EDITORIAL

Dear friends and colleagues,

“TINNITUS: FROM COCHLEA TO BRAIN AND BACK” is the motto of the upcoming 9th International TRI Tinnitus Conference, which will take place in Ann Arbor, Michigan USA, from June 7 till 10, 2015.

We are enthusiastically looking forward to this year's conference. There will be three full conference days of inspiring talks and discussions. Tinnitus specialists from around the world will present their newest research, results and insights. There will be about 50 oral and over 60 poster presentations on the basic mechanisms underlying tinnitus, therapeutic interventions and translational research.

We are very grateful to Prof. Susan Shore, the world leading basic science specialist on somatic tinnitus, who is responsible for the very smooth organization of the 9th TRI conference. Thanks, Susan, for welcoming the tinnitus research community in the "home town of basic somatosensory tinnitus research".

We are looking forward to seeing you in Ann Arbor to share the most recent and exciting research results and to discuss future directions, to foster further scientific collaborations, to meet old friends and to make new ones. Have a save trip.

Sincerely,

Ana Belén Elgoyhen    Dirk De Ridder    Berthold Langguth
Winfried Schlee     Sylvia Dorner-Mitschke

DISCLAIMER
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RESEARCH HIGHLIGHTS


The authors Conrad et al. introduce a new questionnaire that enables researchers to operationalize dysfunctional cognitions in tinnitus patients with a short 22-item self-report.


The gap detection test is used in animal research as a testing instrument for tinnitus. The tinnitus sound is supposed to fill the silent gap in an auditory stream, which makes the gap undetectable for the tinnitus animal. Two independent research groups (Boyen et al. and An et al.) have investigated the gap detection in human tinnitus patients. Both groups found that this test cannot be used in human tinnitus subjects. (Please compare also earlier work on this topic by Campolo et al. 2013 as well as Fournier & Hébert 2013).


The tinnitus perception is not static in most of the patients and rather changes from one moment to the other. The authors Dauman et al. discuss different aspects of this intra-individual tinnitus variability and its relevance for the clinical practice.


Tinnitus can be considered as a heterogeneous phenomenon with different clinical subtypes. The authors of these paper take this fact into account and classify the tinnitus patients to different subtypes. Levine & Oron identified two major subtypes of tinnitus: 1) an auditory disorder and 2) a somatosensory disorder - and a combination of the two. The authors Cianfrone et al. use three major categories: 1) auditory tinnitus, 2) somatosensory tinnitus, 3) psychopathology-related tinnitus - and a combined tinnitus type.
9TH INTERNATIONAL
TRI Tinnitus Conference
Tinnitus: From Cochlea to Brain and Back
June 7-10, 2015, Ann Arbor, Michigan
FEATURED SPEAKERS

Eberhard Biesinger, MD
Head of Tinnitus Clinic, Traunstein, Germany,
Hospital of Traunstein, Department of Otolaryngology

Donald Caspary, PhD
Professor, Distinguished Scholar,
Department of Pharmacology,
Southern Illinois University School of Medicine

Gabriel Corfas, PhD
Professor and Associate Chair for Research,
Department of Otolaryngology,
Director, Kresge Hearing Research Institute
University of Michigan

Jos Eggermont, PhD
Professor,
Department of Physiology and Pharmacology
University of Calgary

James Kaltenbach, PhD
Professor,
Department of Neurosciences
Director, Otology Research
Cleveland Clinic, Ohio

Marlies Knipper, PhD
Professor,
Molecular Physiology of Hearing
Hearing Research Centre Tübingen, Germany

Sharon Kujawa, PhD
Associate Professor,
Department of Otology & Laryngology
Harvard Medical School
Director, Department of Audiology, Massachusetts Eye and Ear Infirmary
Adjunct Faculty, Harvard-MIT Speech and Hearing Biosciences and Technology

Berthold Langguth, MD, PhD
Chair TRI
Professor,
Department of Psychiatry
University of Regensburg, Germany

Jennifer Melcher, PhD
Associate Professor,
Department of Otology and Laryngology
Associate Scientist,
Massachusetts Eye and Ear Infirmary
Harvard Medical School

Yehoash Raphael, PhD
Professor,
Department of Otolaryngology
Kresge Hearing Research Institute
R. Jamison and Betty Williams Professor of Otolaryngology
University of Michigan

Larry Roberts, PhD
Professor,
Department of Psychology, Neuroscience, and Behaviour
McMaster University, Canada

Tanit Sanchez, MD, PhD
Professor,
ENT Department, University of São Paulo School of Medicine
Director of Instituto Ganz Sanchez, Brazil

Martin Sarter, PhD
Professor,
Department of Psychology
Charles M. Butter Collegiate Professor of Psychology
University of Michigan

Winfried Schlee, PhD
Department of Psychiatry and Psychotherapy
University of Regensburg

Michael Seidman, MD, FACS
Director Division Otologic/Neurotologic Surgery
Medical Director Wellness Henry Ford Hospital WB
Medical Director Center for Integrative N + Medicine
Henry Ford Health System

Susan Shore, PhD
Symposium Chair
Professor,
Department of Otolaryngology, Molecular and Integrative Physiology and Biomedical Engineering
Kresge Hearing Research Institute
Joseph Hawkins, Jr. Collegiate Research Professor
University of Michigan

Michael Sutton, PhD
Assistant Professor,
Department of Molecular & Integrative Physiology
Assistant Professor,
Molecular & Behavioral Neuroscience Institute
University of Michigan

Jeremy Turner, PhD
Assistant Professor,
Department of Psychology
Southern Illinois School of Medicine

INVITED DISCUSSANTS

Ana Belén Elgoyhen, PhD
Professor,
Argentine National Research Council

Sylvie Hébert, PhD
Professor,
School of Audiology and Speech Pathology
Université de Montréal

Joseph Rauschecker, PhD
Professor,
Department of Physiology and Biophysics
Georgetown University

Richard Salvi, PhD
Professor,
Department of Communicative Disorders and Sciences
University at Buffalo, State University of New York

PLANNING COMMITTEE

Susan Shore, PhD
Symposium Chair
Professor,
Department of Otolaryngology, Molecular and Integrative Physiology and Biomedical Engineering
Kresge Hearing Research Institute
Joseph Hawkins, Jr. Collegiate Research Professor
University of Michigan
MONDAY, JUNE 8, 2015

8:00 am  Conference Registration/Continental Breakfast

8:30  Opening Remarks and Course Announcements
   Gabriel Corfas, PhD
   Susan Shore, PhD
   Berthold Langguth, MD, PhD

9:00  Molecular Underpinnings of Tinnitus
   Featured Speaker, Marlies Knipper, PhD, Germany
   Introduced by Ana Belén Elgoyhen, PhD

9:30  Cochlear Synaptopathy of Noise and Aging
   Featured Speaker, Sharon Kujawa, PhD, United States
   Introduced by Jennifer Melcher, PhD

10:00  Morning Break

10:15  PODIUM SESSION 1
   Moderators - Ana Belén Elgoyhen, PhD
   Yehoash Raphael, PhD

   Cochlear Pathology Underlying Tinnitus
   *Paul, Brandon; Paul, T.; Roberts, L.E.; Bruce, I.C.; Bosnyak, D.J.; Thompson, D.C., Canada

   On the Newly-Emerging Fields of Perceptual, Emotional, and Cognitive Magnetic Resonance Spectroscopy
   *Cacace, Anthony; Galloway, M.P.; Woodard, J.L.; Sajja, VSSS; Hu, J.; Ghoddoussi, F.; VandeVorde, P.; Xuan Y., United States

   Tinnitus Suppression with Looped Intracochlear Electrical Stimulation
   *Arts, Remo; George, E.L.J.; Griessner A.; Zierhofer, C.; Stokroos, R.J., Netherlands

   Cochlear Implantation in Unilateral Deafness - A Cure for Tinnitus
   *Kirkby-Strachan, Grace; Que-Hee, C.; Hoddinott, B., Australia

   Piribedil, Memantine and ACEMG Pretreatment Reduces Noise-Induced Loss of Inner Hair Cell-Auditory Nerve Ribbons and Reduces Incidence of Tinnitus

3:00  PODIUM SESSION 2
   Moderators - David Martel, MS
   Joseph Rauschecker, PhD

   Deep Brain Stimulation of the Inferior Colliculus Reduces Tinnitus in a Validated Animal Model for Tinnitus
   *Smit, Jasper; Janssen, MILF; Johanshahi, A.; Temel, Y.; Stokroos, R.J., Netherlands

   Auditory Midbrain Implant (AMI): Implications for Tinnitus Treatment
   *Lim, Hubert; Offutt, S.; Hughes, R., United States

   Thalamocortical Rhythms are Altered by RTMS in Association with Tinnitus Improvement
   *Mennemeier, Mark; Carter, G.; Govindan, R.B.; Brown, G.; Dornhoffer, J.; Garcia-Rill, E.; Greenfield, L.J.; Hayor, A.; Shihabuddin, B.; Thostenson, J., United States

   Top-Down and Bottom-Up Neuromodulation to Suppress Tinnitus
   *Zhang, Jinheng, United States

   Acoustic Coordinated Reset Neuromodulation in a Real Life Patient Population with Chronic Tonal Tinnitus

3:45  POSTER SESSION 2
   Discussant - Sylvie Hébert, PhD

   Multiple Parallel Brainstem Pathways are Hyper-Responsive in Human Tinnitus: A Result of Top-Down Neuromodulation?
   Featured Speaker, Jennifer Melcher, PhD, United States
   Introduced by Joseph Rauschecker, PhD

   Brain Stimulation for the Treatment of Tinnitus: Where Do We Stand and What the Future Brings?
   Featured Speaker, Berthold Langguth, MD, PhD, Germany
   Introduced by Richard Salvi, PhD

4:15  PODIUM SESSION 3
   Moderators - Joseph Rauschecker, PhD
   David Martel, MS

   Cofactor-Dependent Tinnitus Suppression
   *Wood, Y.; Green, J.; Wood, A.; Swann, V., United States

   Cortical and Auditory Brainstem Modulation for Tinnitus Suppression
   *Georgiou, C.; Elgoyhen, A., Germany

   Neural Interactions and Tinnitus Suppression with Sound-Induced Neurostimulation
   *Hochmair-Desoyer, I.; Desoyer, H.; Desoyer, A.; Desoyer, T., Austria

   Tinnitus Suppression with Sound-Induced Neurostimulation
   *Rauschecker, J.; Martel, D.; Salvi, R.; Elgoyhen, A., Germany

4:45  Session Adjourns

11:45  Lunch

12:30 pm  POSTER SESSION 1
   Discussant - Richard Salvi, PhD

1:00  Neurotrophin-3 Regulates Ribbon Synapse Density in the Cochlea and Induces Synapse Regeneration After Acoustic Trauma
   Featured Speaker, Gabriel Corfas, PhD, United States
   Introduced by Sharon Kujawa, PhD
TUESDAY, JUNE 9, 2015

7:30 am Continental Breakfast
8:00 Welcome and Course Announcements
8:05 Forebrain Cholinergic Control of Attention: Multiple Modes, Multiple Cognitive Mechanisms
  Featured Speaker, Martin Sarter, PhD, United States
  Introduced by Larry Roberts, PhD
  8:35 Role of the Auditory Cortex in Tinnitus: Hypersynchrony, Attention, and Residual Inhibition
  Featured Speaker, Larry Roberts, PhD, Canada
  Introduced by Joseph Rauschecker, PhD
  8:50 Morning Break
  9:20 Activity-Dependent Proteosome Redistribution in Axons Gates Homeostatic Changes in Presynaptic Function
  Featured Speaker, Michael Sutton, PhD, United States
  Introduced by Richard Altschuler, PhD
  9:50 PODIUM SESSION 3
  Moderators - Phillip Gander, PhD
  Roxana Stefanescu, PhD
  Intracraniel Mapping of a Cortical Tinnitus System Using Residual Inhibition
  *Gander, Phillip; Sedley, W.; Kumar, S.; Oya, H.; Kovach, C.K.; Nourski, K.V.; Kawasaki, H.; Howard Ill, M.A.; Griffiths, T.D., United States
  Multisensory Attention Training and Fluoxetine for Treatment of Tinnitus
  *Searchfield, Grant; Spiegel, D. P.; Linford, T.; Thompson, B.; Petroe, M. A.; Kobayashi, K.; Stinear, C.M.; Poppe, T.; Sundram, F.; Russell, B., New Zealand
  2:35 Effect of Nucleus Accumbens Stimulation on Medial Geniculate Nucleus Neurons
  *Barry, Kristin; Robertson, D.; Paulini, A.G.; Mulders; WHAM, Australia
  Effects of BK Channel Modulators in a Mouse Model of Tinnitus
  *Lowe, Andrea; Cresco, S.; Walton, J., United States
  Hyperactive Auditory-Limbic-Cerebellar-Reticular Network in Tinnitus and Hyperacusis
  12:35 pm Plasticity of Auditory-Somatosensory Integration in Tinnitus
  Featured Speaker, Symposium Chair, Susan Shore, PhD, United States
  Introduced by Larry Roberts, PhD
  1:05 PODIUM SESSION 4
  Moderators - Robert Levine, MD
  Calvin Wu, PhD
  Stimulus-Timing-Dependent Modifications of Rate-Level Functions in Animals With and Without Tinnitus
  *Stefanescu, Roxana; Koehler, S.; Shore, S., United States
  Transdermal-Induced Stimulus-Timing Dependent Plasticity in Dorsal Cochlear Nucleus is Altered with Noise Damage and Tinnitus
  *Martel, David; Wu, C.; Shore, S., United States
  Transdermal-Induced Stimulus-Timing Dependent Plasticity to Treat Tinnitus
  *Marks, Kendra; Martel, D.; Leyzac, K.; Shore, S., United States
  Synaptic Reorganization in Intrinsic Microcircuits of the Inferior Colliculus in Noise-Induced Tinnitus
  *Sturm, Joshua; Roos, H.; Kandler, K., United States
  The Effects of Cannabinoid Drugs on Acoustic Trauma-Induced Tinnitus in Rats
  *Zheng, Yiwen; Reid, P.; Smith, P.F., New Zealand
  Afternoon Break
  3:20 POSTER SESSION 4
  Discussant - Joseph Rauschecker, PhD
  Tinnitus Pathology and Auditory Thalamus: Expect the Unexpected
  Featured Speaker, Donald Caspary, PhD, United States
  Introduced by Richard Salvi, PhD
  Workshop: Somatosensory Tinnitus – Practical Tips for Diagnosis and Therapy
  Featured Speaker, Eberhard Biesinger, MD, Germany
  Featured Speaker, Tanit Sanchez, MD, PhD, Brazil
  Introduced by Larry Roberts, PhD
  5:00 Session Adjourns
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<td>7:30 am</td>
<td>Continental Breakfast</td>
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<td>8:00</td>
<td>Welcome and Course Announcements</td>
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<td>8:05</td>
<td><strong>PODIUM SESSION 1</strong></td>
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<td>8:05</td>
<td>Gap Measurement of Tinnitus: Progress and Pitfalls</td>
<td>Featured Speaker, Jeremy Turner, PhD, United States</td>
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<td>8:05</td>
<td><strong>PODIUM SESSION 1</strong></td>
<td>Introduced by Sylvie Hébert, PhD</td>
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<td>8:35</td>
<td>An Animal Model of Tinnitus that Includes Hyperacusis: How to Differentiate Them in the Gap Detection Test</td>
<td>Featured Speaker, James Kaltenbach, PhD, United States</td>
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<td>8:35</td>
<td><strong>PODIUM SESSION 1</strong></td>
<td>Introduced by Donald Caspary, PhD</td>
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<td>9:05</td>
<td>Novel Therapies for the Auditory Periphery in Deaf Ears</td>
<td>Featured Speaker, Yehoash Raphael, PhD, United States</td>
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<td>9:05</td>
<td><strong>PODIUM SESSION 1</strong></td>
<td>Introduced by Martin Sarter, PhD</td>
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<td>9:35</td>
<td>Morning Break</td>
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<td>9:50</td>
<td><strong>PODIUM SESSION 2</strong></td>
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<td>12:35 pm</td>
<td>POSTER SESSION 6</td>
<td>Discussant - Sylvie Hébert, PhD</td>
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<td>1:05</td>
<td>AM-101 and Vagal Nerve Stimulation for the Management of Tinnitus</td>
<td>Featured Speaker, Michael Seidman, MD, FACS, United States</td>
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<td>1:35</td>
<td><strong>PODIUM SESSION 2</strong></td>
<td>Introduced by Marlies Knipper, PhD</td>
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<td>3:05</td>
<td><strong>POSTER SESSION 5</strong></td>
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<td>3:05</td>
<td>Identification of Biomarkers in a Model of Noise Induced Tinnitus: A Longitudinal Study</td>
<td>*Holt, Avril; Ghodoudsi, F.; Muca, A.; Apawu, A.; Holi, M.; Wilson, S.; Berkowitz, B., United States</td>
<td>United States</td>
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<td>3:05</td>
<td><strong>POSTER SESSION 5</strong></td>
<td>*Galazyuk, Alexander; Hébert, S., United States</td>
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<td>3:35</td>
<td>Bimodal Stimulus Timing Dependent Plasticity in Primary Auditory Cortex is Altered After Noise Induced Tinnitus</td>
<td>*Basura, Greg; Koehler, S.; Shore, S., United States</td>
<td>United States</td>
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<td>4:05</td>
<td>Sodium Salicylate Activates the GABA (B)-Girk Pathway to Hyperpolarize Neurons of Rat Medial Geniculate Body</td>
<td>*Chen, Lin; Wang, X.-X.; Jin, Y., China</td>
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<td>11:20</td>
<td><strong>POSTER SESSION 5</strong></td>
<td>Discussant - Ana Belen Elgoyhen, PhD</td>
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<td>11:50</td>
<td>Lunch</td>
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<td>1</td>
<td>The Effect of Hearing Loss on Tinnitus Related Neuronal Activity</td>
<td>*Muca, Antonela; Standafer, E.; Ahmad, F.; Apawu, A.; Ghodoussi, F.; Hall, M.; Berkowitz, B.</td>
<td>Wayne State University, United States</td>
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<td>2</td>
<td>Gray Matter Differences in Tinnitus Sufferers</td>
<td>*Thomas, Madeleine; Schmidt, S.; Carpenter-Thompson, J.; Husain, F.T.</td>
<td>University of Illinois at Urbana Champaign, United States</td>
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<td>3</td>
<td>Ultra-High Field FMRI of (Sub) Cortical Auditory Structures in Patients with Tinnitus</td>
<td>*George, Erwin; Remo, A.; De Martino, F.; Gülban, Ö.; Smit, J.; Van Zwieten, G.; Formisano, E.; Stokroos, R.</td>
<td>Maastricht University Medical Centre, Netherlands</td>
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<td>4</td>
<td>Factors Associated with Transcranial Magnetic Stimulation Tinnitus Treatment Benefit</td>
<td>*Theodoroff, Sarah; Giest, S.E.; Fielner, R.L.</td>
<td>Oregon Health &amp; Science University, United States</td>
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<td>5</td>
<td>Individualized Multi-Site RTMS in Chronic Tinnitus: A Feasibility Study</td>
<td>*Schecklmann, Martin; Kreuzer, P.; Lehner, A.; Poepl, T.B.; Langguth, B.</td>
<td>University of Regensburg, Germany</td>
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<td>6</td>
<td>Combined tTMS Treatment Targeting the Anterior Cingulate and the Temporal Cortex for the Treatment of Chronic Tinnitus</td>
<td>*Kreuzer, Peter; Lehner, A.; Schlee, W.; Vielsmeier, V.</td>
<td>University of Regensburg, Germany</td>
</tr>
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<td>7</td>
<td>Psychopathological Symptoms and Quality of Life in Patients with Chronic Tinnitus</td>
<td>*Figueiredo, Ricardo; Mucci, S.; Geocze, L.; Tsuneo Onishi, E.; Oliveira Penido, N.</td>
<td>TRI Pharmagroup, Germany</td>
</tr>
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<td>8</td>
<td>Salicylate-and Noise-Induced Hyperacusis and Loudness Recruitment in Rats</td>
<td>*Radziwon, Kelly; Auerbach, B.; Chen, G-D.; Salvi, R.</td>
<td>University at Buffalo, United States</td>
</tr>
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<td>9</td>
<td>Tumor Necrosis Factor-α, a Proinflammatory Cytokine, is Required for Tinnitus and Hearing Loss-Induced Binaural Plasticity</td>
<td>*Bao, Shaowen, Gibboni, R.; Yang, S.</td>
<td>University of California, Berkeley and University of Arizona, United States</td>
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<td>10</td>
<td>Fractal Tones for Normal Hearing Listeners with Tinnitus</td>
<td>*Kuk, Francis</td>
<td>Widex Hearing Aid Company, Denmark</td>
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<td>The Effect of MDMA on Tinnitus: Preliminary Results</td>
<td>*Searchfield, Grant; Poppe, T.; Spiegel, D.P.; Wise, K.; Shekhawat, G.S.; Kennedy, M.; Jensen, M.; Sundaram, F.; Russell, B.</td>
<td>University of Auckland Hearing and Tinnitus Clinic, New Zealand</td>
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<td>12</td>
<td>Alleviation of Behavioral Signs and Electrophysiological Correlates of NIHL Induced Tinnitus by Ginkgo Biloba Extract EGB 761® Treatment in the Gerbil</td>
<td>*Schulze, Holger; Krouss, P.; Tziridis, K.</td>
<td>University of Erlangen-Nuremberg, Germany</td>
</tr>
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<td>13</td>
<td>Epidemiological Study of Tinnitus Prevalence in the City of Sao Paulo</td>
<td>*Oiticica, Jeanne; Bittar, Roseli S.M.</td>
<td>University of São Paulo, Brazil</td>
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<td>14</td>
<td>The Immediate Effects of Acoustic Trauma on the Inferior Colliculus: A Wiener-Kernel Analysis</td>
<td>*Heeringa, Amarins; van Dijk, P.</td>
<td>University of Groningen, Netherlands</td>
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<td>15</td>
<td>Blast-Induced Tinnitus and Neural Activity Changes along the Auditory Axis in Rats</td>
<td>*Luo, Hao; Zhang, X.; Pace, E.; Kallakuri, S.; Zhang, J.</td>
<td>Wayne State University, United States</td>
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<tr>
<td>16</td>
<td>Psychophysiological Association Between Tinnitus And Sleep</td>
<td>*Schecklman, Martin; Kreuzer, P.; Poepple, T.B.; Lehner, A.; Cröllein, T.; Wetter, T.C.; Frank, E.; Landgrebe, M.; Langguth, B.</td>
<td>University of Regensburg, Germany</td>
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<td>17</td>
<td>rTMS Induced Oscillatory Power as Neuroplastic Marker in Chronic Tinnitus</td>
<td>*Schecklmann, Martin; Gollmitzer, J.; Schmidt, E.; Langguth, B.</td>
<td>University of Regensburg, Germany</td>
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<td>18</td>
<td>Sound Localization Accuracy in Lateralized Tinnitus</td>
<td>*Hyvarinen, Petteri, Hiipokka, C.; Santala, O.; Pulkki, V.; Aarnisalo, A.</td>
<td>Helsinki University, Finland</td>
</tr>
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<td>19</td>
<td>Differential Modulation of Electrocortical Responses Evoked from Primary and Nonprimary Auditory Cortex by Forward Masking in Tinnitus</td>
<td>*Roberts, Larry; Bosnyak, D.J.; Bruce, I.C.; Paul, B.T.</td>
<td>McMaster University, Canada</td>
</tr>
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<td>20</td>
<td>Advanced Neuroimaging as a Potential Biomarker in Tinnitus</td>
<td>*Piccirillo, Joy; Peelle, J.E.; Roland, L.; Kallogjeri, D.</td>
<td>Washington University, St. Louis, United States</td>
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<td>21</td>
<td>Resting State Functional Connectivity in Tinnitus Patients Varies with Tinnitus Duration and Severity</td>
<td>*Schmidt, Sara; Carpenter-Thompson, J.R.; Husain, F.T.</td>
<td>University of Illinois at Urbana Champaign, United States</td>
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<td>22</td>
<td>Human Primary Auditory Cortex and Adjacent Non-Auditory Cortical Areas are Hypermetabolic in Tinnitus as Measured by Functional Near-Infrared Spectroscopy</td>
<td>*Issa, Mohamad; Bisconti, S.; Kileny, P.; Basura, G.</td>
<td>University of Michigan, United States</td>
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<td>23</td>
<td>Tinnitus Severity and Gray Matter: A VBM Analysis</td>
<td>*Bido’ Medina, Richard; Carpenter-Thompson, J.; Schmidt, S.; Husain, F.</td>
<td>University of Illinois at Urbana Champaign, United States</td>
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<td>*Shekhawat, Giriraj Singh; Sundram, F.; Bikson, M.; Truong, D.; De Ridder, D.; Stinear, C.; Welch, D.; Searchfield, G.</td>
<td>University of Auckland, New Zealand</td>
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<td>*Carpenter-Thompson, Jake</td>
<td>University of Illinois, United States</td>
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<td>Georgetown University, United States</td>
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<td>MRC Institute of Hearing Research, United Kingdom</td>
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<td>University of Texas at Dallas, United States</td>
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<td>Institute of Physiology and Pathology of Hearing, Poland</td>
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<td>*Lehner, Astrid; Schecklmann, M.; Poeppl, T. B.; Kreuzer, P. M.; Vielsmeier, V.; Langguth, B.</td>
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<td>Several universities and MicroTransponder Inc., United States</td>
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<td>WRC Institute of Hearing Research, United Kingdom</td>
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<td>City College of New York, United States</td>
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<td>Indiana University Bloomington, United States</td>
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<td>University of Texas at Dallas, United States</td>
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<td>*Pawłok-Osinska, Katherine; Kazmierczak, H.</td>
<td>Nicolaus Copernicus University, Poland</td>
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<td>University of Nottingham, United Kingdom</td>
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<td>Keio University, Japan</td>
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<td>*Sheehan Scaglione, Tricia; Estraghi, A.; Davis, P.</td>
<td>University of Miami, United States</td>
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<td>University of São Paulo, Brazil</td>
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<td>*Raj-Koziak, Danuta; Piotrowska, A.; Skarzynski, H.; Skarzynski, P.</td>
<td>Institute of Physiology and Pathology of Hearing, Poland</td>
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<td>Objective Accouphenometry (OA)</td>
<td>*Vergara, Ramiro; Gamba, A.</td>
<td>Science and Technology Foundation, Colombia</td>
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<td>University of Illinois, United States</td>
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<td>University Hospital of Tours, France</td>
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<td>Complexity and Missing Information Measures in Tinnitus</td>
<td>*Das, Tushar; Vanneste, S.; Piarulli, A.; Noirhomme, Q.; Laureys, S.; Owen, A. M.; DeRidder, D.; Soddu, A.</td>
<td>Western University, Canada</td>
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<td>*Gans, Jennifer</td>
<td>University of Southern California, United States</td>
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<td>*Oishi, Naoki; Wakabayashi, S.; Shindou, S.; Ogawa, K.</td>
<td>Keio University, Japan</td>
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<td>*Carmody, Natalie; Elkelboom, R.H.</td>
<td>University of Western Australia, Australia</td>
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Upcoming Meetings
Meetings exclusively dedicated to Tinnitus are marked red

June 2015

8th INTERNATIONAL TRI TINNITUS CONFERENCE
Tinnitus: from cochlea to brain and back
When: June 07 – 10, 2015
Where: Ann Arbor, MI, USA
Detailed Information: http://www.tinnitusresearch.org

23th Annual Management of the Tinnitus Patient Course
When: June 12 – 13, 2015
Where: University of Iowa, IA, USA
Detailed Information: http://www.medicine.uiowa.edu/oto/tinnituscourse/

OHBM 2015: 21st Annual Meeting of the Organization for Human Brain Mapping
When: June 14 – 18, 2015
Where: Honolulu, Hawaii, USA
Detailed Information: http://www.humanbrainmapping.org/i4a/pages/index.cfm?pageid=3298

17th International Symposium on Hearing (ISH)
(The meeting is a sequel to the meeting held in Cambridge in 2012)
When: June 15 – 19, 2015
Where: Familiehotel Paterswolde, Groningen, NL
Detailed Information: http://www.ish2015.nl

BTA Advisor Training
When: June 26 – 27, 2015
Where: London, UK
Detailed Information: www.tinnitus.org.uk/tinnitus-adviser-training

30th Politzer Society Meeting
When: June 30 – 05, 2015
Where: Niigata, Japan
Detailed Information: http://www.c-linkage.co.jp/politzer2015/

July 2015

2nd International Conference on Hyperacusis
When: July 09 – 10, 2015
Where: Birkbeck College, University of London, UK
Detailed Information: http://hyperacuisresearch.co.uk/
September 2015

Herbsttagung Arbeitsgemeinschaft Deutschsprachiger Audiologen und Neurootologen (ADANO)
When: September 10 – 11, 2015
Where: Bern, Switzerland
Detailed Information: http://www.adano2015bern.org/

52nd Inner Ear Biology (IEB) Workshop
When: September 12 – 15, 2015
Where: Rome, Italy
Detailed Information: http://www.ieb2015.it/

AAO-HNSF Annual Meeting & OTO EXPO
When: September 27 – 30, 2015
Where: Dallas, TX, USA
Detailed Information: http://www.entannualmeeting.org/15/index.php

October 2015

BTA Advisor Training
When: October 09 – 10, 2015
Where: Sheffield, UK
Detailed Information: www.tinnitus.org.uk/tinnitus-adviser-training

EUHA 2015 - 60. International Congress of Hearing Aid Acousticians
When: October 14 – 16, 2015
Where: Nürnberg Messe, Nuremberg, Germany
Detailed Information: http://www.euha.org/veranstaltungen/

7th International Symposium on Meniere’s Disease and Inner Ear Disorders
When: October 17 – 20, 2015
Where: Rome, Italy
Detailed Information: https://www.etouches.com/ehome/76981/155439/?&
170th Meeting of the Acoustical Society of America
When: November 02 – 06, 2015
Where: Jacksonville, Florida, USA
Detailed Information: http://acousticalsociety.org/content/fall-2015-meeting

ASHA 2015 Annual Convention
When: November 12 – 14, 2015
Where: Colorado Convention Center, Denver, Colorado, USA
Detailed Information: http://www.asha.org/Events/convention/General-Information/

The Ear Foundation - Implantable Devices 2015: The State of the Art
When: November 13, 2015
Where: National College for Teaching & Leadership, Nottingham UK
Detailed Information: http://www.earfoundation.org.uk/education/articles/709

DGPPN Congress 2015
When: November 25 – 28, 2015
Where: City Cube, Berlin, Germany
Detailed Information: https://www.dgppn.de/kongress.html

British Academy of Audiology 12th Annual Conference
When: November 26 – 27, 2015
Where: Harrogate International Centre, Harrogate, UK
Detailed Information: http://www.baaudiology.org/

ARO (The Association for Research in Otolaryngology) 37th MidWinter Meeting
When: February 20 – 24, 2016
Where: Manchester Grand Hyatt, San Diego, CA, USA
Detailed Information: http://www.aro.org/?page=MidWinterMeeting
I Epidemiology

Incidence Rates of Clinically Significant Tinnitus: 10-Year Trend From a Cohort Study in England.
Ear Hear. 2014 Dec 2. [Epub ahead of print]

Martinez C1, Wallenhorst C, McFerran D, Hall DA.

1 Institute for Epidemiology, Statistics and Informatics GmbH, Frankfurt, Germany; 2 Colchester Hospital University NHS Foundation Trust, Colchester, Essex, United Kingdom; 3 National Institute for Health Research (NIHR) Nottingham Hearing Biomedical Research Unit, University of Nottingham, Nottingham, United Kingdom; and 4 Otology and Hearing Group, Division of Clinical Neuroscience, School of Medicine, University of Nottingham, Nottingham, United Kingdom.

OBJECTIVE: To investigate the incidence of tinnitus that burdens the health service in England. DESIGN: This was an observational study of 4.7 million residents of England under 85 years of age who were at risk for developing clinically significant tinnitus (sigT). SigT was defined by a discharge from hospital with a primary diagnosis of tinnitus, or a primary care recording of tinnitus with subsequent related medical follow-up within 28 days. The database used was the Clinical Practice Research Datalink and individual records were linked to additional data from the Hospital Episode Statistics. The observational period was from January 1, 2002 to December 31, 2011. Age-, gender-, and calendar year-specific incidence rates for and cumulative incidences of sigT were estimated and a projection of new cases of sigT between 2012 and 2021 was performed. RESULTS: There were 14,303 incident cases of sigT identified among 26.5 million person-years of observation. The incidence rate was 5.4 new cases of sigT per 10,000 person-years (95% confidence interval: 5.3 to 5.5). The incidence rate did not depend on gender but increased with age, peaking at 11.4 per 10,000 in the age group 60 to 69 years. The annual incidence rate of sigT increased from 4.5 per 10,000 person-years in 2002 to 6.6 per 10,000 person-years in 2011. The 10-year cumulative incidence of sigT was 58.4 cases (95% confidence interval: 57.4 to 59.4) per 10,000 residents. Nearly 324,000 new cases of sigT are expected to occur in England between 2012 and 2021. CONCLUSIONS: Tinnitus presents a burden to the health care system that has been rising in recent years. Population-based studies provide crucial underpinning evidence; highlighting the need for further research to address issues around effective diagnosis and clinical management of this heterogeneous condition.

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Association of Dietary Factors with Presence and Severity of Tinnitus in a Middle-Aged UK Population.

McCormack A1, Edmondson-Jones M2, Mellor D3, Dawes P4, Munro KJ5, Moore DR6, Fortnum H2.

1 NIHR Nottingham Hearing Biomedical Research Unit, Ropewalk House, 113 The Ropewalk, Nottingham, United Kingdom; Otology and Hearing group, Division of Clinical Neuroscience, School of Medicine, University of Nottingham, Nottingham, United Kingdom; MRC Institute of Hearing Research, University Park, Nottingham, United Kingdom.

OBJECTIVE: The impact of dietary factors on tinnitus has received limited research attention, despite being a considerable concern among people with tinnitus and clinicians. The objective was to examine the link between dietary factors and presence and severity of tinnitus. DESIGN: This study used the UK Biobank resource, a large cross-sectional study of adults aged 40-69. 171,722 eligible participants were asked questions specific to tinnitus (defined as noises such as ringing or buzzing in the head or ears). Dietary factors included portions of fruit and vegetables per day, weekly fish consumption ( oily and non-oily), bread type, cups of caffeinated coffee per day, and avoidance of dairy, eggs, wheat and sugar. We
controlled for lifestyle, noise exposure, hearing, personality and comorbidity factors. RESULTS: Persistent tinnitus, defined as present at least a lot of the time, was elevated with increased: (i) fruit/vegetable intake (OR=1.01 per portion/day), (ii) bread (wholemeal/wholegrain, OR = 1.07; other bread, 1.20) and (iii) dairy avoidance (OR=1.27). Persistent tinnitus was reduced with: (i) fish consumption (non-oily, OR=0.91; oily, 0.95), (ii) egg avoidance (OR=0.87) and (iii) caffeinated coffee consumption (OR=0.99 per cup/day). Reports of "bothersome" tinnitus (moderate-severe handicap) increased with wholemeal/wholegrain bread intake (OR=0.86). Reports of less frequent transient tinnitus increased with dairy avoidance (OR=1.18) and decreased with caffeinated coffee (OR=0.98 per cup/day) and brown bread (OR=0.94).

CONCLUSIONS: This is the first population study to report the association between dietary factors and tinnitus. Although individually dietary associations are mostly modest, particular changes in diet, such as switching between foodstuffs, may result in stronger associations. These findings offer insights into possible dietary associations with tinnitus, and this may be useful when discussing management options in combination with other lifestyle changes and therapies. Free PMC Article.

Does tinnitus, hearing asymmetry, or hearing loss predispose to occupational injury risk?

Cantley LF1, Galusha D, Cullen MR, Dixon-Ernst C, Tessier-Sherman B, Slade MD, Rabinowitz PM, Neitzel RL.

1* Yale Occupational and Environmental Medicine Program, Yale University School of Medicine, New Haven, USA.

Objective: To determine the relative contributions of tinnitus, asymmetrical hearing loss, low frequency hearing loss (pure tone average of 0.5, 1, 2, 3 kHz; PTA.5123), or high frequency hearing loss (pure tone average of 4, 6 kHz; PTA46), to acute injury risk among a cohort of production and maintenance workers at six aluminum manufacturing plants, adjusting for ambient noise exposure and other recognized predictors of injury risk. Design: Retrospective analysis. Study sample: The study considered 9920 workers employed during 2003 to 2008. The cohort consisted of 8818 workers (89%) whose complete records were available. Results: Adjusting for noise exposure and other recognized injury predictors, a 25% increased acute injury risk was observed among workers with a history of tinnitus in conjunction with high-frequency hearing loss (PTA46). Low frequency hearing loss may be associated with minor, yet less serious, injury risk. We did not find evidence that asymmetry contributes to injury risk. Conclusion: These results provide evidence that tinnitus, combined with high-frequency hearing loss, may pose an important safety threat to workers, especially those who work in high-noise exposed environments. These at risk workers may require careful examination of their communication and hearing protection needs.

Prevalence of tinnitus and/or hyperacusis in children and adolescents: study protocol for a systematic review.
Nemholt SS1, Schmidt JH2, Wedderkopp N3, Baguley DM4.

1 Institute of Clinical Research, University of Southern Denmark, and The Social Enterprise, The Capital Region of Denmark, Copenhagen, Denmark Department of Audiology, Odense University Hospital, Odense, Denmark.

INTRODUCTION: There is some debate as to what extent epidemiological data for the prevalence of childhood tinnitus can be relied on. While indications are that the prevalence is relatively high, referral numbers for children with tinnitus are reported to be low and many of the studies have a number of methodological difficulties. We describe the protocol of a systematic review aimed at assessing the prevalence of tinnitus and/or hyperacusis in children and young people. METHODS AND ANALYSIS: We will include studies of any design (except case reports or case series) comparing the prevalence of tinnitus and/or hyperacusis in children and young people with and without hearing loss, any known
Increased risk of tinnitus in patients with temporomandibular disorder: a retrospective population-based cohort study.
Eur Arch Otorhinolaryngol. 2015 Jan 9. [Epub ahead of print]

Lee CF1, Lin MC, Lin HT, Lin CL, Wang TC, Kao CH.

1 Department of Oral and Maxillofacial Surgery, Buddhist Tzu Chi General Hospital, Taichung Branch, Taichung, Taiwan.

This study determined whether there is an increased risk of tinnitus in patients with temporomandibular joint (TMJ). We used information from health insurance claims obtained from Taiwan National Health Insurance (TNHI). Patients aged 20 years and older who were newly diagnosed with TMJ disorder served as the study cohort. The demographic factors and comorbidities that may be associated with tinnitus were also identified, including age, sex, and comorbidities of hearing loss, noise effects on the inner ear, and degenerative and vascular ear disorders. A higher proportion of TMJ disorder patients suffered from hearing loss (5.30 vs. 2.11 %), and degenerative and vascular ear disorders (0.20 vs. 0.08 %) compared with the control patients. The crude hazard ratio (HR) of tinnitus in the TMJ disorder cohort was 2.73-fold higher than that in the control patients, with an adjusted HR of 2.62 (95% CI = 2.29-3.00). The comorbidity-specific TMJ disorder cohort to the control patients’ adjusted HR of tinnitus was higher for patients without comorbidity (adjusted HR = 2.75, 95% CI = 2.39-3.17). We also observed a 3.22-fold significantly higher relative risk of developing tinnitus within the 3-year follow-up period (95% CI = 2.67-3.89). Patients with TMJ disorder might be at increased

Epidemiol Rev. 2015 Jan 19. pii: mxu005. [Epub ahead of print]

Theodoroff SM, Lewis MS, Folmer RL, Henry JA, Carlson KF.

Hearing loss and tinnitus are the 2 most prevalent service-connected disabilities among veterans in the United States. Veterans of Operations Enduring Freedom, Iraqi Freedom, and New Dawn have been exposed to multiple hazards associated with these conditions, such as blasts/explosions, ototoxic chemicals, and most notably high levels of noise. We conducted a systematic literature review of evidence on 1) prevalence of, 2) risk and protective factors for, and 3) functional and quality-of-life outcomes of hearing impairment and tinnitus in US Operations Enduring Freedom, Iraqi Freedom, and New Dawn veterans and military personnel. We identified studies published from 2001 through 2013 using PubMed, PsycINFO, REHABDATA, Cochrane Library, pearling, and expert recommendation. Peer-reviewed English language articles describing studies of 30 or more adults were included if they informed one or more key questions. A total of 839 titles/abstracts were reviewed for relevance by investigators trained in critical analysis of literature; 14 studies met inclusion criteria. Of these, 13 studies presented data on prevalence and 4 on risk/protective factors, respectively. There were no included studies reporting on outcomes. Findings from this systematic review will help inform clinicians, researchers, and policy makers on future resource and research needs pertaining to hearing impairment and tinnitus in this newest generation of veterans. Published by Oxford University Press on behalf of the Johns Hopkins Bloomberg School of Public Health 2015. This work is written by (a) US Government employee(s) and is in the public domain in the US.
Tinnitus prevalence in the city of São Paulo.

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INTRODUCTION: The public and private health care in the city of São Paulo has no data on tinnitus prevalence. OBJECTIVE: Determine tinnitus prevalence in São Paulo city. STUDY DESIGN: Series study. METHODS: Cross-sectional study by field questionnaire with 1960 interviews. Predictor variables included gender, age, tinnitus. RESULTS: The prevalence of tinnitus was 22%. It affects more women (26%) than men (17%) and increases with advancing age. Approximately one third of cases (32%) assert that they have constant tinnitus (i.e., "ringing"), while most describe intermittent tinnitus (68%). The majority (64%) reported feeling annoyed, while others (36%) denied any annoyance. Among women, the occurrence of an annoying tinnitus was significantly higher (73%) than among men (50%). The percentages were: mildly annoying (11%), moderately annoying (55%), and severely annoying (34%). Tinnitus interferes with daily activities in 18% of those reporting to be annoyed. CONCLUSION: The population in the city of São Paulo suffering from tinnitus was more prevalent than previously estimated. Generally, it affects more women and those without occupation, and increases significantly with age. Most respondents described the tinnitus as annoying, and this was more prevalent in females. The degree of discomfort measured by a Visual Analogue Scale showed moderate tinnitus, with responses averaging 6.3. Copyright © 2014 Associação Brasileira de Otorrinolaringologia e Cirurgia Cérvico-Facial. Published by Elsevier Editora Ltda. All rights reserved. Free Article.

Multivariate analysis of prognostic factors for idiopathic sudden sensorineural hearing loss in children.
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OBJECTIVES/HYPOTHESIS: To evaluate clinical characteristics and possible associated factors of idiopathic sudden sensorineural hearing loss (ISSNHL) in children using univariate and multivariate analyses. STUDY DESIGN: A retrospective case series with comparisons. METHODS: From January 2007 to December 2013, medical records of 37 pediatric ISSNHL patients were reviewed to assess hearing recovery rate and examine factors associated with prognosis (gender; side of hearing loss; opposite side hearing loss; treatment onset; presence of vertigo, tinnitus, and ear fullness; initial hearing threshold), using univariate and multivariate analysis, and compare them with 276 adult ISSNHL patients. RESULTS: Pediatric patients comprised only 6.6% of pediatric/adult cases of ISSNHL, and those below 10 years old were only 0.7%. The overall recovery rates (complete and partial) of the pediatric and adult patients were 57.4% and 47.2%, respectively. The complete recovery rate of the pediatric group (46.6%) was higher than that of the adult group (30.8%, P = .040). According to multivariate analysis, absence of tinnitus, later onset of treatment, and higher hearing threshold at initial presentation were associated with a poor prognosis in pediatric ISSNHL. CONCLUSIONS: The recovery rate of ISSNHL in pediatric patients is higher than in adults, and the presence of tinnitus and earlier treatment onset is associated with favorable outcomes. LEVEL OF EVIDENCE: 4 Laryngoscope, 2015. © 2015 The American Laryngological, Rhinological and Otological Society, Inc.
Dynamic representation of spectral edges in the guinea pig primary auditory cortex.
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The central representation of a given acoustic motif is thought to be strongly context-dependent, i.e. to rely on the spectro-temporal past and present of the acoustic mixture in which it is embedded. The present study investigated in guinea pig the cortical representation of spectral edges (i.e. where the stimulus energy changes abruptly over frequency) and its dependence on stimulus duration and depth of the spectral contrast. We devised a stimulus ensemble composed of random tone pips with or without an attenuated frequency band (AFB) of variable depth. Also, the muti-tone ensemble with AFB was interleaved with periods of silence or with multi-tone ensembles without AFB. We show that the representation of the frequencies near but outside the AFB is greatly enhanced whereas the representation of frequencies near and inside the AFB is strongly suppressed. These cortical changes depend on the depth of the AFB: although they are maximal for the largest depth of the AFB, they are also statistically significant for depths as small as 10 dB. Finally, the cortical changes are quick, as they occur within a few seconds of the presentation of the stimulus ensemble with AFB, and are very labile as they disappear within a few seconds after the presentation of the stimulus-ensemble without AFB. Overall, this study demonstrates that the representation of spectral edges is dynamically enhanced in the auditory centers. These central changes may have important functional implications, in particular in noisy environments where it could contribute to preserve the central representation of spectral edges.Copyright © 2014, Journal of Neurophysiology.

The effect of occupational noise exposure on tinnitus and sound-induced auditory fatigue among obstetrics personnel: a cross-sectional study.
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OBJECTIVE: There is a lack of research on effects of occupational noise exposure in traditionally female-dominated workplaces. Therefore, the aim of this study was to assess risk of noise-induced hearing-related symptoms among obstetrics personnel. DESIGN: A cross-sectional study was performed at an obstetric ward in Sweden including a questionnaire among all employees and sound level measurements in 61 work shifts at the same ward. PARTICIPANTS: 115 female employees responded to a questionnaire (72% of all 160 employees invited). MAIN OUTCOME MEASURES: Self-reported hearing-related symptoms in relation to calculated occupational noise exposure dose and measured sound levels. RESULTS: Sound levels exceeded the 80 dB LAeq limit for protection of hearing in 46% of the measured work shifts. One or more hearing-related symptoms were reported by 55% of the personnel. In logistic regression models, a significant association was found between occupational noise exposure dose and tinnitus (OR=1.04, 95% CI 1.00 to 1.09) and sound-induced auditory fatigue (OR=1.04, 95% CI 1.00 to 1.07). Work-related stress and noise annoyance at work were reported by almost half of the personnel. Sound-induced auditory fatigue was associated with work-related stress and noise annoyance at work, although stress slightly missed significance in a multivariable model. No significant interactions were found. CONCLUSIONS: This study presents new results showing that obstetrics personnel are at risk of noise-induced hearing-related symptoms. Current exposure levels at the workplace are high and occupational noise exposure dose has significant effects on tinnitus and sound-induced auditory fatigue among the personnel. These results indicate that preventative action regarding noise exposure is required in obstetrics care and that risk assessments may be needed in previously unstudied non-industrial communication-intense sound environments. Published by the BMJ Publishing Group Limited. For permission to use (where not already granted under a licence) please go to http://group.bmj.com/group/rights-licensing/permissions. Free PMC Article.
Change in and Long-Term Investigation of Neuro-Otologic Disorders in Disaster-Stricken Fukushima Prefecture: Retrospective Cohort Study before and after the Great East Japan Earthquake.


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On March 11, 2011, Japan's northeast Pacific coast was hit by a gigantic earthquake and subsequent tsunami. Soma City in Fukushima Prefecture is situated approximately 44 km north of Fukushima Daiichi Nuclear Power Plant. Soma General Hospital is the only hospital in Soma City that provides full-time otolaryngological medical care. We investigated the changes in new patients from one year before to three years after the disaster. We investigated 18,167 new patients treated at our department during the four years from April 1, 2010 to March 31, 2014. Of the new patients, we categorized the diagnoses into Meniere's disease, acute low-tone sensorineural hearing loss, vertigo, sudden deafness, tinnitus, and facial palsy as neuro-otologic symptoms. We also investigated the changes in the numbers of patients whom we examined at that time concerning other otolaryngological disorders, including epistaxis, infectious diseases of the laryngopharynx, and allergic rhinitis. The total number of new patients did not change remarkably on a year-to-year basis. Conversely, cases of vertigo, Meniere's disease, and acute low-tone sensorineural hearing loss increased in number immediately after the disaster, reaching a plateau in the second year and slightly decreasing in the third year. Specifically, 4.8% of patients suffering from these neuro-otologic diseases had complications from depression and other mental diseases. With regard to new patients in our department, there was no apparent increase in the number of patients suffering from diseases other than neuro-otologic diseases, including epistaxis, and allergic rhinitis. Patients suffering from vertigo and/or dizziness increased during the first few years after the disaster. These results are attributed to the continuing stress and tension of the inhabitants. This investigation of those living in the disaster area highlights the need for long-term support. Free Article.

Prevalence and factors associated with hearing loss and hearing aid use in Korean elders.


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BACKGROUND: This study examined hearing loss prevalence and hearing aid usage rates among Korean elders by comparing the differences between those with and without hearing loss, and between those who used and did not use hearing aids. METHODS: This study was based on data collected during the Korean National Health and Nutrition Examination Survey V (2010-2012). The study sample consisted of 5,447 Koreans aged ≥60 years who received a hearing assessment. Hearing loss was measured using a pure tone audiometry test and classified according to the World Health Organization's criteria. Hearing aid use was assessed by self-report. Multiple logistic regression analyses were performed to determine the associations between hearing loss, hearing aid use, and related variables. RESULTS: Hearing loss was found in 16.8% of the elders and only 15.9% of them used a hearing aid. Male (95% CI: 1.27-2.15), tinnitus (95% CI: 1.58-2.32), dizziness (95% CI: 1.05-1.73), and occupational noise exposure (95% CI: 1.32-2.38) were the variables most strongly associated with hearing loss after multivariate adjustment. Tinnitus (95% CI: 1.34-4.13) and occupational noise exposure (95% CI: 1.01-5.02) were strongly associated with hearing aid use after multivariate adjustment. CONCLUSION: More than half of South Korean elders aged ≥60 and older have hearing loss but the rate of hearing aid use is very low. An aural public health program should address modifiable risk factors, such as tinnitus and noise exposure, and non-modifiable risk factors associated with hearing loss in the elderly. Free PMC Article.
II Pathophysiology

Effects of serum zinc level on tinnitus.

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OBJECTIVE: The aim of this study was to assess zinc levels in tinnitus patients, and to evaluate the effects of zinc deficiency on tinnitus and hearing loss. METHODS: One-hundred patients, who presented to an outpatient clinic with tinnitus between June 2009 and 2014, were included in the study. Patients were divided into three groups according to age: Group I (patients between 18 and 30 years of age); Group II (patients between 31 and 60 years of age); and Group III (patients between 61 and 78 years of age). Following a complete ear, nose and throat examination, serum zinc levels were measured and the severity of tinnitus was quantified using the Tinnitus Severity Index Questionnaire (TSIQ). Patients were subsequently asked to provide a subjective judgment regarding the loudness of their tinnitus. The hearing status of patients was evaluated by audiometry and high-frequency audiometry. An average hearing sensitivity was calculated as the mean value of hearing thresholds between 250 and 20,000 Hz. Serum zinc levels between 70 and 120 μg/dl were considered normal. The severity and loudness of tinnitus, and the hearing thresholds of the normal zinc level and zinc-deficient groups, were compared. RESULTS: Twelve of 100 (12%) patients exhibited low zinc levels. The mean age of the zinc-deficient group was 65.41±12.77 years. Serum zinc levels were significantly lower in group III (p<0.01). The severity and loudness of tinnitus were greater in zinc-deficient patients (p=0.011 and p=0.015, respectively). Moreover, the mean thresholds of air conduction were significantly higher in zinc-deficient patients (p=0.000). CONCLUSION: We observed that zinc levels decrease as age increases. In addition, there was a significant correlation between zinc level and the severity and loudness of tinnitus. Zinc deficiency was also associated with impairments in hearing thresholds. Copyright © 2014 Elsevier Inc. All rights reserved.

Iatrogenic Arteriovenous Fistula of the Superficial Temporal Artery After Reduction Malarplasty.

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The pathologic auditory sensation in decompensated tinnitus patients is accompanied by the inability to habituate even temporary to this sound. This disability might originate from simultaneous activation of brain areas for the appraisal of the stimulus valence as, e.g., the limbic system. This coactivation of limbic areas is likely to modulate the degree and persistence of selective attention assigned to the tinnitus stream, which in turn could also explain interindividual differences in tinnitus loudness perception. Preliminary studies demonstrate that the amount of allocated attention and the habituation deficit can be mapped to changes in auditory late evoked responses (ALRs). Utilizing a numerical model for the simulation of ALRs we were able to predict a general habituation behavior in two patient groups with different degrees of tinnitus severity. Evaluating the instantaneous phase of simulated and measured ALRs by its von Mises concentration parameter, we verify a habituation deficit relative to the degree of decompensation and thus provide additional support for our neurofunctional model of limbic influences on neural processing of sensory information.
Ototoxicity describes reversible or irreversible disorders of inner ear functions due to the influence of chemical, biological, or physical substances. Ototoxicity should be kept in mind during differential diagnosis of hearing loss, tinnitus, dizziness, and vertigo. In clinical practice, drug-induced ototoxic effects play a major role. The otorhinolaryngologist should also be involved in interdisciplinary cooperation, e.g., during treatment with antineoplastic chemotherapeutic agents with potential ototoxic side effects. In clinical practice, multimedication and interactions between different agents can complicate precise correlation in individual cases. Recent studies also show that noncellular components, such as otoconia, are extremely sensitive to chemical attacks.

Providing earplugs to young adults at risk encourages protective behaviour in music venues.
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For some young people, nightclubs and other music venues are a major source of noise exposure, arising from a combination of very high noise levels; relatively long attendance duration; and frequent, sustained participation over several years. Responsibility for hearing protection is largely left to individuals, many of whom choose not to wear earplugs. In order to encourage earplug use in these settings, a new approach is needed. The aim of the study was to examine whether presentation of hearing health information would result in increased use of earplugs, or whether provision of earplugs alone would be sufficient to change behaviour. A total of 51 regular patrons of music venues were allocated to either a low-information (lo-info) or high-information (hi-info) group. Both groups completed a survey about their current noise exposure, earplug usage and perceived risk of hearing damage. Both groups were also provided with one-size-fits-all filtered music earplugs. The hi-info group was also provided with audio-visual and written information about the risks of excessive noise exposure. After 4 weeks, and again after an additional 12 weeks, participants were asked about their recent earplug usage, intention to use earplugs in the future, and perceived risk of hearing damage. The results showed that after 4 weeks, the hi-info group's perceived personal risk of hearing damage was significantly higher than that of the lo-info group. After 16 weeks, these differences were no longer evident; however, at both 4 and 16 weeks, both the lo- and hi-info groups were using the earplugs equally often; and both groups intended to use earplugs significantly more often in the future. This suggests that the information was unnecessary to motivate behavioural change. Rather, the simple act of providing access to earplugs appears to have effectively encouraged young at-risk adults to increase their earplug use. © The Author(s) 2015.
Prospective Associations Between Traumatic Brain Injury and Postdeployment Tinnitus in Active-Duty Marines.

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OBJECTIVE: To examine whether cause, severity, and frequency of traumatic brain injury (TBI) increase risk of postdeployment tinnitus when accounting for comorbid posttraumatic stress disorder. DESIGN: Self-report and clinical assessments were done before and after an "index" deployment to Iraq or Afghanistan. SETTING, PARTICIPANTS, AND MEASURES: Assessments took place on Marine Corps bases in southern California and the VA San Diego Medical Center. Participants were 1647 active-duty enlisted Marine and Navy servicemen who completed pre- and postdeployment assessments of the Marine Resiliency Study. The main outcome was the presence of tinnitus at 3 months postdeployment. RESULTS: Predeployment TBI increased the likelihood of new-onset postdeployment tinnitus (odds ratio [OR] = 1.86; 95% confidence interval [CI], 1.28-2.70). Deployment-related TBIs increased the likelihood of postdeployment tinnitus (OR = 2.65; 95% CI, 1.19-5.89). Likelihood of new-onset postdeployment tinnitus was highest for those who were blast-exposed (OR = 2.93; 95% CI, 1.82-6.17), who reported moderate-severe TBI symptoms (OR = 2.22; 95% CI, 1.22-3.40), and who sustained multiple TBIs across study visits (OR = 2.27; 95% CI, 1.44-4.24). Posttraumatic stress disorder had no effect on tinnitus outcome. CONCLUSIONS: Participants who were blast-exposed, sustained multiple TBIs, and reported moderate-severe TBI symptoms were most at risk for new-onset tinnitus.

Incidence of Vascular Anomalies and Variants Associated with Unilateral Venous Pulsatile Tinnitus in 242 Patients Based on Dual-phase Contrast-enhanced Computed Tomography.


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BACKGROUND: A comprehensive assessment of various vascular anomalies and variants associated with venous pulsatile tinnitus (PT) by radiography is essential for therapeutic planning and improving the clinical outcome. This study evaluated the incidence of various vascular anomalies and variants on the PT side and determined whether these lesions occurred as multiple or single entities. METHODS: The dual-phase contrast-enhanced computed tomography images of 242 patients with unilateral venous PT were retrospectively reviewed. The vascular anomalies and variants on the symptomatic and asymptomatic sides were analyzed, and the incidences of anomalies or variants on each side were compared. The number of anomalies and variants on the symptomatic side in each patient was calculated. RESULTS: (1) A total 170 patients (170/242) had more than one anomaly or variant on the symptomatic side, and 58 patients (58/242) had a single lesion on tomography. (2) There was a statistically significant difference in the incidence of dehiscent sigmoid plate (P = 0.000), lateral sinus stenosis (P = 0.014), high jugular bulb...
(P = 0.000), sigmoid sinus diverticulum (P = 0.000), jugular bulb diverticulum (P = 0.000), dehiscent jugular bulb (P = 0.000), and a large emissary vein (P = 0.006) between the symptomatic and asymptomatic sides. (3) Dehiscent sigmoid plate (86.4%) was the most frequent lesion on the symptomatic side, followed by lateral sinus stenosis (55.8%), high jugular bulb (47.1%), sigmoid sinus diverticulum (34.3%), jugular bulb diverticulum (13.6%), dehiscent jugular bulb (13.6%), large emissary vein (4.1%), sinus thrombosis (1.2%), and petrosquamosal sinus (0.8%). CONCLUSIONS: Various vascular anomalies and variants occur more frequently on the venous PT side. Preliminary findings suggest that venous PT patients may have multiple vascular anomalies or variants on the symptomatic side. Free full text.

The relationship between jugular bulb position and jugular bulb related inner ear dehiscence: a retrospective analysis.

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OBJECTIVE: High jugular bulb (HJB) can erode inner ear structures creating a jugular bulb related inner ear dehiscence (JBID). The aim of this study was to analyze the relationship between the position of jugular bulb (JB) and JBID using high-resolution computed tomography (HRCT). MATERIAL AND METHODS: In this retrospective study HRCT images of 552 ears of 276 patients with hearing loss, otogenic vertigo, tinnitus or idiopathic peripheral facial nerve paralysis were analyzed. HJB type-1 was defined when JB dome reached above the inferior part of the round window, but was below the inferior edge of the internal acoustic meatus (IAM). HJB type-2 was defined when the dome of JB was higher than the inferior edge of IAM. The frequencies and types of HJB were evaluated. JBID for each HJB type was determined. Frequencies of JBID eroding the vestibular aqueduct (VA), the cochlear aqueduct and the posterior semicircular canal were examined. RESULTS: HJB type-1 and HJB type-2 were found in 19% (105/552) and in 15.8% (87/552) of studied ears. JBID showed to be in 3.8% (21/552) of all ears. 90.5% (19/21) of JBID revealed eroding of VA. Jugular bulb related cochlear aqueduct dehiscence and jugular bulb related posterior semicircular canal dehiscence were found in one ear each. The frequency of jugular bulb related vestibular aqueduct dehiscence (JBVAD) in patients with HJB reaching above IAM was higher than in patients with HJB lower than IAM. CONCLUSIONS: HJB is common, but JBID is rare. JBID prevalently erodes VA. HJB rising above IAM is most at risk to show JBVAD. Copyright © 2014 Elsevier Inc. All rights reserved.

Effect of HIV Infection and Highly Active Antiretroviral Therapy on Hearing Function: A Prospective Case-Control Study From Cameroon.

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Importance: Human immunodeficiency virus (HIV) infection remains a major cause of morbidity and mortality worldwide. Many studies have found a higher prevalence of hearing impairment among HIV-positive individuals. Objective: To investigate the effect of HIV and highly active antiretroviral treatment (HAART) on the hearing function in a Cameroonian population. Design, Setting, and Participants: We conducted a prospective case-control study from March 1, 2012, through January 31, 2013. The study took place at the National Social Insurance Fund Hospital in Yaoundé, Cameroon, a public health facility. We included 90 HIV-positive case patients and 90 HIV-negative control patients aged 15 to 49 years without any history of hearing loss or treatment with a known ototoxic drug. The case group was further
divided into 3 subgroups: 30 HAART-naive patients, 30 patients receiving first-line HAART, and 30 patients receiving second-line HAART. Interventions: Hearing function was assessed by pure-tone audiometry and classified according to the criteria of the Bureau International d'Audio-Phonologie. Main Outcomes and Measures: Hearing loss due to HIV and HAART. Results: The HIV-positive patients had more otologic symptoms (hearing loss, dizziness, tinnitus, and otalgia) than HIV-negative patients (41 vs 13, P = .04). There were 49 cases (27.2%) of hearing loss in the HIV-positive group vs 10 (5.6%) in the HIV-negative group (P = .04). Compared with HIV-negative individuals, the odds of hearing loss were higher among HIV-infected HAART-naive patients (right ear: odds ratio [OR], 6.7; 95% CI, 4.3-9.7; P = .004; left ear: OR, 6.2; 95% CI, 3.5-8.3; P = .006), patients receiving first-line HAART (right ear: OR, 5.6; 95% CI, 1.9-10.5; P = .01; left ear: OR, 12.5; 95% CI, 8.5-15.4; P < .001), and patients receiving second-line HAART (right ear: OR, 6.7; 95% CI, 3.3-9.6; P = .004; left ear: OR, 3.7; 95% CI, 3.0-5.0; P = .08). Conclusions and Relevance: Hearing loss is more frequent in HIV-infected patients compared with uninfected patients. Therefore, HIV-infected patients need special audiologic care. Further studies are needed because controversy remains regarding the factors that lead to ear damage.

Transient health symptoms of MRI staff working with 1.5 and 3.0 Tesla scanners in the UK.
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OBJECTIVES: Recent studies have consistently shown that amongst staff working with MRI, transient symptoms directly attributable to the MRI system including dizziness, nausea, tinnitus, and concentration problems are reported. This study assessed symptom prevalence and incidence in radiographers and other staff working with MRI in healthcare in the UK. METHODS: One hundred and four volunteer staff from eight sites completed a questionnaire and kept a diary to obtain information on subjective symptoms and work practices, and wore a magnetic field dosimeter during one to three randomly selected working days. Incidence of MRI-related symptoms was obtained for all shifts and prevalence of MRI-related and reference symptoms was associated to explanatory factors using ordinal regression. RESULTS: Incident symptoms related to working with MRI were reported in 4% of shifts. Prevalence of MRI-related, but not reference symptoms were associated with number of hours per week working with MRI, shift length, and stress, but not with magnetic field strength (1.5 and 3 T) or measured magnetic field exposure. CONCLUSIONS: Reporting of prevalent symptoms was associated with longer duration of working in MRI departments, but not with measured field strength of exposure. Other factors related to organisation and stress seem to contribute to increased reporting of MRI-related symptoms. KEY POINTS: • Routine work with MRI is associated with increased reporting of transient symptoms • No link to the strength of the magnetic field was demonstrated. • Organisational factors and stress additionally contribute to reporting of MRI-related symptoms.
Stress and tinnitus.

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Emotional stress is a constant companion of tinnitus patients, since this phantom sound can unfortunately be a very effective stressor. However, the mechanism of stress contribution to the onset or progression of tinnitus remains unknown. Here, we review the pathways induced by emotional stress and the outcome of their induction: corticosteroid-dependent changes in gene expression, epigenetic modulations, and impact of stress on neuronal plasticity and neurotransmission. Using clinical examples, we demonstrate the presence of emotional stress among tinnitus patients and we present methods to measure the degree of stress. The evidence causally linking emotional stress with tinnitus is still indirect-the main difficulty lies in the inaccessibility of human auditory tissues and the inability to directly measure tinnitus-induced psychological distress in animal models. However, we believe that translational research is the future way of filling this gap, finding the answers, and thereby improving both the diagnosis and treatment of tinnitus patients.

Intra-individual variability in tinnitus patients: Current thoughts and perspectives.

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Most tinnitus studies have attempted to compare groups of individuals, thus revealing inter-individuals differences, i.e., variations between compared subjects. For methodological reasons, inter-individual studies cannot take into account the variability of tinnitus experience, which has been known for decades to be relevant in daily practice with tinnitus patients. The concept of intra-individual variability has been promoted in the research literature, in order to shed light on this aspect of individual perception. In previous studies, unrelated to hearing, the concept of intra-individual variability implied inclusion of the environment (i.e., physical and social interactions) as a factor of individual performance. In tinnitus research, we believe that the concept of variability (within a person) could find a place beside the concept of variation (between groups of subjects). In this paper, four perspectives of tinnitus experiences from the clinical and research fields are described: (1) ENT consultation; (2) short-term group psychotherapy; (3) psychodynamic psychotherapy; and (4) clinical psychological research. Intra-individual variability stresses the importance of defining tinnitus in a dynamic way, contrary to the current definition of tinnitus as the perception of sound(s). In clinical practice, it is useful to embrace the perspective of the perceiver of tinnitus, and to include social and cultural circumstances as well as audiological/physical changes.
Tinnitus-related changes in the inferior colliculus.

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Tinnitus is highly complex, diverse, and difficult to treat, in part due to the fact that the underlying causes and mechanisms remain elusive. Tinnitus is generated within the auditory brain; however, consolidating our understanding of tinnitus pathophysiology is difficult due to the diversity of reported effects and the variety of implicated brain nuclei. Here, we focus on the inferior colliculus (IC), a midbrain structure that integrates the vast majority of ascending auditory information and projects via the thalamus to the auditory cortex. The IC is also a point of convergence for corticofugal input and input originating outside the auditory pathway. We review the evidence, from both studies with human subjects and from animal models, for the contribution the IC makes to tinnitus. Changes in the IC, caused by either noise exposure or drug administration, involve fundamental, heterogeneous alterations in the balance of excitation and inhibition. However, differences between hearing loss-induced pathology and tinnitus-related pathology are not well understood. Moreover, variability in tinnitus induction methodology has a significant impact on subsequent neural and behavioral changes, which could explain some of the seemingly contradictory data. Nonetheless, the IC is likely involved in the generation and persistence of tinnitus perception. Free PMC Article

Tinnitus in adolescents: the start of the vulnerability of the auditory pathways.

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INTRODUCTION: Although tinnitus is an increasingly common symptom, few studies have assessed its prevalence or incidence among adolescents. PURPOSE: To assess whether the presence of tinnitus in adolescents is associated with minimal hearing damage, evaluated through high-frequency audiometry (HFA), otoacoustic emission (OAE), and loudness discomfort level (LDL). METHODS: The sample comprised 168 adolescents of a private school (61.3% boys; mean age 14.1 years old; standard deviation=2). All of them completed a questionnaire about tinnitus and hypersensitivity to sounds (sound intolerance), and then underwent otoscopy, pure-tone audiometry, HFA, LDL, transient and distortion product otoacoustic emissions (TOAE and DPOAE), and tinnitus pitch/loudness matching (the latter only in those with tinnitus). Participants were later divided into three groups: with no tinnitus (n=73, 43.4%), with sporadic tinnitus (n=47, 28%), and with constant tinnitus (n=48, 28.6%). RESULTS: No significant difference was observed between the groups regarding audiometry thresholds in frequencies from 0.25 to 16 kHz, or TOAE and DPOAE. However, the LDL in adolescents with constant tinnitus was significantly lower than that in other groups, suggesting hypersensitivity to sounds. CONCLUSION: There was no evidence of minimal hearing damage in the audiometry and OAE. Nonetheless, the decreased LDL in adolescents with constant tinnitus suggests that their auditory system is more sensitive. Therefore, this may be the first sign of vulnerability to sounds. Future medium- to long-term monitoring of these students may show whether they will begin a process of functional impairment, altering hearing thresholds, and OAE. Free Article.
Exposure to music and noise-induced hearing loss (NIHL) among professional pop/rock/jazz musicians.
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Noise-induced hearing loss (NIHL) has been extensively studied in industrial work environments. With the advent of new technologies, loud music has been increasingly affecting listeners outside of the industrial setting. Most research on the effects of music and hearing loss has focused on classical musicians. The purpose of the current study was to examine the relationship between the amount of experience a professional pop/rock/jazz musician has and objective and subjective variables of the musician's hearing loss. This study also examined professional pop/rock/jazz musicians' use of hearing protection devices in relation to the extent of their exposure to amplified music. Forty-four pop/rock/jazz musicians were interviewed using the Pop/Rock/Jazz Musician's Questionnaire (PRJMQ) in order to obtain self-reported symptoms of tinnitus and hyperacusis. Forty-two of the subjects were also tested for air-conduction hearing thresholds in the frequency range of 1-8 kHz. Results show that the extent of professional pop/rock/jazz musicians' exposure to amplified music was related to both objective and subjective variables of hearing loss: Greater musical experience was positively linked to higher hearing thresholds in the frequency range of 3-6 kHz and to the subjective symptom of tinnitus. Weekly hours playing were found to have a greater effect on hearing loss in comparison to years playing. Use of hearing protection was not linked to the extent of exposure to amplified music. It is recommended that further research be conducted with a larger sample, in order to gain a greater understanding of the detrimental effects of hours playing versus years playing.

Current view of neurotransmitter changes underlying tinnitus.
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III Diagnostics

Relationship between tinnitus pitch and edge of hearing loss in individuals with a narrow tinnitus bandwidth.

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Objective: Psychoacoustic measures of tinnitus, in particular dominant tinnitus pitch and its relationship to the shape of the audiogram, are important in determining and verifying pathophysiological mechanisms of the condition. Our previous study postulated that this relationship might vary between different groups of people with tinnitus. For a small subset of participants with narrow tinnitus bandwidth, pitch was associated with the audiometric edge, consistent with the tonotopic reorganization theory. The current study objective was to establish this relationship in an independent sample. Design: This was a retrospective design using data from five studies conducted between 2008 and 2013. Study sample: From a cohort of 380 participants, a subgroup group of 129 with narrow tinnitus bandwidth were selected. Results: Tinnitus pitch generally fell within the area of hearing loss. There was a statistically significant correlation between dominant tinnitus pitch and edge frequency; higher edge frequency being associated with higher dominant tinnitus pitch. However, similar to our previous study, for the majority of participants pitch was more than an octave above the edge frequency. Conclusions: The findings did not support our prediction and are therefore not consistent with the reorganization theory postulating tinnitus pitch to correspond to the audiometric edge.

Agreement and reliability of tinnitus loudness matching and pitch likeness rating.

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The ability to reproducibly match tinnitus loudness and pitch is important to research and clinical management. Here we examine agreement and reliability of tinnitus loudness matching and pitch likeness ratings when using a computer-based method to measure the tinnitus spectrum and estimate a dominant tinnitus pitch, using tonal or narrowband sounds. Group level data indicated a significant effect of time between test session 1 and 2 for loudness matching, likely procedural or perceptual learning, which needs to be accounted in study design. Pitch likeness rating across multiple frequencies appeared inherently more variable and with no systematic effect of time. Dominant pitch estimates reached a level of clinical acceptability when sessions were spaced two weeks apart. However when dominant tinnitus pitch assessments were separated by three months, acceptable agreement was achieved only for group mean data, not for individual estimates. This has implications for prescription of some sound-based interventions that rely on accurate measures of individual dominant tinnitus pitch. Free PMC Article.
Tinnitus is a common disorder in ear, nose and throat practice. Not only muscular, vascular, neuronal, odiologic and ear pathologies, also psychological parameters contribute to the formation of tinnitus. Scales which evaluate patients' perception of tinnitus and how they are affected from tinnitus psychosomatically have gained increasing importance. Questionnaire studies are very assisting in terms of showing the degree of anxiety and depression experienced by the patients, diagnosis of the disease, evaluation of treatment efficacy, and patient follow-up. In this study, we reviewed the visual analog scale which measures the level of subjective perception in tinnitus, tinnitus evaluation questionnaires, and questionnaires measuring the level of quality of life and depression. Free full text.

Perilimpatic fistula test: a video clip demonstration.
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Perilymphatic fistula (PLF) is an abnormal condition in which a communication is present between the perilymphatic space of the inner ear and the middle ear or mastoid, secondary to a dehiscence in the otic capsule, oval or round window. LF may induce hearing loss, tinnitus, aural fullness, vertigo, disequilibrium, or a combination of these symptoms; the vagueness of symptoms caused by PLF and the lack of specificity of clinical signs and symptoms make the diagnosis elusive. We report a video of a positive PLF test induced by the application of pressure on the tragus, just anterior to the left external auditory canal in a patient with cholesteatoma and PLF of lateral semicircular canal confirmed by CT scan imaging. https://www.youtube.com/watch?v=x5MhSILF9O4.

Tinnitus and Hearing Survey: A Screening Tool to Differentiate Bothersome Tinnitus from Hearing Difficulties.

Purpose: Individuals complaining of tinnitus often attribute hearing problems to the tinnitus. In such cases some (or all) of their reported "tinnitus distress" may in fact be caused by trouble communicating due to hearing problems. We developed the Tinnitus and Hearing Survey (THS) as a tool to rapidly differentiate hearing problems from tinnitus problems. Method: For two of our research studies, we administered the THS twice (mean of 16.5 days between tests) to 67 participants who did not receive intervention. These data allow for measures of statistical validation of the THS. Results: Reliability of the THS was good to excellent regarding internal consistency (α = 0.86-0.94), test-retest reliability (r = 0.76-0.83), and convergent validity between the Tinnitus Handicap Inventory and the A (Tinnitus) subscale of the THS (r = 0.78). Factor analysis confirmed that the two subscales, A (Tinnitus) and B (Hearing), have strong internal structure, explaining 71.7% of the total variance and low correlation with each other (r = 0.46), resulting in a small amount of shared variance (21%). Conclusions: These results provide evidence that the THS is statistically validated and reliable for use in assisting patients and clinicians in quickly (and collaboratively) determining if intervention for tinnitus is appropriate.

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BACKGROUND AND OBJECTIVES: The Gaps-In-Noise (GIN) test is a measure to assess auditory temporal resolution, which is the ability to follow rapid changes in the envelope of a sound stimulus over time. We investigated whether unilateral tinnitus affects temporal resolution by the GIN performance. 

SUBJECTS AND METHODS: Hearing tests including the GIN test were performed in 120 ears of 60 patients with unilateral tinnitus who showed symmetric hearing within 20 dB HL difference up to 8 kHz (tinnitus-affected ears, 14.6±11.2 dB HL; non-tinnitus ears 15.1±11.5 dB HL) and 60 ears of 30 subjects with normal hearing. Comparisons were made between tinnitus and non-tinnitus side of patients and normal ears of controls. RESULTS: There was no significant difference of the mean GIN thresholds among tinnitus-affected ears (5.18±0.6 ms), non-tinnitus ears (4.98±0.6 ms) and normal ears (4.97±0.8 ms). The mean percentage of correct answers in tinnitus side (67.3±5.5%) was slightly less than that in non-tinnitus side (70.0±5.5%) but it was not significantly different from that in normal ears (69.4±7.5%). Neither the GIN threshold nor the GIN perception level in tinnitus ears has relation to sex, frequency and loudness of tinnitus, and audiometric data. Age only showed a significant correlation with the GIN performance. CONCLUSIONS: We found no evidence which supported the influence of unilateral tinnitus on auditory temporal resolution. These results imply that tinnitus may not simply fill in the silent gaps in the background noise. Free PMC Article.

A programmable acoustic stimuli and auditory evoked potential measurement system for objective tinnitus diagnosis research. 


Background: Microvascular decompression has been tested as a treatment for tinnitus. Methods: However, only a fraction of patients appear to benefit from surgery if the combination of findings such as paroxysmal vertigo, ABR changes and tinnitus is used to select patients for microvascular decompression. Results: Instead, a more specific syndrome of staccato or "typewriter" tinnitus, which is highly responsive to carbamazepine, was suggested to be caused by a neurovascular conflict. Conclusion: We present the first case of typewriter tinnitus with complete long-term symptom relief following microvascular decompression of the vestibulocochlear nerve. We suggest that this specific syndrome is caused by a neurovascular conflict and treatable by microvascular decompression.

Otologic manifestations of acoustic neuroma. 

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Conclusion: Many patients with acoustic neuroma (AN) experience hearing loss and tinnitus. Time from first symptoms to diagnosis can be considerable. AN should be suspected, and MRI scans performed, in patients with hearing loss accompanied by asymmetry, tinnitus, low speech discrimination score (SDS), and abnormal auditory brainstem response (ABR). OBJECTIVES: To determine the otorhinolaryngological factors associated with AN by analyzing the clinical manifestations and diagnostic test results of patients with AN before MRI scanning. METHODS: This study enrolled 114 patients definitively diagnosed with AN after visiting the Ear-Nose-and-Throat and Neurosurgery Departments of Kyung Hee University Medical
Center from 2001 to 2013. Factors retrospectively analyzed included patient age, gender, major symptoms, accompanying symptoms, symptom duration, pure-tone audiometry, SDS, asymmetry, tinnitus, ABR, and MRI scan results. RESULTS: The main symptom of AN was hearing loss, and the most frequent accompanying symptom was tinnitus. More severe deafness correlated significantly with lower SDS (p < 0.05). Asymmetric hearing was observed in 75 of 116 patients (64.6%), and mean SDS was 73.1 ± 34.1%. Of patients with latencies of waves I, III, and V on ABR tests, 56.1%, 92.4%, and 92.4%, had interaural latency differences ≥0.2 ms. However, audiometry results did not correlate with lesion site or tumor size (p > 0.05).

A confirmatory factor analytic validation of the Tinnitus Handicap Inventory.


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OBJECTIVE: Because the postulated three-factor structure of the internationally widely used Tinnitus Handicap Inventory (THI) has not been confirmed yet by a confirmatory factor analytic approach this was the central aim of the current study. METHODS: From a clinical setting, N=373 patients with chronic tinnitus completed the THI and further questionnaires assessing tinnitus-related and psychological variables. In order to analyze the psychometric properties of the THI, confirmatory factor analysis (CFA) and correlational analyses were conducted. RESULTS: CFA provided a statistically significant support for a better fit of the data to the hypothesized three-factor structure (RMSEA=.049, WRMR=1.062, CFI=.965, TLI=.961) than to a general factor model (RMSEA=.062, WRMR=1.258, CFI=.942, TLI=.937). The calculation of Cronbach's alpha as indicator of internal consistency revealed satisfactory values (.80-.91) with the exception of the catastrophic subscale (.65). High positive correlations of the THI and its subscales with other measures of tinnitus distress, anxiety, and depression, high negative correlations with tinnitus acceptance, moderate positive correlations with anxiety sensitivity, sleeping difficulties, tinnitus loudness, and small correlations with the Big Five personality dimensions confirmed construct validity. CONCLUSION: Results show that the THI is a highly reliable and valid measure of tinnitus-related handicap. In contrast to results of previous exploratory analyses the current findings speak for a three-factor in contrast to a unifactorial structure. Future research is needed to replicate this result in different tinnitus populations. Copyright © 2015 Elsevier Inc. All rights reserved.

A Russian adaptation of the tinnitus handicap inventory.

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Objective: To establish a Russian version of the English THI. Design: The English THI (THI-E) was translated into Russian by two bilingual investigators, independently. The final Russian THI version (THI-R) was constructed by a third investigator, from the two translations. This version was administered to fifty consecutive patients at a tinnitus clinic. Participants also assessed the loudness of their tinnitus, and completed the Russian versions of the Beck's depression inventory and the state anxiety Inventory. Study sample: The participants were fifty consecutive patients (older than 18 years of age with a tinnitus lasting over three months) who were treated at a tinnitus clinic. Results: A very good internal consistency was found (α = 0.94), with significant correlation between the THI-R score and the Beck depression inventory score. Factor analysis confirmed a uni-dimensional structure of the inventory. Conclusions: A valid and reliable THI-R questionnaire was constructed.
Carotid Doppler ultrasound evaluation in patients with pulsatile tinnitus.

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A wide range of conditions, including atherosclerosis, may lead to pulsatile tinnitus. The objective of this study was to evaluate the patients with pulsatile tinnitus by means of carotid Doppler ultrasound parameters. Thirty-four patients with pulsatile tinnitus were enrolled in the study. Internal carotid artery intima-media thickness (IMT), blood flow velocities and arterial lumen diameters (LD) were measured and compared with the control group. Mean end diastolic velocity (EDV) (32.29 ± 17.22) and IMT (1.06 ± 0.36) values were significantly higher and mean LD (6.69 ± 1.20) was significantly lower compared to the control group. Peak systolic velocity and EDV values were significantly higher in patients whose IMT were greater than 1 mm. Pulsatile tinnitus may be the first symptom of a severe, life threatening disease. Doppler sonography is a noninvasive, safe and easily applicable diagnostic tool for the evaluation of the vascular structures, in patients with pulsatile tinnitus.

Uncovering Hidden Hearing Loss

Zeng, Fan-Gang PhD

No abstract available. Free access.

Measuring health-related quality of life by experiences: the experience sampling method.


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OBJECTIVE: To explore the potential value of obtaining momentary, instead of retrospective, accounts of the description and valuation of a person’s own health-related quality of life (HRQOL). METHODS: Momentary HRQOL was examined with the experience sampling method (ESM) in 139 participants from four different samples. The ESM consists of a so-called beep questionnaire that was administered 10 times a day by an electronic device. Feasibility was determined by assessing willingness to participate in the study and by analyzing the percentage of dropouts and the number of completed beep questionnaires. Multilevel analysis was used to investigate the relation between momentary HRQOL and momentary feelings and symptoms. The relation between momentary outcomes and the EuroQol visual analogue scale was investigated with a multiple regression model. RESULTS: The overall participation rate was low, but there were no dropouts and the number of completed beeps was comparable to that in other studies. Multilevel analysis showed that feelings and symptoms were significant predictors of momentary HRQOL. The strength of these relations differed among three patient groups and a population-based sample. The EuroQol visual analogue scale was not predicted by momentary feelings and symptoms. CONCLUSIONS: We can conclude that the use of the ESM to measure accounts of the momentary experience of health in different populations is feasible. Retrospective measures may provide a biased account of the impact of health problems in the daily lives of people who are affected. Moreover, the bias may be different in different conditions.Copyright © 2015 International Society for Pharmacoeconomics and Outcomes Research (ISPOR). Published by Elsevier Inc. All rights reserved.

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The Tinnitus Questionnaire (TQ) is widely accepted as a reliable and stable tool, which aims to assess the psychological effects of tinnitus related distress. The abridged version of Tinnitus Questionnaire (Mini-TQ) has been developed, to provide a far more rapid and equally reliable measure of tinnitus induced distress restoring the necessity for the prolonged administration time of the original questionnaire in busy clinics. The aim of this study was to investigate the reliability and validity of the Greek version of the Mini-Tinnitus Questionnaire, (Mini-TQ-GR), being the first ever validated questionnaire for measuring tinnitus related distress in Greece. This article is protected by copyright. All rights reserved.

Vertigo and nystagmus in orthostatic hypotension.

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BACKGROUND AND PURPOSE: Generalized cerebral ischaemia from cardiovascular dysfunction usually leads to presyncopal dizziness, but several studies reported a higher frequency of rotatory vertigo in cardiovascular patients. Whether generalized cerebral ischaemia due to cardiovascular disorders may produce objective vestibular dysfunction was investigated. METHODS: Thirty-three patients with orthostatic dizziness/vertigo due to profound orthostatic hypotension and 30 controls were recruited. All participants underwent recording of eye movements during two orthostatic challenging tests: the Schellong and the squatting-standing tests. Most patients had neuroimaging, and patients with abnormal eye movements were subjected to follow-up evaluations. RESULTS: Symptoms associated with orthostatic dizziness/vertigo included blurred vision, fainting and tinnitus. Ten (30%) of 33 patients developed rotatory vertigo and nystagmus during the Schellong (n = 5) or squatting-standing test (n = 5). Four of them showed pure downbeat nystagmus whilst five had downbeat and horizontal nystagmus with or without torsional component. Patients with orthostatic nystagmus had shorter duration of orthostatic intolerance than those without nystagmus (1.0 ± 1.6 vs. 11.0 ± 9.7 months, P < 0.001). In two patients, orthostatic nystagmus disappeared during follow-up despite the persistence of profound orthostatic hypotension. CONCLUSIONS: Generalized cerebral ischaemia caused by orthostatic hypotension induces rotatory vertigo due to objective vestibular dysfunction. The presence of orthostatic vertigo and nystagmus has an association with the duration of orthostatic intolerance. © 2014 EAN.
Validation and translation of the Dutch tinnitus functional index.

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OBJECTIVES: Several questionnaires are used to survey how tinnitus affects quality of life, making comparisons across studies difficult. The questionnaires also are used to measure treatment outcome but were not designed for this purpose. To address these issues, a new questionnaire has been suggested, the tinnitus functional index (TFI), which is highly responsive to treatment-related change. The current study aim was to translate and validate the TFI for a Dutch-speaking population. Factor analysis was performed to characterize the TFI profile in a large tinnitus population. METHODS: The questionnaire was translated using a translation-back translation procedure, and 263 patients in the ENT department of Antwerp University Hospital with tinnitus-related complaints completed it. Factor structure was assessed using exploratory analysis with oblique rotation and compared with the original questionnaire. Internal consistency was measured using Cronbach's alpha coefficient. Spearman correlations with the percentage of time aware of the tinnitus and the visual analogue scales (VAS) for maximum tinnitus loudness and mean tinnitus loudness were calculated to investigate convergent validity. RESULTS: The original eight-factor structure could be confirmed in the Dutch version of the TFI. Internal consistency (a=0.96) and convergent validity showed good results. Statistically significant correlations were found with the VAS for maximum loudness (r=0.59; p<0.001), VAS for mean loudness (r=0.66; p<0.001), and percentage of time aware of tinnitus (r=0.58; p<0.001). CONCLUSIONS: The Dutch version of the TFI is suitable for measuring in clinical and research settings how tinnitus affects daily life, with psychometric properties in line with the original version.

Ecological Momentary Assessment of Tinnitus Using Smartphone Technology: A Pilot Study.

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OBJECTIVE: To explore the feasibility of ecological momentary assessments (EMAs) as a tool to more accurately assess the level of bother from tinnitus. STUDY DESIGN: Longitudinal observational study. SETTING: Washington University Department of Otolaryngology-Head and Neck Surgery faculty practice plan. SUBJECTS AND METHODS: Twenty participants with moderately to severely bothersome tinnitus were enrolled. All participants owned a smartphone device, and all communications were conducted via email, phone, and text messaging. Participants received 4 EMAs per day for 2 weeks via text message and a final survey on the 15th day. In each survey, participants recorded their level of tinnitus bother, their location at the time of response, their stress level, how they were feeling, and what they were doing. Response rates as a proxy for the feasibility of the program. RESULTS: There were a total of 1120 surveys sent to 20 participants (56 surveys per participant), and 889 (79.4%) of the surveys were completed and returned. The median time to response from the moment of receiving the text message was 7 minutes. The distribution of responses to the EMA question, "In the last 5 minutes, how bothered have you been by your tinnitus?" displayed both high between- and within-subject variability. At the end of 2 weeks, the median score on the Tinnitus Handicap Inventory was 37, with a range of 10 to 82 points; the median Tinnitus Functional Index score was 43, with a range of 10 to 82 points. CONCLUSION: This study suggests bothered tinnitus patients will use smartphones as part of EMA. © American Academy of Otolaryngology—Head and Neck Surgery Foundation 2015.
Value of DSA in the Diagnostic Workup of Pulsatile Tinnitus.
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OBJECTIVES: Pulsatile tinnitus (PT) is a rare complaint, but can be a symptom of life-threatening disease. It is often caused by vascular pathologies, e.g. dural arteriovenous fistula (dAVF), arteriovenous malformation (AVM) or vascularized tumors. The current diagnostic pathway includes clinical examination, cranial MRI and additional DSA. The aim of this study was to evaluate the diagnostic impact of DSA in the diagnostic workup of patients with PT in comparison to MRI alone. METHODS: Retrospectively, 54 consecutive patients with pulsatile tinnitus were evaluated. All patients had a diagnostic workup including cranial MRI and DSA. MRI examinations were blinded to the results of DSA and retrospectively analyzed in consensus by two experienced neuroradiologists. The MR-examinations were evaluated for each performed sequence separately: time-of-flight-angiography, ce-MRA, T2, ce-T1-sequence and ce-T1-sequence with fat saturation. RESULTS: 37 of the 54 patients revealed a pathology explaining PT on MRI, which was detected by the readers in 100% and proofed by means of DSA. 24 dAVF, four paraganglioma, two AVM and seven more pathologies were described. All patients without pathology on MRI did also not show any pathology in DSA. CONCLUSIONS: MR imaging is sufficient to exclude pathology in patients with pulsatile tinnitus. Free full text.

Evaluation of iPod-Based Automated Tinnitus Pitch Matching.
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BACKGROUND: Tinnitus is the perception of sound unrelated to any external source. Diagnostic approaches to assess tinnitus characteristics such as tinnitus pitch are crucial for new attempts of tinnitus therapy. PURPOSE: The purpose of this study was to develop and evaluate reliable tinnitus pitch-matching procedures. Existing procedures usually require audiometric equipment and are time consuming. However, some patients with tinnitus find it hard to match their tinnitus in one single session. Therefore, we developed an iPod-based application for self-administered tinnitus pitch matching and compared it with a standardized audiometric procedure. STUDY SAMPLE: A total of 17 patients with chronic tonal tinnitus participated in two sessions including both pitch-matching procedures. METHOD: In the conventional audiometric test, the investigator adjusted the frequency and loudness of pure tones led by the responses of the patient. For the iPod-based procedure, we used a recursive two-interval forced-choice test that required no interaction with an investigator. Both procedures included loudness matching and testing for octave confusion. RESULTS: The iPod-based procedure resulted in lower pitch matches as compared with the conventional audiometry. Psychometric qualities such as test-retest reliability of both methods were comparable. Participants rated the iPod-based procedure as easier to perform and more comfortable to use. CONCLUSIONS: In conclusion, we find that the use of self-administered tinnitus pitch-matching procedures on a mobile device is feasible and easier in practice without any loss of reliability and validity. A major advantage is the possibility of repeated measurements without expensive equipment and experienced staff. Repeated measurements of tinnitus pitch can provide more information about the stability of the tinnitus perception and may improve the ability of participants to match their tinnitus. American Academy of Audiology.
Frequency of migraine as a chief complaint in otolaryngology outpatient practice.

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Objective. To identify the frequency of typical (headache and dizziness) and common atypical (ear fullness, pressure, pain, tinnitus, facial fullness, and nasal congestion) migraine symptoms as chief complaints among patients presenting to otolaryngology clinic. Methods. This is a descriptive study of prospectively collected data from a general otolaryngology practice. Typical migraine presentations were diagnosed by applying international headache society (IHS) criteria for migraine headache and Neuhauser's criteria for migrainous vertigo. Atypical otologic and rhinologic migraine symptoms were diagnosed using individualized criteria. Charts were reviewed at 6-month interval from the first presentation. Results. Out of 1002 consecutive patients, 10.8% presented with "migrainous chief complaint." All migrainous chief complaint patients had a history of headache but not all of them presented with headache. Corrected female to male ratio in the migraine group was 3 to 1; age distributions were significantly different between the migraine and nonmigraine groups by applying t-test. Out of the atypical complaints, 86% of the patients had a history of concomitant typical presentation. Conclusion. Actual diagnostic criteria for migraine do not satisfy the diversity of its presentation. Investigating the history of migraine is enough to diagnose most atypical presentations. Sound knowledge about migraine seems essential for any ENT practitioner.

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OBJECTIVES: Vascular tinnitus is the most common form of pulsatile tinnitus, particularly when the tinnitus corresponds with the pulse of patients. In this study, we reviewed the 10-year clinical data on vascular tinnitus of our tinnitus clinic to investigate the frequency of the underlying etiologies, to introduce a diagnostic protocol, and to evaluate the treatment outcomes. METHODS: We retrospectively collected the data of 57 patients who were diagnosed as vascular tinnitus between April 2001 and December 2011. Careful history taking, otoscopy, thorough physical examinations, audiometry, laboratory tests, as well as radiologic examinations were performed according to our diagnostic protocol to find the origin of pulsatile tinnitus. Treatment options were individualized based on the specific etiology, and the outcomes were assessed using patient's subjective reports at the follow-up interviews. RESULTS:High jugular bulb was the most common cause (47.4%) of vascular tinnitus, and venous hum was the next (17.5%). Dural arteriovenous fistula, intracranial aneurysm, atherosclerotic carotid artery disease, and hypertension were less common causes. Vascular tinnitus was alleviated in most patients after the appropriate treatment: surgical intervention, tinnitus retraining therapy, reassurance, and medications. CONCLUSION: Vascular tinnitus can be successfully diagnosed by the regular use of the suggested protocol. Many patients with vascular tinnitus have treatable underlying etiologies. Treatment of those etiologies or at least counseling about the tinnitus itself can benefit the patients with troublesome vascular tinnitus. Free PMC Article.
Wang P, Qiu Z, Chen L, Gan X, Yu J.

OBJECTIVE: To verify the relationship between THI and VAS scores in patients with sudden hearing loss and tinnitus in a prospective study. METHOD: Forty-four patients classified their tinnitus according to VAS and THI before and after treatment, and both scores were compared through the Pearson’s correlation coefficient test and Nonparametric tests. RESULT: There was a correlation between VAS and THI scores in patients with sudden hearing loss and tinnitus. Tinnitus assessment scores were significantly reduced after treatment. Decreasing of THI and VAS scores were not depended on frequency and loudness of tinnitus and severity of deafness, but therapeutic effect of sudden sensorineural hearing loss. CONCLUSION: THI and VAS scores are useful for assessment of tinnitus in patients with sudden hearing loss and tinnitus.

The Gap Detection Test: Can It Be Used to Diagnose Tinnitus?

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OBJECTIVES: Animals with induced tinnitus showed difficulties in detecting silent gaps in sounds, suggesting that the tinnitus percept may be filling the gap. The main purpose of this study was to evaluate the applicability of this approach to detect tinnitus in human patients. The authors first hypothesized that gap detection would be impaired in patients with tinnitus, and second, that gap detection would be more impaired at frequencies close to the tinnitus frequency of the patient. DESIGN: Twenty-two adults with bilateral tinnitus, 20 age-matched and hearing loss-matched subjects without tinnitus, and 10 young normal-hearing subjects participated in the study. To determine the characteristics of the tinnitus, subjects matched an external sound to their perceived tinnitus in pitch and loudness. To determine the minimum detectable gap, the gap threshold, an adaptive psychoacoustic test was performed three times by each subject. In this gap detection test, four different stimuli, with various frequencies and bandwidths, were presented at three intensity levels each. RESULTS: Similar to previous reports of gap detection, increasing sensation level yielded shorter gap thresholds for all stimuli in all groups. Interestingly, the tinnitus group did not display elevated gap thresholds in any of the four stimuli. Moreover, visual inspection of the data revealed no relation between gap detection performance and perceived tinnitus pitch. CONCLUSIONS: These findings show that tinnitus in humans has no effect on the ability to detect gaps in auditory stimuli. Thus, the testing procedure in its present form is not suitable for clinical detection of tinnitus in humans.
Prestin as a biochemical marker for early detection of acquired sensorineural hearing loss.

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Acquired sensorineural hearing loss and tinnitus can come about through various etiologies such as exposure to excessively loud noise or drugs with ototoxic properties. As such, acquired hearing loss is a common source of morbidity which deleteriously affects the ability to communicate. At present our ability to detect acquired hearing loss and tinnitus at its earliest stages is limited and there are no adjuncts to audiometric evaluation. The earliest cellular targets of noise and ototoxins in the cochlea are the outer hair cells (OHC). I hypothesize that serum assays of OHC specific protein, prestin, will allow detection and quantification of OHC damage before audiometric testing can identify presence of hearing loss. At present, there are no data available to evaluate this hypothesis, but initial evaluation can readily be carried out using existing experimental animal models of ototoxicity and noise-induced hearing loss. Early detection of OHC damage is critical to adoption of measures aimed at ameliorating hearing loss and tinnitus, thus reducing permanent deficits and disability. Copyright © 2015 Elsevier Ltd. All rights reserved.

Alterations in auditory change detection associated with tinnitus residual inhibition induced by auditory electrical stimulation.

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BACKGROUND: Residual inhibition (RI) is a temporary phenomenon that happens following offset of appropriate complete or partial acoustical and electrical masking stimulations in people who experience tinnitus. The biologic mechanisms associated with RI are not yet fully understood. Few studies have been focused on RI. Auditory mismatch negativity (MMN) as a change-detection tool may be an appropriate tool to explore the processing changes because of tinnitus and RI. PURPOSE: The purpose of this study was to investigate alterations in auditory change detection and auditory sensory memory related to RI induced by auditory electrical stimulation (AES) using MMN brain mapping in participants with tinnitus. RESEARCH DESIGN: This investigation was a single-blind randomized controlled clinical trial study. Participants were randomly assigned into two groups: AES and placebo electrical stimulation (PES). STUDY SAMPLE: Twenty-eight participants with chronic subjective tinnitus aged 22- to 45-yr-old participated in the study. INTERVENTION: After randomization, all participants received both AES and PES for 1 min in different sessions. DATA COLLECTION AND ANALYSIS: Brain mapping of multifeature MMN paradigm was recorded from 29 scalp electrodes pre- and post-AES and PES. Following AES, participants were categorized into two groups: RI and nonresidual inhibition (NRI). The grand average MMN waveforms and isopotential topographic maps were obtained in RI, NRI, and PES groups. RESULTS: Three MMN parameters for five deviants of frequency, intensity, duration, location, and silent gap were compared among three groups of RI, NRI, and PES. Statistical analyses revealed significant between-subject effects for AES on MMN amplitude of frequency and duration deviant, MMN area under the curve of frequency, intensity, and duration deviants. CONCLUSIONS: Presence of RI can reestablish change-detection mechanisms in the central auditory pathways. It is suggested that MMN is reliable for assessment of change-detection system in people with tinnitus. It can be a useful technique in monitoring effects of treatments and rehabilitation. American Academy of Audiology.
IV Imaging

**Functional near-infrared spectroscopy to probe state- and trait-like conditions in chronic tinnitus: a proof-of-principle study.**

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OBJECTIVE: Several neuroscience tools showed the involvement of auditory cortex in chronic tinnitus. In this proof-of-principle study we probed the capability of functional near-infrared spectroscopy (fNIRS) for the measurement of brain oxygenation in auditory cortex in dependence from chronic tinnitus and from intervention with transcranial magnetic stimulation. METHODS: Twenty-three patients received continuous theta burst stimulation over the left primary auditory cortex in a randomized sham-controlled neuronavigated trial (verum = 12; placebo = 11). Before and after treatment, sound-evoked brain oxygenation in temporal areas was measured with fNIRS. Brain oxygenation was measured once in healthy controls (n = 12). RESULTS: Sound-evoked activity in right temporal areas was increased in the patients in contrast to healthy controls. Left-sided temporal activity under the stimulated area changed over the course of the trial; high baseline oxygenation was reduced and vice versa. CONCLUSIONS: By demonstrating that rTMS interacts with auditory evoked brain activity, our results confirm earlier electrophysiological findings and indicate the sensitivity of fNIRS for detecting rTMS induced changes in brain activity. Moreover, our findings of trait- and state-related oxygenation changes indicate the potential of fNIRS for the investigation of tinnitus pathophysiology and treatment response. Free PMC Article.

**Specific activation of operculum 3 (OP3) brain region during provoked tinnitus-related phantom auditory perceptions in humans.**
Brain Struct Funct. 2014 Dec 12. [Epub ahead of print]

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The phantom sound perception mechanism by which a sound perception occurs without any external sound source is still enigmatic. According to our previous fMRI study, a small region in the parietal operculum 3 was hyperactivated as a function of tinnitus periodicity in subjects with acoustic trauma tinnitus sequelae. This region was localized in the vicinity of neural correlates of middle-ear tympano-ossicular chain movements due to pressure variations. Disturbed proprioceptors are known to trigger illusory perceptions; therefore, we hypothesized that a disturbance of middle-ear proprioceptors may originate phantom sound perceptions. We designed an fMRI study that aimed to stimulate middle-ear proprioceptors by repetitive vibrations using various rates of click trains. In this study, we report that exposure to specific rates of stimuli for a few minutes at comfortable intensity level in healthy subjects distinctly triggered transient tinnitus-like aftereffects. The fMRI neural correlates of the aftereffects were unequivocally localized in the same parietal region as in acoustic trauma tinnitus sufferers. Our results strongly suggest that a middle-ear kinesthetic/proprioceptive illusion exists at the origin of acoustic trauma tinnitus via a somatosensory pathway encompassing the trigeminal system.
Distress state dependent seed based functional connectivity on resting state EEG in tinnitus.

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The question arises whether functional connectivity changes between the distress and tinnitus loudness network during resting-state depends on the amount of distress tinnitus patients’ experience. Fifty-five patients with constant chronic tinnitus were included in this study. EEG recordings were performed and seed-based (at the auditory cortex) source localized functional connectivity (FC) (lagged phase synchronization) was computed for the different EEG frequency bands. Results initially demonstrate that the correlation between loudness and distress is non-linear. Loudness correlates with beta3 and gamma band activity in the auditory cortices, and distress with alpha1 and beta3 changes in the subgenual, dorsal anterior and posterior cingulate cortex. In comparison to non-tinnitus controls seed based FC differed between the left auditory cortices for the alpha1 and beta3 bands in a network encompassing the posterior cingulate cortex extending into the parahippocampal area, the anterior cingulate, and insula. Furthermore, distress changes the functional connectivity between the auditory cortex, encoding loudness, and different parts of the cingulate, encoding distress: the subgenual anterior, the dorsal anterior and posterior cingulate. These changes are specific for the alpha1 and beta3 frequency bands. These results fit with a recently proposed model that states that tinnitus is generated by multiple dynamically active separable but overlapping networks, each characterizing a specific aspect of the unified tinnitus percept, but adds to this concept that the interaction between these networks is a complex interplay of correlations and anti-correlations between areas involved in distress and loudness depending on the distress state of the tinnitus patient.

Altered spontaneous neuronal activity in chronic posttraumatic stress disorder patients before and after a 12-week paroxetine treatment.


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Background: Abnormal functional brain activity has been revealed in patients with Posttraumatic Stress Disorder (PTSD) in recent years, while the recovery neuromechanism of PTSD has not yet been elucidated. The aim of this study was to investigate the altered spontaneous brain activity in treatment-naïve chronic PTSD patients before and after 12 weeks' treatment with paroxetine. Methods: Twenty-one earthquake-related PTSD patients and seventeen traumatized controls underwent a resting functional magnetic resonance imaging (Rs-fMRI) scan at baseline. Amplitude of low-frequency fluctuation (ALFF) was calculated and compared between PTSD patients and controls. Then, the PTSD group completed 12 weeks of treatment with paroxetine, and Rs-fMRI was repeated to compare with the baseline. Lastly, correlation analyses of ALFF values within altered brain areas were conducted. Results: Hyperactive function of visual cortex was observed in PTSD patients before and after treatment. After treatment, significantly increased ALFF values were observed in the left orbitofrontal cortex (OFC), while decreased ALFF values were found in the precuneus. Interestingly, a negative correlation between the mean ALFF values of OFC and those of precuneus and visual cortex was only observed in controls, but not in PTSD patients pre- or post-treatment. Limitations: A corresponding control condition was absent in this study. Conclusion: The findings showed that manipulating regional spontaneous activity of precuneus and OFC could be a potential prognostic indicator of PTSD. However, hyperactive function of visual cortex and disrupted connections between OFC, precuneus and visual cortex did not reverse after treatment, which could be a potential target for further treatment.
Involvement of different cortico-subcortical circuits in chronic tinnitus: An sLORETA-based EEG study
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To assess the involvement of cortico-subcortical circuits in chronic, normoacoustic tinnitus sufferers using electroencephalography (EEG). 17 normoacoustic patients (6F, mean age 43.6 ± 9.8 y, disease duration 22 ± 35 months) presenting with chronic, unilateral high-pitched tinnitus were included, and compared to 17 controls. Subjects underwent resting-state EEG (29 electrodes, 5 min eyes opened, 5 min eyes closed) and an auditory oddball paradigm for event-related potentials (ERPs) analyses (N1, P2 and P300). Cortical distribution of current source density (CSD) of EEG data was computed with sLORETA. Eyes closed, patients had significantly decreased CSD of the alpha2 (10.5–12 Hz) rhythm in the left postcentral and inferior temporal gyri, and decreased gamma (30–100 Hz) CSD in the left temporal gyrus. Eyes opened, CSD of alpha2, beta2 (18.5–21 Hz), and gamma bands were decreased in patients over the inferior parietal lobule. Latency and amplitude of the P300 and P2 did not differ between groups. N1 latency was significantly shorter in patients. Our results suggest an impairment of cortico-thalamo-cortical circuits involving the auditory cortex in chronic tinnitus. Decreased alpha power is compatible with an increased activity of the postcentral and inferior temporal giri, and might reflect a maladaptive plasticity in chronic tinnitus. Copyright © 2015 Elsevier B.V.

Disrupted neural activity in unilateral vascular pulsatile tinnitus patients in the early stage of disease: Evidence from resting-state fMRI.

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Numerous studies have shown that neurological changes are important findings of tinnitus patients. Previous studies on tinnitus have indicated that patients with pulsatile tinnitus (PT) often show altered baseline brain activity in the resting state. This study used resting-state functional magnetic resonance imaging (rs-fMRI) to investigate changes in spontaneous brain activity among patients with unilateral pulsatile tinnitus in the early stage of disease (less than forty-eight months) and determined the relationship of these changes with clinical data. The PT patients (n=34) and matched normal control subjects (n=34) were enrolled in this study. Spontaneous brain activity was revealed by the regional homogeneity (ReHo) and amplitude of low-frequency fluctuation (ALFF) values. Compared with normal controls, the patients with PT had significantly increased ReHo and ALFF in the posterior cingulate cortex, right inferior parietal lobule (IPL) and right cerebellum posterior lobe. The PT group showed increased ReHo in the posterior cingulate cortex (PCC), precuneus, right IPL, right superior frontal gyrus, some occipital areas and part of the right cerebellum posterior lobe. For ALFF, the increased clusters were in the PCC and precuneus and in some areas of the cerebellum posterior lobe, bilateral IPL and inferior frontal gyrus (IFG). Increased PT duration was correlated with increased ALFF in the bilateral inferior frontal gyrus (IFG) and precuneus. An increased THI score was correlated with ReHo and ALFF values in the precuneus. Taken together, the combined study of ReHo and ALFF measurements may yield a more comprehensive neurological pathophysiology framework for PT patients in the early stage of the disease. Copyright © 2015 Elsevier Inc. All rights reserved.
Sigmoid plate dehiscence: Congenital or acquired condition?

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BACKGROUND AND PURPOSE: The imaging features of sigmoid plate dehiscence-induced pulsatile tinnitus have been presented. The origin of the sigmoid plate dehiscence, however, remains unclear. Our aim was to assess the prevalence and extent of sigmoid plate dehiscence on computed tomography (CT) images in multiple age groups to determine whether this condition is more likely to be congenital or acquired.

MATERIALS AND METHODS: We retrospectively reviewed contrast-enhanced CT images of sigmoid plates of temporal bones in 504 patients. Each temporal bone was characterized as normal or dehiscent. Patients were then subcategorized into four age groups, and the prevalence and extent of dehiscent sigmoid plates in each group were calculated and compared.

RESULTS: Overall, 80 patients had sigmoid plate dehiscence, nine of whom had it bilaterally. In successively older age groups, the prevalences of sigmoid plate dehiscence were 18.9%, 20.1%, 14.5%, and 12.7%, respectively. Respective average anteroposterior bony defect diameters were 3.7±1.7, 3.0±1.3, 3.1±1.5, and 3.0±1.1mm. Respective average vertical bony defect diameters were 3.6±2.3, 2.6±1.2, 3.2±1.5, and 3.0±1.7mm. The prevalence and extent of sigmoid plate dehiscence were not statistically different among the four age groups.

CONCLUSIONS: The similar radiologic prevalence and extent of dehiscent sigmoid plates among the age groups suggest that the dehiscence is more commonly a congenital than an acquired condition. Copyright © 2015 Elsevier Ireland Ltd. All rights reserved.

Altered intra- and interregional synchronization in resting-state cerebral networks associated with chronic tinnitus.

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Objective. Subjective tinnitus is hypothesized to arise from aberrant neural activity; however, its neural bases are poorly understood. To identify aberrant neural networks involved in chronic tinnitus, we compared the resting-state functional magnetic resonance imaging (fMRI) patterns of tinnitus patients and healthy controls. Materials and Methods. Resting-state fMRI measurements were obtained from a group of chronic tinnitus patients (n = 29) with normal hearing and well-matched healthy controls (n = 30). Regional homogeneity (ReHo) analysis and functional connectivity analysis were used to identify abnormal brain activity; these abnormalities were compared to tinnitus distress. Results. Relative to healthy controls, tinnitus patients had significant greater ReHo values in several brain regions including the bilateral anterior insula (AI), left inferior frontal gyrus, and right supramarginal gyrus. Furthermore, the left AI showed enhanced functional connectivity with the left middle frontal gyrus (MFG), while the right AI had enhanced functional connectivity with the right MFG; these measures were positively correlated with Tinnitus Handicap Questionnaires (r = 0.459, P = 0.012 and r = 0.479, P = 0.009, resp.). Conclusions. Chronic tinnitus patients showed abnormal intra- and interregional synchronization in several resting-state cerebral networks; these abnormalities were correlated with clinical tinnitus distress. These results suggest that tinnitus distress is exacerbated by attention networks that focus on internally generated phantom sounds. Free PMC Article.
Involvement of cortico-subcortical circuits in normoacousic chronic tinnitus: A source localization EEG study.

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OBJECTIVE: To better characterize brain circuits dysfunctions in normoacousic tinnitus sufferers.

METHODS: 17 normoacousic chronic, unilateral high-pitched tinnitus sufferers (6 females, 43.6±9.8y.o, disease duration 22±35months) underwent a 29-channel resting-state electroencephalography (EEG - 5min opened-eyes, 5min closed-eyes) and auditory oddball paradigm for event-related potentials analyses (ERPs - N1, P2 and P300). Cortical 3D distribution of current source density was computed with sLORETA. Results were compared with 17 controls (9 females, 45.7±15.1y.o). RESULTS: Eyes opened, tinnitus sufferers had lower alpha and beta sources in the left inferior parietal lobule. Eyes closed, tinnitus sufferers had decreased alpha sources in the left inferior temporal and post-central gyri, and low gamma sources in the left middle temporal gyrus. EEG data did not correlate with tinnitus sufferers' clinical features. Subjects with tinnitus had shorter N1 and P2 latencies. P300 did not differ between groups. sLORETA solutions showed decreased sources of these ERPs in the left inferior temporal gyrus in the tinnitus group. CONCLUSIONS: We showed cortico-thalamo-cortical involvements in normoacousic tinnitus with hyperexcitability of the left auditory cortex and inferior temporal gyrus. SIGNIFICANCE: This might reflect processes of maladaptive cortical plasticity and memory consolidation. Further validation is needed to establish the value of this tool in customizing therapeutic approach.

Tinnitus: A Large VBM-EEG Correlational Study.

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A surprising fact in voxel-based morphometry (VBM) studies performed in tinnitus is that not one single region is replicated in studies of different centers. The question then arises whether this is related to the low sample size of these studies, the selection of non-representative patient subgroups, or the absence of stratification according to clinical characteristics. Another possibility is that VBM is not a good tool to study functional pathologies such as tinnitus, in contrast to pathologies like Alzheimer's disease where it is known the pathology is related to cell loss. In a large sample of 154 tinnitus patients VBM and QEEG (Quantitative Electroencephalography) was performed and evaluated by a regression analysis. Correlation analyses are performed between VBM and QEEG data. Uncorrected data demonstrated structural differences in grey matter in hippocampal and cerebellar areas related to tinnitus related distress and tinnitus duration. After control for multiple comparisons, only cerebellar VBM changes remain significantly altered. Electrophysiological differences are related to distress, tinnitus intensity, and tinnitus duration in the subgenual anterior cingulate cortex, dorsal anterior cingulate cortex, hippocampus, and parahippocampus, which confirms previous results. The absence of QEEG-VBM correlations suggest functional changes are not reflected by co-occurring structural changes in tinnitus, and the absence of VBM changes (except for the cerebellum) that survive correct statistical analysis in a large study population suggests that VBM might not be very sensitive for studying tinnitus. Free Full Text.
Altered interhemispheric functional coordination in chronic tinnitus patients.


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Purpose. Recent studies suggest that tinnitus may be due in part to aberrant callosal structure and interhemispheric interaction. To explore this hypothesis we use a novel method, voxel-mirrored homotopic connectivity (VMHC), to examine the resting-state interhemispheric functional connectivity and its relationships with clinical characteristics in chronic tinnitus patients. Materials and Methods. Twenty-eight chronic tinnitus patients with normal hearing thresholds and 30 age-, sex-, education-, and hearing threshold-matched healthy controls were included in this study and underwent the resting-state fMRI scanning. We computed the VMHC to analyze the interhemispheric functional coordination between homotopic points of the brain in both groups. Results. Compared to the controls, tinnitus patients showed significantly increased VMHC in the middle temporal gyrus, middle frontal gyrus, and superior occipital gyrus. In tinnitus patients, a positive correlation was found between tinnitus duration and VMHC of the uncus. Moreover, correlations between VMHC changes and tinnitus distress were observed in the transverse temporal gyrus, superior temporal pole, precentral gyrus, and calcarine cortex. Conclusions. These results show altered interhemispheric functional connectivity linked with specific tinnitus characteristics in chronic tinnitus patients, which may be implicated in the neuropathophysiology of tinnitus. Free PMC Article.

Source space estimation of oscillatory power and brain connectivity in tinnitus.

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Tinnitus is the perception of an internally generated sound that is postulated to emerge as a result of structural and functional changes in the brain. However, the precise pathophysiology of tinnitus remains unknown. Llinas' thalamocortical dysrhythmia model suggests that neural deafferentation due to hearing loss causes a dysregulation of coherent activity between thalamus and auditory cortex. This leads to a pathological coupling of theta and gamma oscillatory activity in the resting state, localised to the auditory cortex where normally alpha oscillations should occur. Numerous studies also suggest that tinnitus perception relies on the interplay between auditory and non-auditory brain areas. According to the Global Brain Model, a network of global fronto-parietal-cingulate areas is important in the generation and maintenance of the conscious perception of tinnitus. Thus, the distress experienced by many individuals with tinnitus is related to the top-down influence of this global network on auditory areas. In this magnetoencephalographic study, we compare resting-state oscillatory activity of tinnitus participants and normal-hearing controls to examine effects on spectral power as well as functional and effective connectivity. The analysis is based on beamformer source projection and an atlas-based region-of-interest approach. We find increased functional connectivity within the auditory cortices in the alpha band. A significant increase is also found for the effective connectivity from a global brain network to the auditory cortices in the alpha and beta bands. We do not find evidence of effects on spectral power. Overall, our results provide only limited support for the thalamocortical dysrhythmia and Global Brain models of tinnitus. Free full text.
Risk assessment of magnetic resonance imaging in chronically implanted paddle electrodes for cortical stimulation.

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BACKGROUND: Cortical epidural stimulation is used for the treatment of different neuropsychiatric disorders such as chronic neuropathic pain, tinnitus, movement disorders, and psychiatric diseases. While pre-operative magnetic resonance imaging (MRI) is considered the imaging tool of choice for planning the approach and electrode placement, postoperative MRI is still a contraindication with implanted paddle leads due to the risk of thermal damage or current induction creating seizures or neurological deficits. OBJECTIVES: In this feasibility in vitro study the temperature changes and induction were determined as well as the artifacts caused by 2 parallel paddle leads (Resume II, Model 3587 A; Medtronic, Minneapolis, Minn., USA), commonly used in clinical practice with and without a pulse generator (Prime Advanced, Model 7489; Medtronic). METHODS: An ultrasound gel-filled head phantom with 2 paddle leads mimicking the surgical scenario was used to evaluate temperature changes as well as induced currents in a 1.5- and 3-tesla MR scanner. In addition, 1 patient underwent a 3-tesla MRI with an implanted subdural paddle lead. RESULTS: Negligible temperature changes were detected with turbo spin echo sequences in the 1.5- and 3-tesla scanner using a head and body coil. Induced voltages up to 6 V were measured. The imaging artifacts in the phantom were well tolerable. The patient's imaging was uneventful under the settings which are accepted for deep brain stimulation imaging. CONCLUSION: MRI under the conditions described here seems to be safe with the implants used in this study. In particular, the induced temperature is much lower with paddle compared to conventional leads due to the different electrode design. The induced voltage does not carry any risks. However, these findings cannot automatically be transferred to other implants or other scanning conditions, and further studies are needed. The biomedical companies should be encouraged to develop MR-conditional paddle leads. Also, further research is necessary to study the mechanism of action of cortical stimulation in the future. © 2015 S. Karger AG, Basel.

Tinnitus-related abnormalities in visual and salience networks during a one-back task with distractors.

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Tinnitus is highly prevalent in the general population. Tinnitus sufferers often report having difficulties focusing on a task at hand and ignoring the tinnitus percept. Behavioral studies have shown evidence for impairments in attention, interference inhibition, and various other executive functions in tinnitus. However, few neuroimaging studies have directly addressed this issue. In the present functional Magnetic Resonance Imaging (fMRI) study we employed a 1-back task, requiring subjects to monitor relevant auditory and visual information. Additionally, interfering stimuli were presented to investigate selection of relevant information and inhibition of irrelevant information. Significant behavioral group differences were not found, although performance worsened for increasing tinnitus severity. Significant group differences in evoked neural activation neither occurred in the central auditory system, nor in the attentional fronto-parietal network. However, the anterior insula and the vermis of the cerebellum showed significantly stronger task-related activation in the tinnitus group when compared to the controls. Furthermore, deactivation in the primary visual cortex that occurred in the control group for various combinations of modalities and distractors was significantly less in the tinnitus group. These results are consistent with previous studies that showed the involvement of various networks in tinnitus, particularly the salience and visual networks, which are also implicated in attention. Although we did not demonstrate cognitive impairment in tinnitus, significantly different evoked responses were found in various brain regions that we attribute to an abnormal involvement of attention control mechanisms in tinnitus. Copyright © 2015 Elsevier B.V. All rights reserved.
The neural correlates of subjectively perceived and passively matched loudness perception in auditory phantom perception.
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INTRODUCTION: A fundamental question in phantom perception is determining whether the brain creates a network that represents the sound intensity of the auditory phantom as measured by tinnitus matching (in dB), or whether the phantom perception is actually only a representation of the subjectively perceived loudness. METHODS: In tinnitus patients, tinnitus loudness was tested in two ways, by a numeric rating scale for subjectively perceived loudness and a more objective tinnitus-matching test, albeit it is still a subjective measure. RESULTS: Passively matched tinnitus does not correlate with subjective numeric rating scale, and has no electrophysiological correlates. Subjective loudness, in a whole-brain analysis, is correlated with activity in the left anterior insula (alpha), the rostral/dorsal anterior cingulate cortex (beta), and the left parahippocampus (gamma). A ROI analysis finds correlations with the auditory cortex (high beta and gamma) as well. The theta band links gamma band activity in the auditory cortex and parahippocampus via theta-gamma nesting. CONCLUSIONS: Apparently the brain generates a network that represents subjectively perceived tinnitus loudness only, which is context dependent. The subjective loudness network consists of the anterior cingulate/insula, the parahippocampus, and the auditory cortex. The gamma band activity in the parahippocampus and the auditory cortex is functionally linked via theta-gamma nested lagged phase synchronization. Free PMC Article.

Dysfunctional noise cancelling of the rostral anterior cingulate cortex in tinnitus patients.
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BACKGROUND: Peripheral auditory deafferentation and central compensation have been regarded as the main culprits of tinnitus generation. However, patient-to-patient discrepancy in the range of the percentage of daytime in which tinnitus is perceived (tinnitus awareness percentage, 0 - 100%), is not fully explicable only by peripheral deafferentation, considering that the deafferentation is a stable persisting phenomenon but tinnitus is intermittently perceived in most patients. Consequently, the involvement of a dysfunctional noise cancellation mechanism has recently been suggested with regard to the individual differences in reported tinnitus awareness. By correlating the tinnitus awareness percentage with resting-state source-localized electroencephalography findings, we may be able to retrieve the cortical area that is negatively correlated with tinnitus awareness percentage, and then the area may be regarded as the core of the noise cancelling system that is defective in patients with tinnitus. METHODS AND FINDINGS: Using resting-state cortical oscillation, we investigated 80 tinnitus patients by correlating the tinnitus awareness percentage with their source-localized cortical oscillatory activity and functional connectivity. The activity of bilateral rostral anterior cingulate cortices (ACCs), left dorsal- and pregenual ACCs for the delta band, bilateral rostral/pregenual/subgenual ACCs for the theta band, and left rostral/pregenual ACC for the beta 1 band displayed significantly negative correlations with tinnitus awareness percentage. Also, the connectivity between the left primary auditory cortex (A1) and the rostral ACC, as well as between the left A1 and the subgenual ACC for the beta 1 band, were negatively correlated with tinnitus awareness percentage. CONCLUSIONS: These results may designate the role of the rostral ACC as the core of the descending noise cancellation system, and thus dysfunction of the rostral ACC may result in perception of tinnitus. The present study also opens a possibility of tinnitus modulation by neuromodulatory approaches targeting the rostral ACC. Free PMC Article.
Intracranial Mapping of a Cortical Tinnitus System using Residual Inhibition.

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Tinnitus can occur when damage to the peripheral auditory system leads to spontaneous brain activity that is interpreted as sound [1, 2]. Many abnormalities of brain activity are associated with tinnitus, but it is unclear how these relate to the phantom sound itself, as opposed to predisposing factors or secondary consequences [3]. Demonstrating "core" tinnitus correlates (processes that are both necessary and sufficient for tinnitus perception) requires high-precision recordings of neural activity combined with a behavioral paradigm in which the perception of tinnitus is manipulated and accurately reported by the subject. This has been previously impossible in animal and human research. Here we present extensive intracranial recordings from an awake, behaving tinnitus patient during short-term modifications in perceived tinnitus loudness after acoustic stimulation (residual inhibition) [4], permitting robust characterization of core tinnitus processes. As anticipated, we observed tinnitus-linked low-frequency (delta) oscillations [5-9], thought to be triggered by low-frequency bursting in the thalamus [10, 11]. Contrary to expectation, these delta changes extended far beyond circumscribed auditory cortical regions to encompass almost all of auditory cortex, plus large parts of temporal, parietal, sensorimotor, and limbic cortex. In discrete auditory, parahippocampal, and inferior parietal "hub" regions [12], these delta oscillations interacted with middle-frequency (alpha) and high-frequency (beta and gamma) activity, resulting in a coherent system of tightly coupled oscillations associated with high-level functions including memory and perception.

Clinical Predictors of Abnormal Magnetic Resonance Imaging Findings in Patients With Asymmetric Sensorineural Hearing Loss.

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Importance: Asymmetric sensorineural hearing loss (ASNHL) is commonly encountered in an otolaryngologic clinical practice. Determining what factors are associated with abnormal magnetic resonance imaging (MRI) findings will help with diagnostic workup. Objective: To evaluate the association between clinical and audiometric factors and abnormal MRI findings in patients with ASNHL. Design, Setting, and Participants: Retrospective medical record review from an urban, tertiary referral center of 451 patients with ASNHL who underwent MRI testing between January 2005 and December 2011. Main Outcomes and Measures: Medical records were reviewed for audiometric parameters as well as clinical presentation and compared with MRI results, which were categorized as abnormal, normal, or incidental. Data analysis included χ2 tests, logistic regression analysis, and multivariate analysis. Results: A total of 48 patients (10.6%) had abnormal MRI findings. Only 21 patients (4.7%) had a mass of the cerebellopontine angle/internal auditory canal on MRI, making up 40% of all abnormal MRI findings. The next most common MRI finding was labyrinthitis (n = 13; 25%). Vertigo/dizziness (n = 20; P = .01), tinnitus (n = 18; P = .02), sudden hearing loss (n = 15; P = .054), and 15-dB asymmetry at 3 kHz (n = 39; P = .01) were associated with abnormal MRI findings. Loud noise exposure was associated with normal MRI findings. Logistic regression analysis showed that vertigo/dizziness (odds ratio [OR], 2.14; 95% CI, 1.15-3.96; P = .02), unilateral tinnitus (OR, 2.15; 95% CI, 1.14-4.03; P = .02), and 15-dB asymmetry at 3 kHz (OR, 2.62; 95% CI, 1.24-5.57; P = .01) were significantly associated with abnormal MRI findings. Multivariate analysis showed that only 15-dB asymmetry at 3 kHz (OR, 2.42; 95% CI, 1.07-5.50; P = .03) was significantly associated with an abnormal MRI finding. Conclusions and Relevance: This study found that asymmetry of 15 dB at 3 kHz on audiometry was associated with higher positive yield on use of MRI in evaluating patients with ASNHL. We recommend that patients who present with ASNHL with this audiometric characteristic undergo MRI as part of their diagnostic workup.
Pharmacotherapy

Successful treatment of sudden sensorineural hearing loss assures improvement of accompanying tinnitus.

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OBJECTIVES/HYPOTHESIS: To investigate the long-term outcomes of accompanying tinnitus after steroid therapy for patients with sudden sensorineural hearing loss (SSNHL). STUDY DESIGN: Retrospective chart review and survey. METHODS: Fifty patients diagnosed with SSNHL accompanied by tinnitus were enrolled and divided into two groups-satisfied and unsatisfied-according to the degree of improvement of tinnitus after SSNHL treatment. Subjective improvement of tinnitus and hearing status were investigated before and 6 months after SSNHL treatment. Hearing improvement was assessed using criteria from our previous study and Siegel's criteria. The change of tinnitus was assessed using a visual analogue scale for tinnitus intensity and frequency. RESULTS: Patients with more severe initial hearing loss had less chance of hearing recovery (P = .05). The satisfied group included significantly more cases with better hearing recovery after SSNHL treatment than the unsatisfied group (P = .049). Pure-tone threshold and speech discrimination scores were significantly better in the satisfied group than in the unsatisfied group after SSNHL treatment (P = .033 and P = .018, respectively), although the two groups showed no definitive differences before treatment. CONCLUSIONS: Optimal and successful treatment of SSNHL may be an important factor in obtaining favorable long-term control of tinnitus accompanied by SSNHL. LEVEL OF EVIDENCE: 4. Laryngoscope, 2014. © 2014 The American Laryngological, Rhinological and Otological Society, Inc.

Atorvastatin in the management of tinnitus with hyperlipidemias.

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OBJECTIVE: To determine the role of atorvastatin in management of tinnitus in patients with hyperlipidemia. STUDY DESIGN: Quasi-experimental study. PLACE AND DURATION OF STUDY: ENT Department, Combined Military Hospital, Rawalpindi, from July 2011 to August 2012. METHODOLOGY: Ninety eight patients of tinnitus with sensorineural hearing loss having hyperlipidemia were included in the study. Their pre-therapy serum cholesterols were measured, and tinnitus scores were recorded on a 'Tinnitus handicap questionnaire'. They were administered tablet atorvastatin 40 mg once daily with low fat diet for 8 months. After 8 months of therapy, patients were purposefully divided into responsive and unresponsive group depending on serum cholesterol levels. Post therapy serum cholesterol levels and tinnitus scores were also recorded after 8 months and compared with pre-therapy records. RESULTS: Serum cholesterol came to within normal limits in 51 (52%) patients (responsive group), while it remained high in 47 (48%) patients (unresponsive group). Improvement in tinnitus score in the responsive group was seen in 36 (70.5%) patients and in 2 (4.2%) patients of the unresponsive group. Improvement in tinnitus scores was compared in the two groups using Fisher's exact test and were found to be statistically better in the responsive group (p < 0.001). CONCLUSION: Tinnitus, in patients having hyperlipidemia, can be successfully dealt with by treating hyperlipidemia with lipid lowering agent atorvastatin.
Partial to Complete Suppression of Unilateral Noise-Induced Tinnitus in Rats after Cyclobenzaprine Treatment.

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Some forms of tinnitus are believed to arise from abnormal central nervous system activity following a single or repeated noise exposure, for which there are no widely accepted pharmacological treatments. One central site that could be related to tinnitus awareness or modulation is the locus coeruleus, a brainstem structure associated with stress, arousal, and attention. In the present study, we evaluated the effects of cyclobenzaprine, a drug known to act on the rat locus coeruleus, on noise-induced tinnitus using Gap Prepulse Inhibition of the Acoustic Startle (GPIAS). In untreated rats, brief silent gaps presented prior to a 5-10-kHz bandpass startling stimulus produced robust GPIAS. Treatment with cyclobenzaprine alone had no effect on the ability of gaps to suppress the startle response. When animals were exposed to intense narrow-band (126 dB SPL, 16 kHz, 100 Hz BW) unilateral noise, GPIAS was significantly reduced, suggesting the presence of tinnitus. Following the noise exposure, a subset of rats that maintained a robust startle response continued to show GPIAS impairment at 6-20 kHz, 40 days post-noise, suggesting chronic tinnitus. When this subset of animals was treated with cyclobenzaprine, at a dose that had no significant effects on the startle response (0.5 mg/kg), GPIAS recovered partially or to near baseline levels at the affected frequencies. These results were consistent with the absence of tinnitus. By 48 h post-treatment, evidence of tinnitus re-emerged. Our results suggest that cyclobenzaprine was effective in transiently suppressing noise-induced tinnitus in rats.

Clinical pharmacology of melatonin in the treatment of tinnitus: a review.

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PURPOSE: We performed a review with the purpose to summarise, analyse and discuss the evidence provided by clinical studies evaluating effectiveness of melatonin in the cure of tinnitus. Due to the fact that there is no satisfactory treatment for tinnitus, clinical research has explored new therapeutic approaches. METHODS: A search of Pubmed, Medline, Embase, Central and Google Scholar was conducted to find trials published prior March 2014 on melatonin in the treatment of tinnitus. Design of the studies, randomization, allocation concealment procedures and diagnostic instruments (scales for tinnitus evaluation) were critical evaluated. RESULTS: Five clinical studies have been included. Three of them tested effectiveness of melatonin alone, the remaining two along with sulpiride and sulodexide respectively. Considered clinical trials adopted various experimental designs: single arm, randomised placebo-controlled and randomised placebo-controlled followed by crossover. These studies were characterised by several methodological weaknesses. CONCLUSION: Confirmation of melatonin clinical effectiveness in the treatment of tinnitus cannot be given in the light of the biases observed in the considered evidence. Melatonin seems to improve sleep disturbance linked to tinnitus.
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Background: Chinese herbal medicine is an alternative therapy for menopausal problems and is widely practiced in China and many other Asian countries. However, efficacies and side-effects are rarely assessed according to the standards of evidence-based medicine. Patients and Methods: This is a prospective observatory study following efficacy and side-effects of a semi-individualized Chinese herbal mixture "Tiáo Gēng Tāng (TGT)" in 30 patients for 3 months. Another group of 30 patients receiving hormone therapy with tibolone was included as a positive comparison. Common questionnaire-based measuring instruments were: modified Kupperman index, menopause rating scale, life quality and Chinese medical symptom scale (CMSS). Follicle-stimulating hormone (FSH), luteinizing hormone (LH) and estradiol (E2) were determined before and three months after the treatments. Results: Significant improvement was seen in overall scores of all the four measurements in both groups. For some symptoms, including dry mouth, tinnitus, poor appetite and constipation, TGT was more effective than tibolone. For psychosocial and sexual sub-scales of life quality, tibolone has a slightly higher remedy rate than TGT. TGT lowered FSH and LH significantly, as tibolone did, but elevated E2 significantly less than tibolone. Various adverse events, including body weight increase, abdomen discomfort, nausea/vomiting, emotional instability, pressure in breasts and dizziness, were reported by patients treated with tibolone, whereas only diarrhea was observed in two patients treated with TGT. Conclusion: TGT alleviates menopausal symptoms with similar efficacy as tibolone but has fewer side effects. Copyright © 2015 International Institute of Anticancer Research (Dr. John G. Delinassios), All rights reserved. Free full text.

Therapeutic effect of combined steroid-lipoprostaglandin E1 for sudden hearing loss: a propensity score-matched analysis.

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OBJECTIVES: The aim of this study is to analyze the synergistic effect of combined steroid-lipoprostaglandin E1 for the treatment of sudden hearing loss. METHODS: A prospective observational, non-randomized study with a historical cohort was performed at a university hospital. Between 2005 and 2012, 421 patients with idiopathic sudden sensorineural hearing loss were enrolled in this study and treated with combined steroid-lipoprostaglandin E1 treatment. Additionally, 132 patients were prospectively enrolled and treated with steroid treatment alone between January 2013 and March 2014. After performing a propensity score-matched analysis, final hearing levels and the degree of recovery were compared according to treatment options. RESULTS: A total of 240 patients were enrolled after propensity score-matching, with 180 patients classified as combined steroid-lipoprostaglandin E1 treatment group (group I) and 60 patients as steroid treatment alone group (group II). The final hearing level (35.56±34.64dB) in group I was not significantly different from that in group II (34.64±24.67dB) (p=0.05). Logistic regression analysis revealed that the combined treatment did not influence recovery, and the probability of recovery was 1.881 times higher in the absence of dizziness (95% confidence interval: 1.022-3.464, p=0.042), and 1.026 times higher in patients with better hearing in healthy ears (95% confidence interval: 1.010-1.041, p=0.001). CONCLUSION: Compared to steroid treatment alone, combined steroid-lipoprostaglandin E1 treatment failed to improve sudden hearing loss. Copyright © 2015 Elsevier Inc. All rights reserved.
Qualitative and Quantitative Analysis of Eclipta prostrata L. by LC/MS.
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Eclipta prostrata L. is one of the Chinese medicinal tonics which are usually used for treating loose teeth, dizziness, tinnitus, hemoptysis, hematuria, and uterine bleeding. However, quality control of this herbal medicine has been not satisfactory. This study reported its qualitative and quantitative analyses based on LC/MS method. UHPLC-DAD-Q-TOF-MS fingerprinting and MS fragmentation cleavage pathway were investigated for qualitative analysis. Furthermore, a method for simultaneous quantitative determination of nine compounds, luteolin 7-O-β-D-glucopyranoside, ecliptasaponin C, luteolin, eclalbasaponin IV, apigenin, ecliptasaponin A, echinocystic acid 28-O-β-D-glucopyranoside, echinocystic acid, and 3-oxo-16α-hydroxy-olean-12-en-28-oic acid in E. prostrata, was established. The method was validated for samples of E. prostrata from different habitats. The results showed good linear correlation, precision, accuracy, and repeatability that could be used for contents determination of the nine compounds in E. prostrata from different habitats. Free PMC Article.

Tonic Zinc Inhibits Spontaneous Neuronal Firing in Dorsal Cochlear Nucleus Principal Neurons by Enhancing Glycinergic Neurotransmission.
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In many synapses of the CNS, zinc is packaged into glutamatergic vesicles and co-released with glutamate during neurotransmission. Following synaptic release, the mobilized zinc modulates ligand- and voltage-gated channels and receptors, functioning as an inhibitory neuromodulator. However, the origin and role of tonic, as opposed to phasically released, zinc are less well understood. We investigated tonic zinc in the dorsal cochlear nucleus (DCN), a zinc-rich, auditory brainstem nucleus. Our results show that application of a high-affinity, extracellular zinc chelator (ZX1) enhances spontaneous firing in DCN principal neurons, consistent with tonic zinc inhibition of this function. The enhancing effect was prevented by prior application of strychnine, a glycine receptor antagonist, suggesting that ZX1 interferes with zinc-mediated modulation of tonic glycinergic inhibition. In particular, ZX1 decreased the amplitude and the frequency of glycinergic miniature inhibitory postsynaptic currents in DCN principal neurons, from which we conclude that tonic zinc enhances glycinergic inhibitory neurotransmission. The observed zinc-mediated inhibition in spontaneous firing is present in mice lacking the vesicular zinc transporter (ZnT3), which requires that non-vesicular zinc modulates spontaneous firing. Noise-induced increase in the spontaneous firing in DCN principal neurons is crucial for the induction of tinnitus. In this context, tonic zinc provides a powerful break of spontaneous firing that may protect against pathological run-up of spontaneous activity in the DCN. Copyright © 2015. Published by Elsevier Inc.
[Pharmacokinetics study of injected doripenemin healthy volunteers].
[Article in Chinese]


OBJECTIVE: To study the pharmacokinetics of injected doripenem in Chinese healthy volunteers, in order to optimize dosages for patients. METHODS: Twelve healthy volunteers were recruited in the threecross Latin square designed study. Participants received intravenous infusions of 0.25, 0.5 and 1.0 g doripenem sequentially in three periods at a random order. Plasma and urine doripenem were measured by HPLC-UV, using an internal standard method with meropenem for plasma samples and an external standard method for urine samples, respectively. Phoenix WinNonlin 6.1 pharmacokinetic software was used to calculate non-compartment pharmacokinetics parameters. SPSS 19.0 software was used for statistical analysis. RESULTS: A single dose infusion of 0.25, 0.5 and 1.0 g doripenemin 60 min produced the following respective parameters: Cmax (11.81 +/- 1.52), (22.80 +/- 3.80) and (47.26 +/- 8.38) microg/mL, Tmax (60.42 +/- 1.44), (58.33 +/- 5.77) and (60.00 +/- 0) min, t(1/2) (63.48 +/- 10.51), (69.12 +/- 16.72) and (69.30 +/- 11.71) min, AUC(0-1), (1100.86 +/- 150.04), (2111.50 +/- 359.58) and (4359.50 +/- 789.38) microg/(mL x min). Linear Regression and Confidence Interval analyses suggested a linear kinetic characteristic. Doripenem was mainly excreted through kidneys, with 24 h cumulative urine excretion rates ranging from 70% to 75% for the three doses of infusions. It was safe to administer doripenem through infusion in healthy volunteers. Adverse reactions occurred in 19.44% cases of infusions, although all were mild reactions. Tinnitus happened in two cases (8.33%) of infusions, which required close observations. CONCLUSION: Doripenem infusion possesses a linear kinetics. There is no need to adjust the regimen patients.

Efficacy of adjuvant Chinese herbal formula treatment for chronic tinnitus: A retrospective observational study.

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BACKGROUND: The aim of this study was to evaluate the clinical efficacy of using western anti-tinnitus therapy with or without Chai-Hu-Jia-Long-Gu-Mu-Li-Tang (CHJLGMLT) to treat patients with chronic tinnitus. METHODS: A descriptive case series with chart review was established to compare patients with chronic tinnitus who had received CHJLGMLT with western anti-tinnitus therapy (the CHJLGMIT group) with those who received western anti-tinnitus therapy alone (the non-CHJLGMIT group). We included 21 patients, 10 patients in the CHJLGMIT group with CHJLGMLT and 11 patients in the non-CHJLGMIT group. Both groups were comparable in terms of patient demographics and clinical characteristics. The follow-up examinations included the assessment of Tinnitus Handicap Inventory (THI), Pittsburgh Sleep Quality Index (PSQI), Visual Analogue Scale (VAS) of 0-10 for tinnitus intensity, pure tone audiometry (PTA), and speech reception threshold (SRT). RESULTS: After 2 months of treatment, THI and PSQI scores were reduced significantly more in the CHJLGMIT group (p<0.05) than in the non-CHJLGMIT group. Scores on the emotional subscale of the THI were significantly reduced in the CHJLGMIT group (p<0.05) after treatment, but the effects on the seven PSQI subscales did not differ significantly between the two groups (p>0.05). Scores on the VAS for tinnitus loudness were significantly reduced in both groups (p<0.05). No significant differences between the two groups were found on the binaural hearing tests (PTA and SRT). CONCLUSIONS: Our study found that adjuvant CHJLGMLT therapy for chronic tinnitus may exert additional efficacy by improving psychological sensation of tinnitus and sleep quality. Future randomized controlled double-blind studies should be performed to elucidate its efficacy. Copyright © 2015 Elsevier Ltd. All rights reserved.
The use of benzodiazepines for tinnitus: systematic review.

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OBJECTIVES: To investigate the effectiveness of benzodiazepine use for subjective tinnitus and to consider this in the context of the concomitant side effects. METHODS: A systematic search of several databases using the terms 'tinnitus' and 'benzodiazepines' was conducted to find clinical trials of benzodiazepines and comparators in tinnitus patients. These studies were then assessed for risk of bias. RESULTS: Six clinical trials were included. Clonazepam was found to be effective in three studies, but these studies had limitations regarding adequate blinding. The effectiveness of alprazolam was equivocal. Diazepam was not effective in two studies and oxazepam was effective in one study. CONCLUSION: Benzodiazepine use for subjective tinnitus does not have a robust evidence base. Clonazepam has the most evidence to support its use and is relatively less likely to lead to abuse because of its longer half-life, but caution is still needed given the other serious side effects.

Selecting Appropriate Dose Regimens for AM-101 in the Intratympanic Treatment of Acute Inner Ear Tinnitus.
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Inhibition of cochlear N-methyl-D-aspartate (NMDA) receptors with AM-101, a small molecule antagonist delivered by intratympanic injection, represents a novel approach to treat acute tinnitus triggered by glutamate excitotoxicity. An earlier double-blind, randomized, placebo-controlled phase II clinical trial (TACTT0) had demonstrated a significant and dose-dependent improvement in tinnitus triggered by acute acoustic trauma or otitis media from baseline to day 90. A second phase II trial (TACTT1) now sought to evaluate the most appropriate dose regimen for this treatment. Outcomes from the TACTT1 trial showed no significant difference in tinnitus improvement between a single-dose treatment and a dose regimen comprising three doses over 2 weeks. Taken together, three injections over 3 consecutive days showed the best results in the two phase II trials, suggesting that repeated and concentrated inhibition of cochlear NMDA receptors provides best treatment effects, while keeping the procedural impact on patients short. © 2015 S. Karger AG, Basel.

Cochlear NMDA Receptors as a Therapeutic Target of Noise-Induced Tinnitus.


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BACKGROUND: Accumulating evidence suggests that tinnitus may occur despite normal auditory sensitivity, probably linked to partial degeneration of the cochlear nerve and damage of the inner hair cell (IHC) synapse. Damage to the IHC synapses and deafferentation may occur even after moderate noise exposure. For both salicylate- and noise-induced tinnitus, aberrant N-methyl-d-aspartate (NMDA) receptor activation and related auditory nerve excitation have been suggested as origin of cochlear tinnitus. Accordingly, NMDA receptor inhibition has been proposed as a pharmacologic approach for treatment of synaptopathic tinnitus. METHODS: Round-window application of the NMDA receptor antagonist AM-101...
Esketamine hydrochloride gel; Auris Medical AG, Basel, Switzerland) was tested in an animal model of tinnitus induced by acute traumatic noise. The study included the quantification of IHC ribbon synapses as a correlate for deafferentation as well as the measurement of the auditory brainstem response (ABR) to close-threshold sensation level stimuli as an indication of sound-induced auditory nerve activity. RESULTS: We have shown that AM-101 reduced the trauma-induced loss of IHC ribbons and counteracted the decline of ABR wave I amplitude generated in the cochlea/auditory nerve. CONCLUSION: Local round-window application of AM-101 may be a promising therapeutic intervention for the treatment of synaptopathic tinnitus. © 2015 S. Karger AG, Basel.

Potassium channel activator attenuates salicylate-induced cochlear hearing loss potentially ameliorating tinnitus.


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High dose sodium salicylate causes moderate, reversible hearing loss and tinnitus. Salicylate-induced hearing loss is believed to arise from a reduction in the electromotile response of outer hair cells (OHCs) and/or reduction of KCNQ4 potassium currents in OHCs, which decreases the driving force for the transduction current. Therefore, enhancing OHC potassium currents could potentially prevent salicylate-induced temporary hearing loss. In this study, we tested whether opening voltage-gated potassium channels using ICA-105665, a novel small molecule that opens KCNQ2/3 and KCNQ3/5 channels, can reduce salicylate-induced hearing loss. We found that systemic application of ICA-105665 at 10 mg/kg prevented the salicylate-induced amplitude reduction and threshold shift in the compound action potentials recorded at the round window of the cochlea. ICA-105665 also prevented the salicylate-induced reduction of distortion-product otoacoustic emission. These results suggest that ICA-105665 partially compensates for salicylate-induced cochlear hearing loss by enhancing KCNQ2/3 and KCNQ3/5 potassium currents and the motility of OHCs. Free PMC Article.

Intratympanic therapy in Meniere's syndrome or disease: up to date evidence for clinical practise.


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BACKGROUND: Meniere's syndrome or disease (MS/D) is typically characterised by episodic vertigo, aural fullness, tinnitus and fluctuating hearing loss. There are multiple options available for treatment with variation in consensus on the best intervention. OBJECTIVE: To evaluate the evidence on the efficacy of intratympanic therapies [steroids, gentamicin, antiviral therapy and other therapies] on the frequency and severity of vertigo and other symptoms of MS/D. SEARCH STRATEGY: A literature search was performed on AMED, EMBASE, HMIC, MEDLINE, PsycINFO, BNI, CINAHL, HEALTH BUSINESS ELITE, CENTRAL and Cochrane Ear, Nose and Throat disorders group trials register using various MeSH. The search was restricted to English and human subjects and the last date of search was Dec 2014. SELECTION CRITERIA: Randomised controlled trials of intratympanic therapies [steroids, gentamicin and antiviral agents, latanoprost] versus a placebo or another treatment. RESULTS: We analysed 8 RCT's comparing intratympanic steroids, gentamicin, Ganciclovir (antiviral) and latanoprost versus another form of intratympanic treatment or placebo. CONCLUSIONS: On the basis of 6 RCT's (n=242) there is evidence to support the effectiveness of intratympanic steroids and gentamicin to control symptoms of vertigo in MS/D albeit with a risk of hearing loss in gentamicin. However, there was no consensus found on doses or treatment protocols. There was no evidence for the use of other forms of intratympanic therapy (antivirals and latanoprost) in MS/D. This article is protected by copyright. All rights reserved. This article is protected by copyright. All rights reserved.
Histamine H4 Receptor Antagonists: A New Approach for Tinnitus Treatment?
Recent Pat CNS Drug Discov. 2015 Apr 24. [Epub ahead of print]

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Tinnitus, a disorder with disruptive sound perception in the head without an external source, affects around 15% of the worldwide adult population. Since there is no approved drug for the treatment for this symptom, novel strategies need to be developed to provide relief for the patient. A patent from the small French startup company Sensorion suggests the use of histamine H4 receptor (H4R) inhibitors as potential treatment. Since histamine and its receptor subtypes are strongly involved in neuronal and inflammatory processes in vestibular areas, targeting the H4R could be a novel way to gain a treatment for tinnitus. Although mRNA and protein levels of H4R have been demonstrated on isolated spiral ganglion neurons from mice, the methods of receptor detection as well as the species relevance of the data are under discussion and require considerable further verification, especially on a disease with a high medical need like tinnitus.

Enhanced presence of NGF and mast cells number in nasal cavity after autologous stimulation: relation with sensorineural hearing deficit.

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OBJECTIVE: Nerve growth factor (NGF) is a neurotrophic which promote and regulate the survival of neurons in the peripheral nervous system. We aimed to evaluate the nasal NGF expressions of mast cells in healthy patients after stimulation with sterilized isotonic solution delivered at high pressure. PATIENTS AND METHODS: The first part of the study was made with 21 voluntary individuals. The middle third of the inferior turbinate epithelial cells on the right nostril was scraped using a sterile curette and indicated as (pre), than a spray of sterilized isotonic solution at high pressure on the left nostril was delivered and 25 minutes later a similar stimulation was delivered on the same nostril. The stimulation was made with a specific spray. The middle third of the inferior turbinate epithelial cells on the left nostril was scraped using a sterile curette and indicated as (post). RESULTS: Forced nasal stress induced by local delivery of high pressure physiological solution causes an increase in the number of mast cells and enhances level of NGF in the nasal fluid compared to the control subjects. So based on the first part of our study, since NGF is universally known as effective in protection and repairing of neural cells damage, we started the second part and gave a treatment on the same patients, to increase NGF levels with a six months daily therapy and observed the variations in Sensorineural Hearing Loss (SNHL) and tinnitus intensity from the beginning to the end of the therapy. All patients received sterilized isotonic solution at high pressure (pression emission level: PEL): 7 g/sec for 0.5 sec (emission time: ET) in both nostrils. 25 minutes later a similar stimulation was delivered twice a day. The control group (21 pts) received normal therapy with betahistine dihydrochloride 16 mg twice a day. CONCLUSIONS: Upon acuphenometry, there was a lower intensity of tinnitus and the improvement was signaled by the patients. Patients with SNHL treated with conventional therapy had a slight worsening, while the patients treated with our new therapy which increased NGF levels, showed improvement of hearing. This new therapy represents a new therapy of SNHL, tinnitus and hearing disorders. Free full text.
VI Auditive Stimulation

[Research on fractal tones generating method for tinnitus rehabilitation based on musical instrument digital interface technology].
[Article in Chinese]

Wang L, He P, Pan F.

Tinnitus is a subjective sensation of sound without external stimulation. It has become ubiquitous and has therefore aroused much attention in recent years. According to the survey, ameliorating tinnitus based on special music and reducing pressure have good effects on the treatment of it. Meantime, vicious cycle chains between tinnitus and bad feelings have been broken. However, tinnitus therapy has been restricted by using looping music. Therefore, a method of generating fractal tones based on musical instrument digital interface (MIDI) technology and pink noise has been proposed in this paper. The experimental results showed that the fractal fragments were self-similar, incompletely reduplicate, and no sudden changes in pitches and would have a referential significance for tinnitus therapy.

Non-penetrating round window electrode stimulation for tinnitus therapy followed by cochlear implantation.
Eur Arch Otorhinolaryngol. 2014 Dec 6. [Epub ahead of print]


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One main theory behind the origin of tinnitus is based on the idea that alterations of the spontaneous electrical activity within the auditory system lead to abnormal firing patterns in the affected nervous structures [1]. A possible therapeutic option is the use of electrical stimulation of the auditory nerve for the recovery or at least limitation of the abnormal firing pattern to a level that can be easily tolerated by the patient. The Tinnelec Implant consists of a single non-penetrating stimulation electrode connected to a Neurelec cochlear implant system. As a first feasibility study, before starting implantations in hearing patients, we thought to assess the potential of the Tinnelec stimulation to treat tinnitus in unilateral deaf patients, analysing hereby its effectivity and risks. Three patients suffering from unilateral tinnitus resistant to pharmaceutical treatment and ipsilateral severe to profound sensorineural hearing loss/deafness were implanted with a Tinnelec system between September 2007 and July 2008, at the ENT Department of Hannover Medical School. The stimulation strategy was chosen to induce alleviation of the tinnitus through suppression, masking and/or habituation and the response of each patient on the treatment was monitored using a visual analogue scale (VAS) on loudness and annoyance of tinnitus, mood of the patient, as well as the tinnitus handicap inventory (THI). All patients had a benefit from the electrical stimulation for their tinnitus (THI-score improvement of 20-70), however, not all participants profited from the Tinnelec system in same way and degree. In one patient, despite good results, the device had to be replaced with a conventional cochlear implant because of Tinnelec-independent increase in hearing loss on the contralateral ear. Additionally, due to the extension of cochlear implant indications, the devices of the other two patients have been meanwhile replaced with a conventional cochlear implant to benefit additionally from hearing improvement. As demonstrated in the present study, sensorineural tinnitus in humans may be suppressed-masked/habituated by electrical stimulation. The main advantage of the Tinnelec implant would be the option to treat patients with normal and usable hearing, stimulating the affected ear with the cochlear non-penetrating stimulation electrode of the device, and extend the treatment in cases of progressive hearing loss by explanation and reimplantation with a penetrating electrode addressing tinnitus as well as the hearing impairment. The present study is the first report on a long-term follow-up on tinnitus patients implanted with Tinnelec. Further clinical studies to implant tinnitus patients with residual or normal hearing on the affected ear are on the way.
Cochlear Implantation for Patients with Single-Sided Deafness or Asymmetrical Hearing Loss: A Systematic Review of the Evidence.
Otol Neurotol. 2014 Dec 11. [Epub ahead of print]

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OBJECTIVE: A systematic review of the literature to evaluate the clinical outcome of cochlear implantation for patients with single-sided deafness (SSD) or asymmetrical hearing loss (AHL). DATA SOURCES: We searched the PubMed, Embase, Cochrane Library, and CINAHL databases from their inception up to December 10, 2013 for SSD or AHL and cochlear implantation or their synonyms. STUDY SELECTION: In total, 781 articles were retrieved, of which 15 satisfied the eligibility criteria. Our outcomes of interest were speech perception in noise, sound localization, quality of life (QoL), and tinnitus. DATA EXTRACTION: Critical appraisal showed that six studies reported on less than five patients or that they carried a low directness of evidence or a high risk of bias. Therefore, we extracted the data of nine studies (n = 112). Patient numbers, age, duration of deafness, classification of deafness, pure tone audiometry, follow-up duration, and outcome measurements were extracted from all nine articles. DATA SYNTHESIS: Because of large heterogeneity between studies, we were not able to pool data in a meta-analysis. We therefore summarized the results of the studies specified per outcome. CONCLUSION: There are no high-level-of-evidence studies concerning cochlear implantation in patients with SSD or AHL. Current literature suggests important benefits of cochlear implantation regarding sound localization, QoL, and tinnitus. Varying results were reported for speech perception in noise, possibly caused by the large clinical heterogeneity between studies. Larger and high-quality studies are certainly warranted.

[Research on fractal tones generating method for tinnitus rehabilitation based on musical instrument digital interface technology].
[Article in Chinese]

Wang L, He P, Pan F.

Tinnitus is a subjective sensation of sound without external stimulation. It has become ubiquitous and has therefore aroused much attention in recent years. According to the survey, ameliorating tinnitus based on special music and reducing pressure have good effects on the treatment of it. Meantime, vicious cycle chains between tinnitus and bad feelings have been broken. However, tinnitus therapy has been restricted by using looping music. Therefore, a method of generating fractal tones based on musical instrument digital interface (MIDI) technology and pink noise has been proposed in this paper. The experimental results showed that the fractal fragments were self-similar, incompletely reduplicate, and no sudden changes in pitches and would have a referential significance for tinnitus therapy.
A modified speech enhancement algorithm for electronic cochlear implant and its digital signal processing realization.
[Article in Chinese]

Wang Y, Tian X.

In order to improve the speech quality and auditory perceptiveness of electronic cochlear implant under strong noise background, a speech enhancement system used for electronic cochlear implant front-end was constructed. Taking digital signal processing (DSP) as the core, the system combines its multi-channel buffered serial port (McBSP) data transmission channel with extended audio interface chip TLV320AIC10, so speech signal acquisition and output with high speed are realized. Meanwhile, due to the traditional speech enhancement method which has the problems as bad adaptability, slow convergence speed and big steady-state error, versiera function and de-correlation principle were used to improve the existing adaptive filtering algorithm, which effectively enhanced the quality of voice communications. Test results verified the stability of the system and the de-noising performance of the algorithm, and it also proved that they could provide clearer speech signals for the deaf or tinnitus patients.

Quality of life and audiologic performance through the ability to phone of cochlear implant users.
Eur Arch Otorhinolaryngol. 2014 Dec 20. [Epub ahead of print]

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This study aimed to evaluate the impact of cochlear implantation on quality of life (QoL), using general and cochlear implant (CI) specific questionnaires and to determine the relationship of phone ability with QoL, speech recognition abilities and tinnitus. Twenty-six adult volunteers with a post-lingual profound deafness, unilaterally implanted with a CI, were included in this study. All subjects had used a CI for at least 1 year. The Glasgow benefit inventory (GBI) and Nijmegen cochlear implant questionnaire (NCIQ) were administered to assess QoL. Speech recognition was tested using phonemic Lafon’s lists. The subjective tinnitus severity scale (STSS) questionnaire was used to determine the effects of tinnitus. CI users were split into four groups according to their phone ability. There was an improvement in QoL after cochlear implantation. The NCIQ showed significant (p < 0.001) improvements in the total score and in all subdomains after CI. A significant relationship between phone ability, QoL and speech recognition was found. Improving phone ability led to higher QoL (p < 0.05) and speech recognition (p < 0.01) scores. The CI use decreased significantly the occurrence of tinnitus, but its severity was not correlated with QoL. Post-surgery assessment should include speech recognition measures and QoL evaluation. The NCIQ appeared more effective than the GBI in its ability to detect improvements in QoL. Assessing phone ability represents an easy and fast approach to evaluate hearing performances and QoL, and may reflect global outcomes of CI.
Changes in Tinnitus after Cochlear Implantation and Its Relation with Psychological Functioning.

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This study retrospectively assessed the prevalence of tinnitus in cochlear implant patients and the changes after implantation in 212 patients implanted between 2000 and 2009. Patients were included at least 6 months after implantation and received 2 sets of questionnaires, one about the situation before implantation and one about the situation after implantation. Mostly standardized questionnaires assessed tinnitus handicap (Tinnitus Handicap Inventory, THI, and Tinnitus Handicap Questionnaire, THQ), tinnitus characteristics, hearing loss (Abbreviated Profile of Hearing Aid Benefit) and anxiety/depression (Hospital Anxiety and Depression Scale). Of the approached patients, 117 completed the full sets of questionnaires and 35 completed a short version. Preoperative tinnitus was reported by 51.3% of these patients, of which 55.6% reported a reduction or cessation of their tinnitus after implantation. However, 8.2% of the patients with tinnitus reported a postoperative deterioration of their tinnitus. In addition, among the patients without preoperative tinnitus, 19.6% reported the start of tinnitus after implantation. The self-reported change of tinnitus correlated with the pre- and postoperative scores on the THI and THQ. The THQ showed slightly more changes in scores after cochlear implantation compared to the THI. Overall hearing handicap and feelings of anxiety and depression decreased after implantation. In conclusion, tinnitus is reduced after cochlear implantation in an important part of the patients, but in a small part implantation has a negative effect on tinnitus. When tinnitus starts after implantation, the tinnitus handicap is mild. © 2014 S. Karger AG, Basel.

Control of abnormal synchronization in neurological disorders.

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In the nervous system, synchronization processes play an important role, e.g., in the context of information processing and motor control. However, pathological, excessive synchronization may strongly impair brain function and is a hallmark of several neurological disorders. This focused review addresses the question of how an abnormal neuronal synchronization can specifically be counteracted by invasive and non-invasive brain stimulation as, for instance, by deep brain stimulation for the treatment of Parkinson's disease, or by acoustic stimulation for the treatment of tinnitus. On the example of coordinated reset (CR) neuromodulation, we illustrate how insights into the dynamics of complex systems contribute to successful model-based approaches, which use methods from synergetics, non-linear dynamics, and statistical physics, for the development of novel therapies for normalization of brain function and synaptic connectivity. Based on the intrinsic multistability of the neuronal populations induced by spike timing-dependent plasticity (STDP), CR neuromodulation utilizes the mutual interdependence between synaptic connectivity and dynamics of the neuronal networks in order to restore more physiological patterns of connectivity via desynchronization of neuronal activity. The very goal is to shift the neuronal population by stimulation from an abnormally coupled and synchronized state to a desynchronized regime with normalized synaptic connectivity, which significantly outlasts the stimulation cessation, so that long-lasting therapeutic effects can be achieved. Free full text.
Consensus on Hearing Aid Candidature and Fitting for Mild Hearing Loss, With and Without Tinnitus: Delphi Review.
Ear Hear. 2015 Jan 13. [Epub ahead of print]

Sereda M1, Hoare DJ, Nicholson R, Smith S, Hall DA.

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OBJECTIVES: In many countries including the United Kingdom, hearing aids are a first line of audiologic intervention for many people with tinnitus and aidable hearing loss. Nevertheless, there is a lack of high quality evidence to support that they are of benefit for tinnitus, and wide variability in their use in clinical practice especially for people with mild hearing loss. The aim of this study was to identify a consensus among a sample of UK clinicians on the criteria for hearing aid candidature and clinical practice in fitting hearing aids specifically for mild hearing loss with and without tinnitus. This will allow professionals to establish clinical benchmarks and to gauge their practice with that used elsewhere. DESIGN: The Delphi technique, a systematic methodology that seeks consensus amongst experts through consultation using a series of iterative questionnaires, was used. A three-round Delphi survey explored clinical consensus among a panel of 29 UK hearing professionals. The authors measured panel agreement on 115 statements covering: (i) general factors affecting the decision to fit hearing aids, (ii) protocol-driven factors affecting the decision to fit hearing aids, (iii) general practice, and (iv) clinical observations. Consensus was defined as a priori ≥70% agreement across the panel. RESULTS: Consensus was reached for 58 of the 115 statements. The broad areas of consensus were around factors important to consider when fitting hearing aids; hearing aid technology/features offered; and important clinical assessment to verify hearing aid fit (agreement of 70% or more). For patients with mild hearing loss, the greatest priority was given by clinicians to patient-centered criteria for fitting hearing aids: hearing difficulties, motivation to wear hearing aids, and impact of hearing loss on quality of life (chosen as top five by at least 64% of panelists). Objective measures were given a lower priority: degree of hearing loss and shape of the audiogram (chosen as top five by less than half of panelists). Areas where consensus was not reached were related to the use of questionnaires to predict and verify hearing aid benefit for both hearing and tinnitus; audiometric criteria for fitting hearing aids; and safety of using loud sounds when verifying hearing aid fitting when the patient has tinnitus (agreement of <70%). CONCLUSIONS: The authors identified practices that are considered important when recommending or fitting hearing aid for a patient with tinnitus. More importantly perhaps, they identified practical issues where there are divided opinions. Their findings inform the design of clinical trials and open up debate on the potential impact of practice differences on patient outcomes.
The Impact of Cochlear Implantation on Speech Understanding, Subjective Hearing Performance, and Tinnitus Perception in Patients with Unilateral Severe to Profound Hearing Loss.

Otol Neurotol. 2015 Jan 15. [Epub ahead of print]

Távora-Vieira D¹, Marino R, Acharya A, Rajan GP.

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OBJECTIVES: This study aimed to determine the impact of cochlear implantation on speech understanding in noise, subjective perception of hearing, and tinnitus perception of adult patients with unilateral severe to profound hearing loss and to investigate whether duration of deafness and age at implantation would influence the outcomes. In addition, this article describes the auditory training protocol used for unilaterally deaf patients. DESIGN: This is a prospective study of subjects undergoing cochlear implantation for unilateral deafness with or without associated tinnitus. METHODS: Speech perception in noise was tested using the Bamford-Kowal-Bench speech-in-noise test presented at 65 dB SPL. The Speech, Spatial, and Qualities of Hearing Scale and the Abbreviated Profile of Hearing Aid Benefit were used to evaluate the subjective perception of hearing with a cochlear implant and quality of life. Tinnitus disturbance was measured using the Tinnitus Reaction Questionnaire. Data were collected before cochlear implantation and 3, 6, 12, and 24 months after implantation. RESULTS: Twenty-eight postlingual unilaterally deaf adults with or without tinnitus were implanted. There was a significant improvement in speech perception in noise across time in all spatial configurations. There was an overall significant improvement on the subjective perception of hearing and quality of life. Tinnitus disturbance reduced significantly across time. Age at implantation and duration of deafness did not influence the outcomes significantly. CONCLUSION: Cochlear implantation provided significant improvement in speech understanding in challenging situations, subjective perception of hearing performance, and quality of life. Cochlear implantation also resulted in reduced tinnitus disturbance. Age at implantation and duration of deafness did not seem to influence the outcomes.

Temporal bone fractures: sequelae and their impact on quality of life.


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PURPOSE: To present a prospective temporal bone fracture database, and study facial and cochleovestibular sequelae and their impact on quality of life. MATERIALS AND METHODS: Prospective study of consecutive cases of 39 patients with 45 temporal bone fractures over 11-month period in a university tertiary referral center. Based on epidemiological data, clinical and imaging findings, treatment modalities and outcome of patients with follow-up of one year, the present study focused on facial and cochleovestibular sequelae and their impact on quality of life after one-year period. RESULTS: After 12months, 44% of patients present with balance problems, 56% with hypoacusis, 56% with tinnitus, and 15% with facial paralysis. In 75%-80% of patients, the cochleovestibular sequelae are described as disabling. Post-trauma quality of life was significantly impaired compared with pre-trauma quality of life, even after 12months. Long-term cochleovestibular sequelae were significantly associated with poor long-term quality of life. CONCLUSIONS: The study demonstrates the need to focus on prevention of temporal bone fractures, notably by promoting the use of helmets and improvements in helmet design. The rapid diagnosis of temporal bone fracture is crucial as it enables effective initial management aimed at avoiding sequelae. The frequency of cochleovestibular sequelae after temporal bone fracture and their impact on quality of life demonstrate the importance of, and need for, ongoing follow-up by a local medical team who can diagnose and manage these long-term sequelae. Copyright © 2015 Elsevier Inc. All rights reserved.
Optimizing intracochlear electrical stimulation to suppress tinnitus.

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OBJECTIVES: Research on tinnitus suppression by intracochlear electrical stimulation has gained interest over the past few decades and it has become easier to apply since the introduction of cochlear implants (CI). This study attempted to gain more insight into optimal stimulation characteristics for tinnitus suppression.

DESIGN: Eleven subjects with unilateral CI and tinnitus were recruited from our CI clinic. Electrical stimulation, independent of acoustic sounds, was generated using their CI. The current prospective (single blinded) experimental study systematically assessed two stimulation parameters, namely current level and the anatomical stimulation site inside the cochlea and their short-term effect on tinnitus.

RESULTS: Approximately one-third of the tested conditions were successful in which case tinnitus loudness was reduced by at least 30%. At least one successful condition was achieved for nine subjects (82%). Complete suppression was achieved in 6 out of 107 tested conditions (6%). The effect of subthreshold electrical stimulation on tinnitus suppression did not differ significantly from above threshold electrical stimulation. However, a positive relation between mean percentage tinnitus suppression and current level was observed. Pitch-matched electrical stimulation did not appear to suppress tinnitus better than other tested conditions.

CONCLUSIONS: The majority of the subjects were able to experience tinnitus reduction through intracochlear electrical stimulation independent of acoustic sounds. Tinnitus can be reduced with audible or even inaudible, subthreshold stimuli. Clear trends in optimal stimulation characteristics were not found. Optimal stimulus characteristics for tinnitus reduction therefore appear to be highly subject-specific.

An initial experience of cochlear implantation for patients with single-sided deafness after prior osseointegrated hearing device.

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OBJECTIVE: To compare preoperative and postoperative sound localization and surgical outcomes in patients with a history of osseointegrated hearing device (OHD) placement who underwent cochlear implantation for severe to profound sensorineural hearing loss in one ear and normal cochlear function in the contralateral ear (single-sided deafness [SSD]).

STUDY DESIGN: Case series.

STUDY SETTING: Tertiary care center, cochlear implant (CI) program.

PATIENTS: Five patients with a previously placed OHD, implanted at our institution between late 2012 and late 2013, who were undergoing cochlear implantation to address SSD. Causes of their initial SSD included iatrogenic sudden sensorineural hearing loss, and perilymphatic fistula. Indications for cochlear implantation included a desire for binaural hearing, surgical treatment for tinnitus, and staging for treatment of contralateral conductive hearing loss.

INTERVENTIONS: Cochlear implantation; intraoperative and postoperative antibiotics.

MAIN OUTCOME MEASURES: Accuracy of sound localization for environmental sounds presented in a mixture for three device conditions: monaurally with the acoustic hearing ear only, OHD in addition to the acoustic hearing ear, and CI in addition to the acoustic hearing ear. Complications. Continued use of CI.

RESULTS: Modestly improved sound localization with CI compared with monaural listening or listening with an OHD (p < 0.0001). Wound dehiscence and infection with our first two patients; none with the use of perioperative and postoperative antibiotics (three patients). Four patients continued to use their CI for at least 4 months after activation (mean, 13 mo) and expressed satisfaction with the device; one was lost to follow-up.

CONCLUSION: Cochlear implantation for this population of patients produced modestly improved localization accuracy, and most patients expressed satisfaction with this intervention. In this series of cochlear implantation after OHD, our first two patients had wound infection and dehiscence. We recommend perioperative and postoperative antibiotics to prevent this complication.
Hearing performance in single-sided deaf cochlear implant users after upgrade to a single-unit speech processor.

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INTRODUCTION: Single-sided deaf (SSD) patients report multiple benefits after cochlear implantation (CI), such as tinnitus suppression, speech perception, and sound localization. The first single-unit speech processor, the RONDO, was launched recently. Both the RONDO and the well-known behind-the-ear (BTE) speech processor work on the same audio processor platform. However, in contrast to the BTE, the microphone placement on the RONDO is different. The aim of this study was to evaluate the hearing performances using the BTE speech processor versus using the single-unit speech processor. Subjective and objective outcomes in SSD CI patients with a BTE speech processor and a single-unit speech processor, with particular focus on spatial hearing, were compared. METHODOLOGY: Ten adults with unilateral incapacitating tinnitus resulting from ipsilateral sensorineural deafness were enrolled in the study. The mean age at enrollment in the study was 56 (standard deviation, 13) years. The subjects were cochlear implanted at a mean age of 48 (standard deviation, 14) years and had on average 8 years' experience with their CI (range, 4-11 yr). At the first test interval (T0), testing was conducted using the subject's BTE speech processor, with which they were already familiar. Aided free-field audiometry, speech reception in noise, and sound localization testing were performed. Self-administered questionnaires on subjective evaluation consisted of HISQUI-NL, SSQ5, SHQ, and a Visual Analogue Scale to assess tinnitus loudness and disturbance. All 10 subjects were upgraded to the single-unit processor and retested after 28 days (T28) with the same fitting map. At T28, an additional single-unit questionnaire was administered to determine qualitative experiences and the effect of the position of the microphone on the new speech processor. RESULTS: Equal hearing outcomes were found between the single-unit speech processor: median PTAsingle-unit (0.5, 1, 2 kHz) = 40 (range, 33-48) dB HL; median Speech Reception Threshold in noise = -1.00 (range, -8.50 to +1.00) dB SNR; median Root Mean Square Error of sound localization = 45 (range, 19-139) degrees; HISQUI = 128 (range, 106-180); SHQ = 68 (range, 45-83); SSQ5 = 6 (range, 3-9) and the BTE speech processor: median PTABTE (0.5, 1, 2 kHz) = 41 (range, 30-53) dB HL; median Speech Reception Threshold in noise = -0.25 (range, -7.00 to +4.00) dB SNR; median Root Mean Square Error of sound localization = 38 (range, 26-164) degrees; HISQUI = 144 (range, 120-183); SHQ = 56 (range, 47-85); SSQ5 = 6 (range, 3-9). The results in the condition with the single-unit speech processor were not significantly influenced by the position of the microphone. CONCLUSION: The study showed that long-term BTE speech processor SSD users are able to be upgraded to a single-unit speech processor without compromising their speech performance, aided hearing thresholds, sound localization, objective speech quality, hearing abilities, sound localization, and tinnitus reduction. Microphone position on the single-unit speech processor did not influence the outcomes measures. Moreover, after a short time of experience, 80% of the users preferred the single-unit processor.
Cochlear implantation in children with congenital and noncongenital unilateral deafness: a case series.

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OBJECTIVES: Cochlear implantation is rapidly gaining acceptance as the most effective treatment for adult patients with unilateral deafness. The benefits for the pediatric population remain to be investigated. This study aimed to investigate the implications of cochlear implantation in children with congenital and noncongenital unilateral deafness.

DESIGN: Four children, three with congenital and one with a sudden unilateral deafness, were studied after implantation. The children were aged 17 months, 4.5 years, 6.8 years, and 9 years at the time of implantation. Speech perception in noise and sound localization ability were evaluated using age-appropriate materials.

RESULTS: The child with postlingual unilateral deafness rapidly integrated the normal acoustic hearing with the electrical signal from the cochlear implant and showed binaural benefits, as indicated by the localization ability and the improvement of speech perception in noise scores. The younger child with congenital unilateral deafness showed some clinical evidence of binaural integration and the two older children with congenital deafness have not yet indicated signs of binaural benefits.

CONCLUSION: It seems that cochlear implantation in children with congenital unilateral deafness may provide some of the benefits of binaural hearing if implantation occurs within the critical period for bilateral auditory development.

Acoustic Coordinated Reset Neuromodulation in a Real Life Patient Population with Chronic Tonal Tinnitus

Hindawi

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Purpose: Primary tinnitus has a severe negative influence on the quality of life of a significant portion of the general population. Acoustic coordinated reset neuromodulation is designed to induce a long-lasting reduction of tinnitus symptoms. To test acoustic coordinated reset neuromodulation as a treatment for chronic, tonal tinnitus under real-life conditions, an outpatient study “RESET REAL LIFE” was commissioned by ANM GmbH. Herein we present the results of this study.

Methods: In a prospective, open-label, non-randomized, non-controlled multi-center clinical study with 200 chronic tinnitus patients, tinnitus questionnaire TBF-12 and Global Clinical Improvement-Impression scale (CGI-I7) are used to study the safety and efficacy of acoustic coordinated reset neuromodulation. 189 patients completed the last 12 month visit, 11 patients dropped out (8 because of non-treatment related reasons; 2 because tinnitus did not change; 1 because tinnitus got louder). Results: Acoustic coordinated reset neuromodulation caused a statistically and clinically significant decrease in TBF-12 scores as well as in CGI-I7 after 12 months of therapy under real-life conditions. There were no persistent adverse events reported that were related to the therapy.

Conclusion: The field study “RESET REAL LIFE” provides evidence for safety and efficacy of acoustic coordinated reset neuromodulation in a prospective, open-label, real life setting.
Pairing Speech Sounds With Vagus Nerve Stimulation Drives Stimulus-specific Cortical Plasticity.


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BACKGROUND: Individuals with communication disorders, such as aphasia, exhibit weak auditory cortex responses to speech sounds and language impairments. Previous studies have demonstrated that pairing vagus nerve stimulation (VNS) with tones or tone trains can enhance both the spectral and temporal processing of sounds in auditory cortex, and can be used to reverse pathological primary auditory cortex (A1) plasticity in a rodent model of chronic tinnitus. OBJECTIVE/HYPOTHESIS: We predicted that pairing VNS with speech sounds would strengthen the A1 response to the paired speech sounds. METHODS: The speech sounds 'rad' and 'lad' were paired with VNS three hundred times per day for twenty days. A1 responses to both paired and novel speech sounds were recorded 24 h after the last VNS pairing session in anesthetized rats. Response strength, latency and neurometric decoding were compared between VNS speech paired and control rats. RESULTS: Our results show that VNS paired with speech sounds strengthened the auditory cortex response to the paired sounds, but did not strengthen the amplitude of the response to novel speech sounds. Responses to the paired sounds were faster and less variable in VNS speech paired rats compared to control rats. Neural plasticity that was specific to the frequency, intensity, and temporal characteristics of the paired speech sounds resulted in enhanced neural detection. CONCLUSION: VNS speech sound pairing provides a novel method to enhance speech sound processing in the central auditory system. Delivery of VNS during speech therapy could improve outcomes in individuals with receptive language deficits. Copyright © 2015 Elsevier Inc. All rights reserved.

Tinnitus sound therapy: from the Sony Walkman to the Apple iPhone.


Davies-Husband CR, Gatenby C, Phillips JS.

No abstract available.

Relationship between intracochlear electrode position and tinnitus in cochlear implantees.

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CONCLUSION: Cochlear implant electrode position has an impact on the rate of tinnitus suppression and generation. OBJECTIVE: Suppression of pre-operative tinnitus or a generation of a new tinnitus in cochlear implantees is a known effect of cochlear implantation. The aim of the current study was to evaluate different cochlear implant electrode positions and their relationship with tinnitus suppression and tinnitus generation. METHOD: This study retrospectively evaluated four groups of CI recipients with radiologically evaluated electrode positions in relation to their subjective tinnitus quality, as evaluated by an analogue loudness scale (ALS) and a questionnaire. Group 1 consisted of 19 patients with a scalar change of the electrode position. Group 2 consisted of 18 patients with a scala tympani position and a perimodiolar electrode. Group 3 consisted of 10 patients with a scala tympani position and a lateral wall electrode. Group 4 consisted of eight patients with a scala vestibuli position. RESULTS: An overall tinnitus suppression rate of 45.9% and a generation of a new tinnitus or the deterioration of an existing one of 5.6% were observed. A significant difference in tinnitus suppression was found between groups 1 and groups 2, 3, and 4 in tinnitus suppression and tinnitus generation.


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OBJECTIVE: To describe the quantitative treatment outcomes of patients undergoing acoustic coordinated reset (CR) neuromodulation at a single independent audiology practice over a 22- to 26-week period as part of an open label, non-randomized, non-controlled observational study. METHODS: Sixty-six patients with subjective tonal tinnitus were treated with acoustic CR neuromodulation with a retrospective review of patient records being performed in order to identify changes of visual analog scale (VAS, n = 66) and in the score of the tinnitus handicap questionnaire (THQ, n = 51). Patients had their tinnitus severity recorded prior to the initiation of therapy using the tinnitus handicap inventory in order to categorize patients into slight up to catastrophic impact categories. THQ and VAS for tinnitus loudness/annoyance were obtained at the patient's initial visit, at 10-14 and 22-26 weeks. RESULTS: Visual analog scale scores were significantly improved, demonstrating a 25.8% mean reduction in tinnitus loudness and a 32% mean reduction in tinnitus annoyance with a clinically significant reduction in percept loudness and annoyance being recorded in 59.1 and 72.7% of the patient group. THQ scores were significantly improved by 19.4% after 22-26 weeks of therapy compared to baseline. CONCLUSION: Acoustic CR neuromodulation therapy appears to be a practical and promising treatment for subjective tonal tinnitus. However, due to the lack of a control group it is difficult to reach an absolute conclusion regarding to what extent the observed effects are related directly to the acoustic CR neuromodulation therapy. Also, as the observed patient group was made up of paying clients it is unknown as to whether this could have caused any additional placebo like effects to influence the final results. Free PMC Article

[Cochlear implants and tinnitus].
[Article in German]

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The cochlear implant became a very successful method of hearing rehabilitation for patients with profound sensorineural hearing loss. The benefits of the CI extend beyond the medical success and positively influence social and psychosocial areas, reflected by an improved HRQoL. Furthermore, variety of studies demonstrated that the tinnitus severity improves in 46-95% of cases following the cochlear implantation. However, the parameters investigated in such studies are not always standardized or addressed by validated questionnaires, which explains the high outcome variation between the studies. The relationships between HRQoL and tinnitus distress before and after cochlear implantation have not been well studied. Nevertheless, it is believed that the improvement in HRQoL following CI affects particularly tinnitus. However, an existing tinnitus can also worsen or occur for the first time after the surgery. Since neither tinnitus frequency nor tinnitus loudness correlate with the tinnitus-induced distress, the measurement of HRQoL, distress factors, stress reactions and psychiatric comorbidities appears to be the meaningful assessment of positive or negative effects of CI on tinnitus. Initial studies demonstrated that also patients with unilateral hearing loss may benefit from CI supply, as shown by an improvement in HRQoL and reduction of tinnitus-induced distress. For those patients, who despite CI implantation experience severe tinnitus, there is an option of tinnitus-specific CI-fitting and tinnitus-specific therapy with psychosomatic and psychological approaches, and in addition a treatment of possible mental comorbidities.
Feasibility study of a game integrating assessment and therapy of tinnitus.

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BACKGROUND: Tinnitus, head and ear noise, is due to maladaptive plastic changes in auditory and associated neural networks. Tinnitus has been traditionally managed through the use of sound to passively mask or facilitate habituation to tinnitus, a process that may take 6-12 months. NEW METHOD: A game-based perceptual training method, requiring localization and selective attention to sounds, was developed and customized to the individual's tinnitus perception. Eight participants tested the game's usability at home. RE-SULTS: Each participant successfully completed 30 minutes of training, for 20 days, along with daily psychoacoustic assessment of tinnitus pitch and loudness. The training period and intensity of training appears sufficient to reduce tinnitus handicap. COMPARISON WITH EXISTING METHOD(S): The training approach used may be a viable alternative to frequency discrimination based training for treating tinnitus (Hoare et al., 2014) and a useful tool in exploring learning mechanisms in the auditory system. CONCLU-SIONS: Integration of tinnitus assessment with therapy in a game is feasible, and the method(s) warrant further investigation. Copyright © 2015. Published by Elsevier B.V.

A Sound Therapy-Based Intervention to Expand the Auditory Dynamic Range for Loudness among Persons with Sensorineural Hearing Losses: A Randomized Placebo-Controlled Clinical Trial

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The primary aim of this research was to evaluate the validity, efficacy, and generalization of principles underlying a sound therapy–based treatment for promoting expansion of the auditory dynamic range (DR) for loudness. The basic sound therapy principles, originally devised for treatment of hyperacusis among patients with tinnitus, were evaluated in this study in a target sample of unsuccessfully fit and/or problematic prospective hearing aid users with diminished DRs (owing to their elevated audiometric thresholds and reduced sound tolerance). Secondary aims included: (1) delineation of the treatment contributions from the counseling and sound therapy components to the full-treatment protocol and, in turn, the isolated treatment effects from each of these individual components to intervention success; and (2) characterization of the respective dynamics for full, partial, and control treatments. Thirty-six participants with bilateral sensorineural hearing losses and reduced DRs, which affected their actual or perceived ability to use hearing aids, were enrolled in and completed a placebo-controlled (for sound therapy) randomized clinical trial. The 2 × 2 factorial trial design was implemented with or without various assignments of counseling and sound therapy. Specifically, participants were assigned randomly to one of four treatment groups (nine participants per group), including: (1) group 1—full treatment achieved with scripted counseling plus sound therapy implemented with binaural sound generators; (2) group 2—partial treatment achieved with counseling and placebo sound generators (PSGs); (3) group 3—partial treatment achieved with binaural sound generators alone; and (4) group 4—a neutral control treatment implemented with the PSGs alone. Repeated measurements of categorical loudness judgments served as the primary outcome measure. The full-treatment categorical-loudness judgments for group 1, measured at treatment termination, were significantly greater than the corresponding pretreatment judgments measured at baseline at 500, 2,000, and 4,000 Hz. Moreover, increases in their “uncomfortably loud” judgments (-12 dB over the range from...
500 to 4,000 Hz) were superior to those measured for either of the partial-treatment groups 2 and 3 or for control group 4. Efficacy, assessed by treatment-related criterion increases ≥10 dB for judgments of uncomfortable loudness, was superior for full treatment (82% efficacy) compared with that for either of the partial treatments (25% and 40% for counseling combined with the placebo sound therapy and sound therapy alone, respectively) or for the control treatment (50%). The majority of the group 1 participants achieved their criterion improvements within 3 months of beginning treatment. The treatment effect from sound therapy was much greater than that for counseling, which was statistically indistinguishable in most of our analyses from the control treatment. The basic principles underlying the full-treatment protocol are valid and have general applicability for expanding the DR among individuals with sensorineural hearing losses, who may often report aided loudness problems. The positive full-treatment effects were superior to those achieved for either counseling or sound therapy in virtual or actual isolation, respectively; however, the delivery of both components in the full-treatment approach was essential for an optimum treatment outcome.


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Pathophysiology and treatment of tinnitus still are fields of intensive research. The neuroscientifically motivated Heidelberg Model of Music Therapy, previously developed by the German Center for Music Therapy Research, Heidelberg, Germany, was applied to explore its effects on individual distress and on brain structures. This therapy is a compact and fast application of nine consecutive 50-min sessions of individualized therapy implemented over 1 week. Clinical improvement and long-term effects over several years have previously been published. However, the underlying neural basis of the therapy's success has not yet been explored. In the current study, the therapy was applied to acute tinnitus patients (TG) and healthy active controls (AC). Non-treated patients were also included as passive controls (PTC). As predicted, the therapeutic intervention led to a significant decrease of tinnitus-related distress in TG compared to PTC. Before and after the study week, high-resolution MRT scans were obtained for each subject. Assessment by repeated measures design for several groups (Two-Way ANOVA) revealed structural gray matter (GM) increase in TG compared to PTC, comprising clusters in precuneus, medial superior frontal areas, and in the auditory cortex. This pattern was further applied as mask for general GM changes as induced by the therapy week. The therapy-like procedure in AC also elicited similar GM increases in precuneus and frontal regions. Comparison between structural effects in TG vs. AC was calculated within the mask for general GM changes to obtain specific effects in tinnitus patients, yielding GM increase in right Heschl's gyrus, right Rolandic operculum, and medial superior frontal regions. In line with recent findings on the crucial role of the auditory cortex in maintaining tinnitus-related distress, a causative relation between the therapy-related GM alterations in auditory areas and the long-lasting therapy effects can be assumed. Free PMC Article.
Maladaptive neural synchrony in tinnitus: origin and restoration.

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Tinnitus is the conscious perception of sound heard in the absence of physical sound sources external or internal to the body, reflected in aberrant neural synchrony of spontaneous or resting-state brain activity. Neural synchrony is generated by the nearly simultaneous firing of individual neurons, or the synchronization of membrane-potential changes in local neural groups as reflected in the local field potentials, resulting in the presence of oscillatory brain waves in the EEG. Noise-induced hearing loss, often resulting in tinnitus, causes a reorganization of the tonotopic map in auditory cortex and increased spontaneous firing rates and neural synchrony. Spontaneous brain rhythms rely on neural synchrony. Abnormal neural synchrony in tinnitus appears to be confined to specific frequency bands of brain rhythms. Increases in delta-band activity are generated by deafferented/deprived neuronal networks resulting from hearing loss. Coordinated reset (CR) stimulation was developed in order to specifically counteract such abnormal neuronal synchrony by desynchronization. The goal of acoustic CR neuromodulation is to desynchronize tinnitus-related abnormal delta-band oscillations. CR neuromodulation does not require permanent stimulus delivery in order to achieve long-lasting desynchronization or even a full-blown anti-kindling but may have cumulative effects, i.e., the effect of different CR epochs separated by pauses may accumulate. Unlike other approaches, acoustic CR neuromodulation does not intend to reduce tinnitus-related neuronal activity by employing lateral inhibition. The potential efficacy of acoustic CR modulation was shown in a clinical proof of concept trial, where effects achieved in 12 weeks of treatment delivered 4-6 h/day persisted through a preplanned 4-week therapy pause and showed sustained long-term effects after 10 months of therapy, leading to 75% responders.
Mimicking the brain: evaluation of St Jude Medical's Prodigy Chronic Pain System with Burst Technology.

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The Prodigy is a new type of internal pulse generator that controls the delivery of electrical stimuli to nervous tissue. It is capable of delivering burst stimulation, which is a novel waveform that consists of closely spaced high-frequency electrical impulses delivered in packets riding on a plateau, and followed by a quiescent period. Its inception was based on mimicking burst firing in the nervous system and usually delivered by unmyelinated fibers that uniformly have a motivational affective homeostatic function. It thereby targets a multimodal salience network, even though the stimuli are delivered at the level of the spinal cord. As such, it is specifically capable of influencing the affective/attentional components of pain. Burst stimulation was initially safely applied off-label to the auditory cortex for tinnitus, and later also to the spinal cord, the somatosensory cortex for neuropathic pain, subcutaneously for failed back surgery syndrome, and cingulate cortex for addiction and tinnitus.

Safety of Noninvasive Brain Stimulation in Children and Adolescents.

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BACKGROUND: Noninvasive brain stimulation (NIBS) techniques such as transcranial magnetic stimulation (TMS) and transcranial current stimulation (tCS) have the potential to mitigate a variety of symptoms associated with neurological and psychiatric conditions, including stroke, cerebral palsy, autism, depression, and Tourette syndrome. While the safety of these modalities has been established in adults, there is a paucity of research assessing the safety of NIBS among children. OBJECTIVE: To examine the existing literature regarding the safety of NIBS techniques in children and adolescents with neurologic and neuropsychiatric disorders. METHODS: An electronic search was performed on online databases for studies using NIBS in individuals less than 18 years of age. Non-English publications, diagnostic studies, electroconvulsive therapy, single/dual pulse TMS studies, and reviews were excluded. Adverse events reported in the studies were carefully examined and synthesized to understand the safety and tolerability of NIBS among children and adolescents. RESULTS: The data from 48 studies involving more than 513 children/adolescents (2.5-17.8 years of age) indicate that the side effects of NIBS were, in general, mild and transient [TMS: headache (11.5%), scalp discomfort (2.5%), twitching (1.2%), mood changes (1.2%), fatigue (0.9%), tinnitus (0.6%); tCS: tingling (11.5%), itching (5.8%), redness (4.7%), scalp discomfort (3.1%)] with relatively few serious adverse events. CONCLUSION: Our findings indicate that both repetitive TMS and tCS are safe modalities in children and adolescents with various neurological conditions, especially when safety guidelines are followed. The incidence of adverse events appears to be similar to that observed in adults; however, further studies with longer treatment and follow-up periods are needed to better understand the benefits and tolerance of long-term use of NIBS in children. Copyright © 2015 Elsevier Inc. All rights reserved.
Long-term repetitive transcranial magnetic stimulation therapy: new research questions arising from one tinnitus case?

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Tinnitus may become refractory to treatment and disabling. Brain transcranial magnetic stimulation (TMS) has shown promise as a therapy, but has been employed primarily short-term. We treated a patient with 5 weeks of weekly repetitive TMS (rTMS), followed by 6 months of monthly rTMS. He was a 75-year-old dentist with chronic tinnitus from occupational noise exposure. Physical examination and MRIs of the auditory canals and brain had revealed no lesions. The patient showed a general gradual, progressive improvement on percent of severe tinnitus diary days (from baseline 100% to 33%), tinnitus handicap inventory (from baseline score 70 to 18), and mini-tinnitus questionnaire (from baseline score 17 to 6). No changes occurred in serial audiograms. Transient adverse events were a headache during stimulation, and dizziness 30 min after treatment. Implications and questions for future non-invasive neuromodulation clinical research raised by our case are discussed. 2014 BMJ Publishing Group Ltd.

Auditory Cortex tACS and tRNS for Tinnitus: Single versus Multiple Sessions.

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Tinnitus is the perception of a sound in the absence of an external acoustic source, which often exerts a significant impact on the quality of life. Currently there is evidence that neuroplastic changes in both neural pathways are involved in the generation and maintaining of tinnitus. Neuromodulation has been suggested to interfere with these neuroplastic alterations. In this study we aimed to compare the effect of two upcoming forms of transcranial electrical neuromodulation: alternating current stimulation (tACS) and random noise stimulation (tRNS), both applied on the auditory cortex. A database with 228 patients with chronic tinnitus who underwent noninvasive neuromodulation was retrospectively analyzed. The results of this study show that a single session of tRNS induces a significant suppressive effect on tinnitus loudness and distress, in contrast to tACS. Multiple sessions of tRNS augment the suppressive effect on tinnitus loudness but have no effect on tinnitus distress. In conclusion this preliminary study shows a possibly beneficial effect of tRNS on tinnitus and can be a motivation for future randomized placebo-controlled clinical studies with auditory tRNS for tinnitus. Auditory alpha-modulated tACS does not seem to be contributing to the treatment of tinnitus. Free full text.
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Background. Tinnitus is the phantom perception of sound and can have negative effect on the quality of life. Transcranial direct current stimulation (tDCS) is a noninvasive neuromodulation technique, which can increase or decrease the cortical excitability in the brain region to which it is applied. tDCS has been used for tinnitus research since 2006. Objective. To investigate whether tDCS affects tinnitus perception, related emotion, or both, and the potential implications for tinnitus management. Methods. A scoping review was undertaken using the methods proposed by Arksey and O’Malley. After initial consideration of title relevance and reading abstracts, 15 studies were included in this review. The data from these studies were charted to investigate the impact of tDCS on tinnitus perception and emotions. Results. tDCS results in transient suppression of tinnitus loudness and annoyance; however, it does not lead to long-term impact on tinnitus related emotion. Local stimulation of different sites of stimulation (left temporoparietal area, dorsolateral prefrontal cortex, and auditory cortex) might modulate tinnitus perception (loudness) and emotions differently; however, further research is needed to explore this hypothesis. This review has identified aspects of methodologies that require attention in upcoming tinnitus and tDCS trials to offer better insights. Conclusions. tDCS is an effective research tool for transient tinnitus neuromodulation. However, efforts should be invested in designing clinical trials using local and multiple sites of stimulation, optimized parameters, and objective outcome measures before it can be translated in to a clinical tool for tinnitus management. © The Author(s) 2015.

The differential effect of low- versus high-frequency random noise stimulation in the treatment of tinnitus.
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Tinnitus is the sensation of a ringing, buzzing, roaring or hissing sound in the absence of an external sound. As tinnitus has been related to hyperactivity and synaptic plasticity changes in the central auditory system, invasive and noninvasive neuromodulation methods have been used to interfere with this underlying mechanism to reduce tinnitus loudness and distress. Recently, transcranial random noise stimulation applied over the auditory cortex induced a more pronounced effect on tinnitus loudness than transcranial direct current and alternating current stimulation. We performed tRNS over the temporoparietal cortex in 154 patients with non-pulsatile tinnitus. A total of 119 patients received low-frequency tRNS (lf-tRNS), 19 high-frequency tRNS (hf-tRNS) and 16 whole frequency spectrum tRNS (wf-tRNS). The effect was evaluated by using the numeric rating scale loudness and distress pre- and post-stimulation. This study revealed a significant reduction in tinnitus loudness when If-tRNS and hf-tRNS were applied as well as a reduction in tinnitus-related distress with If-tRNS. Moreover, we observed a significantly more pronounced reduction in loudness and distress in pure tone (PT) tinnitus compared to narrow band noise (NBN) tinnitus when hf-tRNS was applied, a difference that could not be obtained with If-tRNS. Based on these results, tRNS might be a promising treatment option for non-pulsatile tinnitus; however, we cannot yet provide a clear mechanistic explanation for the different results obtained with different types of stimulation, i.e., If-tRNS, hf-tRNS and wf-tRNS, or with different types of tinnitus, i.e., PT and NBN tinnitus.
Multitarget surgical neuromodulation: Combined C2 and auditory cortex implantation for tinnitus.

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Tinnitus, as a phantom sound can express itself as a pure tone and as a noise-like sound. It is notoriously difficult to treat, and in medically, psychologically and audiologically intractable, tinnitus patients sometimes intracranial electrodes overlying the auditory cortex are implanted. In this case report, we describe a patient who had a complete resolution of the pure tone component of his tinnitus by an auditory cortex implant, without any beneficial effect on the noise-like aspect of his tinnitus, even after changing the stimulation design to burst stimulation, which is known to treat noise-like tinnitus better than tonic stimulation. After an initial successful treatment of his noise-like component with transcutaneous electrical nerve stimulation, a wire electrode is inserted subcutaneously and connected to his internal pulse generator. With the dual stimulation his pure tone tinnitus remains abolished after 5 years of stimulation and his noise-like tinnitus is improved by 50%, from 8/10 to 4/10. This case report suggests that multi-target stimulation might be better than single target implantation in selected cases. Copyright © 2015. Published by Elsevier Ireland Ltd.


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Chronic tinnitus, also known as ringing in the ears, affects up to 15% of the adults and causes a serious socio-economic burden. At present, there is no treatment available which substantially reduces the perception of this phantom sound. In the past few years, preclinical and clinical studies have unraveled central mechanisms involved in the pathophysiology of tinnitus, replacing the classical periphery-based hypothesis. In subcortical auditory and non-auditory regions, increased spontaneous activity, neuronal bursting and synchrony were found. When reaching the auditory cortex, these neuronal alterations become perceptually relevant and consequently are perceived as phantom sound. A therapy with a potential to counteract deeply located pathological activity is deep brain stimulation, which has already been demonstrated to be effective in neurological diseases such as Parkinson's disease. In this review, several brain targets are discussed as possible targets for deep brain stimulation in tinnitus. The potential applicability of this treatment in tinnitus is discussed with examples from the preclinical field and clinical case studies. Copyright © 2015. Published by Elsevier B.V.
VIII Behavioral Therapy

Effects of Mindfulness Based Stress Reduction Therapy on Subjective Bother and Neural Connectivity in Chronic Tinnitus.

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OBJECTIVE: To evaluate the impact of a Mindfulness Based Stress Reduction (MBSR) program in patients with chronic bothersome tinnitus on the (1) severity of symptoms of tinnitus and (2) functional connectivity in neural attention networks. STUDY DESIGN: Open-label interventional pilot study. SETTING: Outpatient academic medical center. SUBJECTS: A total of 13 adult participants with a median age of 55 years, suffering from bothersome tinnitus. METHODS: An 8-week MBSR program was conducted by a trained MBSR instructor. The primary outcome measure was the difference in patient-reported tinnitus symptoms using the Tinnitus Handicap Index (THI) and Tinnitus Functional Index (TFI) between pre-intervention, post-MBSR, and 4-week post-MBSR assessments. Secondary outcomes included change in measurements of depression, anxiety, mindfulness, and cognitive abilities. Functional connectivity magnetic resonance imaging (MRI) was performed at pre- and post-MBSR intervention time points to serve as a neuroimaging biomarker of critical cortical networks. RESULTS: Scores on the THI and TFI showed statistically significant and clinically meaningful improvement over the course of the study with a median ΔTHI of -16 and median ΔTFI of -14.8 between baseline and 4-week follow-up scores. Except for depression, there was no significant change in any of the secondary outcome measures. Analysis of the resting state functional connectivity MRI (rs-fcMRI) data showed increased connectivity in the post-MBSR group in attention networks but not the default network. CONCLUSION: Participation in an MBSR program is associated with decreased severity in tinnitus symptoms and depression and connectivity changes in neural attention networks. MBSR is a promising treatment option for chronic bothersome tinnitus that is both noninvasive and inexpensive. © American Academy of Otolaryngology—Head and Neck Surgery Foundation 2015.

Assessing the Effects of Tinnitus Retraining Therapy in Patients Lost to Follow-up: A Telephone Survey.
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OBJECTIVE: To evaluate the efficacy of tinnitus retraining therapy (TRT), especially in patients who did not revisit the clinic after starting the program, and to determine the current status of patients who were lost to follow-up. STUDY DESIGN: Telephone survey. SETTING: Tertiary referral center. PATIENTS: Forty-seven patients enrolled in a TRT program at Seoul National University Hospital. Twenty-four patients who regularly visited the clinic were deemed the good follow-up (GF) group, and 23 patients who did not return after the initial counseling were deemed the follow-up loss (FL) group. INTERVENTIONS: Post-TRT questionnaires with the Tinnitus Handicap Inventory (THI) and a tinnitus visual analog scale (VAS), performed with a telephone survey. MAIN OUTCOME MEASURES: TRT efficacy, evaluated via the THI, and tinnitus VAS scores. A questionnaire on reasons for non-attendance after TRT was used. RESULTS: Pre-TRT VAS and THI scores showed no significant difference between groups. After TRT, both groups showed significant decreases in tinnitus VAS and THI scores. Post-TRT VAS scores for awareness, effects on daily life, and post-TRT THI scores were significantly lower in the FL group. CONCLUSIONS: Treatment outcomes were better in the FL group than in the GF group in several parameters. The FL group was greatly influenced by the first TRT counseling and obtained sufficient relief that they no longer felt the need for additional treatment. Treatment outcomes in patients lost to follow-up may not be as bad as presumed.
This year marks 25 years of tinnitus retraining therapy (TRT), the approach that aims to eliminate tinnitus as a problem by extinguishing functional connections between the auditory and the limbic and autonomic nervous systems to achieve habituation of tinnitus-evoked reactions and subsequently habituation of perception. TRT addresses directly decreased sound tolerance (DST) as well as tinnitus. TRT consists of counseling and sound therapy, both based on the neurophysiological model of tinnitus. The main goal of retraining counseling is to reclassify tinnitus into the category of a neutral stimulus, while the main goal of sound therapy is to decrease the strength of tinnitus-related neuronal activity. A unique aspect of TRT is that because treatment is aimed to work above the tinnitus source, and at connections linking the auditory and other systems in the brain, the etiology of tinnitus is irrelevant. Any type of tinnitus, as well as somatosounds, can be successfully treated by TRT. Over 100 publications can be found on Medline when using "tinnitus retraining therapy" as a search term. The majority of these publications indicate TRT offers significant help for about 80% of patients. A randomized clinical trial showing the effectiveness of TRT has been published and another large study is in progress. The principles of the neurophysiological model of tinnitus, and consequently TRT, have not changed in over 25 years of use, but a number of changes have been introduced in TRT implementation. These changes include the recognition of the importance of conditioned reflexes and the dominant role of the subconscious pathways; the introduction of the concept of misophonia (i.e., negative reactions to specific patterns of sound) and the implementation of specific protocols for its treatment; greater emphasis on the concurrent treatment of tinnitus, hyperacusis, misophonia, and hearing loss; extensive modification of counseling; and refinements in sound therapy. The effectiveness of TRT has increased significantly during the past 25 years, presumably due to changes incorporated in its implementation. The main improvement has been to shorten the average time until seeing clear improvement from 1 year to 1 month, with a statistically significant improvement seen at, and after, 3 months. Furthermore, there is a higher effectiveness and a shorter treatment time for DST and an increased extent of help for hearing loss.
IX Somatic Tinnitus

Increased risk of tinnitus in patients with temporomandibular disorder: a retrospective population-based cohort study.
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This study determined whether there is an increased risk of tinnitus in patients with temporomandibular joint (TMJ). We used information from health insurance claims obtained from Taiwan National Health Insurance (TNHI). Patients aged 20 years and older who were newly diagnosed with TMJ disorder served as the study cohort. The demographic factors and comorbidities that may be associated with tinnitus were also identified, including age, sex, and comorbidities of hearing loss, noise effects on the inner ear, and degenerative and vascular ear disorders. A higher proportion of TMJ disorder patients suffered from hearing loss (5.30 vs. 2.11 %), and degenerative and vascular ear disorders (0.20 vs. 0.08 %) compared with the control patients. The crude hazard ratio (HR) of tinnitus in the TMJ disorder cohort was 2.73-fold higher than that in the control patients, with an adjusted HR of 2.62 (95 % CI = 2.29-3.00). The comorbidity-specific TMJ disorder cohort to the control patients' adjusted HR of tinnitus was higher for patients without comorbidity (adjusted HR = 2.75, 95 % CI = 2.39-3.17). We also observed a 3.22-fold significantly higher relative risk of developing tinnitus within the 3-year follow-up period (95 % CI = 2.67-3.89). Patients with TMJ disorder might be at increased

Listening to another sense: somatosensory integration in the auditory system.

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Conventionally, sensory systems are viewed as separate entities, each with its own physiological process serving a different purpose. However, many functions require integrative inputs from multiple sensory systems and sensory intersection and convergence occur throughout the central nervous system. The neural processes for hearing perception undergo significant modulation by the two other major sensory systems, vision and somatosensation. This synthesis occurs at every level of the ascending auditory pathway: the cochlear nucleus, inferior colliculus, medial geniculate body and the auditory cortex. In this review, we explore the process of multisensory integration from (1) anatomical (inputs and connections), (2) physiological (cellular responses), (3) functional and (4) pathological aspects. We focus on the convergence between auditory and somatosensory inputs in each ascending auditory station. This review highlights the intricacy of sensory processing and offers a multisensory perspective regarding the understanding of sensory disorders.
Tinnitus can be caused or triggered by functional disorders of the cervical spine, temporomandibular joint or any other musculoskeletal structure of the neck or head. This special form of tinnitus is called somatosensory tinnitus and represents a discrete subgroup among the different kinds of tinnitus. Distinctive for this kind of tinnitus are alterations in volume and frequency during movement or the stimulation of certain muscles and joints. This can be evaluated using a structured testing method. To be able to easily perceive tinnitus modulations, the test must be performed in total silence. Effective treatment modules are physiotherapy, osteopathy, neural therapy, and Qigong for self-help.

**X Surgical Treatment**

**Self-reporting of symptom development from exposure to radiofrequency fields of wireless smart meters in Victoria, Australia: a case series.**


**Lamech F.**

Context • In 2006, the government in the state of Victoria, Australia, mandated the rollout of smart meters in Victoria, which effectively removed a whole population's ability to avoid exposure to human-made high-frequency nonionizing radiation. This issue appears to constitute an unprecedented public health challenge for Victoria. By August 2013, 142 people had reported adverse health effects from wireless smart meters by submitting information on an Australian public web site using its health and legal registers. Objective • The study evaluated the information in the registers to determine the types of symptoms that Victorian residents were developing from exposure to wireless smart meters. Design • In this case series, the registers' managers eliminated those cases that did not clearly identify the people providing information by name, surname, postal address, and/or e-mail to make sure that they were genuine registrants. Then they obtained consent from participants to have their deidentified data used to compile the data for the case series. The author later removed any individual from outside of Victoria. Participants • The study included 92 residents of Victoria, Australia. Outcome Measures • The author used her medical experience and judgment to group symptoms into clinically relevant clusters (eg, pain in the head was grouped with headache, tinnitus was grouped with ringing in the ears). The author stayed quite close to the wording used in the original entries. She then calculated total numbers and percentages for each symptom cluster. Percentages were rounded to the nearest whole number. Results • The most frequently reported symptoms from exposure to smart meters were (1) insomnia, (2) headaches, (3) tinnitus, (4) fatigue, (5) cognitive disturbances, (6) dysesthesias (abnormal sensation), and (7) dizziness. The effects of these symptoms on people's lives were significant. Conclusions • Review of some key studies, both recent and old (1971), reveals that the participants' symptoms were the same as those reported by people exposed to radiofrequency fields emitted by devices other than smart meters. Interestingly, the vast majority of Victorian cases did not state that they had been sufferers of electromagnetic hypersensitivity syndrome (EHS) prior to exposure to the wireless meters, which points to the possibility that smart meters may have unique characteristics that lower people's threshold for symptom development.
OBJECTIVE: To observe the self-developed horn type of titanium clamp used for inferior turbinate resection from filling effect. METHOD: Choose the cases of inferior turbinate resection of 152 cases randomly selected 92 cases (group) in 2-4 angle type titanium clip head-tail closed wound middle turbinate, and therefore more than nasal passages in the surgical wound, just as in the nasal passages above micro tamponade, bare breathing zone, keep the ventilation, 1-3 days to take out the angle titanium clamp; 60 cases (control group) with vaseline oil gauze or postoperative Merocel hemostatic sponge tamponade nasal bleeding. Observation of 1-3 days after nasal ventilation, headache, nasal bleeding, dry mouth, tolerance is painful, aural fullness tinnitus, a total of 7 indicators of sleep. RESULT: The team outside the there was no difference in blood loss and the control group, the rest of the indicators is better than the control group. CONCLUSION: The angle of titanium clamp used in inferior turbinate resection from stuffing, patients get better comfort, avoid drawn yarn of pain, improve the quality of perioperative patients with life.

What drives quality of life in patients with sporadic vestibular schwannoma?
Carlson ML1, Tveiten ØV, Driscoll CL, Goplen FK, Neff BA, Pollock BE, Tombers NM, Lund-Johansen M, Link MJ.

OBJECTIVES/HYPOTHESIS: To investigate the influence of posttreatment audiovestibular symptoms, facial neuropathy, and headache on long-term quality-of-life outcomes in patients with sporadic vestibular schwannoma (VS) utilizing the Short Form 36 (SF-36) Health Survey and the Penn Acoustic Neuroma Quality of Life (PANQOL) scale. STUDY DESIGN: Cross-sectional observation study. METHODS: Patients with sporadic small- or medium-sized VS (< 3.0 cm) who were evaluated between 1998 and 2008 at two independent tertiary academic referral centers were surveyed. Multivariable associations with the PANQOL total score and the SF-36 physical and mental component scores evaluated using regression analysis. RESULTS: A total of 538 surveyed patients returned a completed questionnaire, providing a response rate of 79%. Two hundred forty-seven (46%) patients underwent stereotactic radiosurgery, 143 (27%) microsurgery, and 148 (28%) observation. Multivariable regression analysis revealed that ongoing dizziness was associated with the greatest reduction in PANQOL total score, followed by headache. After adjusting for all examined features, ongoing dizziness and ongoing headache were the only two variables that were associated with both the SF-36 physical and mental component scores. Patient sex and treatment modality did not significantly influence PANQOL or SF-36 scores. CONCLUSIONS: Ongoing dizziness and headache are the strongest predictors of long-term quality-of-life reduction in patients with sporadic VS, while the impact of hearing loss, facial nerve function, and tinnitus are less by comparison. This information may be valuable for patient counseling, refinement of VS quality-of-life assessment instruments, and determining high-yield targets for therapy in efforts to further improve patient outcomes. LEVEL OF EVIDENCE: 4. Laryngoscope, 2014. © 2014 The American Laryngological, Rhinological and Otological Society, Inc.
Role of magnetic resonance imaging in evaluation of cerebellopontine angle schwannomas.

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The aim of the present study was to evaluate the role of Magnetic Resonance Imaging (MRI) to localize and characterize the MR imaging features of cerebellopontine angle schwannomas and to compare with surgical/histopathological findings. It was a prospective study which included 19 patients, who presented with signs and symptoms s/o any lesion in the CP angle and were referred to the radiology department for MRI. All patients included in the study were subjected to detailed clinical history and physical examination following which MRI was carried out on Philips Gyroscan Achieva 1.5 Tesla unit and the standard protocol consisted of T1WI, T2WI, DWI and FLAIR images in axial, sagittal and coronal planes. Hearing abnormality was the most common presenting complaint in patients with CP angle schwannoma's followed by headache and tinnitus. Vestibulocochlear nerve was the most commonly involved nerve in patients with these lesions followed by involvement of trigeminal nerve. MRI was erroneous in giving provisional diagnosis of schwannoma in one case, which on subsequent surgery and histopathology was found to be a meningoia. The sensitivity of MRI for correctly diagnosing vestibular schwannoma was 100 % and specificity was 92.86 % with a positive predictive value of 94.12 % and accuracy of 96.67 %. MRI is considered as an excellent noninvasive investigation for CP angle schwannoma's. It can identify the site and extension of the lesions as well as the characteristic signal. Apart from diagnosing, MR imaging plays an important role in stratifying patients into appropriate treatment options.

The Relationship of Coloboma of Cortical Plate attaching Sigmoid Sinus and Vascular Pulsatile Tinnitus: A Numerical Study
1st Global Conference on Biomedical Engineering & 9th Asian-Pacific Conference on Medical and Biological Engineering.
IFMBE Proceedings Volume 47, 2015, pp 72-75

Shan Tian, Rui Mao, Zhaohui Liu, Lizhen Wang, Yubo Fan

Vascular pulsatile tinnitus is a common and serious symptom, but no clear biomechanism. According to clinical radiographic reports, coloboma of cortical plate attaching sigmoid sinus occurs widely among patients, and most of them can be cured through cortical plate reconstruction surgery. Therefore cortical plate coloboma is a high-possibility etiology causing vascular pulsatile tinnitus. To study the mechanical relationship between cortical plate coloboma and vascular pulsatile tinnitus, finite element models of sigmoid sinus flow field and cortical plate were developed based on CT images. The generation and propagation of tinnitus noise were simulated separately. The model with and without cortical plate were analyzed to make comparison. The evaluation result provided a mechanical conclusion that coloboma of cortical plate attaching sigmoid sinus would remarkably amplify the noise generated in sigmoid sinus, therefore directly leading to audible perception. The conclusion also positively supported the cortical plate reconstruction surgery to cure vascular pulsatile tinnitus.
Sigmoid plate dehiscence: Congenital or acquired condition?

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Background and Purpose: The imaging features of sigmoid plate dehiscence-induced pulsatile tinnitus have been presented. The origin of the sigmoid plate dehiscence, however, remains unclear. Our aim was to assess the prevalence and extent of sigmoid plate dehiscence on computed tomography (CT) images in multiple age groups to determine whether this condition is more likely to be congenital or acquired.

Materials and Methods: We retrospectively reviewed contrast-enhanced CT images of sigmoid plates of temporal bones in 504 patients. Each temporal bone was characterized as normal or dehiscent. Patients were then subcategorized into four age groups, and the prevalence and extent of dehiscent sigmoid plates in each group were calculated and compared. Results: Overall, 80 patients had sigmoid plate dehiscence, 9 of whom had it bilaterally. In successively older age groups, the prevalences of sigmoid plate dehiscence were 18.9%, 20.1%, 14.5%, and 12.7%, respectively. Respective average anteroposterior bony defect diameters were 3.7 ± 1.7, 3.0 ± 1.3, 3.1 ± 1.5, and 3.0 ± 1.1 mm. Respective average vertical bony defect diameters were 3.6 ± 2.3, 2.6 ± 1.2, 3.2 ± 1.5, and 3.0 ± 1.7 mm. The prevalence and extent of sigmoid plate dehiscence were not statistically different among the four age groups. Conclusions: The similar radiologic prevalence and extent of dehiscent sigmoid plates among the age groups suggest that the dehiscence is more commonly a congenital than an acquired condition.

Diagnosis and treatment of carcinoma in external auditory canal

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Objectives: To evaluate outcomes in treating carcinoma of external auditory canal (EAC) and to analysis factors which effect the prognosis of this disease. Methods: A retrospectively review of 16 patients treated for carcinoma of EAC at our department between April 2000 and April 2014 was conducted. All patients underwent surgical treatment and the diagnosis confirmed by pathological examination. Results. There were adenoid cystic carcinoma (ACC) in 8 patients, squamous cell carcinoma (SCC) in 5 patients, adenocarcinoma (AC) in 2 patients, and verrucous carcinoma (VC) in 1 patient. The tumors were classified as Stage I in 4 cases, Stage II in 2 cases, Stage III in 3 cases, and Stage IV in 7 cases. Five patients underwent extensive tumor resection (ETR), 2 patients underwent lateral temporal bone resection (LTBR), 5 patients underwent modified LTBR, 2 patients underwent subtotal temporal bone resection (STBR), and 2 patients underwent only open biopsy. Besides, adjunctive procedures, including neck dissection, parotidectomy and pinna resection were performed when indicated. Ten patients received postoperative radiotherapy. By the end of follow up, two patients had died of their disease, 2 lost to follow up, 2 survived with the disease, and the rest survived disease-free. The median follow-up period was 24 months. Conclusion: Complete tumor resection appears to be an effective treatment for carcinoma of the EAC. Patients with SCC seem to have worse prognosis than those with ACC. Radiation therapy seems less effective for the disease than surgical treatment.

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Objective: The study aimed to present long-term outcomes of near-total removal of facial nerve schwannomas (FNS) with good facial nerve function (HB Grade III or better). Methods: We successfully performed near-total removal of FNS (tumor removal of 95% or greater) on 13 cases, and the remaining 6 cases who failed underwent total tumor removal and nerve grafting. Patients were divided into near-total removal group and total removal group according to surgical approach, and they were followed up for 7.38 ± 1.98ys (range, 5 to 11ys) and 6.66 ± 1.63ys (range, 5 to 9ys), respectively. Results: 12 of 13 cases (92.3%) in near-total removal group successfully maintained at least Grade III except one who recurred and underwent complete tumor removal and nerve grafting, and 10 cases (76.9%) achieved Grade I or Grade II. 5 of 6 cases (83.3%) in total removal group obtained Grade III, but none recovered to Grade I or II. Tumor growth was noted in only one case (7.7%) among near-total removal group during the follow-up. Conclusions: Long-term outcomes of near-total removal of FNS were favorable, which may be a good choice for the old patients with good facial nerve function.

Endolymphatic Sac Tumors.

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Endolymphatic sac tumors (ELST) are slow-growing, locally aggressive, low-grade malignancies that originate from the epithelium of the endolymphatic duct and sac. ELST often present with sensorineural hearing loss, tinnitus, and vertigo, which may mimic Meniere disease. Large tumors may present with additional cranial neuropathies. Management is primarily via microsurgical excision. Radiation therapy has a limited role for residual or unresectable disease. Early detection may enable hearing preservation techniques. ELST have an association with von Hippel-Lindau disease. Copyright © 2015 Elsevier Inc. All rights reserved.
Does attempt at hearing preservation microsurgery of vestibular schwannoma affect postoperative tinnitus?


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Background. The aim of this study was to analyze the effect of vestibular schwannoma microsurgery via the retrosigmoid-transmeatal approach with special reference to the postoperative tinnitus outcome. Material and Methods. A prospective study was performed in 89 consecutive patients with unilateral vestibular schwannoma indicated for microsurgery. Patient and tumor related parameters, pre- and postoperative hearing level, intraoperative findings, and hearing and tinnitus handicap inventory scores were analyzed. Results. Cochlear nerve integrity was achieved in 44% corresponding to preservation of preoperatively serviceable hearing in 47% and useful hearing in 21%. Main prognostic factors of hearing preservation were grade/size of tumor, preoperative hearing level, intraoperative neuromonitoring, tumor consistency, and adhesion to neurovascular structures. Microsurgery led to elimination of tinnitus in 66% but also new-onset of the symptom in 14% of cases. Preservation of useful hearing and neurectomy of the eighth cranial nerve were main prognostic factors of tinnitus elimination. Preservation of cochlear nerve but loss of preoperative hearing emerged as the main factor for tinnitus persistence and new onset tinnitus. Decrease of THI scores was observed postoperatively. Conclusions. Our results underscore the importance of proper pre- and intraoperative decision making about attempt at hearing preservation versus potential for tinnitus elimination/risk of new onset of tinnitus. Free PMC Article.

Meta-analysis on the clinical outcomes in patients with intralabyrinthine schwannomas: conservative management vs. microsurgery.

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The objective of this review is to compare the symptomatological evolution following conservative management (CM) or microsurgery (MS) in patients with intralabyrinthine schwannomas (ILS). A thorough systematic review of the English and French literature from 1948 to February 2014 was performed using Ovid Medline. An ancestor search was also completed. The major inclusion criterion consisted of a diagnosis of ILS with magnetic resonance imaging. Patients with a classic vestibular schwannoma, cases of incidentaloma during surgery or an autopsy were the main exclusion criteria. Thirty-one studies met our selective criteria. Descriptive data were collected from the articles. Clinical outcomes regarding the hearing loss, tinnitus, vertigo, dizziness and aural fullness were stated as improved, unchanged or worse at the last follow-up. All data were then separated into two different groups according to the management option: CM and MS. The data were analyzed using a Pearson χ 2 test and Fisher's exact test. This meta-analysis suggests that MS has a statistically significant favorable outcome regarding symptom relief compared to CM in patients with ILS suffering from tinnitus, vertigo and dizziness. Hearing level was not compared between treatment groups, as MS leads to anacusis. An indicative bias was the main limitation of this study, as patients suffering from intractable vertigo with moderate-to-severe hearing loss were referred to MS. Therefore, in the presence of a serviceable hearing, we suggest that CM should be the treatment of choice.
Long-term vestibulocochlear functional outcome following retro-sigmoid approach to resection of vestibular schwannoma.
Eur Arch Otorhinolaryngol. 2015 Feb 21. [Epub ahead of print]

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The objective of this study was to evaluate long-term vestibulocochlear functional outcomes of patients operated for unilateral vestibular schwannoma via the retro-sigmoid approach. Patients who underwent vestibular schwannoma resection via retro-sigmoid approach between 2004 and 2008 at our institution, without prior surgical or radio-surgical therapy were considered to be eligible for this study. Preoperative auditory and vestibular symptoms were assessed retrospectively. Postoperative symptoms were prospectively assessed using a standardised questionnaire, pure tone audiometry, video-oculography, and rotary chair testing. Out of a total of 203 patients, 120 were eligible for this study, of whom 64 responded to follow-up requests and could be enrolled. Serviceable hearing was reported in 42 patients (66%) preoperatively and was maintained in 18 (43%) postoperatively. While no significant change in rate of tinnitus and balance impairment between pre- and postoperative periods was detected, vertigo decreased significantly (40 to 28%, p < 0.001). Postoperative video-oculography demonstrated vestibular paresis in 80%. Rotary chair testing demonstrated normal or central compensation in 84%. Absence of central compensation was associated with postoperative balance disturbance (p = 0.035). Increasing tumour size and patient age, also decreasing quality of preoperative hearing were independent factors predictive of a postoperative non-serviceable hearing (p = 0.020, p = 0.039 and p = 0.002, respectively). Resection of vestibular schwannoma via the retro-sigmoid approach is associated with improvement in postoperative vertiginous symptoms. Absence of central compensation leads to increased postoperative balance disturbances. Preservation of serviceable postoperative hearing is associated with good preoperative hearing status, younger age, and smaller tumours.

Hyalinizing clear cell carcinoma of the nasopharynx operated by trans-oral and trans-palatal approach.

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BACKGROUND: Hyalinizing clear cell carcinoma is a rare minor salivary gland neoplasm. The treatment of choice is surgical resection with or without post-operative radiotherapy. This tumour often demonstrates a good prognosis. CASE REPORT: We report a case of hyalinizing clear cell carcinoma arising in the nasopharynx. A 27-year-old female presented with progressive hearing disturbance and tinnitus. On examination, an expansile mass was observed in her nasopharynx. Biopsy was performed and the pathology results returned as clear cell carcinoma. RESULTS AND CONCLUSION: Surgical resection was performed trans-orally accompanied by trans-palatal approach. She has no recurrence during more than two years of follow up.
Lesions involving the jugular foramen: clinical characteristics and surgical management.
Acta Otolaryngol. 2015 Feb 26:1-7. [Epub ahead of print]

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Conclusion: Lesions involving the jugular foramen (JF) present as various diagnoses. Pulsatile tinnitus is more common in glomus jugulare (GJ) tumors, whereas otalgia and facial nerve paresis are more prevalent in temporal bone malignancies (TBMs). Preoperative facial nerve electroneurography (ENoG) was significantly correlated with postoperative facial nerve function. Objective: To describe the diagnosis and surgical management of lesions involving the JF. Methods: The charts were reviewed for 38 patients who had lesions involving the JF, including 14 patients with TBMs, 11 with GJ tumors, 7 with cholesteatomas, 2 with facial nerve schwannomas, 2 with JF schwannomas, and 2 with cholesterol granulomas. The follow-up data were recorded. Results: The most frequent symptoms included hearing loss (89.47%), followed by otorrhea (47.37%) and pulsatile tinnitus (39.47%). With respect to TBMs, 57.14% of patients complained of otorrhea and otalgia, and 50.00% presented with facial nerve paresis. Among the 13 patients with facial nerve paresis, 53.85% were diagnosed with TBMs. Regarding GJ tumors, 81.82% had pulsatile tinnitus and hearing loss. Among the 25 patients with normal preoperative facial nerve function, the mean facial nerve ENoG reduction was 29.48 ± 29.15%, and the mean postoperative facial nerve score was 77.48 ± 33.13. The correlation coefficient was -0.973 (p = 0.000).

The effect of specially designed and managed occlusal devices on patient symptoms and pain:
A cohort study.

Sletten WO, Taylor LP, Goodacre CJ, Dumont TD.

There is limited data regarding the benefit of using an occlusal device to help patients resolve a variety of symptoms involving temporomandibular disorder, as well as head, neck, and shoulder pain. The purpose of this study was to evaluate the effect of a carefully adjusted occlusal device on 12 symptoms to determine if there was enough evidence to justify a randomized control trial of this methodology. Splints were designed to ensure a stable, reproducible, mandibular position in a cohort of 157 dental patients with mixed histories of the following 12 symptoms: temporomandibular joint "pop," "click," and lock; jaw, neck, shoulder, and mouth-opening pain; headache; earache; tinnitus; and clenching and grinding of teeth. The results showed significant improvement (P < 0.001) in 11 of the 12 symptoms.

[Eustachian tube balloon dilation in eustachian tube dysfunction related diseases].
[Article in Chinese]
Lin Chung Er Bi Yan Hou Tou Jing Wai Ke Za Zhi. 2014 Nov;28(22):1759-61, 1764.


OBJECTIVE: To investigate the effect of Eustachian tube balloon dilation (ETBD) in treatment of eustachian tube related diseases. METHOD: Fifteen cases (20 ears) of otitis media with effusion and 22 cases (30 ears) of symptomatic Eustachian tube dysfunction were recruited. Technique of tubomanometry (TMM) showed obstructive Eustachian tube dysfunction in all patients. All the patients were received ETBD and followed up with VAS evaluation of ear fullness, muffled hearing, popping sound in the ear and tinnitus. And also the TMM change and middle ear effusion. RESULT: Ear fullness, muffled hearing released with 1 week (ear fullness: 8.2 ± 1.4 vs. 2.0 ± 1.2, P < 0.05, muffled hearing: 6.2 ± 1.2 vs. 3.1 ± 0.8, P < 0.05). No recurrence was seemed within 6 months. The eustachian function test turned better. Symptomatic Eustachian tube dysfunction had an effective rate of 96.6% while otitis media with effusion was 95.0%. CONCLUSION: ETBD have good short-term effect in obstructive eustachian tube dysfunction related middle ear dysfunction, which might provide a good way to solve the eustachian tube related diseases.
A Randomised, Double Blind Trial of N-Acetylcysteine for Hearing Protection during Stapes Surgery.

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BACKGROUND: Otosclerosis is a disorder that impairs middle ear function, leading to conductive hearing loss. Surgical treatment results in large improvement of hearing at low sound frequencies, but high-frequency hearing often suffers. A likely reason for this is that inner ear sensory cells are damaged by surgical trauma and loud sounds generated during the operation. Animal studies have shown that antioxidants such as N-Acetylcysteine can protect the inner ear from noise, surgical trauma, and some ototoxic substances, but it is not known if this works in humans. This trial was performed to determine whether antioxidants improve surgical results at high frequencies. METHODS: We performed a randomized, double-blind and placebo-controlled parallel group clinical trial at three Swedish university clinics. Using block-stratified randomization, 156 adult patients undergoing stapedotomy were assigned to intravenous N-Acetylcysteine (150 mg/kg body weight) or matching placebo (1:1 ratio), starting one hour before surgery. The primary outcome was the hearing threshold at 6 and 8 kHz; secondary outcomes included the severity of tinnitus and vertigo. FINDINGS: One year after surgery, high-frequency hearing had improved 2.7 ± 3.8 dB in the placebo group (67 patients analysed) and 2.4 ± 3.7 dB in the treated group (72 patients; means ± 95% confidence interval, p = 0.54; linear mixed model). Surgery improved tinnitus, but there was no significant intergroup difference. Post-operative balance disturbance was common but improved during the first year, without significant difference between groups. Four patients receiving N-Acetylcysteine experienced mild side effects such as nausea and vomiting. CONCLUSIONS: N-Acetylcysteine has no effect on hearing thresholds, tinnitus, or balance disturbance after stapedotomy. TRIAL REGISTRATION: ClinicalTrials.gov NCT00525551. Free Article.

Combined endoscopic-microscopic approach for vestibular schwannoma removal: outcomes in a cohort of 81 patients.

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Patients affected by vestibular schwannomas typically report a number of symptoms and minor disabilities after surgery. Therefore, surgeons dealing with this pathology should also try to achieve a good QoL for patients who have undergone tumour removal. The aim of this study was to analyse QoL in subjects undergoing surgery for vestibular schwannomas and to try to establish a relationship with both the tumour size and post-surgical alterations (e.g. facial motor dysfunctions, difficulties in balance, persistence of headache and tinnitus). A retrospective analysis was performed on a consecutive series of 81 patients affected by vestibular schwannomas and treated by a combined microscopic-endoscopic approach. Three groups of patients were identified on the basis of tumour size. Group 1 (lesions < 25 mm) with 31 patients (38%); Group 2 (lesions > 26 mm and < 40 mm) with 39 patients (48%); Group 3 (lesions > 41 mm) with 11 patients (14%). Data obtained with the Short Form Questionnaire showed a statistically significant difference in QoL in those undergoing intervention compared with a control group of healthy subjects. The Glasgow Benefit Inventory Questionnaire showed that 25 (31%) patients felt better, 11 (14%) felt similarly, and 45 (55%) felt poorer health conditions in comparison to the pre-surgical period. Concerning the relationship between preservation of facial nerve function and QoL, using the Glasgow Health Status Inventory, it appeared that only 34% of subjects with good facial nerve function (RGS grade I-II) complained of worsening of QoL, while 45% of those with serious facial nerve injury (RGS grade IV-V) referred poorer QoL. Moreover, the possibility of recovery of facial nerve function during the months following surgery was clearly highlighted by our analysis. Our study confirmed the close relation between tumour size and post-surgical QoL, which is worse for patients affected by larger lesions. Free PMC Article.
Contemporary Management of Jugular Paragangliomas.

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Jugular paragangliomas are generally benign slow-growing tumors that can cause pulsatile tinnitus, hearing loss, and cranial nerves neuropathy. Progressive growth can also lead to intracranial extension. Historically, the treatment of choice for these lesions has been gross total resection. However, over the last 15 years, many groups have adopted less invasive management strategies including stereotactic radiation therapy, subtotal resection, and primary observation in order to reduce treatment-associated morbidity. The focus of this article is to review the modern management of jugular paraganglioma, highlighting the evolving treatment paradigm at the Otology Group of Vanderbilt. Copyright © 2015 Elsevier Inc. All rights reserved.

Acromegaly: otolaryngic manifestations following pituitary surgery.

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OBJECTIVES: Acromegals present with a wide range of otolaryngic symptoms, including rhinosinusitis, changes in facial appearance, obstructive sleep apnea (OSA), and voice disturbances. Treatment typically involves transnasal-transsphenoidal (TNTS) resection of the offending pituitary adenoma. In this study, we identify the prevalence of otolaryngic symptoms of acromegalic patients, and evaluate Sinonasal Outcome Test (SNOT-22) scores preceding and following pituitary resection. DESIGN: Retrospective chart review. SETTING: Tertiary academic medical center. PARTICIPANTS: Patients diagnosed with acromegaly who underwent surgical resection of a growth-hormone secreting pituitary adenoma between August 2010 and September 2013. MAIN OUTCOME MEASURES: Subjects were asked to complete questionnaires detailing otolaryngic symptoms as well as SNOT-22 surveys before and after TNTS surgery. A Student's t-test was used to compare preoperative and postoperative SNOT-22 scores. RESULTS: Twenty-five patients underwent pituitary surgery for acromegaly. Acromegalic patients were found to have macroglossia (60%), OSA or sleep-disordered breathing (52%), thyroid neoplasia (20%), hearing loss/tinnitus (20%), sinonasal symptoms (16%), and parathyroid pathology (8%). Differences in preoperative and postoperative SNOT-22 scores were not statistically significant. CONCLUSION: Acromegals present with assorted otolaryngic complaints. Routine screening of all acromegals with sleep evaluations (for both surgical and perioperative planning), thyroid ultrasound, and audiologic testing should be strongly considered. Copyright © 2015. Published by Elsevier Inc.
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BACKGROUND: There are limited data on the long-term auditory symptoms in patients with sporadic small- and medium-sized vestibular schwannoma (VS). The initial treatment strategy for VS is controversial.

OBJECTIVE: To characterize auditory symptoms in a large cohort of patients with VS.

METHODS: Patients with ≤3 cm VS who underwent primary microsurgery, gamma knife surgery, or observation between 1998 and 2008 at 2 independent hospitals were identified. Clinical data were extracted from existing VS databases. At a mean time of 7.7 years after initial treatment, patients were surveyed via mail with the use of the Hearing Handicap Inventory for Adults (HHIA) and the Tinnitus Handicap Inventory. RESULTS: The response rate was 79%; a total of 539 respondents were analyzed. Overall, the hearing prognosis was poor, because more than 75% of all patients had nonserviceable hearing at the last clinical follow-up. Good base-line hearing proved to be a strong predictor for maintained serviceable hearing. Treatment modality was independently associated with both audiometric outcome and HHIA results. Active treatment with micro-surgery or gamma knife surgery did not appear to be protective, because patients who were observed had the greatest probability of durable hearing. Patients in the surgical series had the greatest hearing loss. Tinnitus Handicap Inventory results were less predictable. The only predictors of tinnitus handicap were age and HHIA score.

CONCLUSION: The overall prognosis for hearing in sporadic VS is poor regardless of treatment strategy. Treatment modality was an independent predictor of hearing status; observation was associated with the highest rate of hearing preservation.

ABBREVIATIONS: AAO-HNS, American Academy of Otolaryngology-Head and Neck SurgeryGKS, gamma knife radiosurgeryHHIA, Hearing Handicap Inventory for AdultsMS, microsurgeryOBS, observationTHI, Tinnitus Handicap InventoryVS, vestibular schwannoma.

Undetected metallic chopstick stabbed on neck resulting tinnitus and foreign body sensation.

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Penetrating neck injuries constitute 5-10% of all trauma cases. These injuries may cause life-threatening suppurrative or vascular complications, but the severity and extent of damage depends upon the inflicting object and the involved structures. If significant complications are not expected, then it is best to leave the foreign body embedded and avoid surgical risks. We present a rare case of a foreign body embedded in the neck causing tinnitus and foreign body sensation. Free PMC Article.
Decreased sound tolerance: hyperacusis, misophonia, diplacousis, and polyacousis.

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Definitions, potential mechanisms, and treatments for decreased sound tolerance, hyperacusis, misophonia, and diplacousis are presented with an emphasis on the associated physiologic and neurophysiological processes and principles. A distinction is made between subjects who experience these conditions versus patients who suffer from them. The role of the limbic and autonomic nervous systems and other brain systems involved in cases of bothersome decreased sound tolerance is stressed. The neurophysiological model of tinnitus is outlined with respect to how it may contribute to our understanding of these phenomena and their treatment.© 2015 Elsevier B.V. All rights reserved.

Investigating a new neuromodulation treatment for brain disorders using synchronized activation of multimodal pathways.

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Neuromodulation is an increasingly accepted treatment for neurological and psychiatric disorders but is limited by its invasiveness or its inability to target deep brain structures using noninvasive techniques. We propose a new concept called Multimodal Synchronization Therapy (mSync) for achieving targeted activation of the brain via noninvasive and precisely timed activation of auditory, visual, somatosensory, motor, cognitive, and limbic pathways. In this initial study in guinea pigs, we investigated mSync using combined activation of just the auditory and somatosensory pathways, which induced differential and timing dependent plasticity in neural firing within deep brain and cortical regions of the auditory system. Furthermore, by varying the location of somatosensory stimulation across the body, we increased or decreased spiking activity across different neurons. These encouraging results demonstrate the feasibility of systematically modulating the brain using mSync. Considering that hearing disorders such as tinnitus and hyperacusis have been linked to abnormal and hyperactive firing patterns within the auditory system, these results open up the possibility for using mSync to decrease this pathological activity by varying stimulation parameters. Incorporating multiple types of pathways beyond just auditory and somatosensory inputs and using other activation patterns may enable treatment of various brain disorders.

Tinnitus: from basic principles to therapy.

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No abstract available.
Health effects related to wind turbine noise exposure: a systematic review.

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BACKGROUND: Wind turbine noise exposure and suspected health-related effects thereof have attracted substantial attention. Various symptoms such as sleep-related problems, headache, tinnitus and vertigo have been described by subjects suspected of having been exposed to wind turbine noise. OBJECTIVE: This review was conducted systematically with the purpose of identifying any reported associations between wind turbine noise exposure and suspected health-related effects. DATA SOURCES: A search of the scientific literature concerning the health-related effects of wind turbine noise was conducted on PubMed, Web of Science, Google Scholar and various other Internet sources. STUDY ELIGIBILITY CRITERIA: All studies investigating suspected health-related outcomes associated with wind turbine noise exposure were included. RESULTS: Wind turbines emit noise, including low-frequency noise, which decreases incrementally with increases in distance from the wind turbines. Likewise, evidence of a dose-response relationship between wind turbine noise linked to noise annoyance, sleep disturbance and possibly even psychological distress was present in the literature. Currently, there is no further existing statistically-significant evidence indicating any association between wind turbine noise exposure and tinnitus, hearing loss, vertigo or headache. LIMITATIONS: Selection bias and information bias of differing magnitudes were found to be present in all current studies investigating wind turbine noise exposure and adverse health effects. Only articles published in English, German or Scandinavian languages were reviewed. CONCLUSIONS: Exposure to wind turbines does seem to increase the risk of annoyance and self-reported sleep disturbance in a dose-response relationship. There appears, though, to be a tolerable level of around LAeq of 35 dB. Of the many other claimed health effects of wind turbine noise exposure reported in the literature, however, no conclusive evidence could be found. Future studies should focus on investigations aimed at objectively demonstrating whether or not measureable health-related outcomes can be proven to fluctuate depending on exposure to wind turbines. Free PMC Article.

Cochlear damage affects neurotransmitter chemistry in the central auditory system.

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Tinnitus, the perception of a monotonous sound not actually present in the environment, affects nearly 20% of the population of the United States. Although there has been great progress in tinnitus research over the past 25 years, the neurochemical basis of tinnitus is still poorly understood. We review current research about the effects of various types of cochlear damage on the neurotransmitter chemistry in the central auditory system and document evidence that different changes in this chemistry can underlie similar behaviorally measured tinnitus symptoms. Most available data have been obtained from rodents following cochlear damage produced by cochlear ablation, intense sound, or ototoxic drugs. Effects on neurotransmitter systems have been measured as changes in neurotransmitter level, synthesis, release, uptake, and receptors. In this review, magnitudes of changes are presented for neurotransmitter-related amino acids, acetylcholine, and serotonin. A variety of effects have been found in these studies that may be related to animal model, survival time, type and/or magnitude of cochlear damage, or methodology. The overall impression from the evidence presented is that any imbalance of neurotransmitter-related chemistry could disrupt auditory processing in such a way as to produce tinnitus. Free PMC Article.
Tinnitus what and where: an ecological framework.

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Tinnitus is an interaction of the environment, cognition, and plasticity. The connection between the individual with tinnitus and their world seldom receives attention in neurophysiological research. As well as changes in cell excitability, an individual's culture and beliefs, and work and social environs may all influence how tinnitus is perceived. In this review, an ecological framework for current neurophysiological evidence is considered. The model defines tinnitus as the perception of an auditory object in the absence of an acoustic event. It is hypothesized that following deafferentation: adaptive feature extraction, schema, and semantic object formation processes lead to tinnitus in a manner predicted by Adaptation Level Theory (1, 2). Evidence from physiological studies is compared to the tenants of the proposed ecological model. The consideration of diverse events within an ecological context may unite seemingly disparate neurophysiological models. Free full text.

Consensus on Hearing Aid Candidature and Fitting for Mild Hearing Loss, With and Without Tinnitus: Delphi Review.
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OBJECTIVES: In many countries including the United Kingdom, hearing aids are a first line of audiologic intervention for many people with tinnitus and aidable hearing loss. Nevertheless, there is a lack of high quality evidence to support that they are of benefit for tinnitus, and wide variability in their use in clinical practice especially for people with mild hearing loss. The aim of this study was to identify a consensus among a sample of UK clinicians on the criteria for hearing aid candidature and clinical practice in fitting hearing aids specifically for mild hearing loss with and without tinnitus. This will allow professionals to establish clinical benchmarks and to gauge their practice with that used elsewhere. DESIGN: The Delphi technique, a systematic methodology that seeks consensus amongst experts through consultation using a series of iterative questionnaires, was used. A three-round Delphi survey explored clinical consensus among a panel of 29 UK hearing professionals. The authors measured panel agreement on 115 statements covering: (i) general factors affecting the decision to fit hearing aids, (ii) protocol-driven factors affecting the decision to fit hearing aids, (iii) general practice, and (iv) clinical observations. Consensus was defined as a priori ≥70% agreement across the panel. RESULTS: Consensus was reached for 58 of the 115 statements. The broad areas of consensus were around factors important to consider when fitting hearing aids; hearing aid technology/features offered; and important clinical assessment to verify hearing aid fit (agreement of 70% or more). For patients with mild hearing loss, the greatest priority was given by clinicians to patient-centered criteria for fitting hearing aids: hearing difficulties, motivation to wear hearing aids, and impact of hearing loss on quality of life (chosen as top five by at least 64% of panelists). Objective measures were given a lower priority: degree of hearing loss and shape of the audiogram (chosen as top five by less than half of panelists). Areas where consensus was not reached were related to the use of questionnaires to predict and verify hearing aid benefit for both hearing and tinnitus; audiometric criteria for fitting hearing aids; and safety of using loud sounds when verifying hearing aid fitting when the patient has tinnitus (agreement of <70%). CONCLUSIONS: The authors identified practices that are considered important when recommending or fitting hearing aid for a patient with tinnitus. More importantly perhaps, they identified practical issues where there are divided opinions. Their findings inform the design of clinical trials and open up debate on the potential impact of practice differences on patient outcomes.
Listening to another sense: somatosensory integration in the auditory system.

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Conventionally, sensory systems are viewed as separate entities, each with its own physiological process serving a different purpose. However, many functions require integrative inputs from multiple sensory systems and sensory intersection and convergence occur throughout the central nervous system. The neural processes for hearing perception undergo significant modulation by the two other major sensory systems, vision and somatosensation. This synthesis occurs at every level of the ascending auditory pathway: the cochlear nucleus, inferior colliculus, medial geniculate body and the auditory cortex. In this review, we explore the process of multisensory integration from (1) anatomical (inputs and connections), (2) physiological (cellular responses), (3) functional and (4) pathological aspects. We focus on the convergence between auditory and somatosensory inputs in each ascending auditory station. This review highlights the intricacy of sensory processing and offers a multisensory perspective regarding the understanding of sensory disorders.

Clinical pharmacology of melatonin in the treatment of tinnitus: a review.

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PURPOSE: We performed a review with the purpose to summarise, analyse and discuss the evidence provided by clinical studies evaluating effectiveness of melatonin in the cure of tinnitus. Due to the fact that there is no satisfactory treatment for tinnitus, clinical research has explored new therapeutic approaches. METHODS: A search of Pubmed, Medline, Embase, Central and Google Scholar was conducted to find trials published prior March 2014 on melatonin in the treatment of tinnitus. Design of the studies, randomization, allocation concealment procedures and diagnostic instruments (scales for tinnitus evaluation) were critical evaluated. RESULTS: Five clinical studies have been included. Three of them tested effectiveness of melatonin alone, the remaining two along with sulpiride and sulodexide respectively. Considered clinical trials adopted various experimental designs: single arm, randomised placebo-controlled and randomised placebo-controlled followed by crossover. These studies were characterised by several methodological weaknesses. CONCLUSION: Confirmation of melatonin clinical effectiveness in the treatment of tinnitus cannot be given in the light of the biases observed in the considered evidence. Melatonin seems to improve sleep disturbance linked to tinnitus.
Positive experiences associated with acquired hearing loss, Ménière's disease, and tinnitus: A review.
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Abstract
Objective: It is common to study and understand how various illness and disorders result in negative consequences. However, positive experiences have been reported in a range of disabling conditions including multiple sclerosis, heart disease, physical and sensory disabilities. This paper presents a literature review of studies that have explored positive experiences associated with acquired hearing loss, Ménière's disease, and tinnitus. DESIGN: A review of the peer reviewed scientific literature. STUDY SAMPLE: A comprehensive search strategy identified 15 articles after applying inclusion criteria. RESULTS: A range of positive experiences have been reported by patients with hearing and balance disorders and by their significant others. Associations between demographic variables (e.g. age, gender), audiological variables (e.g. severity of the condition, duration) and the reported positive experiences are low. In Ménière's disease, self-reported positive experiences can predict the impact of the condition. However, this phenomenon has not yet been demonstrated in relation to hearing loss and tinnitus. CONCLUSIONS: Positive experiences associated with audio-vestibular disorders have been demonstrated. Further research is needed on the long-term benefits of the encouragement of such experiences and positive attitudes in persons with hearing loss, tinnitus, and imbalance.

Otomycosis in Iran: A Review.
OMycopathologia. 2015 Jan 30. [Epub ahead of print]
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Fungal infection of the external auditory canal (otitis externa and otomycosis) is a chronic, acute, or subacute superficial mycotic infection that rarely involves middle ear. Otomycosis (swimmer's ear) is usually unilateral infection and affects more females than males. The infection is usually symptomatic and main symptoms are pruritus, otalgia, aural fullness, hearing impairment, otorrhea, and tinnitus. Fungal species such as yeasts, molds, dermatophytes, and Malassezia species are agents for otitis externa. Among molds, Aspergillus niger was described as the most common agent in the literature. Candida albicans was more prevalent than other yeast species. Otomycosis has a worldwide distribution, but the prevalence of infection is related to the geographical location, areas with tropical and subtropical climate showing higher prevalence rates. Otomycosis is a secondary infection and is more prevalent among swimmers. As a result, a higher incidence is reported in summer season, when more people interested in swimming. Incidence of otomycosis in our review ranged from 5.7 to 81 %, with a mean value of 51.3 %. Our results showed that 78.59 % of otomycosis agents were Aspergillus, 16.76 % were Candida species, and the rest (4.65 %) were other saprophytic fungi. Among Iranian patients, incidence of infection was highest in summer, followed by autumn, winter, and spring. In Iran, otomycosis was most prevalent at the age of 20-40 years and the lowest prevalence was associated with being <10 years old. The sex ratio of otomycosis in our study was (M/F) 1:1.53.
Neurorehabil Neural Repair. 2015 Feb 10. pii: 1545968314567152. [Epub ahead of print]

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Background. Tinnitus is the phantom perception of sound and can have negative effect on the quality of life. Transcranial direct current stimulation (tDCS) is a noninvasive neuromodulation technique, which can increase or decrease the cortical excitability in the brain region to which it is applied. tDCS has been used for tinnitus research since 2006. Objective. To investigate whether tDCS affects tinnitus perception, related emotion, or both, and the potential implications for tinnitus management. Methods. A scoping review was undertaken using the methods proposed by Arksey and O'Malley. After initial consideration of title relevance and reading abstracts, 15 studies were included in this review. The data from these studies were charted to investigate the impact of tDCS on tinnitus perception and emotions. Results. tDCS results in transient suppression of tinnitus loudness and annoyance; however, it does not lead to long-term impact on tinnitus related emotion. Local stimulation of different sites of stimulation (left temporoparietal area, dorsolateral prefrontal cortex, and auditory cortex) might modulate tinnitus perception (loudness) and emotions differently; however, further research is needed to explore this hypothesis. This review has identified aspects of methodologies that require attention in upcoming tinnitus and tDCS trials to offer better insights. Conclusions. tDCS is an effective research tool for transient tinnitus neuromodulation. However, efforts should be invested in designing clinical trials using local and multiple sites of stimulation, optimized parameters, and objective outcome measures before it can be translated in to a clinical tool for tinnitus management. © The Author(s) 2015.


PURPOSE: Hyperacusis can be extremely debilitating, and at present, there is no cure. We provide an overview of the field, and possible related areas, in the hope of facilitating future research. METHOD: We review and reference literature on hyperacusis and related areas. We have divided the review into 2 articles. In Part I, we discuss definitions, epidemiology, different etiologies and subgroups, and how hyperacusis affects people. In Part II, we review measurements, models, mechanisms, and treatments, and we finish with some suggestions for further research. RESULTS: Hyperacusis encompasses a wide range of reactions to sound, which can be grouped into the categories of excessive loudness, annoyance, fear, and pain. Many different causes have been proposed, and it will be important to appreciate and quantify different subgroups. Reasonable approaches to assessing the different forms of hyperacusis are emerging, including psychoacoustical measures, questionnaires, and brain imaging. CONCLUSIONS: Hyperacusis can make life difficult for many, forcing sufferers to dramatically alter their work and social habits. We believe this is an opportune time to explore approaches to better understand and treat hyperacusis.


PURPOSE: Hyperacusis can be extremely debilitating, and at present, there is no cure. In this detailed review of the field, we consolidate present knowledge in the hope of facilitating future research. METHOD: We review and reference the literature on hyperacusis and related areas. This is the 2nd of a 2-part review. RESULTS: Hyperacusis encompasses a wide range of reactions to sounds, which can be grouped into the categories of excessive loudness, annoyance, fear, and pain. Reasonable approaches to assessing the different forms of hyperacusis are emerging, including brain-imaging studies. Researchers are only beginning to understand the many mechanisms at play, and valid animal models are still evolving. There are many counseling and sound-therapy approaches that some patients find helpful, but well-controlled studies are needed to measure their long-term efficacy and to test new approaches. CONCLUSIONS: Hyperacusis can make life difficult in this increasingly noisy world, forcing sufferers to dramatically alter their work and social habits. We believe this is an opportune time to explore approaches to better understand and treat hyperacusis.

The potential role of the medial olivocochlear bundle in the generation of tinnitus: controversies and weaknesses in the existing clinical studies.

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OBJECTIVE: The physiology of the efferent cochlear innervation and the pathophysiology of tinnitus are 2 important but rather obscure chapters of neuro-otology. The possible interference of the medial olivocochlear bundle (MOCB) in the pathophysiology of tinnitus is not only a matter of strong controversy but also a field with possible important clinical and therapeutic implications. The aim of this study was to reveal the differences in study population, design, and methodology that may have attributed the conflicting results in the existing clinical trials. DATA SOURCES: A review of the relevant literature published between January 1990 and June 2013 was conducted via the PubMed database (www.pubmed.org) with the search terms "tinnitus" and "otoacoustic emissions and suppression or efferent." STUDY SELECTION: Clinical studies on patients with additional pathologic abnormalities that may implicate the MOCB, such as hyperacusis or auditory neuropathy, were excluded. DATA EXTRACTION: The 15 relevant studies were reviewed for critical differences in the recruitment of their study population and control group, as well as their methods of testing and evaluating the results. DATA SYNTHESIS: The different methods and study parameters are compared to each other. Factors known to attribute different MOCB responses, possibly responsible for the controversial results, are highlighted. CONCLUSION: The remarkable heterogeneity of the existing studies does not allow for safe conclusions. Insufficient knowledge on the physiology of the MOCB reflex seems to preclude the formation of a consensus on the optimal protocol for the evaluation of its function. Further research is definitely needed.
Tinnitus is the sound heard in the absence of physical sound sources external or internal to the body. Tinnitus never occurs in isolation; it typically develops after hearing loss, and not infrequently for losses at the higher frequencies not tested in clinical audiology. Furthermore, tinnitus is often accompanied by hyperacusis, i.e. increased loudness sensitivity, which may reflect the central gain change in the auditory system that occurs after hearing loss. I will first review the electrophysiological findings in the thalamus and cortex pertaining to animal research into tinnitus. This will comprise the changes in tonotopic maps, spontaneous firing rates and changes in pairwise neural cross-correlation induced by tinnitus-inducing agents that are commonly used in animal experiments. These are systemic application of sodium salicylate, and noise exposure at levels ranging from those that do not cause a hearing loss, to those that only cause a temporary threshold shift, to those that cause a permanent hearing loss. Following this, I will review neuroimaging and electrophysiological findings in the auditory cortex in humans with tinnitus. The neural substrates of tinnitus derived from animal data do not apply universally, as neither hearing loss nor hyperacusis appear to be necessary conditions for tinnitus to occur in humans. Finally, I will relate the findings in humans to the predictions from animal models of tinnitus. These comparisons indicate that neural correlates of tinnitus can be studied successfully both at the level of animal models and in humans.

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Ménière's Disease Treatment: A Patient-Centered Systematic Review.

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Ménière's disease is a disorder of the inner ear affecting hearing and balance to a varying degree. It is characterized by episodes of vertigo, low-pitched tinnitus, and hearing loss. There is currently no gold standard treatment for Ménière's disease. We conducted a systematic search of the Cochrane Database, as a high-quality source of evidence-based therapies, for reviews on the efficacy of etiological therapy or on Ménière's disease or its symptoms. Following recent positive experiences reported by other research teams, we decided to involve a patients’ representative in the assessment and analysis of the evidence retrieved in the literature in order to achieve a more patient-centered evaluation of the therapies. Evidence confirms that an effective treatment of Ménière's disease is still missing, but recent discoveries on the microvascular etiology of Ménière's disease may be assimilated by new evidence-based therapeutic approaches. © 2015 S. Karger AG, Basel.
Tinnitus is an auditory phantom phenomenon characterized by the sensation of sounds without objectively identifiable sound sources. To date, its causes are not well understood. The perceived severity of tinnitus correlates more closely to psychological and general health factors than to audiometric parameters. Together with limbic structures in the ventral striatum, the prefrontal cortex forms an internal "noise cancelling system", which normally helps to block out unpleasant sounds, including the tinnitus signal. If this pathway is compromised, chronic tinnitus results. Patients with chronic tinnitus show increased functional connectivity in corticolimbic pathways. Psychiatric comorbidities are common in patients who seek help for tinnitus or hyperacusis. Clinicians need valid screening tools in order to identify patients with psychiatric disorders and to tailor treatment in a multidisciplinary setting.

Intratympanic therapy in Meniere's syndrome or disease: up to date evidence for clinical practise.

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BACKGROUND: Meniere's syndrome or disease (MS/D) is typically characterised by episodic vertigo, aural fullness, tinnitus and fluctuating hearing loss. There are multiple options available for treatment with variation in consensus on the best intervention. OBJECTIVE: To evaluate the evidence on the efficacy of intratympanic therapies [steroids, gentamicin, antiviral therapy and other therapies] on the frequency and severity of vertigo and other symptoms of MS/D. SEARCH STRATEGY: A literature search was performed on AMED, EMBASE, HMIC, MEDLINE, PsycINFO, BNI, CINAHL, HEALTH BUSINESS ELITE, CENTRAL and Cochrane Ear, Nose and Throat disorders group trials register using various MeSH. The search was restricted to English and human subjects and the last date of search was Dec 2014. SELECTION CRITERIA: Randomised controlled trials of intratympanic therapies [steroids, gentamicin and antiviral agents, latanoprost] versus a placebo or another treatment. RESULTS: We analysed 8 RCT's comparing intratympanic steroids, gentamicin, Ganciclovir (antiviral) and latanoprost versus another form of intratympanic treatment or placebo. CONCLUSIONS: On the basis of 6 RCT's (n=242) there is evidence to support the effectiveness of intratympanic steroids and gentamicin to control symptoms of vertigo in MS/D albeit with a risk of hearing loss in gentamicin. However, there was no consensus found on doses or treatment protocols. There was no evidence for the use of other forms of intratympanic therapy (antivirals and latanoprost) in MS/D. This article is protected by copyright. All rights reserved. This article is protected by copyright. All rights reserved.

Gaitanou K1, Fildissis G, Vavasis P, Kalentzos V, Baltopoulos G.

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Idiopathic sudden sensorineural hearing loss (ISSHL) is defined as the sensorineural hearing loss of a minimum of 30 dB in at least three frequencies for three days or more. This study aims to evaluate the clinical efficacy of hyperbaric oxygen therapy (HBO2) in the management of idiopathic sudden sensorineural hearing loss. MATERIAL-METHODS: Patients with ISSHL received treatment including oral corticosteroids and HBO2. HBO2 protocol included five phases of five sessions each. ISSHL was assessed by measuring the tonal audiogram before and after each phase. Tinnitus was assessed using a questionnaire and a visual analogue scale at the beginning and the end of the study. Secondary assessment points included changes in the intensity and the improvement of tinnitus. RESULTS: 56 patients were included in the study. All patients completed Phases I and II of HBO2, 43 completed Phase III, 13 completed Phase IV, and six completed all five phases. Overall, a significant improvement was noted between the initial and final audiogram after HBO2 (p < 0.001). Tinnitus evaluation score, intensity and related problems were also significantly reduced (p < 0.001). CONCLUSION: This study affirms previous findings that the use of HBO2 and vasodilators are efficacious in the treatment of ISSHL. Our findings also suggest benefit for the treatment of tinnitus. Comment in Idiopathic sudden sensorineural hearing loss: beyond the window and tinnitus, too? An editorial perspective. [Undersea Hyperb Med. 2014]


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Many treatments for chronic tinnitus have been attempted, but the condition remains difficult to cure, especially in the case of cochlear tinnitus. We conducted a prospective, double-blind, placebo-controlled study to assess the effect of low-dose laser therapy on chronic cochlear tinnitus. Our study population was made up of 66 patients-33 who received active laser treatment (case group) and 33 who received inactive dummy treatment (control group). Patients in the laser group received 5 mV with a wavelength of 650 nm for 20 minutes a day, 5 days a week, for 4 weeks. The controls followed the same schedule, but they were "treated" with an inactive device. The degree of tinnitus was evaluated before and after treatment in each group in three ways: (1) the Tinnitus Severity Index (TSI), (2) a subjective 10-point self-assessment scale for tinnitus loudness, and (3) the Tinnitus Evaluation Test (TET). At study's end, we found no statistically significant differences between the case and control groups in the number of patients who experienced a reduction in TSI values (p = 0.589) or a reduction in subjective self-assessment scores (p = 0.475). Nor did we find any significant reductions in the loudness (p = 0.665) and frequency (p = 0.396) of tinnitus as determined by the TET. We conclude that 5-mV laser therapy with a wavelength of 650 nm is no better than placebo for improving hearing thresholds overall or for treating tinnitus with regard to age, sex, environmental noise level, and the duration of tinnitus.
Cost of Care for Subjective Tinnitus in Relation to Patient Satisfaction.

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OBJECTIVE: A consistent management algorithm for subjective tinnitus remains to be elucidated. Chronic tinnitus yields approximately US$2110 in annual health care costs per patient. However, it is unclear whether spending more in the management of tinnitus equates with greater patient satisfaction. Thus, the aim of this study is to correlate patient satisfaction with patient demographics, provider recommendations, and total health care-related expenditures. STUDY DESIGN: A retrospective chart review and a patient satisfaction questionnaire. SETTING: All data were collected from a large Midwestern hospital. SUBJECTS AND METHODS: Patients were included who presented to the tinnitus clinic during the year 2011 and were between the ages of 18 and 89 years. They were excluded with diagnoses of Ménière's disease, pulsatile tinnitus, acoustic neuromas, or autoimmune inner ear diseases. The retrospective data and satisfaction surveys were entered by 3 of the authors. Responses were based on Likert scales. RESULTS: Of the 692 patients included, 230 completed and returned the satisfaction questionnaire (33.2% response rate), yielding an overall mean of $662.60 charges. The frequency of intervention recommendations per patients ranged from 0 to 13, with a median of 4. Spearman's correlations did not result in significant correlations between patient satisfaction and number of clinic visits (P = .499) or associated charges (P = .453). CONCLUSION: Given that the variability among provider recommendations, the high overall mean of tinnitus-related charges, and patient satisfaction was not related to costs, further research is needed examining patient preference in the treatment of tinnitus. © American Academy of Otolaryngology—Head and Neck Surgery Foundation 2015.

Treatment of pulsatile tinnitus associated with multiple factors.


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Free Full Text.
Low level laser effect in treatment of patients with intractable tinnitus due to sensorineural hearing loss.

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INTRODUCTION: Tinnitus is defined as a perception of sound without an external acoustic stimulus. Due to large number of causes and limited knowledge of its pathophysiology, tinnitus still remains an obscure symptom. METHODS: This was a cross-sectional study on 120 patients with tinnitus and sensorineural hearing loss who were randomly divided into two groups; one group received low-level laser and the second group used the same instrument but off, for 20 sessions of 20 minutes. A tinnitus handicap inventory (THI) and Visual Analog Scale (VAS) were used to evaluate the severity of patients' symptoms. Severity and frequency of tinnitus were also determined using Audiometric tests. RESULTS: The average age of the 120 patients in the two groups of study were not statistically significantly different. The mean difference of severity of tinnitus between the two groups was statistically significant at the end of the study and 3 month after completion of treatment. The VAS and THI mean differences after the treatment were statistically significant between the two groups but not statistically significant after 3 months of completion the study. CONCLUSION: Low level laser radiation is effective for short-term treatment of Tinnitus caused by sensorineural hearing loss and its impact may be reduced over the time.

Modulating central gain in tinnitus: changes in nitric oxide synthase in the ventral cochlear nucleus.

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A significant challenge in tinnitus research lies in explaining how acoustic insult leads to tinnitus in some individuals, but not others. One possibility is genetic variability in the expression and function of neuromodulators - components of neural signaling that alter the balance of excitation and inhibition in neural circuits. An example is nitric oxide (NO) - a free radical and potent neuromodulator in the mammalian brain - that regulates plasticity via both pre-synaptic and postsynaptic mechanisms. Changes in NO have previously been implicated in tinnitus generation, specifically in the ventral cochlear nucleus (VCN). Here, we examined nitric oxide synthase (NOS) - the enzyme responsible for NO production - in the guinea pig VCN following acoustic trauma. NOS was present in most cell types - including spherical and globular bushy cells, small, medium, and large multipolar cells, and octopus cells - spanning the entire extent of the VCN. The staining pattern was symmetrical in control animals. Unilateral acoustic over-exposure (AOE) resulted in marked asymmetries between ipsilateral and contralateral sides of the VCN in terms of the distribution of NOS across the cochlear nuclei in animals with behavioral evidence of tinnitus: fewer NOS-positive cells and a reduced level of NOS staining was present across the whole extent of the contralateral VCN, relative to the ipsilateral VCN. The asymmetric pattern of NOS-containing cells was observed as early as 1 day after AOE and was also present in some animals at 3, 7, and 21 days after AOE. However, it was not until 8 weeks after AOE, when tinnitus had developed, that asymmetries were significant overall, compared with control animals. Asymmetrical NOS expression was not correlated with shifts in the threshold hearing levels. Variability in NOS expression between animals may represent one underlying difference that can be linked to whether or not tinnitus develops after noise exposure. Free full text.
Transcutaneous electrical stimulation at auricular acupoints innervated by auricular branch of vagus nerve pairing tone for tinnitus: study protocol for a randomized controlled clinical trial.

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BACKGROUND: Subjective tinnitus is a phantom sensation experienced in the absence of any source of sound. Its mechanism remains unclear, and no approved drugs are available. Vagus nerve stimulation (VNS) is an exciting new method to treat tinnitus, but direct electrical stimulation of the cervical vagus has disadvantages. This randomized controlled clinical trial aims to overcome these limitations by stimulating the auricular branch of vagus nerve (ABVN) on the outer ear. Since the ABVN is the only peripheral branch of the vagus nerve distributed on the ear's surface, it should be possible to achieve analogous efficacy to VNS by activating the central vagal pathways. However, researches have indicated that the curative effect lies in a combination of auditory and vagal nerve stimulation. Moreover, from traditional Chinese theory, auricular acupoints used to treat tinnitus are mainly in the regions supplied by the ABVN. Whether stimulation at the auricular acupoints is due to unintentional stimulation of vagal afferent fibers also needs evidence.

METHODS/DESIGN: A total of 120 subjects with subjective tinnitus are randomized equally into four groups: (1) electrical stimulation at auricular acupoints (CO10, CO11, CO12, and TF4) innervated by the ABVN; (2) electrical stimulation at auricular acupoints (CO10, CO11, CO12, and TF4) innervated by ABVN pairing tones; (3) electrical stimulation at auricular acupoints innervated by non-ABVN pairing tones; (4) electrical acupuncture. Patients will be treated for 30 minutes every other day for 8 weeks. The primary outcome measure is the Tinnitus Handicap Inventory. The secondary outcome measure combines a visual analogue scale to measure tinnitus disturbance and loudness with the Hospital Anxiety and Depression Scale. Assessment is planned at baseline (before treatment) and in the 4th and 8th week, with further follow-up visits after termination of the treatment at the 12th week. Any adverse events will be promptly documented.

DISCUSSION: Completion of this trial will help to confirm whether ABVN or the combination of ABVN and sound stimulus plays a more important role in treating tinnitus. Moreover, the result of this clinical trial will enhance our understanding of specific auricular acupoints.


[Short-term and long-term efficacy analysis of acupoint catgut embedding at cervical Jiaji (EX-B 2) points combined with electroacupuncture at acupoints near ears for nervous tinnitus].
[Article in Chinese]

Zhou X, Ruan J, Li Z, Xing B.

OBJECTIVE: To observe the efficacy differences between acupoint catgut embedding at cervical Jiaji (EX-B 2) points combined with electroacupuncture (EA) at acupoints near ear and simple EA for the treatment of nervous tinnitus. METHODS: Sixty-three patients were randomly divided into an observation group (31 cases) and a control group (32 cases). The observation group was treated with acupoint catgut embedding at C4-C7 Jiaji (EXB 2) points on the affected side combined with EA at acupoints near ears, including Ermen (TE 21), Tinggong (SI 19), Tinghui (GB 2), etc.; the control group was treated with EA at regular acupoints near ears alone. The EA treatment was given five times per week, and the acupoint catgut embedding was given once every two weeks. All the treatment was given for 6 weeks. The Tinnitus severity score (TSS) was applied to assess the severity of tinnitus before the treatment, 2 weeks, 4 weeks and 6 weeks into treatment and one month after treat ment. Also the efficacy of two groups was compared. RESULTS: After the treatment, the severity of tinnitus was both improved in two groups at each time point (all P<0.05), which was more significant in the observation group (P<0.05, P<0.01). The cured and markedly effective rate was 77.4% (24/31) in the observation group, which was superior to 50.0% (16/32) in the control group (P<0.05). CONCLUSION: The short-term and long-term efficacy of acupoint catgut embedding at cervical Jiaji (EX-B 2) points combined with electroacupuncture are both superior to those of simple electroacupuncture for treatment of nervous tinnitus.
Bilateral muscular tinnitus due to myoclonus of extrinsic auricular muscles.

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The muscular tinnitus due to an extrinsic auricular myoclonus is an extremely rare disorder which demonstrates a semirhythmic involuntary movement of the ear. We report a 33-year-old man with clicking tinnitus caused by focal myoclonic jerks of bilateral posterior auricularis muscle and bilateral temporalis muscle. This muscular tinnitus persisted except for when he was sleeping or breath holding. His symptom responded poorly to medical therapy but was controlled by botulinum toxin type A injection under electromyography monitoring with favorable outcome. Previous reports of this condition and possible therapeutic approaches are discussed. Copyright © 2014 Elsevier Ireland Ltd. All rights reserved.

Endovascular treatment of vein of Galen dural arteriovenous fistula presenting as dementia.

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Dural arteriovenous fistula (DAVF) is an important cause of neurological dysfunction that is often misdiagnosed, especially in elderly population. Galenic DAVFs are a subtype of the rare falcotentorial DAVFs with a high risk of hemorrhage and aggressive clinical course. In most cases, DAVFs present with pulsatile tinnitus, headache, or orbital symptoms such as chemosis and proptosis. We report a patient with DAVF of Vein of Galen presented with progressive dementia, treated by Onyx embolisation and had good clinical outcome. Free PMC Article.
Reiter’s syndrome and hearing loss: a possible association?

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KEY CLINICAL MESSAGE: Patient complained of hearing loss and tinnitus after the onset of Reiter’s syndrome. Audiometry confirmed the hearing loss on the left ear; blood work showed increased erythrocyte sedimentation rate and C3 fraction of the complement. Genotyping for HLA-B27 was positive. Treatment with prednisolone did not improve the hearing levels. Free full text.

Microvascular decompression for typewriter tinnitus-case report.

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Background: Microvascular decompression has been tested as a treatment for tinnitus. Methods: However, only a fraction of patients appear to benefit from surgery if the combination of findings such as paroxysmal vertigo, ABR changes and tinnitus is used to select patients for microvascular decompression. Results: Instead, a more specific syndrome of staccato or “typewriter” tinnitus, which is highly responsive to carbamazepine, was suggested to be caused by a neurovascular conflict. Conclusion: We present the first case of typewriter tinnitus with complete long-term symptom relief following microvascular decompression of the vestibulocochlear nerve. We suggest that this specific syndrome is caused by a neurovascular conflict and treatable by microvascular decompression.

Spontaneous bilateral dural arteriovenous fistulas with pulsatile tinnitus.

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Pulsatile tinnitus with norma otoscopic findings often presents a diagnostic challenge to otolaryngologists and can be attributed to serious vascular malformations such as dural arteriovenous fistulas (DAVF). Spontaneous DAVFs are relatively rare. A 65-year-old woman presented with sudden-onset subjective/objective pulsatile tinnitus on the right side that had persisted for 2 months. Angiography and magnetic resonance angiography revealed DAVF formation. Stereotactic radiosurgery was performed, and total remission of the DAVFs was achieved.
A 5-year-old boy is brought to the doctor by his mother because she is concerned that he may be experiencing hearing loss. Over the past several weeks, he has been turning the volume of his favorite television program louder and has been sitting closer to the television. He has reached all his developmental milestones and is up to date with his immunizations. When asked, the child states that he feels that his ears are always "plugged up." His medical history includes recurrent episodes of acute otitis media. On exam, he is afebrile. His nasopharynx is clear and he has no cervical lymphadenopathy. On otoscopic examination, his left tympanic membrane is immobile with an air-fluid level behind it and partial opacification dependently. It does not appear to be erythematous. A vibrating tuning fork placed on the middle of his forehead is appreciated as louder on the left side when compared to the right. The same tuning fork, when placed on the left mastoid bone, is appreciated as louder on the left, while softer when it is placed near the left external auditory meatus.

Iatrogenic arteriovenous fistula of the superficial temporal artery after reduction malarplasty.
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A 34-year-old woman who had a history of undergoing reduction malarplasty at a local clinic about 1 year ago developed gradually increasing pulsatile tinnitus in the right preauricular area since the last 6 months. On physical examination, there were an approximately 1 × 0.5-cm nontender, soft, pulsatile mass with a palpable thrill and a continuous machinery-like buzzing sound in synchrony with the heartbeat. She had a fine scar near the mass, which was supposed to be a postoperative scar of reduction malarplasty. A three-dimensional computed tomographic angiogram revealed a direct arteriovenous fistula between the superficial temporal artery and superficial temporal vein in the right preauricular area. The arteriovenous fistula was embolized using Tornado coils. After coiling, the thrill and disturbing tinnitus disappeared immediately, and postembolization angiography confirmed obliteration of the arteriovenous shunt. This is the first case of an arteriovenous fistula of the superficial temporal artery after reduction malarplasty, and it indicates that arteriovenous fistula can occur as a delayed complication of reduction malarplasty.

Deafness and sickle cell disease: three case reports and review of the literature.
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The otological complications of sickle cell disease (SCD) in general and the audiological complications in particular are not well documented and studied. Because the general management of patients with SCD has improved after the advent of newborn screening, antibiotic prophylaxis, safer blood transfusion and hydroxyurea therapy, patients with SCD are doing better in general and living longer than before. With longer longevity, the incidence of new complications of SCD became apparent and previously milder complications became more severe and more common. The dental and otological complications of SCD are examples of these changes that have become more common than before. Unfortunately with this increase, there are no guidelines or recommendations based on evidence on how to manage and treat these complications. The aim of this study was to describe three patients with SCD and deafness due to three different causes that were not adequately treated and to review the literature of deafness in SCD. We hope this may initiate more controlled trials on the incidence, prevalence and management of these complications.
Paraneoplastic syndrome: a masquerade of autoimmune inner ear disease.

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Rare and diagnostically challenging, paraneoplastic syndromes can appear months to years before detection of their underlying neoplasms and are associated with rapidly progressive neurologic deficits, including cochleovestibulopathy and death. Less than 20 cases of paraneoplastic cochleovestibulopathy have been reported in the online database PubMed. We present three recent cases: one patient with a history of B-cell follicular lymphoma who developed dermatomyositis and hearing loss before detection of lymphoma recurrence in his anterior chest wall, a second patient with sudden asymmetric hearing loss, found to have a 12-cm renal mass before death, and a third with fluctuating bilateral hearing loss who was ultimately found to have a thymoma. Although characterized as type VI (non-immune rapidly progressive sensorineural hearing loss) within the Harris autoimmune inner ear disease classification system, the mechanism of paraneoplastic cochleovestibulopathy is not well understood. Although specific anti-neuronal antibodies such as anti-Hu may be associated with other paraneoplastic neurologic disorders, these antibodies have limited diagnostic utility with paraneoplastic cochleovestibulopathy. Steroids have limited efficacy with regard to hearing recovery, whereas intravenous immunoglobulin has been shown to be of benefit. These recent cases demonstrate how auditory and vestibular deficits may be indicative of a rare but potentially life-threatening occult neoplasm where timely diagnosis is critical. We believe that understanding paraneoplastic cochleovestibulopathy is of interest across a broad range of clinical practices.

Unilateral musical hallucination after a hybrid cochlear implantation.

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OBJECTIVE: To provide a description of musical hallucination associated with hybrid cochlear implantation. METHOD: Case report. RESULTS: We report a case of musical hallucination secondary to hybrid cochlear implantation. Activation of electrical stimulation was closely related to onset of musical hallucination and deactivation was associated with attenuation of hallucination. Persistent musical hallucination severely impaired speech discrimination in spite of 2 years of listening rehabilitation. CONCLUSIONS: The hybrid cochlear implant is a relatively new surgical method, and its side effects have not been well documented. This is the first report of musical hallucination after a hybrid cochlear implantation. Also we provide evidence of the peripheral origin of musical hallucination by reporting lateralization and intensity change of hallucination by activation status of cochlear implant. Copyright © 2015 Elsevier Inc. All rights reserved.
Tinnitus 3 years after strangulation.

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Because psychogenic tinnitus can be a presentation of a wide range of psychiatric diseases such as anxiety disorders, somatoform and mood disorders, and personality disorders, the presence of tinnitus in the patient in this case can be easily misdiagnosed as her coexisting major depressive disorder. If brain imaging had been the only modality used, this case patient's cervical dissecting pseudoaneurysm would have been overlooked. Examination of carotid pulses and detection of carotid bruits were crucial parts in the diagnosis of the current patient's pseudoaneurysm.

Atypical Teratoid/Rhabdoid Tumor (AT/RT) Arising From the Acoustic Nerve in a Young Adult: A Case Report and a Review of Literature.


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Atypical teratoid/rhabdoid tumors (AT/RTs) are rare, highly malignant central nervous system tumors that predominantly occur in young children. A 22-year-old woman presented with a 4-year history of relapsing tinnitus and gradual hearing loss. Neuroimaging revealed an enhanced intrinsic left internal auditory canal mass. The patient underwent radiotherapy treatment. Three years later, the tumor size continued to increase, as observed by imaging, and ultimately evolved into the left cerebellopontine angle. As a consequence, a total tumor resection was performed, and a pathological diagnosis of AT/RT was made. Aggressive radiotherapy and chemotherapy treatment continued; however, the tumor recurred within 11 months after the total tumor resection. The patient died within 4 months of the second operation. Histopathologically, the tumor contained characteristic rhabdoid cells with areas that resembled a classical primitive neuroectodermal tumor. Immunostaining showed loss of INI1 protein expression in tumor cells, and fluorescence in situ hybridization showed a hemizygous deletion of the hSNF5/INI1 gene region on 22q11.2. This is the first report of an AT/RT that arised from the acoustic nerve in a young adult. Despite manifold diagnostic and therapeutic advances, the prognosis of patients with AT/RT remains poor.

Recovery of hearing after surgical removal of Intralabyrinthine schwannoma.

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Intralabyrinthine schwannomas (ILSs) are rare benign tumors arising from the distal part of the cochleovestibular nerve confined within the labyrinth. Patients with ILSs complain of hearing loss, vertigo, tinnitus, and ear fullness. Surgical treatment of ILS is performed in special cases such as in cases of patients with nonserviceable hearing, progressive hearing loss, intractable vertigo, or tumor extension. We present an unusual case of a patient with intralabyrinthine schwannoma who underwent surgery to treat progressive hearing loss and recovered his hearing after surgery. LEVEL OF EVIDENCE: NA Laryngoscope, 2015. © 2015 The American Laryngological, Rhinological and Otological Society, Inc.
Metastatic breast carcinoma presenting as unilateral pulsatile tinnitus: A case report.

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Pulsatile tinnitus is a rare symptom, yet it may herald life-threatening pathology in the absence of other symptoms or signs. Pulsatile tinnitus tends to imply a vascular cause, but metastatic disease also can present in this way. Clinicians should therefore adopt a specific diagnostic algorithm for pulsatile tinnitus and always consider the possibility of metastatic disease. A history of malignant disease and new cranial nerve palsies should raise clinical suspicion for skull base metastases. We describe the case of a 63-year-old woman presenting with unilateral subjective pulsatile tinnitus and a middle ear mass visible on otoscopy. Her background included the diagnosis of idiopathic unilateral vagal and hypoglossal nerve palsies 4 years previously, with normal magnetic resonance imaging (MRI). Repeat MRI and computed tomography imaging were consistent with metastatic breast carcinoma. This case raises important questions about imaging protocols and the role of serial scanning in patients at high risk of metastatic disease.

Middle ear capillary haemangioma causing vestibulocochlear symptoms: a case report.

Wuyts L, Potvin J, Vanderveken OM, Spaepen M, Lammens M, Van de Heyning P.

PROBLEM: A 58-year-old man presented with transient vertigo and pulsatile tinnitus. METHODS: High-resolution computed tomography, magnetic resonance imaging, excision, and subsequent immunohistochemical assays were performed. RESULTS: Imaging showed a soft tissue mass in the epitympanum and mastoid with bone erosion of the tegmen tympani and a dural tail sign, suggesting meningioma. Subsequently, because of signs of clinical progression, a canal-wall-up attico-antromastoidectomy was performed, with near-complete removal of a granulomatous, ossifying, haemorrhagic mass. CONCLUSIONS: Radiological imaging was critical in determining the extent of the mass and excluding other pathologies. Due to the atypical clinical and radiological signs, the final diagnosis of capillary haemangioma of the middle ear and temporal bone was made only after surgical resection and histopathological examination with immunohistochemistry, which excluded meningioma. The contiguous occurrence of cutaneous capillary haemangioma of the lateral face and neck was an important clue to the diagnosis.

Elongated styloid processes and calcified stylohyoid ligaments in a patient with neck pain: implications for manual therapy practice.

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OBJECTIVE: The purpose of this paper is to present a case of a patient with neck pain, tinnitus, and headache in the setting of bilateral elongated styloid processes (ESP) and calcified stylohyoid ligaments (CSL), how knowledge of this anatomical variation and symptomatic presentation affected the rehabilitation management plan for this patient, and to discuss the potential relevance of ESPs and CSLs to carotid artery dissection. CLINICAL FEATURES: A 29-year-old male military helicopter mechanic presented for chiropractic care for chronic pain in the right side of his neck and upper back, tinnitus, and dizziness with a past history of right side parietal headaches and tonsillitis. Conventional radiographs showed C6 and C7 spinous process fractures, degenerative disc disease at C6/7, and an elongated right styloid process with associated calcification of the left stylohyoid ligament. Volumetric computerized tomography demonstrated
calcification of the stylohyoid ligaments bilaterally. INTERVENTION AND OUTCOME: Given the proximity of the calcified stylohyoid apparatus to the carotid arteries, spinal manipulation techniques were modified to minimize rotation of the neck. Rehabilitation also included soft tissue mobilization and stretching, corrective postural exercises, and acupuncture. An otolaryngologist felt that the symptoms were not consistent with Eagle syndrome and the tinnitus was associated with symmetric high frequency hearing loss, likely due to occupational noise exposure. Initially, the patient's symptoms improved but plateaued by the fifth visit.

CONCLUSION: Neck pain in the presence of ESPs and CSLs can be associated with Eagle syndrome, which can include ipsilateral head and neck pain, odynophagia, dysphagia, and cerebrovascular symptoms. This case, initially thought to be Eagle syndrome, highlights proper diagnostic workup for this condition and presents potential contraindications to consider with regard to cervical spine manipulation in such patients. Manual therapy precautions pertaining to cervical spine manipulation may be appropriate in cases involving ESPs and calcified stylohyoid ligaments. Select item 256786083. Free PMC Article.

Endovascular treatment of jugular bulb diverticula causing debilitating pulsatile tinnitus.

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We describe the case of a patient who presented with debilitating pulsatile tinnitus in association with two jugular bulb diverticula. The diverticula were treated with stenting of the jugular bulb and coil embolization of the diverticula over two procedures. This resulted in successful resolution of symptoms and at 10 months follow-up the patient is asymptomatic. The technique is discussed with regard to similar published cases and surrogate measures of safety taken from the literature pertaining to idiopathic intracranial hypertension. 2015 BMJ Publishing Group Ltd.

Placebo-Controlled Vagus Nerve Stimulation Paired with Tones in a Patient with Refractory Tinnitus: A Case Report.
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OBJECTIVE: Classical neuromodulation consists of applying electrical or magnetic stimuli to the nervous system to modulate ongoing activity and connectivity. However, recently, an exciting novel neuromodulation technique was developed in which stimulation of the vagal nerve was paired with simultaneous presentation of tones, demonstrating that it reverses a tinnitus percept in noise-exposed rats. STUDY DESIGN: To determine whether this therapy could also be effective in humans, we delivered a similar therapy in a patient with chronic tinnitus unresponsive to previous therapies. In this report, we describe the case of a 59-year-old man who suffered from bilateral tinnitus for 14 years that arose after a cervical fusion operation. Pharmacotherapy, transcranial magnetic stimulation, transcranial direct current stimulation, neurofeedback, and bilateral auditory cortex stimulation via implanted electrodes did not improve the tinnitus. After implanting the vagal nerve stimulator, the patient received daily vagus nerve stimulation tone pairings for 4 weeks in a non-placebo-controlled way. RESULTS: At the end of therapy, the patient experienced a significant reduction in tinnitus symptoms that lasted for 2 months after treatment. Tinnitus Handicap Inventory and Tinnitus Reaction Questionnaire were reduced by 48% and 68%, respectively. Symptoms of depression were also improved by 40%, as quantified by the Beck Depression Inventory. Three months after ending therapy, placebo stimulation was performed consisting of only tone presentation without the simultaneous electrical stimuli. This resulted in further continuation of the gradual relapse to the baseline state, without renewed improvement. CONCLUSION: Our results suggest that vagus nerve stimulation paired with tones could become an effective therapy for the treatment of tinnitus.
**Endovascular treatment of jugular bulb diverticula causing debilitating pulsatile tinnitus.**


Mortimer AM¹, Harrington T¹, Steinfort B¹, Faulder K¹.

¹ Department of Radiology, Royal North Shore Hospital, Sydney, New South Wales, Australia.

We describe the case of a patient who presented with debilitating pulsatile tinnitus in association with two jugular bulb diverticula. The diverticula were treated with stenting of the jugular bulb and coil embolization of the diverticula over two procedures. This resulted in successful resolution of symptoms and at 10 months follow-up the patient is asymptomatic. The technique is discussed with regard to similar published cases and surrogate measures of safety taken from the literature pertaining to idiopathic intracranial hypertension.

**Sudden bilateral hearing loss after spinal anaesthesia.**


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Background: Spinal anaesthesia is one of the most widely used regional anaesthesia techniques. Sudden bilateral hearing loss following spinal anaesthesia has only been reported in a few cases. Case report: This paper reports the case of a 50-year-old woman who developed sudden bilateral hearing loss following spinal anaesthesia for hallux valgus orthopaedic surgery. This is followed by a literature review. Results: The patient's hearing improved almost completely on the morning of the 3rd day following surgery. No recurrence of hearing loss, tinnitus or vertigo was reported during the six-month follow-up period. Conclusion: Some complications regarding hearing may emerge after spinal anaesthesia. The possibility of hearing loss after spinal anaesthesia should be taken into consideration. Complaints such as hearing loss, tinnitus or vertigo should be taken seriously when reported, and the patient should be referred to an ENT clinic. This will ensure early diagnosis and treatment.

**Acquired auditory neuropathy spectrum disorder after an attack of chikungunya: case study.**

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Auditory neuropathy spectrum disorder (ANSD) is a retrocochlear disorder in which the cochlear functioning is normal but the transmission in the auditory neural pathway is affected. The present study reports of a 14-year-old teenager with acquired ANSD after an attack of chikungunya. He reported symptoms of difficulty in understanding speech, tinnitus and vertigo when exposed to loud sounds. The audiological characteristics suggested auditory neuropathy spectrum disorder with raising audiogram configuration. The results of tinnitus evaluation showed low-pitched tinnitus and it was persistent causing significant handicap to him based on self report tinnitus handicap questionnaire results. The results of depression, anxiety and stress scale also suggested symptoms of mild depression and anxiety. Chikungunya virus is suspected to be neurotropic in nature which can damage auditory nerve cells and may have caused ANSD. The result also shows presence of tullio's phenomenon and absence of cervical vestibular evoked myogenic potentials suggesting damage to the vestibular neuronal system. The possible pathophysiology of chikungunya virus causing ANSD and vestibular symptoms needs to be explored further in future studies.
Cochlear implantation leading to successful stapedectomy in the contralateral only-hearing ear.
Ear Nose Throat J. 2015 Mar;94(3):105-7.

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Cochlear implants have recently begun to be offered to patients with single-sided deafness (SSD). Implantation in these patients has led to good results in suppressing ipsilateral tinnitus and in providing audiologic benefits in terms of speech perception in noise and localization. One previously unreported benefit of cochlear implantation in patients with SSD is the restoration of functional hearing in the previously deaf ear, which may allow for surgical opportunities in the contralateral hearing ear. We report a case in which cochlear implantation in the deaf left ear of a 50-year-old man allowed for surgical intervention in the previously only-hearing right ear, which in turn led to the restoration of normal middle ear function. Further studies may be warranted to consider the surgical candidacy of the contralateral only-hearing ear as another potential indication for cochlear implantation in patients with SSD.

Efficacy of carnitine in treatment of tinnitus: evidence from audiological and MRI measures-a case study.

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BACKGROUND: Tinnitus, or ringing in the ears, is an extremely common ear disorder. However, it is a phenomenon that is very poorly understood and has limited treatment options. PURPOSE: The goals of this case study were to identify if the antioxidant acetyl-L-carnitine (ALCAR) provides relief from tinnitus, and to identify if subjective satisfaction after carnitine treatment is accompanied by changes in audiological and imaging measures. RESEARCH DESIGN: Case Study. PATIENT CASE: A 41-yr-old female with a history of hearing loss and tinnitus was interested in exploring the benefits of antioxidant therapy in reducing her tinnitus. The patient was evaluated using a standard audiological/tinnitus test battery and magnetic resonance imaging (MRI) recordings before carnitine treatment. After her physician's approval, the patient took 500 mg of ALCAR twice a day for 30 consecutive days. The audiological and MRI measures were repeated after ALCAR treatment. DATA COLLECTION AND ANALYSIS: Pure-tone audiometry, tympanometry, distortion-product otoacoustic emissions, tinnitus questionnaires (Tinnitus Handicap Inventory and Tinnitus Reaction Questionnaire), auditory brainstem response, functional MRI (fMRI), functional connectivity MRI, and cerebral blood flow evaluations were conducted before intake of ALCAR and were repeated 30 days after ALCAR treatment. RESULTS: The patient's pretreatment pure-tone audiogram indicated a mild sensorineural hearing loss at 6 kHz in the right ear and 4 kHz in the left ear. Posttreatment evaluation indicated marginal improvement in the patient's pure-tone thresholds, but was sufficient to be classified as being clinically normal in both ears. Distortion-product otoacoustic emissions results showed increased overall emissions after ALCAR treatment. Subjective report from the patient indicated that her tinnitus was less annoying and barely noticeable during the day after treatment, and the posttreatment tinnitus questionnaire scores supported her statement. Auditory brainstem response peak V amplitude growth between stimulus intensity levels of 40-80 dB nHL indicated a reduction in growth for the posttreatment condition compared with the pretreatment condition. This was attributed to a possible active gating mechanism involving the auditory brainstem after ALCAR treatment. Posttreatment fMRI recordings in response to acoustic stimuli indicated a statistically significant reduction in brain activity in several regions of the brain, including the auditory cortex. Cerebral blood flow showed increased flow in the auditory cortex after treatment. The functional connectivity MRI indicated increased connectivity between the right and left auditory cortex, but a decrease in connectivity between the auditory cortex and some regions of the "default mode network," namely the medial prefrontal cortex and posterior cingulate cortex. CONCLUSIONS: The changes observed in the objective and subjective test measures after ALCAR treatment, along with the patient's personal observations, indicate that carnitine intake may be a valuable pharmacological option in the treatment of tinnitus.
You H, Li X, Wang W.

Vestibular schwannoma is a rare tumor, which is easily misdiagnosed. The authors presented a case of vestibular schwannoma in a 36-year-old woman. The clinical manifestations were recurrent vertigo, hearing loss of the left ear, and tinnitus. The pure tone audiometry threshold of the left ear was 45dBHL with air conduction, and 33 dBHL with bone conduction. A CT scan of the temporal bone region didn't show any abnormal finding. A MRI scan of the head showed nodule abnormal signal in the internal of left vestibular and the narrow of perilymphaticum gap in T2W1 + T2Flair. The initial diagnosis was Meniere's disease. And the post-operation pathologic diagnosis was vestibular schwannoma.

Treatment of Venous Pulsatile Tinnitus in Younger Women.

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INTRODUCTION: We present seven cases of pulsatile tinnitus (PT) of venous origin in younger women seen over a period of 24 years and treated by Internal Jugular Bulb ligation. MATERIAL AND METHODS: All patients had a pulsatile bruit in one side of the neck that disappeared when gentle pressure over the internal jugular vein (IJV) caused it to collapse as seen in a Duplex scan. Their CT showed a dominant venous system with a High Jugular Bulb (HJB) on the side of the bruit RESULTS: The IJV was ligated under local anesthesia. Five patients in whom the ligation was done above the facial vein were cured. Two patients in whom the ligation was done below the facial vein experienced a decrease but not disappearance of the PT. CONCLUSION: Once other possible causes for PT have been discarded, ligation of the IJV above the facial vein cures this condition. Copyright © 2015 Elsevier Inc. All rights reserved.

Aberrant carotid artery in the middle ear.

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BACKGROUND: Carotid artery abnormality in the middle ear is a rare clinical condition. Recognition of the problems related with this abnormality is important since it may mimic vascular tumors. Any intervention with incomplete evaluation can be fatal. CASE REPORT: A 23-year-old girl with carotid abnormality and sensorineural hearing loss, unsteadiness and tinnitus is presented. She was followed for 2 months elsewhere assuming that she had Meniere's disease and had previously received some medication for otitis media with effusion. CONCLUSION: Tomography and magnetic resonance imaging of the temporal bone are very helpful for visualization of an aberrant carotid in the middle ear. Radiological presentations are the reduced caliber of the aberrant carotid, an absence of cranial opening of carotid canal, tubular coursing along the medial wall of the middle ear in continuity with the horizontal carotid canal, dehiscence of the lateral carotid plate and enlargement of the tympanic canalicus. Free PMC Article.
A case of vogt-koyanagi-harada syndrome with persistent dyspnea secondary to laryngeal edema.


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PURPOSE: We report a case of laryngeal edema associated with the Vogt-Koyanagi-Harada (VKH) syndrome. PATIENT AND METHODS: A 32-year-old African-American female presented with a 12-day prodrome, including headache, tinnitus and shortness of breath, which preceded sudden photophobia and bilateral visual loss. Examination and clinical testing were most consistent with VKH, and the patient improved with intravenous methylprednisolone therapy. RESULTS: The patient had persistent dyspnea, which was out of proportion to chest CT findings and which was exacerbated during a recurrence of VKH. Flexible fiberoptic laryngoscopy with stroboscopy revealed diffuse laryngeal edema. Symptoms were alleviated with breathing exercises. CONCLUSIONS: Several autoimmune diseases may cause diffuse laryngeal edema. In this case, VKH was associated with the patient's glottic edema and dyspnea. We recommend that laryngeal edema be considered in the differential diagnosis for patients with dyspnea and VKH. Free PMC Article.

Contralateral transvenous approach and embolization with 360° guglielmi detachable coils for the treatment of cavernous sinus dural fistula.


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carotid-cavernous fistulas are spontaneous acquired connections between the carotid artery and the cavernous cavernous sinus, being classified as direct or indirect; being usually diagnosed in postmenopausal women, but are also associated with other pathologies such as pregnancy, sinusitis and cavernous sinus thrombosis. They are clinically characterized by ophthalmological symptoms and pulsatile tinnitus. A 51-year-old woman who started her current condition about 4 years ago with pulsatile tinnitus, to which were added progressively: Pain, conjunctival erythema, right eye proptosis and the occasional headache of moderate intensity. Carotid-cavernous fistula was diagnosed, for the technical difficulty inherent in the case was made a contralateral transvenous approach and embolization with 360° GDG coils, with successful evolution of the patient. The endovascular management of these lesions is currently possible with excellent results.
Endovascular treatment of a symptomatic vertebral artery pseudoaneurysm.

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A 35 year-old-patient was brought to the emergency department referring dysarthria, left ear tinnitus for 5 minutes and short lasting blindness, with headache in the 45 minutes prior to the clinical presentation. In the MRi an acute-subacute lesion in the cerebellum right-anterior lobe (in the territory of the cerebellum anterior artery) and a dilatation near the ostium of the right vertebral artery were seen. For a better assessment an AngioCT was done, showing a 9 mm saccular pseudoaneurysm of the right vertebral artery close to the origin of the vessel, without being able to determine if it had been caused due to a dissection. The rest of the study (cerebral vessels and supraaortic vessels) showed no disorders. He was operated under local anaesthesia and sedation a week after the onset of the symptoms. Through an 0.014 wire, a Biotronik PK Papyrus balloon expandable covered cobalt-chromium stent was deployed covering the hole in the artery. Antiplatelet drugs were prescribed and the patient was discharged 24 hours after surgery. He has remained symptom-free since then. Copyright © 2015 Elsevier Inc. All rights reserved.

Computed tomography and magnetic resonance imaging features of a rare case of a primary epidermoid tumor of the jugular foramen.

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We present computed tomography (CT) and magnetic resonance imaging (MRI) features of a very rare case of a primary epidermoid tumor of the jugular foramen (JF). A 45-year-old male patient presented with gradually progressive vertigo and tinnitus. CT and MRI scans revealed a 3.5 cm right-sided JF tumor with characteristic bright signal (restricted diffusion) on diffusion-weighted MRI (DWI). DWI may be useful in accurately differentiating the lesion from other cystic neoplasms of the JF. We describe the imaging features of intracranial epidermoid and JF tumors and discuss its differential diagnosis.

Jugulotympanic paraganglioma: a rare cause of vertigo.

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Background Jugulotympanic paraganglioma generally presents in the 5th or 6th decades of life with tinnitus and hearing loss. In this manuscript, we present a rare case of jugulotympanic paraganglioma presenting in the 9th decade with vertigo as the most bothersome symptom. Case Report An 83-year-old woman presented with worsening episodes of dizziness of a few months duration. She also complained of tinnitus and hearing loss, more severe on the left side. Examination revealed a red bulging left-sided tympanic membrane, conductive hearing loss, and a bruit at the base of the skull. Dix-Hallpike test was negative. CT head and MRI brain revealed findings consistent with a large left-sided jugulotympanic paraganglioma, which was found to be hormonally inactive on laboratory tests. The patient underwent treatment with radiotherapy, which resulted in partial improvement of symptoms. Conclusions Jugulotympanic paraganglioma may manifest in the elderly with the chief complaint of intermittent vertigo, as in our case. A red bulging mass on otoscopy raises the suspicion, necessitating further investigations, including CT and MRI.
Specific Forms of Tinnitus

Endolymphatic sac surgery versus tenotomy of the stapedius and tensor tympani muscles in the management of patients with unilateral definite Meniere's disease.
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This study aims to compare the outcomes of patients with Meniere's disease submitted to either endolymphatic mastoid shunt (ES) or tenotomy of the stapedius and tensor tympani muscles (TSTM). This is a retrospective chart review of patients treated with ES or TSTM between 2000 and 2010 and followed up for at least 12 months. The main outcomes were represented by: (1) vertigo class, hearing stage and functional level according to the American Academy of Otolaryngology-Head and Neck Surgery criteria; (2) adjustment of dizziness handicap inventory (DHI) and (3) complete and substantial vertigo control using the Kaplan-Meier survival method. Sixty-three patients met the inclusion criteria: 34 underwent ES and 29 TSTM. The baseline demographic characteristics, the hearing stage, the functional level, the DHI and hearing levels were not different between the two groups. No significant difference in vertigo class was demonstrated: 66 % of TSTM patients attained class A compared to 44 % in the ES group (p = 0.14). Kaplan-Meier survival curves specific to class A showed significant differences, favoring TSTM (log-rank test, p = 0.022). TSTM patients demonstrated significantly improved functional level (p = 0.0004) and improved DHI scores (p = 0.001). Eight ES patients (25 %) demanded a second surgical attempt compared to none in the TSTM. Aural fullness was significantly improved in TSTM group (p = 0.01), while the difference in tinnitus improvement was non-significant. Hearing preservation was significantly better in TSTM group (p = 0.001). TSTM is a safe surgical procedure, with significant vertigo control rates, and important hearing preservation rates. More patients and longer follow-up are needed to support our preliminary findings.

Aural Fullness in Ménière's Disease.

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OBJECTIVE: Aural fullness in Ménière's disease and the predisposing and consequential factors were investigated and possible consequences of aural fullness on participation activity were explored. METHODS: 726 subjects of the Finnish Ménière Association replied to a questionnaire focusing on symptoms of Ménière's disease, sense of coherence, attitude, participation restriction, and general health-related quality of life (EQ-5D). In the analysis, the severity of the disease was controlled. RESULTS: 68% of the subjects had aural fullness and in 37% it was moderate or strong. Aural fullness was rated as the worst problem by 4.4% of the subjects. Females reported more aural fullness than males. Tinnitus, hyperacusis and balance problems were significant predictors of aural fullness. Aural fullness was associated with reduced quality of life and complaints such as vertigo attacks, balance problems and hearing loss. Analysis based on participation restriction indicated that severe aural fullness leads to social isolation. CONCLUSIONS: Largely, psychological factors and personal traits modify problems experienced by aural fullness. Relaxation was the only statistically significant method that alleviated aural fullness. © 2014 S. Karger AG, Basel.
Intratympanic dexamethasone versus high dosage of betahistine in the treatment of intractable unilateral Meniere disease.


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PURPOSE: The objective of our randomized, double-blind study was to compare the effectiveness of intratympanic (IT) dexamethasone versus high-dosage of betahistine in the treatment of patients with intractable unilateral Meniere disease (MD). MATERIALS AND METHODS: Sixty six patients with definite unilateral MD were randomly divided in two groups: Group A received a combination of IT dexamethasone (DX) and identical-appearing placebo pills while Group B received a combination of high-dosage betahistine and IT saline. Intratympanic injections were repeated for three times with an interlude of 3days. High-dosage of betahistine entailed 144mg/day. Mean outcome measures consisted of vertigo control, pure tone average (PTA), speech discrimination score, Functional Level Score, Dizziness Handicap Inventory and Tinnitus Handicap Inventory. RESULTS: Fifty nine patients completed the study and were available at 12months for analysis. In Group A complete vertigo control (class A) was attained in 14 patients (46.6%) and substantial control (class B) in 7 patients (20%). In Group B, 12 patients (41%) achieved complete vertigo control (class A), 5 patients (17%) substantial control (class B). There is no statistical difference in vertigo control between the two treatment groups. In Group A hearing was unchanged in 14 patients and improved in 4 patients, while in Group B hearing was unchanged in 16 patients and improved in 2 patients. CONCLUSIONS: Our preliminary results demonstrate that high-dosage of betahistine achieved similar outcomes as IT dexamethasone in the control of vertigo and hearing preservation. Copyright © 2014 Elsevier Inc. All rights reserved.

Earlier immunomodulatory treatment is associated with better visual outcomes in a subset of patients with Vogt-Koyanagi-Harada disease.


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PURPOSE: To evaluate clinical outcomes of first-line immunomodulatory therapy (IMT) and prednisone alone or late IMT in Vogt-Koyanagi-Harada disease. METHODS: Retrospective cohort study of 152 patients with Vogt-Koyanagi-Harada disease evaluated in a referral uveitis clinic in Chile from 1985 to 2011. Medical records of these patients were reviewed. Demographic data, clinical evaluation, type of treatment, functional outcomes, glucocorticoid (GC) dose and complications were recorded. Multivariate logistic regression was used to identify prognostic factors of poor response to GC. RESULTS: There were no significant differences between first-line IMT group and prednisone alone/late IMT group in terms of visual acuity (VA) improvement, complications and GC sparing effect. There was a trend for a higher frequency of systemic adverse effects leading to discontinuation of treatment in patients receiving IMT than in those receiving prednisone (14.6% and 6.5%, respectively). The subgroup of patients with poor response to GC who showed functional improvement had a significantly earlier time to IMT initiation than the patients who had no improvement. We identified following prognostic factors of poor response to GC: VA ≤20/200, fundus depigmentation, chronic disease and tinnitus at diagnosis. Patients with a prognostic factor (excluding tinnitus) and VA improvement had an earlier IMT initiation than those who had worse functional outcome. CONCLUSION: There were no differences in outcomes between first-line IMT and prednisone alone/late IMT in the entire VKH group. However, in a subset of patients, there was a significant better functional outcome with earlier IMT initiation. © 2015 Acta Ophthalmologica Scandinavica Foundation. Published by John Wiley & Sons Ltd.
Accompanying Symptoms Overlap during Attacks in Menière's Disease and Vestibular Migraine.
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Menière's disease and vestibular migraine (VM) are the most common causes of spontaneous recurrent vertigo. The current diagnostic criteria for the two disorders are mainly based on patients’ symptoms, and no biological marker is available. When applying these criteria, an overlap of the two disorders is occasionally observed in clinical practice. Therefore, the present prospective multicenter study aimed to identify accompanying symptoms that may help to differentiate between MD, VM, and probable vestibular migraine (pVM). Two hundred and sixty-eight patients were included in the study (MD: n = 119, VM: n = 84, pVM: n = 65). Patients with MD suffered mainly from accompanying auditory symptoms (tinnitus, fullness of ear, and hearing loss), while accompanying migraine symptoms (migraine-type headache, photo-/phonophobia, visual aura), anxiety, and palpitations were more common during attacks of VM. However, it has to be noted that a subset of MD patients also experienced (migraine-type) headache during the attacks. On the other hand, some VM/pVM patients reported accompanying auditory symptoms. The female/male ratio was statistically higher in VM/pVM as compared to MD, while the age of onset was significantly lower in the former two. The frequency of migraine-type headache was significantly higher in VM as compared to both pVM and MD. Accompanying headache of any type was observed in declining order in VM, pVM, and MD. In conclusion, the present study confirms a considerable overlap of symptoms in MD, VM, and pVM. In particular, we could not identify any highly specific symptom for one of the three entities. It is rather the combination of symptoms that should guide diagnostic reasoning. The identification of common symptom patterns in VM and MD may help to refine future diagnostic criteria for the two disorders. [Free full text]

Symptom severity, social supports, coping styles, and quality of life among individuals’ diagnosed with Ménière’s disease.
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OBJECTIVES: To (1) examine the quality of life of individuals with Ménière's disease in relation to symptom severity, social supports, and coping styles and (2) develop a prediction model to identify factors most strongly associated with quality of life. METHODS: Data were collected using a web-based survey that included previously developed and validated measures (i.e. SF-12, Dizziness Handicap Inventory, Hearing Handicap Inventory for Elderly Screening Version, Iowa Tinnitus Handicap Questionnaire, Interpersonal Support Evaluation List, Brief COPES, Lehman’s Quality of Life). Ninety-five individuals with Ménière’s disease who were members of one of five online Ménière's disease support groups responded to the survey. RESULTS: The findings indicated that symptom severity was negatively associated with patients' quality of life, social supports were positively associated with quality of life, and the use of negative coping styles (e.g. substance use, blaming) was negatively associated with quality of life. Four predictors (i.e. SF-12 mental health, dizziness severity, self-esteem support, and negative coping styles) accounted for 62% of the variance in quality of life. DISCUSSION: The findings suggest that the factors associated with the quality of life of patients with Ménière's disease are similar to those reported in the literature among patients with other chronic illnesses. The results also suggested that emphasis on psychosocial factors may be an important aspect of a comprehensive treatment intervention for individuals with Ménière’s disease. © The Author(s) 2015 Reprints and permissions: sagepub.co.uk/journalsPermissions.nav.
Capillary Haemangioma: A Rare Vascular Tumour of the External Auditory Canal
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Haemangiomas are relatively common in the head and neck region, but cases in the temporal bone are rare. Hemangioma of the external auditory canal (EAC) is a rare otologic entity. Up till now (till 2013), only 18 cases of hemangioma EAC have been reported in the English literature. It is commonly classified as capillary or cavernous hemangioma. According to the literature, this case represents the fourth patient with capillary hemangioma of the EAC. A 22-year-old male presented to our department with a 3 years history of right-sided aural fullness, mild pain and decreased hearing. There was no history of ear discharge, pulsatile tinnitus, vertigo and local trauma. Oto-microscopic and otoendoscopic examination revealed a smooth surface, reddish pulsatile mass arising from the right postero–superior portion of bony canal wall, which measured about 1 cm in diameter, obstructing 2/3rd of the EAC. The tympanic membrane was not seen. No facial nerve dysfunction was observed. Patient had moderate conductive hearing loss in right ear on audiology. HRCT temporal bone showed soft tissue mass involving the right EAC and middle ear. The lesion was excised via a postaural approach under general anesthesia. The tumor was a reddish, soft mass and measured 1.6 × 1.7 × 2.8 cm. The histopathologic assessment indicated a capillary hemangioma.

Comparative Study of Endolymphatic Sac Decompression and Vestibular Neurectomy in Intractable Meniere's Disease.

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To comparative study the clinical effect of endolymphatic sac decompression (ELSD) and vestibular neurectomy (VN) in intractable Meniere's disease (MD). The study included 30 MD intractable patients, 21 of which underwent ELSD and nine of which were treated by VN via retrosigmoid approach. Follow-up period ranged from 3 to 6 years. In 21 patients by ELSD, excellent vertigo control and good control were noted in 11 patients (52.4 %) and 4 patients (19.0 %), partial control in 4 and no control in 2 patients. All the 9 patients by VN, vertigo was excellent control. ELSD can improve hearing and tinnitus, but VN not. VN can achieve much better effect in improving vertigo in intractable MD patients. But relative to ELSD, it has much more disadvantages.
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OBJECTIVE: To assess the prevalence of vestibular migraine (VM) in patients consulting to an otolaryngology clinic, the neuro-otological associated symptoms, and the effect of prophylactic antimigrainous medication on VM symptom improvement. STUDY DESIGN: Retrospective chart review. SETTING: Tertiary referral otolaryngology clinic. SUBJECTS AND METHODS: We used the diagnostic criteria from the Bárány Society and the International Headache Society to allocate patients to a subgroup: VM, possible VM, and atypical VM. MAIN OUTCOME MEASURE: The prevalence of VM, percentages of associated neurotological symptoms, and percentages of effectiveness of prophylactic medication. RESULTS: Sixty-five (16%) patients were selected from the total patient population (n = 407) from which 4.2% were assigned to the definite VM group, 5.7% to the probable VM group, and 6.1% to the atypical VM group. We found a significantly different distribution between the groups for photophobia (p = 0.035), ear pressure (p = 0.023), and scotoma (p = 0.015). Thirty patients were administered with flunarizine and 68% responded with an improvement in VM symptoms (p < 0.001). For propranolol, 31 patients were treated and there was an improvement of symptoms in 73% (p < 0.001). Remarkable was the fact that these percentages were not significantly different between the subgroups. CONCLUSION: VM is a common disorder presenting in a dizziness clinic, and detailed history taking is important to assess VM-associated symptoms and thus to prevent underdiagnosis. The latter is very important because our study shows that the majority of patients, regardless of VM subtype, can benefit from a prophylactic treatment, but further prospective studies are necessary.

Relationship between hearing threshold at the affected and unaffected ear in unilateral Meniere’s disease.
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Hearing loss in Menière’s disease has been described to affect above all low frequencies (upward curve) with a tendency to become irreversible and non-fluctuating at the higher frequencies (peaked curve) over time. The aim of the study was to determine the effects of MD on hearing function on the basis of differences existing between the affected and the unaffected ear in a group of patients affected by definite unilateral MD and whose contralateral ear was not affected by any disease other than age-related hearing loss (ARHL). Following this procedure we have also evaluated the possible effects of age and disease duration on hearing loss in MD. The study group consisted of 86 subjects affected by definite unilateral MD. In our sample a peaked audiometric curve characterized the affected ears; however, the result after subtracting the normal ear hearing threshold was an upward sloping curve, which highlighted the greater suffering at the lower frequencies. On the basis of differences existing between affected and unaffected ear, our data suggest that threshold evolution is more related to disease duration rather than to age.
Long-term effects of intratympanic methylprednisolone perfusion treatment on intractable Ménière’s disease.
J Laryngol Otol. 2015 Feb 6:1-6. [Epub ahead of print]
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Objective: This study aimed to investigate the long-term efficacy of intratympanic methylprednisolone perfusion treatment for intractable Ménière’s disease. Methods: A retrospective analysis of 17 intractable Ménière’s disease patients treated with intratympanic methylprednisolone perfusion was performed. Treatment efficacy was evaluated according to the American Academy of Otolaryngology-Head and Neck Surgery criteria. Short and long-term control or improvement rates were calculated after 6 and 24 months, respectively. Results: Sixteen patients were followed for more than two years. Short- and long-term vertigo control rates were 94 per cent and 81 per cent, respectively; short- and long-term functional activity improvements were 94 per cent and 88 per cent, respectively. The pure tone average was 53 ± 14 dB before treatment, and 50 ± 16 dB at 6 months and 52 ± 20 dB at 24 months after intratympanic methylprednisolone perfusion. Tinnitus was controlled or improved in five patients over the two-year follow-up period. Conclusion: Intratympanic methylprednisolone perfusion can effectively control vertigo and improve functional activity in intractable Ménière’s disease patients with good hearing preservation. It may therefore be a viable alternative treatment for intractable Ménière’s disease.

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OBJECTIVES: Vascular tinnitus is the most common form of pulsatile tinnitus, particularly when the tinnitus corresponds with the pulse of patients. In this study, we reviewed the 10-year clinical data on vascular tinnitus of our tinnitus clinic to investigate the frequency of the underlying etiologies, to introduce a diagnostic protocol, and to evaluate the treatment outcomes. METHODS: We retrospectively collected the data of 57 patients who were diagnosed as vascular tinnitus between April 2001 and December 2011. Careful history taking, otoscopy, thorough physical examinations, audiometry, laboratory tests, as well as radiologic examinations were performed according to our diagnostic protocol to find the origin of pulsatile tinnitus. Treatment options were individualized based on the specific etiology, and the outcomes were assessed using patients’ subjective reports at the follow-up interviews. RESULTS: High jugular bulb was the most common cause (47.4%) of vascular tinnitus, and venous hum was the next (17.5%). Dural arteriovenous fistula, intracranial aneurysm, atherosclerotic carotid artery disease, and hypertension were less common causes. Vascular tinnitus was alleviated in most patients after the appropriate treatment: surgical intervention, tinnitus retraining therapy, reassurance, and medications. CONCLUSION: Vascular tinnitus can be successfully diagnosed by the regular use of the suggested protocol. Many patients with vascular tinnitus have treatable underlying etiologies. Treatment of those etiologies or at least counseling about the tinnitus itself can benefit the patients with troublesome vascular tinnitus. Free PMC Article.
The effect of specially designed and managed occlusal devices on patient symptoms and pain: a cohort study.

Sletten WO, Taylor LP, Goodacre CJ, Dumont TD.

There is limited data regarding the benefit of using an occlusal device to help patients resolve a variety of symptoms involving temporomandibular disorder, as well as head, neck, and shoulder pain. The purpose of this study was to evaluate the effect of a carefully adjusted occlusal device on 12 symptoms to determine if there was enough evidence to justify a randomized control trial of this methodology. Splints were designed to ensure a stable, reproducible, mandibular position in a cohort of 157 dental patients with mixed histories of the following 12 symptoms: temporomandibular joint "pop," "click," and lock; jaw, neck, shoulder, and mouth-opening pain; headache; earache; tinnitus; and clenching and grinding of teeth. The results showed significant improvement (P < 0.001) in 11 of the 12 symptoms.

Treatment of Menière's Disease.

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OPINION STATEMENT: Diagnosis of Menière's disease is made with a characteristic patient history, including discrete episodes of vertigo lasting 20 min or longer, accompanied by sensorineural hearing loss, which is typically low frequency at first, aural fullness, and tinnitus. Workup includes audiometry, a contrast enhanced MRI of the internal auditory canals, and exclusion of other diseases that can produce similar symptoms, like otosyphilis, autoimmune inner ear disease, perilymphatic fistula, superior semicircular canal syndrome, Lyme disease, multiple sclerosis, vestibular paroxysmia, and temporal bone tumors. A history of migraine should be sought as well because of a high rate of co-occurrence (Rauch, Otolaryngol Clin North Am 43:1011-1017, 2010). Treatment begins with conservative measures, including low salt diet, avoidance of stress and caffeine, and sleep hygiene. Medical therapy with a diuretic is the usual next step. If that fails to control symptoms, then the options of intratympanic (IT) steroids and betahistine are discussed. Next tier treatments include the Meniett device and endolymphatic sac surgery, but the efficacy of both is controversial. If the above measures fail to provide symptomatic control of vertigo, then ablative therapies like intratympanic gentamicin are considered. Rarely, vestibular nerve section or labyrinthectomy is considered for a patient with severe symptoms who does not show a reduction in vestibular function with gentamicin. Benzodiazepines and anti-emetics are used for symptomatic control during vertigo episodes. Rehabilitative options for unilateral vestibular weakness include physical therapy and for unilateral hearing loss include conventional hearing aids, contralateral routing of sound (CROS) and osseointegrated hearing aids.
Positive pressure therapy for Ménière’s disease or syndrome.
Cochrane Database Syst Rev. 2015 Mar 10:3;CD008419. [Epub ahead of print]

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BACKGROUND: Ménière's disease is an incapacitating disease in which recurrent attacks of vertigo are accompanied by hearing loss, tinnitus and/or aural fullness, all of which are discontinuous and variable in intensity. A number of different therapies have been identified for patients with this disease, ranging from dietary measures (e.g. a low-salt diet) and medication (e.g. betahistine (Serc®), diuretics) to extensive surgery (e.g. endolymphatic sac surgery). The Meniett® low-pressure pulse generator (Medtronic ENT, 1999) is a device that is designed to generate a computer-controlled sequence of low-pressure (micro-pressure) pulses, which are thought to be transmitted to the vestibular system of the inner ear. The pressure pulse passes via a tympanostomy tube (grommet) to the middle ear, and hence to the inner ear via the round and/or oval window. The hypothesis is that these low-pressure pulses reduce endolymphatic hydrops. OBJECTIVES: To assess the effects of positive pressure therapy (e.g. the Meniett device) on the symptoms of Ménière's disease or syndrome. 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; Cambridge Scientific Abstracts; ICTRP and additional sources for published and unpublished trials. The date of the search was 6 June 2014. SELECTION CRITERIA: Randomised controlled trials (RCTs) comparing positive pressure therapy (using the Meniett or a similar device) with placebo in patients with Ménière’s disease. The primary outcome was control of vertigo; secondary outcomes were loss or gain of hearing, severity of tinnitus, perception of aural fullness, functional level, complications or adverse effects, and sick days. DATA COLLECTION AND ANALYSIS: Two authors independently selected studies, assessed risk of bias and extracted data. We contacted authors for additional data. Where possible, we pooled study results using a fixed-effect, mean difference (MD) meta-analysis and tested for statistical heterogeneity using both the Chi² test and I² statistic. This was only possible for the secondary outcomes loss or gain of hearing and sick days. We presented results using forest plots with 95% confidence intervals (CI). MAIN RESULTS: We included five randomised clinical trials with 265 participants. All trials were prospective, double-blind, placebo-controlled randomised controlled trials on the effects of positive pressure therapy on vertigo complaints in Ménière’s disease. Overall, the risk of bias varied: three out of five studies were at low risk, one was at unclear risk and one was at high risk of bias. Control of vertigo For the primary outcome, control of vertigo, it was not possible to pool data due to heterogeneity in the measurement of the outcome measures. In most studies, no significant difference was found between the positive pressure therapy group and the placebo group in vertigo scores or vertigo days. Only one study, at low risk of bias, showed a significant difference in one measure of vertigo control in favour of positive pressure therapy. In this study, the mean visual analogue scale (VAS) score for vertigo after eight weeks of treatment was 25.5 in the positive pressure therapy group and 46.6 in the placebo group (mean difference (MD) -21.10, 95% CI -35.47 to -6.73; scale not stated - presumed to be 0 to 100). Secondary outcomes For the secondary outcomes, we carried out two pooled analyses. We found statistically significant results for loss or gain of hearing. Hearing was 7.38 decibels better in the placebo group compared to the positive pressure therapy group (MD) (95% CI 2.51 to 12.25; two studies, 123 participants). The severity of tinnitus and perception of aural fullness were either not measured or inadequate data were provided in the included studies. For the secondary outcome functional level, it was not possible to perform a pooled analysis. One included study showed less functional impairment in the positive pressure group than the placebo group (AAO-HNS criteria, one- to six-point scale: MD -1.10, 95% CI -1.81 to -0.39, 40 participants); another study did not show any significant results. In addition to the predefined secondary outcome measures, we included sick days as an additional outcome measure, as two studies used this outcome measure and it is a complementary measurement of impairment due to Ménière's disease. We did not find a statistically significant difference in sick days. No complications or adverse effects were noted by any study. AUTHORS’ CONCLUSIONS: There is no evidence, from five included studies, to show that positive pressure therapy is effective for the symptoms of Ménière's disease. There is some moderate quality evidence, from two studies, that hearing levels are worse in patients who use this therapy. The positive pressure therapy device itself is minimally invasive. However, in order to use it, a tympanostomy tube (grommet) needs to be inserted, with the associated risks. These include the risks of anaesthesia, the general risks of any surgery and the specific risks of otorhhea and tympanosclerosis associated with the insertion of a tympanostomy tube. Notwithstanding these comments, no complications or adverse effects were noted in any of the included studies.
Meniere's disease: histopathology, cytochemistry, and imaging.

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Meniere's disease is a poorly understood, disabling syndrome causing spells of vertigo, hearing fluctuation, tinnitus, and aural fullness. In this paper, we present a review of the histopathology, cytochemistry, and imaging of Ménière's disease. Histopathology is significant for neuroepithelial damage with hair cell loss, basement membrane thickening, and perivascular microvascular damage. Cytochemical alterations are significant for altered AQP4 and AQP6 expression in the supporting cell, and altered cochlin and mitochondrial protein expression. Current developments include imaging techniques to determine the degree and presence of endolymphatic hydrops, and future studies will endeavor to correlate the observance of hydrops with clinical findings. © 2015 New York Academy of Sciences.

Association between idiopathic intracranial hypertension and sigmoid sinus dehiscence/diverticulum with pulsatile tinnitus: a retrospective imaging study.
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INTRODUCTION: The mechanism of occurrence of sigmoid sinus dehiscence/diverticulum (SSDD) in pulsatile tinnitus (PT) patients remains under debate. Its association with idiopathic intracranial hypertension (IIH) lacks evidence, which is important for therapeutic planning and improving the clinical outcome. This study aimed to evaluate the association between SSDD and IIH by comparing the prevalence of several established imaging features of IIH between PT patients with SSDD and healthy volunteers. METHODS: Thirty-three unilateral PT patients with SSDD identified on CT images and 33 age- and sex-matched healthy volunteers underwent T1-weighted volumetric magnetic resonance imaging (MRI). The optic nerve, pituitary gland, transverse sinus, and ventricles were assessed. The prevalence of established IIH imaging features was compared between the two groups. Furthermore, the PT patients were divided into two subgroups: PT patients with dehiscence only and PT patients with diverticulum. The same statistical analysis was performed on each pathophysiologic entity respectively. RESULTS: The PT patients with SSDD showed a significantly higher prevalence of empty sella (P < 0.001), flattened posterior sclera (P = 0.001), vertical tortuosity of the optic nerve (P = 0.001), protrusion of the optic nerve (P = 0.006), transverse sinus stenosis (P = 0.011), and distension of the optic nerve sheath (P = 0.000). There were no significant differences between the PT and control groups in the maximum widths of the third and fourth ventricles and the lateral ventricle size. In contrast to controls, the imaging findings persisted in both of pathophysiologic entities, except for transverse sinus stenosis. CONCLUSIONS: Several IIH imaging features occur more frequently in PT patients with SSDD than in healthy individuals, which suggests a potential correlation between SSDD with PT and IIH.

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The present study was designed to verify the correlation between tinnitus and temporomandibular joint dysfunction. 86 consecutive patients were enrolled in the study, all affected by subjective tinnitus without hearing impairment, from both genders, age between 18 and 60 years old. The final number of patients included in the study was 55. All patients received a temporo-mandibular joint examination. All the patients were asked to rate the severity of their symptoms before and after treatment using a VAS scale and the Tinnitus Handicap Inventory (THI) and they followed a standardized protocol for the investigation of tinnitus. All the subjects were monitored by the same researcher and they underwent the same splint treatment. The comparison between pre- and posttreatment phase scores showed in patients with predisposition of TMD and with TMD a statistically significant decrease of THI and VAS values. The characteristics of tinnitus and the degree of response to treatment confirmed the relationship between tinnitus and TMD. The authors believe that, when the most common causes of tinnitus, such as otologic disorders and neurological diseases are excluded, it is correct to evaluate the functionality of the temporo-mandibular joint and eventually treat its pathology to obtain tinnitus improvement or even resolution. Copyright © 2015 European Association for Cranio-Maxillo-Facial Surgery. Published by Elsevier Ltd. All rights reserved.

Diagnostic criteria for Menière's disease.


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This paper presents diagnostic criteria for Menière’s disease jointly formulated by the Classification Committee of the Bárány Society, The Japan Society for Equilibrium Research, the European Academy of Otology and Neurotology (EAONO), the Equilibrium Committee of the American Academy of Otolaryngology-Head and Neck Surgery (AAO-HNS) and the Korean Balance Society. The classification includes two categories: definite Menière’s disease and probable Menière’s disease. The diagnosis of definite Menière’s disease is based on clinical criteria and requires the observation of an episodic vertigo syndrome associated with low- to medium-frequency sensorineural hearing loss and fluctuating aural symptoms (hearing, tinnitus and/or fullness) in the affected ear. Duration of vertigo episodes is limited to a period between 20 minutes and 12 hours. Probable Menière’s disease is a broader concept defined by episodic vestibular symptoms (vertigo or dizziness) associated with fluctuating aural symptoms occurring in a period from 20 minutes to 24 hours.
Jugulotympanic paraganglioma: a rare cause of vertigo.

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Background Jugulotympanic paraganglioma generally presents in the 5th or 6th decades of life with tinnitus and hearing loss. In this manuscript, we present a rare case of jugulotympanic paraganglioma presenting in the 9th decade with vertigo as the most bothersome symptom. Case Report An 83-year-old woman presented with worsening episodes of dizziness of a few months duration. She also complained of tinnitus and hearing loss, more severe on the left side. Examination revealed a red bulging left-sided tympanic membrane, conductive hearing loss, and a bruit at the base of the skull. Dix-Hallpike test was negative. CT head and MRI brain revealed findings consistent with a large left-sided jugulotympanic paraganglioma, which was found to be hormonally inactive on laboratory tests. The patient underwent treatment with radiotherapy, which resulted in partial improvement of symptoms. Conclusions Jugulotympanic paraganglioma may manifest in the elderly with the chief complaint of intermittent vertigo, as in our case. A red bulging mass on otoscopy raises the suspicion, necessitating further investigations, including CT and MRI.

Mental Health and Subjective Well-being of Individuals with Ménière's: Cross-sectional Analysis in the UK Biobank.
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Tyrrell J1, White MP, Barrett G, Ronan N, Phoenix C, Whinney DJ, Osborne NJ.

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HYPOTHESIS: Ménière's disease significantly impacts on an individual's mental health and subjective well-being (SWB). BACKGROUND: Ménière's disease is an unpredictable illness that impacts on mental health. The symptom triad of vertigo, tinnitus, and hearing loss all contribute to the disabling nature of the condition. To date, limited research has investigated the mental health and SWB impact of Ménière's disease. METHODS: We investigated the mental health and SWB of 1,376 Ménière's sufferers in the UK Biobank and compared this to over 500,000 controls. Participants in the Biobank were asked 38 questions pertaining to mental health and SWB. We utilized crude and adjusted linear and logistic regression to investigate the association between Ménière's and mental health and SWB. We also investigated how mental health and SWB might be related to length of diagnosis to see whether people might adapt to Ménière's over time. RESULTS: Ménière's was associated with increased frequency of depression, tiredness, tenseness, and unenthusiasm in the 2 weeks before recruitment. Ménière's was associated with longer periods of depression than controls (10.2 wk [95% CI: 5.2-15.2 wk]). Reduced health satisfaction was associated with Ménière's, but in other aspects of life (general happiness, work, family, friends, financial), individuals with Ménière's were as happy as controls. Mental health and SWB in individuals diagnosed for longer was better than in those who were recently diagnosed suggesting at least partial adaptation. DISCUSSION:This is the largest population study investigating the mental health impact of Ménière's. Our findings suggest that Ménière's adversely impacts on mental health, an individual's emotional state, and their life satisfaction. However, our findings raise the importance of supporting social relations for people with Ménière's and that although a cure is not currently available, we can still learn much about the adaptation strategies developed by long-term sufferers to help individuals with new diagnoses.
Glutamic acid decarboxylase levels in the cochlear nucleus of rats with acoustic trauma-induced chronic tinnitus.
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Tinnitus is the perception of phantom sounds, a phenomenon believed to be due to abnormal neuronal activity in auditory regions of the CNS such as the brainstem cochlear nucleus (CN). One possible mechanism for the abnormal neuronal activity in the CN, supported by recent animal studies, is a decrease in GABAergic inhibition. One possible explanation for this is a decrease in the enzyme responsible for the synthesis of GABA, glutamic acid decarboxylase (GAD). In this study, we used immunohistochemistry to analyse the levels of GAD in the dorsal and ventral CN of rats that had been exposed to noise trauma and had been confirmed to exhibit psychophysical evidence of tinnitus (at 17.5 weeks post-exposure) using a conditioned behavioural task. At 22 weeks following noise trauma or sham treatment, the levels of GAD in the dorsal and ventral CN were not significantly different. This result suggests that acoustic trauma that can cause chronic tinnitus is not associated with changes in GAD in the CN at 22 weeks post-exposure.

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Partial to Complete Suppression of Unilateral Noise-Induced Tinnitus in Rats after Cyclobenzaprine Treatment.
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Some forms of tinnitus are believed to arise from abnormal central nervous system activity following a single or repeated noise exposure, for which there are no widely accepted pharmacological treatments. One central site that could be related to tinnitus awareness or modulation is the locus coeruleus, a brainstem structure associated with stress, arousal, and attention. In the present study, we evaluated the effects of cyclobenzaprine, a drug known to act on the rat locus coeruleus, on noise-induced tinnitus using Gap Prepulse Inhibition of the Acoustic Startle (GPIAS). In untreated rats, brief silent gaps presented prior to a 5-10-kHz bandpass startling stimulus produced robust GPIAS. Treatment with cyclobenzaprine alone had no effect on the ability of gaps to suppress the startle response. When animals were exposed to intense narrow-band (126 dB SPL, 16 kHz, 100 Hz BW) unilateral noise, GPIAS was significantly reduced, suggesting the presence of tinnitus. Following the noise exposure, a subset of rats that maintained a robust startle response continued to show GPIAS impairment at 6-20 kHz, 40 days post-noise, suggesting chronic tinnitus. When this subset of animals was treated with cyclobenzaprine, at a dose that had no significant effects on the startle response (0.5 mg/kg), GPIAS recovered partially or to near baseline levels at the affected frequencies. These results were consistent with the absence of tinnitus. By 48 h post-treatment, evidence of tinnitus re-emerged. Our results suggest that cyclobenzaprine was effective in transiently suppressing noise-induced tinnitus in rats.
Restoring synaptic connections in the inner ear after noise damage.

Cunningham LL, Tucci DL.

Prolonged exposure to noise results in loss of ribbon synapses, composed in part by superclusters of neurotransmitter vesicles in the sensory hair cells of the cochlea. Expression of a nerve growth factor in mouse cochlea mitigates noise-induced damage and hearing loss.

In vivo fluorescence sensing of the salicylate-induced change of zinc ion concentration in the auditory cortex of rat brain.

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This study demonstrates a fluorescence method for in vivo sensing of the dynamic change of Zn(2+) concentration in auditory cortex microdialysates induced by salicylate with N’-(7-nitro-2,1,3-benzoxadiazole-4-yl)-N,N,N’-tris(pyridine-2-ylmethyl) ethane-1,2-diamine (NBD-TPEA) as a probe. The excellent properties of the NBD-TPEA probe make it possible to achieve a high selectivity for Zn(2+) sensing with the co-existence of amino acids and other metal ions as well as the species commonly existing in the cerebral system. To validate the method for in vivo fluorescence sensing of Zn(2+) in the rat brain, we pre-mix the microdialysates in vivo sampled from the auditory cortex with the NBD-TPEA probe and then perfuse the mixtures into a fluorescent cuvette for continuous-flow fluorescence detection. The method demonstrated here shows a linear relationship between the signal output and Zn(2+) concentration within the concentration range from 0.5 μM to 4 μM, with a detection limit of 156 nM (S/N = 3). The basal level of extracellular Zn(2+) in auditory cortex microdialysates is determined to be 0.52 ± 0.082 μM (n = 4). This value is increased by the injection of 100 mg mL(-1) of salicylate (1 μL min(-1), 5 min, i.p.), reaches a peak at the time point of 90 min, and levels off with time. Such an increase is attenuated by the injection of MK-801, a potent and specific NMDA receptor antagonist, after the pre-injection of 100 mg mL(-1) salicylate for 5 min. This study offers a fluorescence method for in vivo sensing of Zn(2+) in the rat brain that could be useful for the investigations of chemical processes involved in brain functions.

Expression of immediate-early genes in the dorsal cochlear nucleus in salicylate-induced tinnitus.
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Spontaneous neuronal activity in dorsal cochlear nucleus (DCN) may be involved in the physiological processes underlying salicylate-induced tinnitus. As a neuronal activity marker, immediate-early gene (IEG) expression, especially activity-dependent cytoskeletal protein (Arc/Arg3.1) and the early growth response gene-1 (Egr-1), appears to be highly correlated with sensory-evoked neuronal activity. However, their relationships with tinnitus induced by salicylate have rarely been reported in the DCN. In this study, we assessed the effect of acute and chronic salicylate treatment on the expression of N-methyl D-aspartate receptor subunit 2B (NR2B), Arg3.1, and Egr-1. We also observed ultrastructural alterations in the DCN synapses in an animal model of tinnitus. Levels of mRNA and protein expression of NR2B and Arg3.1 were increased in rats that were chronically administered salicylate (200 mg/kg, twice daily for 3, 7, or 14 days). These levels returned to baseline 14 days after cessation of treatment. However, no significant changes were observed in Egr-1 gene expression in any groups. Furthermore, rats subjected to long-term salicylate administration showed more presynaptic vesicles, thicker and longer postsynaptic densities, and increased synaptic interface curvature. Alterations of Arg3.1 and NR2B may be responsible for the changes in the synaptic ultrastructure. These changes confirm that salicylate can cause neural plasticity changes at the DCN level.
Forward acoustic masking enhances the auditory brainstem response in a diotic, but not dichotic, paradigm in salicylate-induced tinnitus.

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We recently reported that forward acoustic masking can enhance the auditory brainstem response (ABR) in rats treated with a high dose of sodium salicylate (NaSal), a tinnitus inducer, when tested in open acoustic field (Liu and Chen, 2012, Brain Research 1485, 88-94). In the present study, we first replicated this experiment in closed acoustic field under two conditions: (1) the forward masker and the probe were presented to both ears (diotic paradigm); (2) the forward masker was presented to one ear and the probe to the other ear (dichotic paradigm). We found that only when the stimuli were presented by using the diotic, rather than the dichotic, paradigm could forward acoustic masking enhance the ABR in the rat treated with NaSal (300 mg/kg). The enhancement was obvious for ABR waves II and IV, but not for wave I, indicating a central origin. The enhancement occurred at the high frequencies (16, 24, 32 kHz) at which the animals demonstrated a tinnitus-like behavior as revealed by using the gap prepulse inhibition of acoustic startle paradigm. We then administered vigabatrin, a GABA transaminase inhibitor, in the animals to suppress NaSal-induced tinnitus. The vigabatrin treatment successfully prevented forward acoustic masking from enhancing the ABR. These findings demonstrate that the observed enhancement of ABRs by forward acoustic masking originates in the central auditory pathway ipsilateral to the stimulated ear. We propose that the enhancement is closely associated with NaSal-induced tinnitus. Copyright © 2015. Published by Elsevier B.V.

Pairing broadband noise with cortical stimulation induces extensive suppression of ascending sensory activity.

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Objective. The corticofugal system can alter coding along the ascending sensory pathway. Within the auditory system, electrical stimulation of the auditory cortex (AC) paired with a pure tone can cause egocentric shifts in the tuning of auditory neurons, making them more sensitive to the pure tone frequency. Since tinnitus has been linked with hyperactivity across auditory neurons, we sought to develop a new neuromodulation approach that could suppress a wide range of neurons rather than enhance specific frequency-tuned neurons. Approach. We performed experiments in the guinea pig to assess the effects of cortical stimulation paired with broadband noise (PN-Stim) on ascending auditory activity within the central nucleus of the inferior colliculus (CNIC), a widely studied region for AC stimulation paradigms. Main results. All eight stimulated AC subregions induced extensive suppression of activity across the CNIC that was not possible with noise stimulation alone. This suppression built up over time and remained after the PN-Stim paradigm. Significance. We propose that the corticofugal system is designed to decrease the brain's input gain to irrelevant stimuli and PN-Stim is able to artificially amplify this effect to suppress neural firing across the auditory system. The PN-Stim concept may have potential for treating tinnitus and other neurological disorders.
Alterations in peripheral and central components of the auditory brainstem response: a neural assay of tinnitus.

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Chronic tinnitus, or "ringing of the ears", affects upwards of 15% of the adult population. Identifying a cost-effective and objective measure of tinnitus is needed due to legal concerns and disability issues, as well as for facilitating the effort to assess neural biomarkers. We developed a modified gap-in-noise (GIN) paradigm to assess tinnitus in mice using the auditory brainstem response (ABR). We then compared the commonly used acoustic startle reflex gap-prepulse inhibition (gap-PPI) and the ABR GIN paradigm in young adult CBA/CaJ mice before and after administrating sodium salicylate (SS), which is known to reliably induce a 16 kHz tinnitus percept in rodents. Post-SS, gap-PPI was significantly reduced at 12 and 16 kHz, consistent with previous studies demonstrating a tinnitus-induced gap-PPI reduction in this frequency range. ABR audiograms indicated thresholds were significantly elevated post-SS, also consistent with previous studies. There was a significant increase in the peak 2 (P2) to peak 1 (P1) and peak 4 (P4) to P1 amplitude ratios in the mid-frequency range, along with decreased latency of P4 at higher intensities. For the ABR GIN, peak amplitudes of the response to the second noise burst were calculated as a percentage of the first noise burst response amplitudes to quantify neural gap processing. A significant decrease in this ratio (i.e. recovery) was seen only at 16 kHz for P1, indicating the presence of tinnitus near this frequency. Thus, this study demonstrates that GIN ABRs can be used as an efficient, non-invasive, and objective method of identifying the approximate pitch and presence of tinnitus in a mouse model. This technique has the potential for application in human subjects and also indicates significant, albeit different, deficits in temporal processing in peripheral and brainstem circuits following drug induced tinnitus. Free article.

Noise Trauma Induced Neural Plasticity Throughout the Auditory System of Mongolian Gerbils: Differences between Tinnitus Developing and Non-Developing Animals.


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In this study, we describe differences between neural plasticity in auditory cortex (AC) of animals that developed subjective tinnitus (group T) after noise-induced hearing loss (NIHL) compared to those that did not [group non-tinnitus (NT)]. To this end, our analysis focuses on the input activity of cortical neurons based on the temporal and spectral analysis of local field potential (LFP) recordings and an in-depth analysis of auditory brainstem responses (ABR) in the same animals. In response to NIHL in NT animals we find a significant general reduction in overall cortical activity and spectral power as well as changes in all ABR wave amplitudes as a function of loudness. In contrast, T-animals show no significant change in overall cortical activity as assessed by root mean square analysis of LFP amplitudes, but a specific increase in LFP spectral power and in the amplitude of ABR wave V reflecting activity in the inferior colliculus (IC). Based on these results, we put forward a refined model of tinnitus prevention after NIHL that acts via a top-down global (i.e., frequency-unspecific) inhibition reducing overall neuronal activity in AC and IC, thereby counteracting NIHL-induced bottom-up frequency-specific neuroplasticity suggested in current models of tinnitus development. Free article.
Dynamic representation of spectral edges in the guinea pig primary auditory cortex.
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The central representation of a given acoustic motif is thought to be strongly context-dependent, i.e. to rely on the spectro-temporal past and present of the acoustic mixture in which it is embedded. The present study investigated in guinea pig the cortical representation of spectral edges (i.e. where the stimulus energy changes abruptly over frequency) and its dependence on stimulus duration and depth of the spectral contrast. We devised a stimulus ensemble composed of random tone pips with or without an attenuated frequency band (AFB) of variable depth. Also, the multi-tone ensemble with AFB was interleaved with periods of silence or with multi-tone ensembles without AFB. We show that the representation of the frequencies near but outside the AFB is greatly enhanced whereas the representation of frequencies near and inside the AFB is strongly suppressed. These cortical changes depend on the depth of the AFB: although they are maximal for the largest depth of the AFB, they are also statistically significant for depths as small as 10 dB. Finally, the cortical changes are quick, as they occur within a few seconds of the presentation of the stimulus ensemble with AFB, and are very labile as they disappear within a few seconds after the presentation of the stimulus-ensemble without AFB. Overall, this study demonstrates that the representation of spectral edges is dynamically enhanced in the auditory centers. These central changes may have important functional implications, in particular in noisy environments where it could contribute to preserve the central representation of spectral edges. Copyright © 2014, Journal of Neurophysiology.

Salicylate-induced hearing loss and gap detection deficits in rats.

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To test the "tinnitus gap-filling" hypothesis in an animal psychoacoustic paradigm, rats were tested using a go/no-go operant gap detection task in which silent intervals of various durations were embedded within a continuous noise. Gap detection thresholds were measured before and after treatment with a dose of sodium salicylate (200 mg/kg) that reliably induces tinnitus in rats. Noise-burst detection thresholds were also measured to document the amount of hearing loss and aid in interpreting the gap detection results. As in the previous human psychophysical experiments, salicylate had little or no effect on gap thresholds measured in broadband noise presented at high-stimulus levels (30-60 dB SPL); gap detection thresholds were always 10 ms or less. Salicylate also did not affect gap thresholds presented in narrowband noise at 60 dB SPL. Therefore, rats treated with a dose of salicylate that reliably induces tinnitus have no difficulty detecting silent gaps as long as the noise in which they are embedded is clearly audible. Free full text.
Assessment of the Potential Ototoxicity of High-Dose Celecoxib, a Selective Cyclooxygenase-2 Inhibitor, in Rats.

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OBJECTIVE: To evaluate the potential ototoxicity of high-dose celecoxib, a selective cyclooxygenase-2 (COX-2) inhibitor. STUDY DESIGN: Prospective animal study. SETTING: Laboratory. METHODS: Twenty adult male Sprague Dawley rats were divided into 2 groups for hearing and tinnitus tests, respectively. The auditory brain-stem response (ABR) and the gap prepulse inhibition of acoustic startle (GPIAS) were used as indicators of hearing loss and tinnitus, respectively, and were measured before and at 2, 4, 6, 8, 12, 24, and 48 hours after administration of celecoxib (2 g/kg) via gavage. RESULTS: ABR threshold and wave III latencies did not increase significantly at any frequency following celecoxib administration, at any time point (P > .05). GPIAS remained below 30% after celecoxib, from a baseline of 20.03% ± 3.62%; no change was significant. CONCLUSION: High-dose celecoxib (2 g/kg), a selective COX-2 inhibitor, did not cause hearing loss or tinnitus in Sprague Dawley rats within 48 hours of administration. Further studies are needed to explore the roles played by COX-related mechanisms when nonselective COX inhibitors induce ototoxicity. © American Academy of Otolaryngology—Head and Neck Surgery Foundation 2015.

Serotonergic regulation of excitability of principal cells of the dorsal cochlear nucleus.

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The dorsal cochlear nucleus (DCN) is one of the first stations within the central auditory pathway where the basic computations underlying sound localization are initiated and heightened activity in the DCN may underlie central tinnitus. The neurotransmitter serotonin (5-hydroxytryptamine; 5-HT), is associated with many distinct behavioral or cognitive states, and serotonergic fibers are concentrated in the DCN. However, it remains unclear what is the function of this dense input. Using a combination of in vitro electrophysiology and optogenetics in mouse brain slices, we found that 5-HT directly enhances the excitability of fusiform principal cells via activation of two distinct 5-HT receptor subfamilies, 5-HT2A/2CR (5-HT2A/2C receptor) and 5-HT7R (5-HT7 receptor). This excitatory effect results from an augmentation of hyperpolarization-activated cyclic nucleotide-gated channels (Ih or HCN channels). The serotonergic regulation of excitability is G-protein-dependent and involves cAMP and Src kinase signaling pathways. Moreover, optogenetic activation of serotonergic axon terminals increased excitability of fusiform cells. Our findings reveal that 5-HT exerts a potent influence on fusiform cells by altering their intrinsic properties, which may enhance the sensitivity of the DCN to sensory input. Copyright © 2015 the authors 0270-6474/15/354540-12$15.00/0.
The Gap Detection Test: Can It Be Used to Diagnose Tinnitus?
Ear Hear. 2015 Mar 27. [Epub ahead of print]

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OBJECTIVES: Animals with induced tinnitus showed difficulties in detecting silent gaps in sounds, suggesting that the tinnitus percept may be filling the gap. The main purpose of this study was to evaluate the applicability of this approach to detect tinnitus in human patients. The authors first hypothesized that gap detection would be impaired in patients with tinnitus, and second, that gap detection would be more impaired at frequencies close to the tinnitus frequency of the patient. DESIGN: Twenty-two adults with bilateral tinnitus, 20 age-matched and hearing loss-matched subjects without tinnitus, and 10 young normal-hearing subjects participated in the study. To determine the characteristics of the tinnitus, subjects matched an external sound to their perceived tinnitus in pitch and loudness. To determine the minimum detectable gap, the gap threshold, an adaptive psychoacoustic test was performed three times by each subject. In this gap detection test, four different stimuli, with various frequencies and bandwidths, were presented at three intensity levels each. RESULTS: Similar to previous reports of gap detection, increasing sensation level yielded shorter gap thresholds for all stimuli in all groups. Interestingly, the tinnitus group did not display elevated gap thresholds in any of the four stimuli. Moreover, visual inspection of the data revealed no relation between gap detection performance and perceived tinnitus pitch. CONCLUSIONS: These findings show that tinnitus in humans has no effect on the ability to detect gaps in auditory stimuli. Thus, the testing procedure in its present form is not suitable for clinical detection of tinnitus in humans.

Cochlear ablation effects on amino acid levels in the chinchilla cochlear nucleus.

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Inner ear damage can lead to hearing disorders, including tinnitus, hyperacusis, and hearing loss. We measured the effects of severe inner ear damage, produced by cochlear ablation, on the levels and distributions of amino acids in the first brain center of the auditory system, the cochlear nucleus. Measurements were also made for its projection pathways and the superior olivary nuclei. Cochlear ablation produces complete degeneration of the auditory nerve, which provides a baseline for interpreting the effects of partial damage to the inner ear, such as that from ototoxic drugs or intense sound. Amino acids play a critical role in neural function, including neurotransmission, neuromodulation, cellular metabolism, and protein construction. They include major neurotransmitters of the brain - glutamate, glycine, and γ-aminobutyrate (GABA) - as well as others closely related to their metabolism and/or functions - aspartate, glutamine, and taurine. Since the effects of inner ear damage develop over time, we measured the changes in amino acid levels at various survival times after cochlear ablation. Glutamate and aspartate levels decreased by 2 weeks in the ipsilateral ventral cochlear nucleus and deep layer of the dorsal cochlear nucleus, with the largest decreases in the posteroventral cochlear nucleus (PVCN): 66% for glutamate and 63% for aspartate. Aspartate levels also decreased in the lateral part of the ipsilateral trapezoid body, by as much as 50%, suggesting a transneuronal effect. GABA and glycine levels showed
some bilateral decreases, especially in the PVCN. These results may represent the state of amino acid metabolism in the cochlear nucleus of humans after removal of eighth nerve tumors, which routinely involves destruction of the auditory nerve. Measurement of chemical changes following inner ear damage may increase understanding of the pathogenesis of hearing impairments and enable improvements in their diagnosis and treatment. Copyright © 2015. Published by Elsevier Ltd.

Cannabinoid CB1 Receptor Agonists Do Not Decrease, but may Increase Acoustic Trauma-Induced Tinnitus in Rats.
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Tinnitus has been suggested to arise from neuronal hyperactivity in auditory areas of the brain, and antiepileptic drugs are sometimes used to provide relief from tinnitus. Recently, the anti-epileptic properties of the cannabinoid drugs have gained increasing interest; however, the use of cannabinoids as a form of treatment for tinnitus is controversial. In this study, we tested whether a combination of del-ta-9-tetrahydrocannabinol (delta-9-THC) and cannabidiol (CBD), delivered in a 1:1 ratio, could affect tinnitus perception in a rat model of acoustic trauma-induced tinnitus. Following sham treatment or acoustic trauma, the animals were divided into the following groups: (1) sham (i.e., no acoustic trauma) with vehicle treatment; (2) sham with drug treatment (i.e., delta-9-THC + CBD); (3) acoustic trauma-exposed exhibiting tinnitus, with drug treatment; and (4) acoustic trauma-exposed exhibiting no tinnitus, with drug treatment. The animals received either the vehicle or the cannabinoid drugs every day, 30 min before the tinnitus behavioral testing. Acoustic trauma caused a significant increase in the auditory brainstem response (ABR) thresholds in the exposed animals, indicating hearing loss; however, there was a partial recovery over 6 months. Acoustic trauma did not always result in tinnitus; however, among those that did exhibit tinnitus, some of them had tinnitus at multiple frequencies while others had it only at a single frequency. The cannabinoids significantly increased the number of tinnitus animals in the exposed-tinnitus group, but not in the sham group. The results suggest that cannabinoids may promote the development of tinnitus, especially when there is pre-existing hearing damage. Free PMC Article.

Neural substrates of tinnitus in animal and human cortex: Cortical correlates of tinnitus.
HNO. 2015 Apr;63(4):298-301.
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Animal models of tinnitus complement human findings and potentially deepen our insight into the neural substrates of tinnitus. The fact that animal data are largely based on recordings from the auditory system, in particular from subcortical structures, makes comparison with human electrophysiological data from pre-dominantly cortical areas difficult. Electro/magnetoencephalography and imaging data extend beyond the auditory cortex. The most challenging link to be made is the one between the macroscopic data in humans and the microscopic (single neuron action potentials) and mesoscopic (local field potentials) results obtained in animal models. Since invasive recordings in humans are rare, a bridge needs to be built on the basis of changes in brain rhythms in animals with putative tinnitus.


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High dose sodium salicylate causes moderate, reversible hearing loss and tinnitus. Salicylate-induced hearing loss is believed to arise from a reduction in the electromotile response of outer hair cells (OHCs) and/or reduction of KCNQ4 potassium currents in OHCs, which decreases the driving force for the transduction current. Therefore, enhancing OHC potassium currents could potentially prevent salicylate-induced temporary hearing loss. In this study, we tested whether opening voltage-gated potassium channels using ICA-105665, a novel small molecule that opens KCNQ2/3 and KCNQ3/5 channels, can reduce salicylate-induced hearing loss. We found that systemic application of ICA-105665 at 10 mg/kg prevented the salicylate-induced amplitude reduction and threshold shift in the compound action potentials recorded at the round window of the cochlea. ICA-105665 also prevented the salicylate-induced reduction of distortion-product otoacoustic emission. These results suggest that ICA-105665 partially compensates for salicylate-induced cochlear hearing loss by enhancing KCNQ2/3 and KCNQ3/5 potassium currents and the motility of OHCs. Free PMC Article.

XVII Psychological Factors


Haab L, Mortezapouraghdam Z, Strauss DJ.

The pathologic auditory sensation in decompensated tinnitus patients is accompanied by the inability to habituate even temporary to this sound. This disability might originate from simultaneous activation of brain areas for the appraisal of the stimulus valence as, e.g., the limbic system. This coactivation of limbic areas is likely to modulate the degree and persistence of selective attention assigned to the tinnitus stream, which in turn could also explain interindividual differences in tinnitus loudness perception. Preliminary studies demonstrate that the amount of allocated attention and the habituation deficit can be mapped to changes in auditory late evoked responses (ALRs). Utilizing a numerical model for the simulation of ALRs we were able to predict a general habituation behavior in two patient groups with different degrees of tinnitus severity. Evaluating the instantaneous phase of simulated and measured ALRs by its von Mises concentration parameter, we verify a habituation deficit relative to the degree of decompensation and thus provide additional support for our neurofunctional model of limbic influences on neural processing of sensory information.
The epworth sleepiness scale in the assessment of sleep disturbance in veterans with tinnitus.

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Purpose. Tinnitus and sleep disturbance are prevalent in veterans, and a better understanding of their relationship can help with tinnitus treatment. Materials and Methods. Retrospective chart review of 94 veterans seen in audiology clinic between 2010 and 2013 is presented. Results. The mean age was 62 years, and 93 of 94 veterans were males. The majority (96%) had hearing loss. The positive predictive value of the ESS for sleep disorder was 97% and the negative predictive value was 100%. Veterans with a Tinnitus Handicap Inventory (THI) score ≥38 had significantly higher Epworth Sleepiness Scale (ESS) scores compared to those with THI score <38 (P = 0.006). The former had a significantly higher incidence of PTSD, anxiety, and sleep disorder. A subgroup of patients had normal sleep despite rising THI scores. Bilateral tinnitus, vertigo, and anxiety were found to be predictors of sleep disturbance. Conclusions. The ESS can be used as a tool in the initial assessment of sleep disorders in veterans with tinnitus. Higher tinnitus handicap severity is significantly associated with greater sleep disturbance. Optimal management of tinnitus may require concomitant treatment of sleep disorder, PTSD, anxiety, and depression. Free PMC Article.

Acceptance of Tinnitus As an Independent Correlate of Tinnitus Severity.
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OBJECTIVES:: Tinnitus is the experience of sounds without an identified external source, and for some the experience is associated with significant severity (i.e., perceived negative affect, activity limitation, and participation restriction due to tinnitus). Acceptance of tinnitus has recently been proposed to play an important role in explaining heterogeneity in tinnitus severity. The purpose of the present study was to extend previous investigations of acceptance in relation to tinnitus by examining the unique contribution of acceptance in accounting for tinnitus severity, beyond anxiety and depression symptoms. DESIGN:: In a cross-sectional study, 362 participants with tinnitus attending an ENT clinic in Sweden completed a standard set of psychometrically examined measures of acceptance of tinnitus, tinnitus severity, and anxiety and depression symptoms. Participants also completed a background form on which they provided information about the experience of tinnitus (loudness, localization, sound characteristics), other auditory-related problems (hearing problems and sound sensitivity), and personal characteristics. RESULTS:: Correlational analyses showed that acceptance was strongly and inversely related to tinnitus severity and anxiety and depression symptoms. Multivariate regression analysis, in which relevant patient characteristics were controlled, revealed that acceptance accounted for unique variance beyond anxiety and depression symptoms. Acceptance accounted for more of the variance than anxiety and depression symptoms combined. In addition, mediation analysis revealed that acceptance of tinnitus mediated the direct association between self-rated loudness and tinnitus severity, even after anxiety and depression symptoms were taken into account. CONCLUSIONS:: Findings add to the growing body of work, supporting the unique and important role of acceptance in tinnitus severity. The utility of the concept is discussed in relation to the development of new psychological models and interventions for tinnitus severity. Providing earplugs to young adults at risk encourages protective behaviour in music venues.

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BACKGROUND: Tinnitus refers to the objective or subjective perception of a series of sounds most frequently described as ringing in the ear or within the head itself. Anxiety and depressive disorders frequently accompany this complaint. In this study, we aimed to investigate the presence of psychiatric symptoms and the degree of anxiety sensitivity in patients with chronic tinnitus. METHODS: Fifty patients with chronic tinnitus who had been followed up for at least 6 months or longer were enrolled in this study. All subjects completed the Anxiety Sensitivity Index-3 (ASI-3), Stait-Trait Anxiety Inventory (STAI), and Symptom Check List-90-Revised (SCL-90-R) questionnaires. Fifty healthy volunteers were given the same tests and a statistical comparison of the psychometric outcome data was done for subjects with and without chronic tinnitus. RESULTS: Patients with chronic tinnitus demonstrated higher statistically meaningful scores than the healthy group. Comparison between chronic tinnitus group and control group scores showed that patient group has a high rate of statistically significant results than controls; ASI-3, STAI-2, SCL-90-R GSI, SCL-90-R Somatization, SCL-90-R Depression, SCL-90-R Anxiety (z=-8.00, P<0.01), SCL-90-R Phobic Anxiety. CONCLUSION:Higher scores for anxiety sensitivity and other psychiatric symptoms in patients with chronic tinnitus reflects the prevalence of psychiatric disorders such as depression, anxiety, somatoform disorder, and chronic tinnitus. The finding of more psychiatric comorbidity in patients with chronic tinnitus indicates that planning and follow-up in both otolaryngology and psychiatry is necessary to improve the overall results of treatment. Free PMC Article.


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Tinnitus is the perception of sound in the absence of external stimulus. Currently, the pathophysiology of tinnitus is not fully understood, but recent studies indicate that alterations in the brain involve non-auditory areas, including the prefrontal cortex. In experiment 1, we used a go/no-go paradigm to evaluate the target detection speed and the inhibitory control in tinnitus participants (TP) and control subjects (CS), both in unimodal and bimodal conditions in the auditory and visual modalities. We also tested whether the sound frequency used for target and distractors affected the performance. We observed that TP were slower and made more false alarms than CS in all unimodal auditory conditions. TP were also slower than CS in the bimodal conditions. In addition, when comparing the response times in bimodal and auditory unimodal conditions, the expected gain in bimodal conditions was present in CS, but not in TP when tinnitus-matched frequency sounds were used as targets. In experiment 2, we tested the sensitivity to cross-modal interference in TP during auditory and visual go/no-go tasks where each stimulus was preceded by an irrelevant pre-stimulus in the untested modality (e.g. high frequency auditory pre-stimulus in visual no/no-go condition). We observed that TP had longer response times than CS and made more false alarms in all conditions. In addition, the highest false alarm rate occurred in TP when tinnitus-matched/high frequency sounds were used as pre-stimulus. We conclude that the inhibitory control is altered in TP and that TP are abnormally sensitive to cross-modal interference, reflecting difficulties to ignore irrelevant stimuli. The fact that the strongest interference effect was caused by tinnitus-like auditory stimulation is consistent with the hypothesis according to which such stimulations generate emotional responses that affect cognitive processing in TP. We postulate that executive functions deficits play a key-role in the perception and maintenance of tinnitus. Free full text.
Investigating the association between tinnitus severity and symptoms of depression and anxiety, while controlling for neuroticism, in a large middle-aged UK population.

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OBJECTIVE: Clinical studies indicate increased risk for depression and anxiety among tinnitus patients. However, population data are scarce, and no studies have controlled for neuroticism. We examined associations between tinnitus and symptoms of depression and anxiety in a large UK population, controlling for neuroticism, to explore whether neuroticism, as previously reported, fully explains the association between symptoms of depression and anxiety, and tinnitus. DESIGN: We used the UK Biobank resource. STUDY SAMPLE: 171,728 participants answered hearing questions. RESULTS: Using generalized linear modelling, we examined associations between tinnitus (mild to severe) and symptoms of depression and anxiety. Controlling for neuroticism, patients with severe tinnitus were at increased risk of depression (odds ratio (OR) = 1.27) and anxiety (OR = 1.11) symptoms, compared to those without tinnitus. CONCLUSIONS: Although it is not possible to determine whether tinnitus is a predisposing factor to depression, these results suggest an association. We suggest further exploration to determine the clinical significance of this association. Early psychosocial intervention aimed at reducing anxiety and depression in patients at increased risk might influence the extent to which tinnitus is experienced as troubling, and therefore psychological distress associated with it. Likewise, with tinnitus patients, assessment for anxiety/depression should be considered.

Acceptance Mediates the Relationship Between Tinnitus-Related Cognitions and Anxiety Sensitivity.

Moring J, Bowen A, Thomas J, Joseph J.

Purpose: Negative cognitions related to tinnitus sensation have been previously shown to impact the level of emotional distress. Anxiety sensitivity is another psychological factor that influences individuals to more closely monitor their own bodily sensations, resulting in increased negative cognitions and negative emotional responses among tinnitus patients. However, increasing acceptance of tinnitus sensation may attenuate emotional distress. The goal of this research was to investigate the relationship between negative tinnitus-related cognitions, acceptance, and anxiety sensitivity. Method: Two hundred sixty-seven participants completed online measures of the Tinnitus Handicap Inventory (THI), Acceptance and Action Questionnaire (AAQ), and the Anxiety Sensitivity Index-3. Results: Hierarchical regression analyses indicated that acceptance fully mediated the relationship between negative tinnitus-related cognitions and anxiety sensitivity. Conclusions: Based on these results, it is suggested that practitioners improve acceptance of tinnitus sensation, duration, and intensity. More research is warranted on the clinical techniques to improve acceptance.
The Role of Dysfunctional Cognitions in Patients With Chronic Tinnitus.
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OBJECTIVES: The present study investigates the role of dysfunctional cognitions in patients with chronic tinnitus. To explore different dimensions of tinnitus-related thoughts, a 22-item self-report measure, the "Tinnitus Cognitions Scale" (T-Cog), is presented. Furthermore, dysfunctional cognitions are examined as a possible mediator of the relation between tinnitus distress and depression. DESIGN: The present study analyzes the cross-sectional data of 373 patients with chronic tinnitus. Parallel analysis and principal axis factoring are used to identify the factor structure of the T-Cog. Assumed mediating effects are tested using the asymptotic and resampling procedure. RESULTS: Factor analysis reveals two factors interpreted as "tinnitus-related catastrophic thinking" and "tinnitus-related avoidance cognitions." Internal consistency is sufficient with a Cronbach's α of 0.88 for the total scale and 0.74 and 0.87 for the subscales. The authors find high associations between the T-Cog and other measures of tinnitus distress, depression, anxiety, and tinnitus acceptance, indicating convergent validity. With the exception of neuroticism, low correlations with personality factors are found, indicating discriminant validity. Patients with moderate or severe tinnitus distress report significantly higher scores of dysfunctional cognitions than patients with mild tinnitus distress. Tinnitus-related catastrophic thinking and tinnitus-related avoidance cognitions partially mediate the relation between tinnitus distress and depression. CONCLUSIONS: Dysfunctional cognitions can play an important role in the degree of tinnitus distress. Catastrophic and avoidant thoughts contribute to the explanation of depression among tinnitus patients. The T-Cog is a reliable and valid questionnaire for the assessment of different dimensions of cognitions. Its use could provide information for identifying tinnitus patients who are particularly suitable for cognitive-behavioral therapy.

Physical Activity, Tinnitus Severity, and Improved Quality of Life.
Ear Hear. 2015 Apr 22. [Epub ahead of print]

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OBJECTIVES: The objective of this study was to examine the effects of tinnitus severity on quality of life (QOL) and the benefits physical activity may have on tinnitus severity and QOL. The authors hypothesized that (1) QOL would be negatively correlated with tinnitus severity, (2) physical activity would be negatively correlated with tinnitus severity, (3) tinnitus severity and physical activity would have significant independent effects on QOL, and (4) physical activity would have significant and independent effects on tinnitus severity. DESIGN: An online survey was used to collect data from adults with tinnitus; 1030 individuals initiated the survey. Approximately 40% of responses were not included in data analysis due to incomplete data. The following measures were included in the survey: the Tinnitus Functional Index, the Godin Leisure-Time Exercise Question, the Medical Outcomes Study 36-item short form (Physical Component Score [PCS]; Mental Component Score [MCS]), and the Satisfaction with Life Scale (SWLS). Descriptive statistics, Pearson correlations, and multiple linear regression analyses were conducted. RESULTS: Higher levels of physical activity were significantly associated with improved health-related and global QOL and lower levels of tinnitus severity. Both tinnitus severity (12.3% SWLS, 3.8% PCS, and 21.2% MCS) and physical
activity (1.1% SWLS, 5.8% PCS, and 1.1% MCS) accounted for significant unique variations in the QOL measures. Physical activity accounted (0.8% Tinnitus Functional Index) for significant unique variation in tinnitus severity. CONCLUSIONS: Physical activity had a small but statistically significant correlation with QOL and tinnitus distress. Our results suggest that physical activity may be a management strategy for those with tinnitus, but further testing is necessary to assess the relationship between physical activity and tinnitus severity.

XVIII Hyperacusis

No publications this time.

XIX Heterogeneity of Tinnitus

Tinnitus Holistic Simplified Classification (THoSC): A New Assessment for Subjective Tinnitus, With Diagnostic and Therapeutic Implications.
Ann Otol Rhinol Laryngol. 2015 Feb 27. pii: 0003489415570931. [Epub ahead of print]

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OBJECTIVE: One of the most debated topics in tinnitus is its standard and practical classification. The most popular classification distinguishes subjective from objective tinnitus. Other classifications are based on different features. On the whole, they seem incomplete, and the diagnostic and therapeutic algorithms are often difficult for practical purposes. The aim of this work is to develop a new diagnostic and therapeutic algorithm. METHODS: Our model is based on 10 years of experience. In particular, the starting point is the data retrieved from 212 consecutive patients in our Tinnitus Unit between May and December 2013: We found a clear auditory disorder in 74.5% of the population, muscolo-skeletal disorders and/or trigeminal disease in 57.1%, and psychiatric comorbidities in 43.8%. Different features coexisted in 59.9% of the population. RESULTS: Following such data we propose the Tinnitus Holistic Simplified Classification, which takes into account the different tinnitus mechanisms and the interactions between them. It differentiates tinnitus that arises from: (1) auditory alterations (Auditory Tinnitus), (2) complex auditory-somatosensory interactions (Somatosensory Tinnitus), (3) psychopathological-auditory interactions (Psychopathology-related Tinnitus), and (4) 2 or all of the previous mechanisms (Combined Tinnitus). CONCLUSIONS: In our opinion this classification provides an accurate and easy tailored path to manage tinnitus patients. © The Author(s) 2015.
Tinnitus, the perception of sound in the absence of an external sound, usually results from a disorder of: (1) the auditory system (usually peripheral, rarely central); (2) the somatosensory system (head and neck); or (3) a combination of the two. Its cause can be determined through its characteristics. The history must include the tinnitus: (1) quality (including whether it can ever be pulsatile or have a clicking component); (2) location; (3) variability; (4) predominant pitch (low or high); and (5) whether the patient can do something to modulate the percept. In addition to the standard neuro-otologic examination, the exam should include inspection of the teeth for evidence of wear, listening around the ear and neck for sounds similar to the tinnitus, palpation of the craniocervical musculature for trigger points, and probing whether the tinnitus percept can be modulated with "somatic testing." All subjects should have a recent audiogram. Presently the most compelling tinnitus theory is the dorsal cochlear nucleus (DCN) hypothesis: both the auditory and somatosensory systems converge upon and interact within the DCN. If the activity of the DCN's somatosensory-interacting fusiform cells exceeds an individual's tinnitus threshold, then tinnitus results. © 2015 Elsevier B.V. All rights reserved.


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In Europe alone, over 70 million people experience tinnitus; for seven million people, it creates a debilitating condition. Despite its enormous socioeconomic relevance, progress in successfully treating the condition is somewhat limited. The European Union has approved funding to create a pan-European tinnitus research collaboration network (2014-2018). The goal of one working group is to establish an international standard for outcome measurements in clinical trials of tinnitus. Importantly, this would enhance tinnitus research by informing sample-size calculations, enabling meta-analyses, and facilitating the identification of tinnitus subtypes, ultimately leading to improved treatments. The first meeting followed a workshop on "Agreed Standards for Measurement: An International Perspective" with invited talks on clinimetrics and existing international initiatives to define core sets for outcome measurements in hearing loss (International classification of functioning, disability, and health core sets for hearing loss) and eczema (Harmonizing outcome measures for eczema). Both initiatives have taken an approach that clearly distinguishes the specification of what to measure from that of how to measure it. Meeting delegates agreed on taking a step-wise roadmap for which the first output would be a consensus on what outcome domains are essential for all trials. The working group seeks to embrace inclusivity and brings together clinicians, tinnitus researchers, experts on clinical research methodology, statisticians, and representatives of the health industry. People who experience tinnitus are another important participant group. This meeting report is a call to those stakeholders across the globe to actively participate in the initiative. © The Author(s) 2015.
**Cognitive Behavioral Therapy (CBT) for Tinnitus**

This study is completed. Has results.
ClinicalTrials.gov Identifier: NCT00724152
Sponsor: Department of Veterans Affairs
Information provided by (Responsible Party): Department of Veterans Affairs
Study start: February 2009
Study Completion: February 2011
Results first received: January 6, 2015

This study examined how useful it is to teach veterans coping skills for dealing with tinnitus, also called ringing in the ears. A psychological intervention, cognitive-behavioral therapy, was used to teach coping skills even though tinnitus is not a psychological disorder. Participants in Period 1 of the study were assigned to one of two groups for the duration of the study and were blinded to their group assignment until the end of the study. One group received education about tinnitus. The other group received education about tinnitus plus additional ways to cope with problems associated with tinnitus such as sleep disturbance and frustration. Participants were selected to participate if their tinnitus was severe and they had been exposed to loud sound. Participants attended up to six weekly group meetings. It was predicted that participants who were randomly assigned to the cognitive behavioral therapy group would report a greater reduction in tinnitus severity than education controls. During Period 2 of the study, a third "standard care" arm was added. Baseline and outcome data of the 4 participants who completed the study after this third arm was added to the study design are not reported.

**A CBT-based Internet Intervention for Adults With Tinnitus in the United Kingdom**

This study is not yet open for participant recruitment.
ClinicalTrials.gov Identifier: NCT02370810
Sponsor: Anglia Ruskin University
Information provided by (Responsible Party): Eldre Beukes, Anglia Ruskin University
Study start: September 2015
Estimated Primary Completion Date: November 2016
First received: February 3, 2015

Objectives: Tinnitus is one of the most distressing disabilities and innovative ways of managing the related health care burden is required. A cognitive behavioural therapy (CTB) based internet intervention (iCBT) has been developed in Europe to improve access to tinnitus treatments. This study aims to determine the feasibility and effectiveness of iCBT in reducing the impact associated with tinnitus in the United Kingdom (UK). It furthermore, aims to establish for which subgroups of tinnitus suffers this iCBT intervention would be a suitable intervention.

Design: A two-armed Randomized Control Trial (RCT), with a one year follow-up design will be used to evaluate the effectiveness iCBT on tinnitus distress Setting: This will be an internet-based study for adults with tinnitus living in the UK.

Participants: Eligible participants will include adults with tinnitus for a minimum period of 3 months with internet access and no major medical or psychiatric conditions. 40 participants will be recruited for each group and will be randomly assigned using a computer generated randomization schedule by an independent research assistant after being pre-stratified for age and tinnitus severity.

Intervention: The intervention offered is a CTB-based internet intervention, providing an opportunity to
learn about new ways of coping with tinnitus during everyday life. It is 8 week long e-learning intervention, with new modules introduced weekly and assignments given to practice techniques learnt.

Outcome measures: The main outcome measure is the Tinnitus Functional Index. Secondary outcome measures with visual analogue scales and self-reported measures for insomnia, cognitive functioning, hyperacusis, anxiety and depression and quality of life.

Hypothesis: If this intervention proves feasible it is and effective, it may have implications for the way tinnitus suffers are managed in the UK. It may be that a subset of tinnitus suffers can be managed through an e-learning treatment program, freeing up services for those with more severe problems that need face to face treatment.

**Hearing Aids With "Notched Amplification" for the Treatment of Chronic Tinnitus - A Controlled Randomized Pilot Study on Safety, Tolerability and Clinical Performance**

This study is currently recruiting participants.
ClinicalTrials.gov Identifier: NCT02408575
Sponsor: University of Regensburg
Information provided by (Responsible Party): Berthold Langguth, MD, Ph.D., University of Regensburg
Study start: February 2015
Estimated Primary Completion Date: October 2015
First received: March 18, 2015

Pilot study on safety, tolerability and clinical performance/randomized double-blind active-controlled pilot-study. Patients are being recruited from patients of the Tinnitus Center of Regensburg and groupwise randomized. Control groups are being treated with hearing aids without notch-filter. Patients and raters are blinded, only the coworker, who is programming the hearing aids, is informed about the group assigned.

A Hearing aid with notched amplification filters frequencies in a specific manner, depending on the individual tinnitus frequency. Through this special filtering the neuronal functional changes of the auditory cortex are supposed to be affected therapeutically.

**A Monocentric Study for Development and Use of Tomographic Neurofeedback Protocols for Patients Suffering From Chronic Tinnitus**

This study is enrolling participants by invitation only.
ClinicalTrials.gov Identifier: NCT02383147
Sponsor: University of Zurich
Information provided by (Responsible Party): University of Zurich
Study start: March 2015
Estimated Primary Completion Date: August 2016
First received: February 18, 2015

Chronic tinnitus affects about 10-15% of the population in industrialized countries. Investigations of the brain activity by using electroencephalography (EEG) showed that in localized regions of the hearing system brain activity was decreased. This reduction of activity is thought to be one of the reasons that keep the perception of the tinnitus going. Recent studies have shown that neurofeedback is a viable option for treatment of chronic tinnitus. By using neurofeedback it is possible to train brain functions by the simple principle of rewarding wanted changes and punishing unwanted ones. The purpose of the investigators study is to show the efficacy of specific localized neurofeedback training in comparison to global relaxing neurofeedback training. In order to achieve decreased tinnitus symptoms or even disappearance of the tinnitus, 15 neurofeedback trainings are planned. Before and up to 6 month after the training EEG-recordings are performed.
**Evaluation of an Internet-based Sound and Cognitive Behavioral Therapy Course for Treatment for Tinnitus**

This study is currently recruiting participants.
ClinicalTrials.gov Identifier: NCT02438891
Sponsor: University of California, Irvine
Information provided by (Responsible Party): Hamid Djalilian, University of California, Irvine
Study start: March 2015
Estimated Primary Completion Date: January 2018
First received: May 6, 2015

Most tinnitus sufferers experience significant anxiety or depression that worsens the subjective symptoms related to tinnitus. In this study, we intend to use internet-based cognitive behavioral therapy (CBT) in addition to sound therapy to provide psychotherapy to patients with tinnitus. Multiple research studies have found CBT to be effective in improving the subjective symptoms of tinnitus. The internet-based CBT course developed for this study is 8 weeks in duration and organized into eight 1-week modules; each module contains 2-4 separate lessons and homework assignments. Patients will be given unique usernames and passwords. In each weekly module, patients will review educational materials online, do exercises, and will be given feedback based on the results of the completed exercises. In addition, patients are given different meditation exercises each week for relaxation and coping with their tinnitus. These interactive materials enable patients to manage and control any negative feelings and thoughts that may be associated with tinnitus and help take their attention away from tinnitus. Tinnitus loudness and annoyance will be measured before and after the program. An internet-based course enables care providers to monitor patients’ progress with the CBT course remotely, and allows patients to learn CBT at their own convenience and schedule.

**Deep TMS of the Left Auditory Cortex Using the HMCIPCC Coil, in the Treatment of Patients With Tinnitus.**

This study is not yet open for participant recruitment.
ClinicalTrials.gov Identifier: NCT02053961
Sponsor: Brainsway
Information provided by (Responsible Party): Brainsway
Study start: February 2015
Estimated Primary Completion Date: February 2016
First received: January 28, 2014
Last verified: September 2014

The study is a double-blind study designed to evaluate the efficacy of deep transcranial magnetic stimulation (deep TMS) of the left auditory cortex using the HMCIPCC coil, in the treatment of patients with tinnitus.
Acoustic Stimulation Paired With Body and Cortical Stimulation for Modulating Tinnitus

This study is not yet open for participant recruitment.
ClinicalTrials.gov Identifier: NCT02283216
Sponsor: University of Minnesota - Clinical and Translational Science Institute
Information provided by (Responsible Party): University of Minnesota - Clinical and Translational Science Institute
Study start: June 2015
Estimated Primary Completion Date: May 2016
First received: October 26, 2014

The purpose of the study is to investigate different stimulation parameters for a new noninvasive approach for modulating the brain that could potentially be beneficial for decreasing tinnitus perception. The new approach is called Multimodal Synchronization Therapy (mSync). mSync uses a combination of acoustic stimulation played through headphones and low levels of electrical current delivered via electrodes placed on the surface of different body regions. The timing interval between the acoustic and body stimulation is varied in order to cause different types of changes in the brain. In addition to acoustic and body stimulation, noninvasive cortical stimulation will also be presented as part of mSync to attempt to further modulate or decrease the tinnitus percept. Cortical stimulation will be performed by placing a magnetic coil over a spot on the head and sending a brief magnetic pulse that can travel through the skin and bone to create electrical current inside the head. For this study, different body locations as well as specific timing intervals among acoustic, body, and cortical stimulation will be investigated to identify appropriate parameters that can modulate and potentially decrease tinnitus perception. Different mSync parameters will be investigated across multiple testing sessions (up to 16 weekly sessions) and the tinnitus percept will be closely monitored throughout the study.

The Effect of Coenzyme Q10 on Hearing and Tinnitus Characteristics of Chronic Tinnitus Patients: a Double-blinded Randomized Trial.

This study is currently recruiting participants.
ClinicalTrials.gov Identifier: NCT02353650
Sponsor: University Hospital, Antwerp
Information provided by (Responsible Party): Ethisch Comité UZ Antwerpen, University Hospital, Antwerp
Study start: November 2014
Estimated Primary Completion Date: November 2015
First received: January 22, 2015

The study is a randomised double-blinded trial. A group of 40 tinnitus patients with a naturally low Q10 level will be selected out of a preselected group of 160 screened out of a pre-existed database or patients which visited the ENT-consultation. The 40 patients with the lowest level will be asked to take 2 months Q10 (n=20) or the placebo (n=20). To evaluate the effect on hearing and tinnitus characteristic; audiometric test, tinnitus analysis and auditory evoked responses will be used as outcome measurements.