigo spells per month before ITI (P = .883). Six to 12 months after ITI, 82.9% of the ITG group and 48.1% of the ITMP group achieved complete control of vertigo (P = .004). There was better control of tinnitus and aural fullness with ITG than with ITMP (P ≤ .002). The 2 groups had a statistically significant difference in hearing level before ITI (P ≤ .001). This difference was no longer present 6 to 12 months after ITI (P > .05).

Conclusion: Intratympanic injections of gentamicin are more efficient than ITMP in controlling the symptoms of Ménière's disease. The 2 groups ended up without a difference in hearing level after ITI. According to these findings, administering ITMP to control Ménière's disease seems to be less beneficial than ITG.
Reevaluation of presentation and course of idiopathic intracranial hypertension - a large cohort comprehensive study.

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OBJECTIVES: We analyzed the clinical and ophthalmological findings in a large group of patients with idiopathic intracranial hypertension (IIH) trying to find factors that might influence the course of the disease.

MATERIALS AND METHODS: Medical records of patients with IIH were retrospectively reviewed. The patients included were women after menarche and men older than 18 years of age who were followed up for at least 1 year. RESULTS: Eighty-two patients (89% women) with a mean age of 30.2 ± 12.0 years were included. The prevailing complaint was headache and transient visual obscurations followed by tinnitus and double vision. Eighty-two percent of patients were overweight at the time of diagnosis. Overweight patients had higher opening cerebrospinal fluid (CSF) pressure than patients with normal weight did. The grade of papilledema correlated with the CSF opening pressure. Inverse correlation was found between the depression of the visual field sensitivity and the grade of papilledema. The mean follow-up time was 61.3 ± 62.3 months. Eighty-four percent of the patients have improved while in 22% CSF diversion procedures or optic nerve decompression was required. The mean body mass index (BMI) at the end of follow-up decreased significantly. Sixty-seven percent of the patients suffered a recurrence of IIH. The number of recurrences inversely correlated with weight loss. Visual field defects on presentation were encountered more frequently in patients with recurrence. Women with recurrence had a history of more pregnancies. CONCLUSIONS: Our results confirm the strong association between overweight and IIH. The recurrence rate seemed to be influenced by the obstetrical history and the severity of visual field defects at presentation. In contrast to some previous studies, we have found an interrelation between the CSF opening pressure, grade of papilledema and depression of the visual field sensitivity. © 2012 John Wiley & Sons A/S.

Long-term results of endolymphatic sac drainage with local steroids for intractable Meniere's disease.

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OBJECTIVES: Meniere's disease is a common inner ear disease characterized by vertigo, hearing loss and tinnitus. Since Meniere's disease is thought to be triggered by an immune insult to inner ear hydrops, we examined endolymphatic sac drainage with intra-endolymphatic sac application of large doses of steroids for intractable Meniere's patients and observed long-term results from 2 years to over a decade until 13 years. METHODS: Between 1998 and 2009, we enrolled and assigned 286 intractable Meniere's patients to two groups: group-I (G-I) included patients who underwent endolymphatic sac drainage with steroid instillation and group-II (G-II) included those who declined endolymphatic sac drainage. Definitive spells and hearing improvement in these two groups were determined for 2-13 years after treatment. RESULTS: According to the established criteria, vertigo was completely controlled in 88% of patients in G-I in the 2nd year, in 73% in the 12th year and in 70% in the 13th year. These results in G-I were significantly better than those in G-II for 13 years after treatment. Hearing was improved in 49% of patients in G-I in the 2nd year, in 27% in the 12th year and in 25% in the 13th year. These results in G-I were significantly better than those in G-II for 12 years after treatment, but this was not significant in the 13th year. CONCLUSIONS: Endolymphatic sac drainage with intra-endolymphatic sac application of large doses of steroids could improve long-term follow-up results of hearing as well as vertigo control. This means that the drainage with local steroids could also improve patients' long-term quality in the prime of life. Copyright © 2012 Elsevier Ireland Ltd. All rights reserved.
'Wind turbine syndrome': fact or fiction?
J Laryngol Otol. 2013 Jan 21:1-5. [Epub ahead of print]

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Objective: Symptoms, including tinnitus, ear pain and vertigo, have been reported following exposure to wind turbine noise. This review addresses the effects of infrasound and low frequency noise and questions the existence of 'wind turbine syndrome'. Design: This review is based on a search for articles published within the last 10 years, conducted using the PubMed database and Google Scholar search engine, which included in their title or abstract the terms 'wind turbine', 'infrasound' or 'low frequency noise'. Results: There is evidence that infrasound has a physiological effect on the ear. Until this effect is fully understood, it is impossible to conclude that wind turbine noise does not cause any of the symptoms described. However, many believe that these symptoms are related largely to the stress caused by unwanted noise exposure. Conclusion: There is some evidence of symptoms in patients exposed to wind turbine noise. The effects of infrasound require further investigation.

Treatment outcomes of intracranial dural arteriovenous fistulas of the transverse and sigmoid sinuses from a single institute in Asia.

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Intracranial dural arteriovenous fistulas (DAVFs) of the transverse and sigmoid sinuses (TSS) are rare in Asian populations. This study sought to evaluate the treatment outcomes of intracranial TSS DAVFs at a single Asian institute. Between 1989 and 2007, 122 patients presented to the Seoul National University Hospital with intracranial DAVFs; we performed a retrospective analysis of the 38 patients (31.1%) with TSS DAVFs. The common clinical presentations were headache (44.7%), tinnitus (39.5%), and intracranial hemorrhage (26.3%), and 71.1% had Borden type II or III lesions. Two patients were conservatively managed, two underwent surgery, and 34 were treated endovascularly with transarterial embolization (TAE), transvenous embolization (TVE), or both. The complete occlusion rate immediately after treatment was 50%. Of the 31 patients (81.6%) who underwent follow-up angiography, initial complete occlusion was achieved in 51.6%, and, at the last follow-up, the complete occlusion rate was 64.5%, with the surgery and TVE groups achieving 100% occlusion. The clinical cure rate was 34.2%, and 86.8% of patients had a favorable clinical outcome. However, all patients in both the surgery and TVE groups achieved a favorable clinical outcome. Four (26.7%) of 15 lesions with initially partial embolization showed delayed occlusion. Five patients (13.2%) exhibited clinical or angiographic signs of recurrence, and five patients had permanent complications. TSS DAVFs were less common than cavernous sinus DAVFs, unlike in Western countries, but the angiographic and clinical characteristics of TSS DAVFs were similar to those in Western countries. TSS DAVFs were successfully managed with different modalities, but both surgery and TVE were superior to conservative management or TAE. Copyright © 2012 Elsevier Ltd. All rights reserved.
Intracranial dural arteriovenous fistulas: natural history and rationale for treatment with stereotactic radiosurgery.

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Dural arteriovenous fistulas (DAVFs) are abnormal arteriovenous communications within the dura. The symptoms depend on their location and the pattern of the venous drainage. Patients with cavernous sinus DAVFs often present with ocular manifestations such as exophthalmos, chemosis and diplopia. Patients with transverse or sigmoid sinus DAVFs frequently experience headache and tinnitus on the affected side. DAVFs with anterograde sinus or cortical venous drainage (CVD) have been clinically regarded as benign, whereas DAVFs with retrograde CVD are considered aggressive in behavior. Similar to other cerebral arteriovenous malformations, DAVFs can hemorrhage, with an estimated annual risk of approximately 1.8%. The recommended therapeutic intervention for a DAVF is dependent on the anticipated natural history of the lesion. Management options include surgical resection, embolization and radiosurgery. Radiosurgical treatment has been used for DAVFs in various locations including the anterior cranial fossa, cavernous sinus, transverse/sigmoid sinus, superior sagittal sinus and tentorium. We present an update on 321 DAVF patients treated at the Taipei Veterans General Hospital using Gamma Knife radiosurgery. The prescribed mean margin dose was 17.2 Gy. In our series, 98% of patients had a stable or improved clinical condition after radiosurgery. Stereotactic radiosurgery using the Gamma Knife is a safe and effective alternative for the treatment of DAVFs. Copyright © 2013 S. Karger AG, Basel.

Pediatric sudden sensorineural hearing loss: Diagnosed causes and response to intervention.

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OBJECTIVE: Sudden sensorineural hearing loss (SSNHL) is an underappreciated issue in pediatric patient care. The goal of this study was to identify children who met the criteria for SSNHL and examine the etiologies, useful diagnostic studies, and treatment outcomes for these patients. METHODS: A retrospective medical records review was performed in patients meeting the criteria for SSNHL seen at a tertiary care pediatric hospital from 2007 to 2012. Information collected included age, gender, audiometric evaluations, onset and duration of hearing loss, additional symptoms, diagnostic studies and response to any medical management. The Institutional Review Board approved this project. RESULTS: 12/20 patients were male. Mean age was 11.41 years (3 months-24 years). Hearing loss was bilateral in 9/20 patients. Degree of hearing loss ranged from mild to profound across frequencies. Probable etiologies were viral of unknown type (n=12), late presentation of congenital CMV (n=1), noise-related (n=1), non organic (n=1), enlarged vestibular aqueduct (EVA) (n=1), one with both acute Epstein-Barr virus (EBV) and significant ototoxic exposure (n=1), one had significant ototoxic exposure and an inflammatory cerebrovascular incident (n=1), and unknown (n=2). Diagnostic studies included temporal bone computed tomography (CT) (n=15) and/or magnetic resonance imaging (MRI) (n=15), Lyme titers (n=9), streptococcal throat culture (n=1) and EBV (n=1) and mumps titers (n=1). Positive diagnostic studies included 1 MRI consistent with congenital CMV, and one CT that showed an EVA. 15/20 patients received systemic steroids, 3 received antivirals, and 4 got antibiotics. Response to steroids varied from complete resolution of SSNHL to worsening. Symptoms reported, in addition to the hearing loss included tinnitus (n=9), vertigo (n=9), sensation of a blocked ear (n=6), and otalgia (n=4). CONCLUSIONS: The incidence of SSNHL in pediatric patients is unknown. Etiologies of SSNHL include viral, EVA, ototoxicity, noise, and non-organic. Most studies were non-diagnostic although 2/22 CT/MRI provided an etiology. Identification of other causes required careful history review. The incidence of SSNHL in the pediatric population needs to be studied, and the timing, dosage, route and efficacy of steroids further evaluated. Copyright © 2013 Elsevier Ireland Ltd. All rights reserved.
Audiologic evaluation of Menière's disease patients one day and one week after intratympanic application of Gadolinium contrast agent: our experience in sixty-five patients.

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For many years the diagnosis of Menière's disease was a clinical diagnosis based on recurrent episodes of vertigo, hearing loss, aural fullness and/or tinnitus. The pathologic hallmark of Menière's disease is endolymphatic hydrops(1). Recently, the development of MRI and the use of intratympanically applied Gadolinium-based contrast agents have enabled the visualization of endolymphatic hydrops in living patients(2). © 2013 Blackwell Publishing Ltd. © 2013 Blackwell Publishing Ltd.

Lipomas of the cerebellopontine angle and internal auditory canal: Primum Non Nocere.

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OBJECTIVES/HYPOTHESIS: To describe the presentation and clinical course of cerebellopontine angle (CPA) and internal auditory canal (IAC) lipomas. STUDY DESIGN: Retrospective cohort study at a tertiary academic referral center. METHODS: All patients presenting with a CPA or IAC mass radiographically consistent with a lipoma on high-resolution magnetic resonance imaging (MRI) were identified. Data including presenting symptomatology, tumor characteristics, management strategy, and patient course were collected. RESULTS: Between 1996 and 2012, 15 patients were diagnosed with a CPA or IAC lipoma at the authors' institution and were included in the analysis. The mean duration of radiological and clinical follow-up was 3.4 years and 5.1 years, respectively. Eight lesions were confined to the IAC, while seven involved the CPA. The median tumor size at diagnosis was 7.2 mm; one patient demonstrated tumor growth on serial MRI while the remaining subjects did not have radiological progression. The most common presenting symptoms were sensorineural hearing loss (40%) and tinnitus (33%); five patients were diagnosed after incidental discovery on MRI. Fourteen patients were managed with observation, while one subject underwent subtotal resection. None of the observed patients reported worsening symptoms at last follow-up. CONCLUSIONS: While rare, lipomas should be included in the differential diagnosis of CPA and IAC lesions. Owing to a generally benign clinical course and high morbidity associated with resection, microsurgery should only be considered in cases of definite tumor enlargement with intractable symptoms from mass effect. Careful radiological evaluation is critical for establishing an accurate diagnosis in order to prevent unnecessary morbidity associated with resection. LEVEL OF EVIDENCE: 2b. Copyright © 2012 The American Laryngological, Rhinological, and Otological Society, Inc.
Endolymphatic hydrops in patients with tinnitus as the major symptom.
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Tinnitus is one of the symptoms of Meniere's disease. The relationship between a clinical presentation of subjective tinnitus or ear fullness and endolymphatic hydrops (EH) has not yet been explored. We studied 15 patients with symptoms of tinnitus as their major complaint, with or without hearing loss, who were evaluated using magnetic resonance imaging (MRI). The mean age of the subjects was 59 years (range 35-79 years). Nine were women and six were men. Patients were divided into two groups based on whether they had fluctuating or stable tinnitus. These groups were subdivided in the presence or absence of accompanying sensation of ear fullness. MRI was performed 4 h after intravenous gadolinium administration. Overall, 30 ears were evaluated. EH in the cochlea was present in 14 of 25 symptomatic ears (56 %) in patients with tinnitus as the major complaint. Significant hydrops was present in 7 of 14 ears and mild hydrops in the other ears. Patients with fluctuating tinnitus had EH more frequently than patients with stable tinnitus. Furthermore, the presence of ear fullness also correlated with the presence of EH in the cochlea. However, there was no significant relationship between EH in the cochlea and age, sex, duration of tinnitus, hearing level or the configuration of the audiogram. Our study revealed that patients who had tinnitus as their major symptom often had EH. Using MRI to identify this covert early EH in patients who have tinnitus as their major symptom may broaden the treatment options for tinnitus.

Meniere’s disease: a reappraisal supported by a variable latency of symptoms and the MRI visualisation of endolymphatic hydrops.

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OBJECTIVES: To evaluate the onset of vertigo, hearing loss and tinnitus in Ménière's disease and the associated endolymphatic hydrops (EH) of the inner ear. DESIGN: Multicentre evaluation of three patient groups. SETTINGS: Disease-specific symptoms were reviewed among referred patients in a tertiary referral hospital in Finland and in members of a Finnish Ménéière Association in Finland. The MRI of a separate group of patients was undertaken in a tertiary referral centre in Japan. PARTICIPANTS: 340 patients were reviewed in the referral hospital along with 740 members of the Ménéière Association. MRI was undertaken in 224 patients in Japan. PRIMARY AND SECONDARY OUTCOME MEASURES: Latency and symptom development in Ménière’s disease, and the appearance of EH of the inner ear in monosymptomatic patients and in Ménière’s disease. RESULTS: The mean age of the first symptom was 43.8 years, with 10% of the patients being older than 65 years. The time delay between hearing loss and vertigo was more than 5 years in 20% of the members and of the patients. Gadolinium-contrasted MRI demonstrated EH in 90% of the patients with Ménéière's disease, in which 75% was bilateral among patients with unilateral symptoms. In monosymptomatic patients with vertigo, tinnitus or hearing loss; EH was demonstrated in 55-90% of the patients either in the cochlea and/or the vestibulum of the symptomatic ear. CONCLUSIONS: Ménéiere's disease often shows bilateral EH and comprises a continuum from a monosymptomatic disease to the typical symptom complex of the disease. We suggest that a 3T MRI measurement should be carried out in patients with sensory-neural hearing loss, vertigo and tinnitus, 4 h after the intravenous injection of a gadolinium-contrast agent to verify the inner ear pathology. This may lead to a better management of the condition.
Surgery for Ménière’s disease.

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BACKGROUND: This is an update of a Cochrane review first published in The Cochrane Library in Issue 1, 2010. Ménière’s disease is characterised by three major symptoms: vertigo, deafness, and tinnitus or aural fullness, all of which are discontinuous and variable in intensity. A number of surgical modalities, of varying levels of invasiveness, have been developed to reduce the symptoms of Ménière’s disease, but it is not clear whether or not these are effective. OBJECTIVES: To assess the effectiveness of surgical options for the treatment of Ménière's disease. All surgical interventions used in the treatment of Ménière’s disease, either to alter the natural history of the disease or to abolish vestibular function, were considered for this review. SEARCH METHODS: We searched the Cochrane Ear, Nose and Throat Disorders Group Trials Register; the Cochrane Central Register of Controlled Trials (CENTRAL); PubMed; EMBASE; CINAHL; Web of Science; BIOSIS Previews; Cambridge Scientific Abstracts; ICTR and additional sources for published and unpublished trials. The date of the most recent search was 7 November 2012. SELECTION CRITERIA: Randomised or quasi-randomised controlled studies of a surgical modality versus a placebo therapy in Ménière’s disease. DATA COLLECTION AND ANALYSIS: Two authors independently assessed trial quality and extracted data. We contacted study authors for further information. MAIN RESULTS: The only surgical intervention which has been evaluated in randomised controlled trials and met the inclusion criteria was endolymphatic sac surgery. We identified two randomised trials, involving a total of 59 patients; one comparing endolymphatic sac surgery with ventilation tubes and one with simple mastoidectomy. Neither study reported any beneficial effect of surgery either in comparison to placebo surgery or grommet insertion. AUTHORS’ CONCLUSIONS: The two trials included in this review provide insufficient evidence of the beneficial effect of endolymphatic sac surgery in Ménière’s disease. Update of Cochrane Database Syst Rev. 2010;(1):CD005395.

Hearing loss in Muckle-Wells syndrome.


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OBJECTIVE: Muckle-Wells syndrome (MWS) is an inherited autoinflammatory disease characterized by fevers, rashes, arthralgia, conjunctivitis, and sensorineural hearing loss. In MWS, NLRP3 gene mutations are associated with excessive interleukin-1 release. The aims of this study were to determine the otologic characteristics of MWS, define trajectories of hearing loss, and explore the association with distinct NLRP3 genotypes. METHODS: A prospective observational cohort study of children and adults diagnosed as having MWS was conducted at a single center. NLRP3 gene mutations were determined. Patients underwent standardized clinical, laboratory, and otologic assessments, including pure tone audiometry, vestibular organ testing, and tinnitus evaluation. Trajectories of hearing loss were defined for each genotype. The genotype-specific risk of progression of hearing loss was determined. RESULTS: A total of 33 patients ages 3-75 years who were members of 5 families with 4 different NLRP3 gene mutations were included. The majority of patients (67%) experienced bilateral sensorineural hearing loss. Even in cases of profound hearing loss vestibular reactivity remained normal. Fourteen adult patients reported nondebilitating tinnitus. Overall, hearing impairment progressed with age. Patients with the T348M mutation were at highest risk of rapid progression of sensorineural hearing loss. CONCLUSION: Patients with MWS are at risk of developing progressive sensorineural hearing loss without vestibular involvement. Hearing impairment starts at high frequencies and can subsequently progress to profound hearing loss. Progression is age dependent. Patients with different NLRP3 mutations had distinctly different trajectories of hearing loss, suggesting a mutation-specific risk that should be considered when making treatment decisions. Copyright © 2013 by the American College of Rheumatology.
Occipital artery anastomosis to vertebral artery causing pulsatile tinnitus.

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Pulsatile tinnitus can result from various vascular etiologies that cause transmission of pulsatile turbulent flow into the inner ear. Less commonly, non-vascular sources cause increased blood flow and transmission of sound perceived as tinnitus. Thorough clinical examination leads to appropriate imaging evaluation and therapeutic planning. Most pulsatile tinnitus results from expected mechanisms, such as dural arteriovenous fistula, jugular bulb dehiscence, or paraganglioma; however, the literature contains reports of numerous rare causes, particularly variant anatomic morphologies. We present the case of a novel cause of pulsatile tinnitus in which collateral vascular flow compensated for decreased normal intracranial cerebral arterial supply and might have caused catastrophic consequences if intervened upon after assumptions based on an incomplete evaluation.

[Post-dural puncture headache and blood-patch: Theoretical and practical approach.]
[Article in French]
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OBJECTIVE: To review the current research and formulate a rational approach to the physiopathology, cause and treatment of post-dural puncture headache (PDPH). DATA SOURCES: Articles published to December 2011 were obtained through a search of Medline for the MeSh terms "epidural blood-patch" and "post-dural puncture headache". STUDY SELECTION: Six hundred and eighty-two pertinent studies were included and 200 were analysed. DATA SYNTHESIS: Resulting of a dural tap after spinal anaesthesia or diagnostic lumbar puncture or as a complication of epidural anaesthesia, PDPH occurs when an excessive leak of cerebrospinal fluid leads to intracranial hypotension associated to a resultant cerebral vasodilatation. Reduction in cerebrospinal fluid volume in upright position may cause traction of the intracranial structure and stretching of vessels. Typically postural, headache may be associated to nausea, photophobia, tinnitus or arm pain and changes in hearing acuity. In severe cases, there may be cranial nerve dysfunction and nerve palsies secondary to traction on those nerves. The Epidural Blood-Patch (EBP) is considered as the "gold standard" in the treatment of PDHP because it induces a prolonged elevation of subarachnoid and epidural pressures, whereas such elevation is transient with saline or dextran. EBP should be performed within 24-48 hours of onset of headache; the optimum volume of epidural blood appears to be 15-20 mL. Severe complications following EBP are exceptional. The use of echography may be safety puncture. The optimum timing of epidural blood-patch, the resort of repeating procedure if the symptomatology does not disappear, the alternative to the conventional medical treatment need to be determined by future clinical trial. Copyright © 2013 Société française d'anesthésie et de réanimation (Sfar). Published by Elsevier SAS. All rights reserved.
Working disability in Norwegian patients with Vestibular Schwannoma: Vertigo predicts future dependence.

Breivik CN, Nilsen RM, Myrseth E, Finnkirk MK, Lund-Johansen M.

Objective: We examined if reduced hearing, tinnitus, dizziness and unsteadiness affected the patients' ability to maintain work within a time frame of 2-10 years after diagnosis. Method: Altogether 434 consecutive patients were followed at regular intervals. Data on symptoms were scored prospectively in a dichotomized way each time and by Visual Analog Scales for tinnitus and vertigo. Study design is retrospective. Hearing acuity was scored according to the Gardner-Robertson scale, and unsteadiness was measured on a balance platform. Patients were asked about working status, and scored as receiving governmental compensation for disability or not. Results: 206 patients were eligible for study. Of these, 1 died and 9 were lost to follow up. 97 patients received conservative management, 49 patients received gamma knife radiosurgery and 50 patients were treated by microsurgery. Mean follow-up time was 58.7 months (range 20-132). There was a significant increase in the number of individuals receiving compensation during the study period (p<0.0001). At baseline, the proportion of pension receivers was within same range as that of the age-and sex-matched Norwegian population, (5.61 versus 6.91%, case-control OR of 0.82 (0.45-1.49 CI 95%, p=0.51, NS). At final time point, the rise in the number of receivers deviated significantly from the reference population (case-control OR 3.80 (2.71-5.33 CI 95 %, p= <0.001, S). Examining symptoms at first presentation as predictors of future dependence revealed that vertigo and higher mean age were associated with a higher risk(p<0.001 and p= 0.015,respectively) No other symptoms were predictive of dependence. Conclusion: In a prospectively followed cohort of Norwegian VS patients, vestibular complaints were significant predictors for becoming dependant of disability pension.

Tonic tensor tympani syndrome in tinnitus and hyperacusis patients: A multi-clinic prevalence study.

Westcott M, Sanchez TG, Diges I, Saba C, Dineen R, McNeill C, Chiam A, O'Keefe M, Sharples T.

Tonic tensor tympani syndrome (TTTS) is an involuntary, anxiety-based condition where the reflex threshold for tensor tympani muscle activity is reduced, causing a frequent spasm. This can trigger aural symptoms from tympanic membrane tension, middle ear ventilation alterations and trigeminal nerve irritability. TTTS is considered to cause the distinctive symptoms of acoustic shock (AS), which can develop after exposure to an unexpected loud sound perceived as highly threatening. Hyperacusis is a dominant AS symptom. Aural pain/blockage without underlying pathology has been noted in tinnitus and hyperacusis patients, without wide acknowledgment. This multiclinic study investigated the prevalence of TTTS symptoms and AS in tinnitus and hyperacusis patients. This study included consecutive patients with tinnitus and/or hyperacusis seen in multiple clinics. Data collected: Symptoms consistent with TTTS (pain/numbness/burning in and around the ear; aural "blockage"; mild vertigo/nausea; "muffled" hearing; tympanic flutter; headache); onset or exacerbation from exposure to loud/intolerable sounds; tinnitus/hyperacusis severity. All patients were medically cleared of underlying pathology, which could cause these symptoms. 60.0% of the total sample (345 patients), 40.6% of tinnitus only patients, 81.1% of hyperacusis patients had ≥1 symptoms (P < 0.001). 68% of severe tinnitus patients, 91.3% of severe hyperacusis patients had ≥1 symptoms (P < 0.001). 19.7% (68/345) of patients in the total sample had AS. 83.8% of AS patients had hyperacusis, 41.2% of non-AS patients had hyperacusis (P < 0.001). The high prevalence of TTTS symptoms suggests they readily develop in tinnitus patients, more particularly with hyperacusis. Along with AS, they should be routinely investigated in history-taking.
Illustrative cases of unorthodox tinnitus management.

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Bone remodeling disorders have been identified as potential candidates for the etiology underlying some forms of otologic disease. Here, four clinical cases are presented to demonstrate a novel approach to tinnitus management that focuses on two fundamental etiologic bases. First, is the effect of bone remodeling abnormalities of the otic capsule and second, the effect of blood sugar and insulin abnormalities upon the function of the inner ear and self-reports of tinnitus. This report presents the effect of treatment directed at bone remodeling abnormalities of the otic capsule and abnormalities of blood sugar and insulin. The treatment effects led to a substantial reduction in subjective tinnitus. These findings suggest a potential convergence between bone pathophysiology and some forms of tinnitus.

Is there a relationship between subjective pulsatile tinnitus and petrous bone pneumatization?

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Our objective was to evaluate the relationship between subjective pulsatile tinnitus and petrous bone pneumatization. Twenty-five patients admitted between January 2012 and March 2012 were assessed. The control group data were obtained by assessment of petrous bone images of 25 cases in which paranasal sinus computed tomography (CT) was performed because of chronic sinusitis and in which no ear pathology was present. Temporal bone CT images of patients with subjective pulsatile tinnitus were compared with those of patients with no ear complaints. The presence of petrous bone pneumatization was evaluated by CT. Subjective pulsatile tinnitus complaints were present for 32 of 50 ears. Pneumatization was detected in the petrous bone of 22 (68.8%) of 32 ears with subjective pulsatile tinnitus. In the control group, 25 patients (50 ears) with no ear complaints were assessed. Petrous bone pneumatization was detected in 12 (24%) of 50 ears comprising the control group. There was a statistically significant difference between the 2 groups (P = 0.000 < 0.001). Petrous bone pneumatization might be the cause of the subjective pulsatile tinnitus.

[Idiopathic intracranial hypertension--what's new in 2012?].
[Article in Hebrew]
Harefuah. 2013 Feb;152(2):115-8, 121.

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Idiopathic intracranial hypertension (IIH) is a syndrome characterized by elevated intracranial pressure, without evidence of intracranial mass lesion or venous thrombosis on brain imaging. The syndrome mainly occurs in young, fertile and overweight women, but may emerge in any age group, even in young children or individuals over 45 years of age. The incidence of the disease in Israel is similar to that of other developed countries, approximately 1:100,000. This syndrome's most prominent symptom is headaches, which are reported by approximately 90% of the patients. Other symptoms are transient visual obscurations, tinnitus, or diplopia. Some patients may be asymptomatic, and only diagnosed after having undergone routine fundus examination; however, this is more common in children. Treatment is based on weight loss. The medical therapy prescribed is carbonic anhydrase inhibitors, especially: acetazolamide, and in severe cases, surgery may be indicated. The syndrome is paroxysmal by nature, and an attack may develop even after periods of remission; therefore, a long continuous follow-up is needed to monitor disease progression,
and to intervene in time. The etiology of the disease is unknown. Nevertheless, new data has emerged in past years, and the goal of this review is to describe the syndrome and present new recently published information.

**Why do patients with fibromyalgia complain of ear-related symptoms? Ear-related symptoms and otological findings in patients with fibromyalgia.**
Clin Rheumatol. 2013 May 23. [Epub ahead of print]


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While fibromyalgia is frequently associated with ear-related symptoms such as feeling of ear fullness, earache, and tinnitus, the pathogenesis of these ear-related symptoms in fibromyalgia patients is unknown. Here, we focused on clarifying the pathogenesis of ear fullness, a particularly common symptom observed in fibromyalgia patients. Twenty patients diagnosed with fibromyalgia on outpatient psychosomatic treatment complaining of ear-related symptoms answered our questionnaire and underwent neurotological examination, including pure tone audiometry and Eustachian tube function testing. While ear-related symptoms were significantly exacerbated after onset of fibromyalgia, we noted no correlation between the presence or absence of feeling of ear fullness and abnormal findings on neurotological examination. Given our findings, we suspect that onset of ear fullness may be associated not with abnormal findings in the middle and inner ear function tests but with other causes, such as central desensitization.

**Rotational Vertebral Artery Occlusion: Mechanisms and Long-term Outcome.**
Stroke. 2013 May 28. [Epub ahead of print]


From the Departments of Neurology.

BACKGROUND AND PURPOSE: To elucidate the mechanisms and prognosis of rotational vertebral artery occlusion (RVAO). METHODS: We analyzed clinical and radiological characteristics, patterns of induced nystagmus, and outcome in 21 patients (13 men, aged 29-77 years) with RVAO documented by dynamic cerebral angiography during an 8-year period at 3 University Hospitals in Korea. The follow-up periods ranged from 5 to 91 months (median, 37.5 months). Most patients (n=19; 90.5%) received conservative treatments. RESULTS: All the patients developed vertigo accompanied by tinnitus (38%), fainting (24%), or blurred vision (19%). Only 12 (57.1%) patients showed the typical pattern of RVAO during dynamic cerebral angiography, a compression of the dominant vertebral artery at the C1-2 level during contralateral head rotation. The induced nystagmus was mostly downbeat with horizontal and torsional components beating toward the compressed vertebral artery side. None of the patients with conservative treatments developed posterior circulation stroke, and 4 of them (21.1%) showed resolution of symptoms during the follow-ups. CONCLUSIONS: RVAO has various patterns of vertebral artery compression, and favorable long-term outcome with conservative treatments. In most patients with RVAO, the symptoms may be ascribed to asymmetrical excitation of the bilateral labyrinth induced by transient ischemia or by disinhibition from inferior cerebellar hypoperfusion. Conservative management might be considered as the first-line treatment of RVAO.
Auditory profile in superficial siderosis of the central nervous system: a prospective study.

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OBJECTIVE: To identify auditory pathology resulting from superficial siderosis of the central nervous system (SSCN), auditory site of lesion, and a clinical profile for differential diagnosis and development of recommendations. STUDY DESIGN: Prospective study. SETTING: Academic clinical center. PATIENTS: Ten participants with SSCN (the largest prospective evaluation of audiologic status reported to date). INTERVENTION(S): Demographics, clinical characteristics and history, audiometric evaluation, and Tinnitus Handicap Inventory (THI). MAIN OUTCOME MEASURE(S): Type and degree of hearing loss, relationship to clinical course of SSCN, and expected results based on age and sex. RESULTS: Sensorineural hearing loss (SNHL) is the most common symptom in SSCN (100%). Tinnitus (100%), imbalance (80%), and gait disorder (80%) were also frequently reported. Hearing loss is typically bilateral, asymmetric, progressive, sloping, and exceeds expected hearing loss related to age and sex. Hearing loss may be cochlear and/or retrocochlear in origin. Decreased word recognition is possible, and traditional amplification may offer limited benefit. CONCLUSION: We observed significant audiometric findings in all participants. SSCN variably and pathologically targets the auditory system without regard for duration of disorder. A long asymptomatic phase and lack of predictive relationship between duration and severity of hearing loss makes suspicion of SSCN based solely on audiometric battery difficult; however, asymmetric hearing loss exceeding expectations, particularly with history of head trauma or previous neurosurgical procedure, should raise a red flag and trigger further medical evaluation including MRI. Diagnosis of SSCN may alter expectations for audiologic prognosis and is a critical component for comprehensive management of SSCN patients.

Hearing handicap in adults with unilateral deafness and bilateral hearing loss.

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OBJECTIVE: To assess the perception of hearing handicap in adult patients with unilateral sudden sensorineural hearing loss (SNHL) compared with those with bilateral SNHL or unilateral congenital SNHL. STUDY DESIGN: Retrospective chart review. SETTING: Multicenter department of otolaryngology referrals. PATIENTS: Seventy-one subjects in the unilateral severe-profound (>70 dB) sudden SNHL group (Group 1), 17 subjects in the unilateral prelingual or congenital SNHL group (Group 2), and 121 subjects in the bilateral SNHL group (Group 3). INTERVENTIONS: Questionnaire. MAIN OUTCOME MEASURES: Hearing Handicap Inventory for Adults (HHIA) and visual analogue scale (VAS) measurements of hearing handicap. RESULTS: Average levels of hearing loss were 92 dB in Group 1, 109 dB in Group 2, and 67 dB in Group 3. The relative percentage scores of HHIA and VAS compared with Group 3 were 72.6% and 81.0% in Group 1 and 25.4% and 50.3% in Group 2, respectively. A mild correlation between the HHIA subscale or VAS scores and degree of hearing loss could be found in Group 3. No significant correlation was found between the HHIA subscale or VAS scores and duration of hearing loss in Group 1 or Group 3. Higher scores were obtained in male subjects than in female subjects. Patients in Group 1 who were troubled by tinnitus scored significantly higher in the HHIA. In multiple logistic regression analysis, presence of tinnitus, older age, higher average hearing loss level, and group (bilateral SNHL>unilateral
sudden SNHL>unilateral precongenital SNHL) revealed a significant positive association with high score (>42) of HHIA (odds ratio, 3.171, 1.021, 1.031, and 6.690, respectively). CONCLUSION: The results of HHIA and VAS suggest that not only patients with bilateral SNHL but also those with unilateral sudden SNHL, particularly those who have tinnitus, experience a hearing handicap.

Differences and similarities between spontaneous dissections of the internal carotid artery and the vertebral artery.


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BACKGROUND AND PURPOSE: To compare potential risk factors, clinical symptoms, diagnostic delay, and 3-month outcome between spontaneous internal carotid artery dissection (sICAD) and spontaneous vertebral artery dissection (sVAD). METHODS: We compared patients with sICAD (n=668) and sVAD (n=302) treated in 3 university hospitals. RESULTS: Patients with sICAD were older (46.3±9.6 versus 42.0±10.2 years; P<0.001), more often men (62.7% versus 53.0%; P=0.004), and presented more frequently with tinnitus (10.9% versus 3.4%; P<0.001) and more severe ischemic strokes (median National Institutes of Health Stroke Scale, 10±7.1 versus 5±5.9; P<0.001). Patients with sVAD had more often bilateral dissections (15.2% versus 7.6%; P<0.001) and were more often smokers (36.0% versus 28.7%; P=0.007). Thunderclap headache (9.2% versus 3.6%; P=0.001) and neck pain were more common (65.8% versus 33.5%; P<0.001) in sVAD. Subarachnoid hemorrhage (6.0% versus 0.6%; P<0.001) and ischemic stroke (69.5% versus 52.2%; P<0.001) were more frequent in sVAD. After multivariate analysis, sex difference lost its significance (P=0.21), and all other variables remained significant. Time to diagnosis was similar in sICAD and sVAD and improved between 2001 and 2012 compared with the previous 10-year period (8.0±10.5 days versus 10.7±13.2 days; P=0.004). In sVAD, favorable outcome 3 months after ischemic stroke (modified Rankin Scale, 0-2: 88.8% versus 58.4%; P<0.001), recurrent transient ischemic attack (4.8% versus 1.1%; P=0.001), and recurrent ischemic stroke (2.8% versus 0.7%; P=0.02) within 3 months were more frequent. CONCLUSIONS: sICAD and sVAD patients differ in many aspects. Future studies should perform separate analyses of these 2 entities.

Synthesis of neamine-based pseudodisaccharides as potential vestibulotoxic agents to treat vertigo in Ménière's disease.

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Ménière's disease (MD) is a progressive disease of the inner ear characterized by recurring attacks of disabling vertigo, hearing loss and tinnitus. Patients who do not respond to vestibular sedatives or steroids may require an intratympanic application of aminoglycoside antibiotics, which destroys the vestibular function of the affected ear in order to avoid the debilitating vertigo attacks. Although effective, this procedure causes hearing loss in almost one third of the patients due to the aminoglycosides cochlear toxicity. Here we describe the synthesis of two pseudodisaccharides structurally related to neamime aiming to mimic the aminoglycosides pharmacophore core by replacing their toxic amine by azide and hydroxyl groups. Products 1 and 2 selectively promoted 'in vivo' damage to vestibular tissues without causing hearing loss or cochlear toxicity. Therefore, these pseudodisaccharides stand as promising lead compounds for the development of a safer and more effective therapeutic procedure to manage the symptoms of MD severe dizziness. Copyright © 2013 Elsevier Ltd. All rights reserved.
Visual and neurological outcomes following endovascular stenting for pseudotumor cerebri associated with transverse sinus stenosis.


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BACKGROUND: : Pseudotumor cerebri (PTC) is characterized by raised intracranial pressure (ICP) without an identifiable mass, evidence of hydrocephalus, or abnormal cerebrospinal fluid content. In the past, most cases of PTC appeared to have no identifiable etiology, and thus, they were classified as "idiopathic intracranial hypertension" (IIH). Recently, however, a subset of patients with presumed IIH has been found to have evidence of cerebral dural sinus stenoses, particularly involving one or both transverse sinuses (TS). The belief that the stenoses are the cause, rather than an effect of the increased ICP, has led investigators to recommend stenting of the stenosed sinus for the treatment of the condition. We describe detailed visual and neurological outcomes after stenting for PTC associated with hemodynamically significant dural sinus stenosis.

METHODS: : All patients with PTC had initial neurological, neuro-ophthalmological, and imaging assessments. Regardless of the findings, all were treated with medical therapy. If medical therapy failed and TS stenosis was detected on contrast-enhanced magnetic resonance or computed tomographic venography, catheter cerebral angiography with venous manometry was performed. If a mean pressure gradient (MPG) of 4 mm Hg or greater was present, unilateral transverse sinus stenting was performed.

RESULTS: : Twelve patients with PTC and TS stenosis associated with an MPG of >4 mm Hg who failed medical therapy were identified. TS stenting significantly decreased the pressure gradient in all cases. Unilateral stenting was sufficient to reduce pressure gradients even when the stenosis was bilateral. At a mean follow-up of 16 months (range, 9-36 months), tinnitus had improved in all patients, and 10 of 12 patients had improvement in visual function. Seven patients had significant improvement in headaches.

CONCLUSION: : In this small series of patients with PTC associated with TS stenosis, endovascular stent placement was generally effective in treating visual dysfunction and tinnitus, although not headaches. The optimum gradient and vascular characteristics amenable for selection of patients for stenting needs further research.

Middle ear myoclonus: two informative cases and a systematic discussion of myogenic tinnitus.


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BACKGROUND: THE TERM MIDDLE EAR MYOCLONUS (MEM) HAS BEEN INVOKED TO EXPLAIN SYMPTOMS OF TINNITUS PRESUMABLY CAUSED BY THE DYSFUNCTIONAL MOVEMENT OF EITHER OF THE TWO MUSCLES THAT INSERT IN THE MIDDLE EAR: tensor tympani and stapedius. MEM has been characterized through heterogeneous case reports in the otolaryngology literature, where clinical presentation is variable, phenomenology is scarcely described, the pathogenic muscle is usually not specified, natural history is unknown, and the presumptive definitive treatment, tensor tympani or stapedius tendon lysis, is inconsistently effective. It is not surprising that no unique acoustogenic mechanism or pathophysiologic process has been identified to explain MEM, one of several descriptive diagnoses associated with the complicated disorders of myogenic tinnitus. METHODS: Here, we explore MEM from the neurologist's perspective. Following the detailed descriptions of two informative cases from our clinic, we systematically evaluate the different mechanisms and movement disorder phenomena that could lead to a diagnosis of MEM. RESULTS: From a functional neuroanatomic perspective, we explain how tensor tympani MEM is best explained as a form of peritubal myogenic tinnitus, similar to the related
disorder of essential palatal tremor. From a pathogenic perspective, we discuss how MEM symptomatology may reflect different mechanical and neurologic processes. We emphasize the diagnostic imperative to recognize when myogenic tinnitus is consistent with a psychogenic origin. DISCUSSION: Both individual patient care and further elucidation of MEM will rely on more detailed clinical characterization as well as multidisciplinary input from neurology, otolaryngology, and dentistry. Free PMC Article.

Dehiscence of the superior semicircular canal: a review of the literature on its possible pathogenic explanations.
Eur Arch Otorhinolaryngol. 2013 Apr 18. [Epub ahead of print]
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The dehiscence of superior semicircular canal is a well-known affection which is able to explain some cases of hearing loss, tinnitus and/or vertigo unexpectedly presenting in adults without previous otologic affections. Although a diagnostic algorithm has been assessed and a surgical therapy has been indicated, the review of the literature shows that a completely satisfactory explanation for the reason why symptoms of a supposed congenital condition only occur in adulthood is still lacking. A pathogenic hypothesis based on the slow metabolism of the bony labyrinth, which could in time result in a prevalence of bone re-absorption on new bone formation leading to a dehiscence, despite some controversial findings could represent a the most reliable explanation for the question.

XVI Animal Models

Experimental Hyperactivity of the Endolymphatic Sac.
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Injury to the endolymphatic sac may play an important role in the pathogenesis of Ménière's disease, an inner ear disorder characterized by hearing loss, tinnitus and attacks of vertigo. Isoimmunization of 16 inbred Lewis rats with a crude endolymphatic sac extract and complete Freund's adjuvant induced hyperactivity of the endolymphatic sac. One group of rats was immunized by a single dose whereas a second group was immunized twice. Control animals were injected with Freund's adjuvant in saline only. Serum was collected from all rats by the end of the study and harvested autoantibodies were tested by immunohistochemistry. The endolymphatic sacs were investigated by transmission electron microscopy. Endolymphatic sac stimulation was observed in all immunized rats. Based on detailed ultrastructural observations, the degree of reactivity seemed proportional to the number of injections and the extent of immunization. Moreover, the ribosome-rich cells seemed hyperactive with an extravagant content of intracellular components: numerous rough endoplasmic reticulum and free ribosomes, morphological signs of extensive endo- and exocytosis, vesicles of material with a density similar to the homogeneous substance of which many were observed to fuse with primary lysozymes. Basolateral foldings were numerous and in the subepithelial capillaries formation of multiple and apposing fenestrations were observed. No endolymphatic sac stimulation was observed in the control animals. Specific ribosome-rich cell alterations identical to those present in the endolymphatic sac of Ménière's disease were observed 21 days after the first immunization. The observations suggest that either an autoantigen or a trophic factor, capable of inducing a hyperactivity of the ribosome-rich cells and an imbalance of the homogeneous substance metabolism, exists in the endolymphatic sac of the rat. Copyright © 2013 S. Karger AG, Basel.
A novel behavioural approach to detecting tinnitus in the guinea pig.


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Tinnitus, the perception of sound in the absence of an external stimulus, is a particularly challenging condition to demonstrate in animals. In any animal model, objective confirmation of tinnitus is essential before we can study the neural changes that produce it. A gap detection method, based on prepulse inhibition of the whole-body startle reflex, is often used as a behavioural test for tinnitus in rodents. However, in the guinea pig the whole-body startle reflex is subject to rapid habituation and hence is not an ideal behavioural measure. By contrast, in this species the Preyer or pinna reflex is a very reliable indicator of the startle response and is much less subject to habituation. We have developed a novel adaptation of the gap detection paradigm, which uses the Preyer reflex to measure the startle response, rather than whole-body movement. Using this method, we have demonstrated changes in gap detection, in guinea pigs where tinnitus had been induced by the administration of a high dose of salicylate. Our data indicate that the Preyer reflex gap detection method is a reliable test for tinnitus in guinea pigs. Copyright © 2013. Published by Elsevier B.V.

Behavioral Evidence for Possible Simultaneous Induction of Hyperacusis and Tinnitus Following Intense Sound Exposure.


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Many human subjects suffering from chronic tinnitus also suffer from hyperacusis, a heightened perception of loudness at moderate to intense sound levels. While numerous studies suggest that animals develop chronic tinnitus following intense noise exposure, it is not yet clear whether sound exposure also induces chronic hyperacusis-like responses in animals. We addressed this question by examining the chronic effects of intense sound exposure on the acoustic startle response (ASR) and its suppression by background noise containing brief gaps. We compared startle amplitudes in intense tone-exposed (10 kHz, 115 dB SPL, 4 h) and age-matched controls at 2-28 weeks post-exposure. While both groups showed similar startle thresholds, exposed animals showed a hyperacusis-like augmentation of ASR at high stimulus levels. Addition of background noise had little effect on ASR in controls but had a strong suppressive effect on startle in exposed animals, indicating a sensitization to background noise. When the background noise contained a gap preceding the startle stimulus, ASR was suppressed in control animals, but exposed animals showed a marked weakening of gap-induced suppression of ASR. This weakening of gap-induced startle suppression is consistent with the interpretation that the gap may have been masked by tinnitus. The associated hyper-responsiveness to startle stimuli presented alone and the sensitization to background noise suggest that hyperacusis may have also been induced. The results indicate that noise exposure leads to increases in the gain of auditory responsiveness and may offer a model of the association of hyperacusis with tinnitus.
Establishment of auditory discrimination and detection of tinnitus induced by salicylic acid and intense tone exposure in the rat.
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Rats were trained in a two lever food reinforced operant procedure to discriminate a 8000Hz pure tone stimulus from its absence. Responding on one lever was reinforced in the presence of the tone and responding on the other lever was reinforced when the tone was absent. Frequency generalization testing yielded an inverted U-shaped function, whereas sound pressure level generalization testing yielded a continuous decrease in responding on the tone associated lever with decreasing sound pressure levels. The administration of sodium salicylic acid (150-450mg/kg) generated responding on the tone associated lever suggesting that salicylic acid induced an experience that had commonalities with the percept of the training tone stimulus. After exposure to intense sound, responding consistent with the presence of tinnitus was achieved and Lidocaine failed to reduce tinnitus behavior. The use of a two choice design helped avoid confounding factors induced by drug induced side effects. Further, since no auditory cues were employed in the test situation the model achieves resistance to potential bias due to hearing impairment and hyperacusis. We propose that this model may be useful in detecting tinnitus. Copyright © 2013 Elsevier B.V. All rights reserved.

XVII Psychological Factors

Association between depression and tinnitus in a nationally representative sample of US older adults.
Aging Ment Health. 2013 Mar 6. [Epub ahead of print]

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Objectives: Few population-based studies examining the association between tinnitus and depression among older adults have been conducted. Therefore, the purpose of this study was to examine the association between tinnitus and depression among a nationally representative sample of US older adults.

Methods: Data from the 2005-2006 National Health and Nutrition Examination Survey was used. 696 older adults (70-85 yr) completed questionnaires on tinnitus and depression, with depression assessed using the Patient Health Questionnaire-9. Results: After controlling for firearm use, age, gender, race-ethnicity, cardiovascular/stroke history, diabetes, smoking status, body mass index, physical activity, noise exposure and elevated blood pressure, there was a significant positive association (beta coefficient: 1.28, 95% CI: 0.26-2.29, p = 0.01) between depression and tinnitus being at least a moderate problem, suggesting that those who perceived their tinnitus to be a moderate problem were more likely to be depressed than those perceiving it to be a small or no problem. Additionally, after adjustments, those who were bothered by tinnitus when going to bed were 3.06 times more likely to be depressed than those who were not bothered by tinnitus when going to bed (OR = 2.44, 95% CI: 1.03-5.76, p = 0.04). Conclusion: These findings suggest that individuals who perceive their tinnitus to be a problem or have problems with tinnitus when going to bed may be in need of intervention to prevent or reduce their depression symptoms so as to ensure that other areas of their life are not negatively influenced.
Gender and Chronic Tinnitus: Differences in Tinnitus-Related Distress Depend on Age and Duration of Tinnitus.

Ear Hear. 2013 Feb 22. [Epub ahead of print]

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OBJECTIVE:: Conflicting data about the role of gender in tinnitus distress exist in the literature. In addition, little is known about gender differences regarding age and duration of tinnitus. Tinnitus was shown to be related to stress and impairment of coping, sense of coherence, and personal resources. There are known differences in the aforementioned psychological parameters between man and women or among different age groups. The authors hypothesized that this may also be true for patients with chronic tinnitus in addition to gender- and age-related differences in tinnitus annoyance. Therefore, using a large number of patients with chronic tinnitus, the authors analyzed pretherapeutic scores of tinnitus annoyance, perceived stress, proactive coping strategies, sense of coherence, and personal resources in addition to hearing loss and tinnitus pitch and loudness in respect to gender and age of the patients as well as duration of tinnitus.

DESIGN:: The study group included 607 female and 573 male patients who reported tinnitus for longer than 3 months. The age of the patients ranged from 17 to 81 years in both gender groups. Pretherapeutic scores of tinnitus annoyance, perceived stress, proactive coping strategies, sense of coherence, and personal resources as well as the degree of hearing loss and tinnitus pitch and loudness were analyzed.

RESULTS:: Irrespective of age and tinnitus duration, women were more annoyed by tinnitus and perceived more stress than men did. In addition, women scored lower than men in proactive coping, sense of coherence, and personal resources but had lower levels of hearing loss and tinnitus loudness than men did. The differences were small, but statistically significant. Analysis of three age groups revealed significant differences between older female and male patients. Tinnitus annoyance was stronger in the middle-age groups of women and men (45-59 years of age) than in younger patients and decreased again in older men (≥60 years of age), but not in older women. Women, but not men, had cognitive distress scores that progressed with age. Older women (≥60 years of age) reported more sleep disturbances than older men. Women had more somatic complaints and coped less efficiently than men, except for younger patients (<45 years of age). The scores of perceived stress decreased whereas scores of sense of coherence and self-efficacy increased in older men and women (≥60 years of age). However, women scored worse than men did in this age group. Hearing loss was found to be correlated with tinnitus loudness and age in both gender groups. The duration of tinnitus affected subjective hearing problems, intrusiveness of tinnitus, and proactive coping. This association was in part age-dependent. CONCLUSIONS:: The authors found gender differences regarding tinnitus-related distress in patients with chronic tinnitus; however, these differences depended on age and in part on duration of tinnitus. Addressing these differences could result in improved, tailored therapy approaches. For instance, applying physical exercise and relaxation techniques could be of special help for older women to reduce their somatic complaints and sleep disturbances. Similarly, cognitive behavioral therapy could reduce their cognitive distress. Therapy for younger patients should in particular include stress management.
Medically unexplained symptoms and somatisation in ENT.
J Laryngol Otol. 2013 Apr 10:1-6. [Epub ahead of print]

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Background: Somatisation has been described as the perception of a physiological event influenced by emotion. Method: A review of the medical literature was carried out using the following Medical Subject Headings: somatisation (which identified 357 articles), medically unexplained symptoms (749 articles), unexplained or idiopathic dizziness (142 articles), tinnitus (360 articles), catarrh (1068 articles) and globus pharyngeus (3114 articles). Results: Up to 40 per cent of out-patient attendances have medically unexplainable symptoms. In ENT clinics, this includes patients with dizziness, tinnitus, 'pseudo' eustachian tube dysfunction, being 'unable to hear', catarrh and postnasal drip, atypical facial pain, globus pharyngeus, and functional dysphonia. Medical explanations of these symptoms often differ from patients' perceptions. Demonstrating normal test results and providing reassurance have little effect on patients’ doubts and anxieties. Consultations that recognise the symptoms and their impact, and offer a tangible and involving explanation are more likely to satisfy and empower patients. Conclusion: The treatment of medically unexplained symptoms has changed in recent years; there is now more emphasis on psychological factors due to an association with anxiety and depression.

Systematic review on the evidences of an association between tinnitus and depression.

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Tinnitus has been associated with several psychiatric disorders, however there are still several questions regarding such association. OBJECTIVE: To assess the scientific evidence on the associations between symptoms of depression, depression, and tinnitus. METHOD: A systematic review was performed using PubMed, Lilacs, and SciELO scientific databases. This review included studies published in Portuguese, Spanish, or English correlating tinnitus with depression; letters to the editor and case reports were excluded. RESULTS: A total of 64 studies were identified, of which only 20 met the inclusion criteria and only 2 were case-control clinical trials. The majority of the studies (n = 18) found that depression is associated with tinnitus, either as a predisposition - resulting in poor adaptation to tinnitus or as a consequence of severe disease. CONCLUSION: An overall assessment of all of the selected studies suggests at least 3 possible associations between depression and tinnitus: depression affecting tinnitus, tinnitus predisposing individuals to depression, and tinnitus appearing as a comorbidity in patients with depression. There is a high prevalence of depressive symptoms in individuals with tinnitus, but the mechanisms by which depression and tinnitus mutually interact, are not fully understood. Free Article.
Association between sleep disorders, hyperacusis and tinnitus: Evaluation with tinnitus questionnaires.

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Patients with tinnitus are heterogeneous and several factors influence the impact of this symptom on the quality of life. The aim of the study is to evaluate the relationship between age, gender, sleep disorders, hyperacusis and tinnitus annoyance and to demonstrate the utility of tinnitus questionnaires as screening tools for sleep disorders and hyperacusis in patients with tinnitus. 37 consecutive patients (18 males and 19 females) with subjective tinnitus lasting over 3 months were evaluated with a complete interview, otological examination, pure tone audiometry, Italian version of tinnitus sample case history (TSCH) and tinnitus handicap inventory (THI). Statistical analysis was performed with the Wilcoxon's rank sum test, the Spearman's rho non-parametric correlation and the logistic regression analysis. THI grades were slight (16%), mild (32%), moderate (30%), severe (19%) and catastrophic (3%). Based on the answers to TSCH 20 patients reported sleep disorders (54%) and 20 patients reported hyperacusis (54%). 11 patients (30%) reported sleep disorders and hyperacusis. No significant correlation was found between the severity of tinnitus and patients' age and gender. Significant correlation was found between sleep disorders (P = 0.0009) and tinnitus annoyance and between hyperacusis (P = 0.03) and tinnitus annoyance. TSCH and THI may be considered as screening tools in the clinical practice to evidence sleep disorders and hyperacusis in patients with tinnitus.


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OBJECTIVE: Sudden sensorineural hearing loss (SSNHL) is defined as >30dB of hearing loss in at least three contiguous test frequencies occurring within 3 days or less and may be accompanied by tinnitus and vertigo. Despite the well-documented association between hearing loss and depressive symptoms, research on the emotional distress after SSNHL receives only scant attention. DESIGN: The current study sought to (1) investigate the degree of self-reported mental distress in patients with SSNHL after a median follow-up period of 1 year, (2) investigate the association between mental distress, hearing recovery, and tinnitus. Study sample: 147 patients admitted for sudden hearing loss and diagnosed with SSNHL. RESULTS: Patients who recovered from SSNHL reported significantly less depressive symptoms. Patients with tinnitus, compared to those without tinnitus, reported more depressive thoughts and feelings, more disruptive activities and personal relationships, and more physical symptoms. CONCLUSIONS: This study showed that SSNHL patients who developed continuous tinnitus had a higher rate of greater emotional distress than those without tinnitus. Further research on the consequences of different risk factors specific to SSNHL, their impact on psychological well-being, and the development of better treatment strategies is needed to lessen the burdens associated with SSNHL. Copyright © 2013 Elsevier Inc. All rights reserved.
Clinical Trials
Source: www.clinicaltrials.gov (July 2013)

Neuro-Music-Therapy for Patients With Chronic Tinnitus - a Controlled Clinical Trial Condition: Tinnitus

This study has been completed.
Study NCT01845155
Information provided by (Responsible Party): German Center for Music Therapy Research
Study Start Date: March 2006
First Received on April 24, 2013.

BACKGROUND: Tinnitus is a nonspecific symptom of hearing disorder characterized by the sensation of buzzing, ringing, clicking, pulsations, and other noises in the ear. Despite a variety of treatments, many patients with chronic tinnitus ask for more active ways in coping with their tinnitus. Gold standard treatment in chronic tinnitus is a comprehensive directive counseling explaining the underlying mechanisms leading to the tinnitus percept. Therefore a neuro-music therapeutic treatment based on a bio-psycho-social framework was developed and compared to a counselling-only control group.

INTERVENTION: two standardized protocols for tinnitus therapy were defined ("neuro-music therapy" vs. "counselling")

Investigating the Neurobiology of Tinnitus

This study is not yet open for participant recruitment.
Study NCT01294124
Information provided by (Responsible Party): Jay F. Piccirillo, MD, Washington University School of Medicine
Study Start Date: September 2013
First Received on February 9, 2011

The investigators hypothesize that individual differences exist in resting-state cortical attention, control, sensory, and emotion networks prior to noise exposure and these differences predispose some to the development of bothersome tinnitus. Furthermore, the investigators hypothesize that these changes in functional connectivity of these vulnerable systems after noise exposure are responsible for tinnitus. The proposed study will use a case-control cohort study design. Cases will be those soldiers who develop tinnitus and controls will be those who do not. This will be the first prospective study of tinnitus and will provide important information about the neurobiology of tinnitus. If a cortical neural network etiology for bothersome tinnitus is confirmed, it will be an astounding, powerful, paradigm shifting model for the diagnosis, prevention and, most importantly, treatment of tinnitus. Furthermore, if a battery of neurocognitive tests can identify soldiers at risk for the development of tinnitus then appropriate primary prevention strategies can be introduced. There are three Specific Aims to this project.

Specific Aim 1. To determine if soldiers who develop tinnitus display pre-deployment differences in a set of physical, functional, cognitive, vulnerability, perpetuating factors, pre-deployment neurocognitive scores, or neuroimaging features compared to soldiers who do not develop tinnitus ("control group").

Specific Aim 2. To determine if particular scores on neurocognitive tests or neuroimaging features of functional/structural connectivity networks are associated with the development of tinnitus.

Specific Aim 3. To identify a set of pre-deployment physical, functional, cognitive, vulnerability, and perpetuating factors, neurocognitive responses, and neuroimaging features that are associated with the development of tinnitus. The investigators plan to recruit 200 soldiers, between the ages of 18 and 30 years who do not have hearing loss or tinnitus and have never been deployed to military theater. The soldier participants will undergo a variety of tests before and after deployment, which will include a hearing
test, neurocognitive tests (i.e., brain function tests), and a variety of novel radiologic imaging studies of the brain. One of these novel radiologic imaging studies is functional connectivity Magnetic Resonance Imaging, a proven methodology that monitors changes in brain activity and connections based on blood flow between different brain areas and levels of consumption of oxygen. This information is used to describe the condition of important neural networks responsible for such things as attention, mood, sensation, vision, hearing, and introspection or self-contemplation.

**The Influence of the Sound Generator Combined With Conventional Amplification for Tinnitus Control: Blind Randomized Clinical Trial**

This study has been completed.
ClinicalTrials.gov Identifier: NCT01857661
Information provided by (Responsible Party): Gisele Munhoes dos Santos, University of Sao Paulo
Study Start Date: September 2012
First received: May 15, 2013

This study, in the form of a blind randomized clinical trial, was approved by CAPPesq under protocol number: 0163/10. 49 adults with tinnitus and sensorineural hearing loss were randomly assigned into 2 groups. Both groups received counseling about tinnitus. One group received hearing aids with only amplification and the other group received hearing aids with an integrated sound generator. After the fitting process, both groups were told to use the hearing devices 8 hours per day. The outcome measures as the tinnitus handicap inventory and psychoacoustics measurements were conducted by a blind audiologist that didn't know each group each patient belonged to.

**Treatment of Acute Peripheral Tinnitus Following Traumatic Cochlear Injury or Otitis Media (TACTT2)**

This study is not yet open for participant recruitment.
ClinicalTrials.gov Identifier: NCT01803646
Information provided by (Responsible Party): Auris Medical, Inc.
Study Start Date: August 2013
First received: March 1, 2013

This phase III study is being conducted to confirm the efficacy and safety of AM-101 in the treatment of peripheral tinnitus in the acute stage (up to 3 months from onset). The present study is assessing the drug's safety and is aiming to demonstrate and confirm that three i.t. administrations of AM-101 at a concentration of 0.87 mg/mL will show a therapeutic benefit through a improvement in tinnitus loudness.

**Verify the Effectiveness rTMS Using MEG**

This study is currently recruiting participants.
ClinicalTrials.gov Identifier: NCT01874444
Information provided by (Responsible Party): Seoul National University Hospital
Study Start Date: May 2013
First received: June 4, 2013

The purpose of this study is to determine whether rTMS are effective in the treatment of tinnitus. Repetitive transcranial magnetic stimulation (rTMS) of the dorsolateral prefrontal cortex (DLPFC) has an add-on effect for primary auditory cortex rTMS in improving tinnitus-related distress. We aimed to investigate whether rTMS of the dorsolateral prefrontal cortex and primary auditory cortex are capable of reducing tinnitus loudness. Linked to a neuronavigation system that is guided by magnetic resonance imaging (MRI) of the frontal and temporal, rTMS can suppress areas of cortical plasticity. This cortical reorganization can be demonstrated by magnetoencephalography (MEG)
Cone Beam CT for Diagnosis of Select Otorhinolaryngology (ENT) Indications at Lower Dose (CBCT-ENT)

This study is enrolling participants by invitation only.
ClinicalTrials.gov Identifier: NCT01855425
Information provided by (Responsible Party): Carestream Health, Inc.
Study Start Date: September 2012
First received: May 6, 2013

The study objective is to compare the CBCT images generated by the CS 9300 to those generated by conventional CT. It proposes a direct comparison of diagnostic image quality between the CS 9300 and conventional CT using double image examinations.

Dose-Response Study of MDMA-assisted Psychotherapy in People With PTSD

This study is currently recruiting participants.
ClinicalTrials.gov Identifier: NCT01793610
Information provided by (Responsible Party): Multidisciplinary Association for Psychedelic Studies
Study Start Date: April 2013
First received: February 13, 2013

Posttraumatic stress disorder (PTSD) is a debilitating disorder that can develop after people experience a traumatic event, such as a rape, car accident or other life threatening event. PTSD is a worldwide health problem. PTSD is treated with psychotherapy or drugs, but these treatments do not help everyone. 3,4-methylenedioxymethamphetamine (MDMA)-assisted psychotherapy might be a potential treatment for PTSD. MDMA is the active ingredient in ecstasy. Before it was made illegal, some psychotherapists combined MDMA with psychotherapy to help treat people with psychological problems, including PTSD.

This study is a randomized, double-blind dose-response study comparing comparator-dose MDMA with full-dose MDMA. The study drug will be given as an initial dose possibly followed 1.5 hours later by a second dose half the size of the first dose. This Phase 2 pilot study will examine the safety and efficacy of MDMA-assisted psychotherapy in 12 subjects with chronic, treatment-resistant PTSD of at least 6 months duration who were unable to recover despite having received prior treatment with either drug or psychotherapy, or who discontinued treatment due to lack of tolerance for the treatment. Seven subjects will be randomized to the full dose condition of full-dose MDMA and five subjects will be randomized to comparator-dose MDMA.

MDMA will be administered in two experimental sessions lasting up to 8 hours and scheduled three to five weeks apart.

The will last up to one and a half years, including approximately three to five months of psychotherapy, and a long-term follow up visit scheduled a year after the final experimental session. Study subjects will have a medical and psychiatric examination to make sure that they can take part in the study. Once in the study, they will see the same male and female psychotherapist for the entire study. The subject will learn more about MDMA-assisted psychotherapy and the investigators will learn more about the subject during three preparatory sessions occurring before the first experimental session. During experimental sessions, subjects will receive an initial dose of either full or comparator-dose MDMA along with psychotherapy, and one and a half to two and a half hours later, the subject may have a supplemental dose half the size of the initial dose of MDMA. Vital signs and psychological distress will be measured throughout the experimental session. There will be three integrative psychotherapy sessions after each experimental session, including one occurring the day after an experimental session. Subjects will express, understand, bring together and connect any of their thoughts or feelings about your symptoms and their causes, and they will discuss their experience during experimental sessions with the therapists.

Subjects will learn whether they received the comparator or the full dose of MDMA one month after their second experimental session. Subjects who received full-dose MDMA will finish Stage 1 and have a third experimental session, while subjects who received comparator-dose may go on to Stage 2, an open-label
stage that is nearly identical to stage 1, with one instead of three preparatory sessions and full-dose MDMA during all sessions.

Symptoms of PTSD and depression and sleep quality will be measured in all subjects at baseline, one month after the second experimental session and 12 months after their final experimental session. Subjects who received the full dose and go on to the third experimental session will complete questionnaires and measures of their symptoms of PTSD and depression and sleep quality two months after the third experimental session. Subjects assigned to comparator-dose MDMA will be tested one month after their second Stage 2 experimental session and two months after the third experimental session. People will also complete measures of their experience of the experimental session soon after each experimental session.

This study will compare the effects of MDMA-assisted psychotherapy with comparator versus full-dose MDMA, and it will also assess the duration of any changes in symptoms a year after MDMA-assisted psychotherapy.

**Phase 2 Study of Bevacizumab in Children and Young Adults With Neurofibromatosis 2 and Progressive Vestibular Schwannomas (NF-2)**

This study is currently recruiting participants.
ClinicalTrials.gov Identifier: NCT01767792
Information provided by (Responsible Party): Bruce Korf, MD, University of Alabama at Birmingham
Study Start Date: May 2013
First received: January 7, 2013

Subjects will be treated with open-label bevacizumab 10 mg/kg every 2 weeks for 24 weeks (induction therapy). Clinical response will be assessed by audiology and MRI at weeks 12 and 24. Subjects with hearing decline at weeks 12 or 24 will be taken off of protocol. At week 24, patients with a clinical response or stable disease (together comprising "clinical benefit") will transition to maintenance therapy with bevacizumab. During the maintenance phase, subjects will be treated with open-label bevacizumab 5 mg/kg every 3 weeks for up to 72 weeks. Subjects will be followed with audiology and MRI scans every 12 weeks. The total time of the study will be 96 weeks (24 weeks induction + 72 weeks maintenance).

Subjects will be allowed to increase their bevacizumab dose to 10 mg/kg every 2 weeks during maintenance therapy if they experience hearing decline during maintenance therapy (defined as decrease in word recognition score below the 95% critical difference compared with the word recognition score at baseline, Appendix A). Subjects will be taken off of study if their word recognition score does not remain within the 95% critical difference after receiving bevacizumab 10 mg/kg every 2 weeks.