Abstract Book

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OP-01
Hyperacusis

OP-01-001
Measurements of sound sensitivity: lessons from the citizen science project

Submitter: Laure Jacquemin, Belgium

No Co-Authors submitted

Topic:
12) Hyperacusis, 8) Diagnosis

Abstract

Objective:
Environmental noise is recognized by the WHO as a significant public health concern, negatively impacting human health and well-being. To address and better understand these effects, the citizen science project “De Oorzaak” was initiated in Flanders, Belgium. This citizen science seeks to explore the role of sound sensitivity in noise pollution. This study focused on comparing the different measures for sound sensitivity within the project.

Methods:
A subset of 101 citizens from Antwerp underwent an extensive audiological test battery. This included self-report questionnaires, audiometry, uncomfortable loudness levels (ULLs) and a newly devel¬oped diagnostic tablet test for hyperacusis utilizing natural sounds. Participants were categorized into two groups based on their scores from the Hyperacusis Questionnaire (HQ): with or without hyperacusis.

Results / Discussion:
The average HQ score for the hyperacusis group was 27/42 and for the control group was 13/42. While there was a trend for lower uncomfortable loudness levels (ULLs), this was not significant ($p = 0.12$). The tablet test did not differ between the two groups ($p= 0.57$). The three measures for hyperacusis did not show a good agreement, with weak correlations between the measures.

Conclusion:
The limited agreement between the HQ, ULLs, and the tablet-based test suggests that sound sensitivity is a multidimensional phenomenon, in which subjective experience, auditory tolerance, and perceptual processing each play a distinct role. This implies that sound sensitivity cannot be reduced to a single score or threshold.

OP-01
Hyperacusis

OP-01-002
Dissociation between perceived symptom severity and uncomfortable loudness level in hyperacusis

Submitter: Pey-Yu Chen, Taiwan

Co-Authors:
Chia-huei Chu
Hung-ching Lin
Tien-chen Liu

Topic:
12) Hyperacusis, 6) Clinical studies

Abstract

Objective:
Hyperacusis refers to decreased tolerance to everyday sounds typically perceived as normal and affects up to 17.2% of the general population, with higher prevalence in those with migraine. Currently, no standardized diagnostic criteria exist. Furthermore, discrepancies exist between the subjective Hyperacusis Questionnaire (HQ) scores and psychoacoustic measurements of uncomfortable loudness level (ULLs). This study investigates the association between HQ scores and ULLs and explores potential confounding factors.

Methods:
We prospectively recruited 20 adults with migrainous headache, 10 with hyperacusis and 10 without. All participants completed the HQ and questionnaires evaluating tinnitus, emotional status, and sleep quality, followed by pure-tone audiometry (PTA) and ULL measurements. Partial correlation analysis was performed to examine the HQ-ULL correlation with adjustment for subjective questionnaire scores. ANCOVA compared ULLs between groups using the average pure-tone threshold as a covariate.

Results / Discussion:
Subjective hyperacusis was associated with lower bilateral ULL at 250 Hz (right $p = .021$; left $p = .009$) and reduced left ULLs from 500 to 4 kHz (all $p < .05$). HQ scores were not correlated with ULLs across all frequencies or the THI score. The HQ-mean ULL association remained non-significant after adjustment. ANCOVA confirmed significant left mean ULL differences between groups after adjusting for PTA thresholds ($p = .011$), but not on the right.

Conclusion:
The decoupling of subjective hyperacusis symptoms from psychoacoustic measurements in our findings suggests partially distinct dimensions of the condition and is independent of tinnitus, emotional distress, or sleep quality. Furthermore, a more prominent association between left-ear ULL and subjective hyperacusis indicates potential lateralized auditory processing involvement.

OP-01
Hyperacusis

OP-01-003
Motor trigeminocervical involvement in pain hyperacusis: preliminary observations supporting a sensitisation model

Submitter: Michael Boedts, Belgium

Co-Authors:
Anja Taevernier

Topic:
12) Hyperacusis

Abstract

Objective:
Hyperacusis is not a single entity. Clinically, at least four forms can be distinguished: loudness hyperacusis, annoyance hyperacusis, anxiety-related hyperacusis, and pain hyperacusis (noxacusis). Pain hyperacusis is characterized by sound-evoked ear pain.

Within our working model, pain hyperacusis reflects increased sensitisation of the trigeminocervical system combined with persistent strain from a centrally driven input source (e.g., hypervigilance or sustained listening effort). The exact pathway of this central input and the site of sensitisation remain unclear. Clinical observations have suggested a possible role for the tensor veli palatini region within the trigeminocervical network. We present preliminary observations from a small case series that was initiated following previously reported clinical experiences consistent with this hypothesis.

Methods:
We describe a descriptive case series of eight patients with pain hyperacusis treated in routine care. Treatment consisted of botulinum toxin injections targeting primarily tensor veli palatini and, when indicated, related trigeminocervical muscles. Most patients received concomitant medication, usually clomipramine, targeting central sensitisation and anxiety-related components.

Outcomes were based mainly on patient-reported changes in sound-evoked pain and daily sound tolerance. We did not make use of questionnaires or objective measurements.

Results / Discussion:
Several patients reported reduction in sound-evoked pain and improved tolerance of everyday sounds. Because treatment combined peripheral motor modulation and centrally acting medication, the relative contribution of each cannot be determined.

These preliminary clinical observations support our model of sensitization combined with a trigeminocervical strain. Other types of hyperacusis, such as loudness hyperacusis, may also be related to sensitization but rely on different pathways and possibly different sources of trigeminocervical input.

Conclusion:
This case series represents an exploratory attempt to understand mechanism by treating carefully selected subgroups. Even when effects are partial or temporary, such targeted approaches may help clarify peripheral–central interactions and improve staging models.

By studying specific patient groups in this structured way, we aim to gradually refine subgrouping and, over time, move toward more rational and targeted treatment strategies.

OP-01
Hyperacusis

OP-01-004
Prevalence and characteristics of tinnitus in a large database of subjects (n>250000) who consulted an audiologist in France: Effects of hearing loss, audiometric profile, loudness discomfort level, age and other factors

Submitter: Arnaud J. Noreña, France

Co-Authors:
Nicolas Detroy
Wolfgang Reip

Topic:
9) Epidemiology, 12) Hyperacusis

Abstract

Objective:
We had access to a database collected by hearing aid suppliers from Amplifon retailers in France. We analysed more than 250,000 subjects with and without tinnitus. The main objective of this study was to assess whether the prevalence of tinnitus varied according to audiometric profiles and other audiological variables.

Methods:
For most subjects, we had audiograms, loudness discomfort levels (LDL), and a numeric rating scale of tinnitus intensity and distress. All subjects were also asked whether they were or had been exposed to noise. The data were processed using principal component analysis, hierarchical clustering (PCA-HC) and logistic regression.

Results / Discussion:
The population is skewed with a high prevalence of hearing loss, as well as in terms of age distribution (average age of around 70). The prevalence of tinnitus in this population is very high, at around 43% (50% among subjects who answered “yes” to the question “Have you been exposed to noise?”). The prevalence of tinnitus follows a bell curve with age, peaking around 50-60 years of age. The ACP-HC identified 14 subtypes of audiograms. Tinnitus increased with average hearing loss, but was higher for audiograms with steep slopes (negative or positive). The prevalence of tinnitus is higher when LDL is lower. The intensity of tinnitus is rated higher (mean ~5.7) than the discomfort caused by tinnitus (mean ~4). There is no relationship between audiometric profiles and tinnitus intensity/discomfort. Tinnitus discomfort follows a bell curve with age, peaking around 50 years of age.

Conclusion:
The prevalence of tinnitus may result, at least in part, from the combined action of spontaneous peripheral activity (SA) and increased central gain. In other words, cochlear lesions that preserve SA (loss of outer hair cells only, for example) and increase central gain due to reduced sensory input are considered to maximize the risk of tinnitus development.

OP-02
Stress I

OP-02-004
Amygdala structural and functional reorganization as an indicator of affective dysfunction in patients with tinnitus

Submitter: Qian Chen, People's Republic of China

No Co-Authors submitted

Topic:
6) Clinical studies, 20) Stress and tinnitus

Abstract

Objective:
The aim of this study was to systematically investigate structural and functional alterations in amygdala subregions using multimodal magnetic resonance imaging (MRI) in patients with tinnitus with or without affective dysfunction.

Methods:
We studied 60 tinnitus patients and 40 controls, categorizing patients by affective dysfunction (TPAD/TPWAD). We analyzed multimodal MRI data—gray matter volume, fALFF, ReHo, DC, FC, and FA—within 14 amygdala subregions for group comparisons. Partial correlation analyses then linked these brain measures to clinical characteristics.

Results / Discussion:
Both patient groups showed structural and functional alterations in specific amygdala subregions. The TPAD group had more pronounced white matter changes and exhibited decreased FC between the left AB/BM, left basal nucleus, and right lateral nuclei and various frontal/occipital cortices. Collectively, these amygdalar alterations demonstrated a sensitivity of 65.4% and a specificity of 96.9% in predicting affective dysfunction in tinnitus.

Conclusion:
Although similar structural and functional amygdala remodeling were observed in the TPAD and TPWAD groups, the changes were more pronounced in the TPAD group. These changes mainly involved alterations in functionality and white matter microstructure in various amygdala subregions; in combination, these changes could serve as an imaging-based predictor of emotional disorders in patients with tinnitus.

OP-02
Stress I

OP-02-003
Changes in tinnitus loudness are driven by the type and intensity of exercise

Submitter: Antonios Chalimourdas, Belgium

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Sarah Michiels

Topic:
6) Clinical studies, 20) Stress and tinnitus

Abstract

Objective:
Tinnitus, an auditory phantom percept, affects approximately 15% of adults. Its loudness can be influenced by various factors, including stress, anxiety, neck dysfunction, and physical activity. However, the specific impact of different exercise modalities on tinnitus loudness remains unclear. This study therefore examined changes in tinnitus loudness during and immediately after exercises differing in both intensity and type.

Methods:
Thirty-nine adults with chronic subjective tinnitus completed four randomized sessions: low-intensity aerobic exercise (LIAE), high-intensity aerobic exercise (HIAE), low-intensity resistance exercise (LIRE), and high-intensity resistance exercise (HIRE). Tinnitus loudness was measured using a visual analog scale before, during, and up to 60 minutes after exercise. Participants were classified as “Better” (loudness decreased), “Worse” (loudness increased), or “Same” (no change).

Results / Discussion:
At the whole-group level, HIAE significantly reduced tinnitus loudness compared to other modalities ($p < 0.001$), with effects persisting for 60 minutes. LIAE, HIRE, and LIRE showed no overall changes. Subgroup analyses revealed that the “Better” group experienced the largest and most sustained reductions during HIAE, followed by smaller reductions with LIAE. In the “Worse” group, aerobic exercise—regardless of intensity—increased loudness during exercise but returned to baseline within 15 minutes post-exercise. Resistance exercises had minimal impact in any group.

Conclusion:
High-intensity aerobic exercise most effectively reduces tinnitus loudness in some individuals, whereas resistance exercise has little effect. Responses to aerobic exercise are heterogeneous, with some patients experiencing transient worsening. These findings highlight the need for personalized exercise recommendations in tinnitus management and warrant further investigation into underlying mechanisms.

OP-02
Stress I

OP-02-001
Inflammation in tinnitus with near-normal hearing

Submitter: Lina Albakri, The Netherlands

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Topic:
6) Clinical studies, 20) Stress and tinnitus

Abstract

Objective:
Tinnitus is the perception of sound without an external stimulus. Recently, inflammation has been implicated in

the pathophysiology of tinnitus. In tinnitus animal models, cytokine levels are increased throughout the whole

auditory pathway, and microglia and astrocytes are activated. However, only a few human studies on inflammation in tinnitus were conducted, which generally did not account for confounders such as hearing loss, anxiety and depression. The current study therefore aimed to evaluate the association between inflammation and tinnitus specifically in participants with (near-)normal hearing and without signs of anxiety or depression.

Methods:
In this cross-sectional study, fifty tinnitus participants and fifty healthy controls completed a tinnitus questionnaire and underwent audiometric testing. Complete blood count measures were determined in blood plasma, as well as cytokine concentrations by using the enzyme-linked immunosorbent assay (ELISA) technique.

Results / Discussion:
Tinnitus patients showed lower platelet counts and reduced IL-10 and IFN-γ levels. Moreover, male sex, lower MCV, platelet count, IL-10, and IFN-γ predicted tinnitus presence. These findings suggest altered inflammatory markers independent of hearing loss, anxiety, and depression, supporting a role for inflammation in tinnitus pathophysiology.

Conclusion:
Inflammatory markers are altered in chronic tinnitus even after strict exclusion of major confounders. Reduced IL-10 and IFN-γ and lower platelet count indicate immune dysregulation and inflammation may contribute to tinnitus, warranting further mechanistic and longitudinal research.

OP-02
Stress I

OP-02-002
Tinnitus, challenging not only during listening but even during talking phases: an investigation of voice fundamental frequency, heart rate and electrodermal activity

Submitter: Klajdi Gega, Italy

Co-Authors:
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Topic:
2) Basic research, 20) Stress and tinnitus

Abstract

Objective:
Tinnitus patients have been widely investigated for the implication of tinnitus on performances and neurophysiological and psychological reactions during auditory tasks, but a neglected field is the study of this symptom during talking activities. In this context the fundamental frequency (f0) of the voice may act as a sensitive biomarker of autonomic nervous system activation and emotional distress. In addition to such index, specific of the vocal production, two common indices of the autonomic nervous system activation were included into the analysis, also given their involvement in the affective reaction: the heart rate (HR), and the tonic GSR component (tGSR).

Methods:
12 participants with tinnitus and normal hearing (mean age: 47.42 years old) and 7 healthy controls (mean age: 46.32 years old) were instructed to prepare in advance a 5-minute speech on common topic of conversation (leisure time, cuisine, holidays). Speech topic was selected on the day of testing and the speech was recorded through a professional microphone. For each participant half of the speech was performed in quiet, whilst the other half was performed with background babble noise. The order of quiet (Q) and background noise (N) phase was pseudorandomized among participants, with no interruption between the phases. The measures collected during both the Q and N phases of the talking task were: i) the fundamental frequency of the voice (f0), analysed by the software WASP (https://www.speechandhearing.net/laboratory/wasphelp.htm); ii) the heart rate (HR), and iii) the tonic GSR component (tGSR), acquired by means of the Shimmer 3 GSR+ (Shimmer Sensing, Dublin, Ireland) with a sampling frequency of 64 Hz. In addition, Tinnitus Questionnaire (TQ12-I), Tinnitus Handicap Inventory (THI) and Hyperacusis Questionnaire (HQ) by Khalfa were administered to tinnitus patients. Non parametric statistical analysis was performed: Psychological assessment also included the State-Trait Anxiety Inventory (STAI-Y) to evaluate both transient and stable anxiety levels. Mann-Whitney test for the comparisons between the

groups for each considered variable and Wilcoxon test for within group comparisons, and Spearman's rank correlation coefficient (ρ) for correlations between variables.

Results / Discussion:
Results showed no statistically significant differences between the tinnitus and control groups for any variable across phases or for within-group comparisons between Q and N phases ($p > 0.05$), possibly reflecting the normal hearing condition shared by both groups. Only in the tinnitus group, a positive correlation emerged between average f0 and HR in both Q and N phases ($\rho = 0.685$, $p = 0.017$). In addition, TQ12-I scores positively correlate with average tGSR values in both Q ($\rho = 0.675$, $p = 0.016$) and N ($\rho = 0.601$, $p = 0.039$) phases. These phase-independent results suggest that background noise did not strongly influence physiological responses, whereas tinnitus-related factors may have played a greater role. The correlation between TQ12-I and tGSR is consistent with previous findings from the present group during listening tasks, supporting a relationship between emotional arousal (indexed by tGSR) and tinnitus distress reported by participants. Notably, in the control group f0 was mainly associated with state anxiety ($\rho = 0.821$, $p = 0.034$), whereas in the tinnitus group f0 was more closely related to autonomic activity (HR), suggesting a shared modulation by stress. This pattern extends previous observations on the link between emotional arousal and tinnitus distress from listening to speaking conditions.

Conclusion:
Despite the current lack of investigation, talking activities are affected by tinnitus symptom, and this influence can be measured through biosignals processing. Moreover, this effect appears to be modulated by tinnitus severity, as assessed by traditional clinical questionnaires with respect to the emotional arousal reaction. The observed correlation between voice fundamental frequency (f0) and heart rate (HR) may reflect a common modulation due to stress or autonomic arousal, consistent with previous evidence that cardiovascular activity can influence vocal pitch and that f0 may serve as a stress biomarker. Furthermore, TQ12-I was correlated with tGSR, suggesting reduced sympathetic responsiveness in tinnitus patients, consistent with previous work showing that emotional and listening-related distress in tinnitus patients modulates autonomic responses. Among tinnitus patients with normal hearing, the external auditory condition (Q or N) seemed not to affect physiological responses, whereas the source of distress appeared more directly related to tinnitus itself. Interestingly, while healthy controls showed a vocal response primarily driven by state anxiety, tinnitus patients exhibited a coupling between voice and cardiac activity, highlighting a shift in how stress is physiologically processed. Nevertheless, these results need to be further investigated in a larger sample including tinnitus patients and hearing loss.

OP-03
Psychological aspects and intervention

OP-03-005
Diurnal Variation of Tinnitus Discomfort Across Different Times of the Day: A Preliminary Analysis

Submitter: Basak Özkisi Yazgan, Turkey

Co-Authors:
Emre Gürses
Rojbin Karakaya
Songül Aksoy

Topic:
2) Basic research, 20) Stress and tinnitus

Abstract

Objective:
This study aimed to investigate the level of discomfort experienced across different times of the day

Methods:
The sample consisted of retrospective analysis of 53 participants, including 24 females (45.3%) and 29 males (54.7%). The mean age of the participants was 44.04 ± 13.42 years (range: 17–70). The mean duration of tinnitus was 4.34 ± 5.37 years (range: 0–20 years). Participants were asked to rate their level of tinnitus awareness using a five-point Likert scale at four time points during the day: morning, afternoon, evening, and night.

Results / Discussion:
Tinnitus awareness was assessed using a five-point Likert scale (0 = never aware, 1 = seldom aware, 2 = sometimes aware, 3 = often aware, 4 = always aware) at four time points during the day (morning, afternoon, evening, and night). A Friedman test revealed a significant difference in tinnitus awareness across different times of the day ($\chi^2(3) = 17.31$, $p = 0.0006$, Kendall's $W = 0.11$). Mean tinnitus awareness scores were 3.11 ± 0.93 in the morning, 2.60 ± 1.13 in the afternoon, 3.00 ± 0.85 in the evening, and 3.02 ± 1.07 during the night. The lowest tinnitus awareness was reported in the afternoon.

Conclusion:
Participants generally reported being "often aware" of their tinnitus throughout the day. However, tinnitus awareness tended to decrease slightly in the afternoon, where the mean score fell between "sometimes aware" and "often aware." Morning, evening, and night scores were relatively similar and corresponded to the "often aware" category.

OP-03
Psychological aspects and intervention

OP-03-002
A Comprehensive Tinnitus Management Method by Integrating Factors of Sensation, Emotion, and Cognition (SEC)

Submitter: Ali Danesh, USA

Co-Authors:
MCarmen Moleon Gonzalez
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Topic:
5) Clinical management, 21) Therapy

Abstract

Objective:
Tinnitus, the perception of sound in the absence of an external source, is a prevalent condition that can substantially affect physical and mental health. Although tinnitus is not typically curable, it is often manageable with structured, multidisciplinary care. This pilot research describes the Sensation–Emotion–Cognition (SEC) model, a practical audiological framework that targets three core dimensions of the tinnitus experience. Other clinical methods incorporate only one or two factors of treatment. This method provides a more comprehensive approach.

Methods:
We integrate findings from an exploratory retrospective cohort and a prospective expansion study. The SEC protocol included sound therapy, counseling and relaxation training, and cognitive behavioral therapy (CBT) delivered through either unguided, module-based internet CBT (N=50), clinician-guided module-based internet CBT (N=16), or six therapist-led CBT sessions (N=11). The objective was to evaluate whether this multifactorial approach is associated with reductions in tinnitus-related distress by using TRQ, SAD-T, and 4C tools.

Results / Discussion:
The initial retrospective report (N = 50) evaluated the foundational SEC audiological management combined with unguided iCBT. Mean pre-treatment TRQ scores were 57.1, decreasing to 31.5 post-treatment showing reduction of 44.8%. The preliminary results from N=16 (guided iCBT) and N=11 (face-to-face CBT) participants who completed the study were associated with significant pre–post changes in tinnitus-related outcomes (i.e., SAD-T and 4C tools) and indicated clinically meaningful improvements across the assessed outcome measures.

Conclusion:
A key strength of the SEC model is its integrative structure, explicitly targeting sensory, emotional, and cognitive dimensions of tinnitus distress, an approach consistent with clinical guidance and the recent literature advocating multi-component interventions. These findings suggest the potential value of an integrated management strategy; however, given the single-

group pre–post design and attrition, the results should be interpreted as exploratory and warrant confirmation in larger controlled trials.

OP-03
Psychological aspects and intervention

OP-03-004
Preliminary Findings on Tinnitus Prevalence and Associated Risk Factors in Older Adults: A Cross-Sectional Study

Submitter: Sevval Özüm Açiksöz Yay, Turkey

Co-Authors:
Songül Aksoy

Topic:
9) Epidemiology, 7) Comorbidity

Abstract

Objective:
Tinnitus is common in older adults; however, studies examining its relationship with lifestyle, psychosocial status, and clinical characteristics in this population are limited. In addition, the number of studies using both qualitative and quantitative data collection methods to reveal the multidimensional nature of tinnitus is also limited. Accordingly, this study aimed to determine the prevalence of tinnitus in individuals aged 65 years and older; to examine the relationship between tinnitus and hearing handicap, lifestyle characteristics, stress level, depression, and quality of life; and to comprehensively evaluate tinnitus characteristics (localization, frequency, severity, and triggering factors) in individuals with tinnitus.

In Türkiye, studies investigating the prevalence of tinnitus and its associated risk factors in older adults have generally focused on single factor. Therefore, determining the prevalence of tinnitus and identifying potential associated risk factors in this population is of great importance. The findings are expected to contribute to the development of preventive and protective strategies by identifying modifiable risk factors and to provide a scientific basis that can be shared with relevant institutions.

Methods:
This study, approved by the ethics committee (No: 2024230), was designed as a prospective cross-sectional study presenting preliminary findings. Individuals aged 65 years and older who were cognitively able to understand and respond to the questions were included.

Data collection tools included the Standardized Mini-Mental Test (SMMT), a questionnaire covering demographic information, general health status, hearing health, and lifestyle characteristics (sleep, nutrition, and physical activity). The presence of tinnitus was determined by asking participants about “ringing in the ears.” For individuals with tinnitus, a tinnitus evaluation form assessing localization, duration, severity, frequency, and treatment/therapy methods was administered. Both qualitative and quantitative data collection methods were used.

The Hearing Handicap Inventory for the Elderly (HHIE) was used to assess hearing handicap, the Geriatric Depression Scale–Short Form to evaluate depressive status, and the World Health Organization Quality of Life Instrument–Older Adults Module (WHOQOL-OLD) to assess quality

of life. The Tinnitus Handicap Inventory (THI) was additionally administered to participants with tinnitus.

Statistical analyses were performed using IBM SPSS Statistics 25, with $p < 0.05$ considered statistically significant. Analyses included descriptive statistics and group comparisons between participants with and without tinnitus.

Results / Discussion:
At this stage of the study, data were collected from 66 participants; one participant was excluded due to missing data, and analyses were conducted on 65 individuals. Of these, 40 were female and 25 were male. The mean age was 74.63 ± 7.02 years (range: 65–95), and 22 participants reported tinnitus. Among those with tinnitus, 63.6% reported experiencing hearing problems. The mean HHIE score was 9.17 ± 1.34, with no significant difference between groups ($p > 0.05$).

In terms of lifestyle characteristics, higher tea consumption (≥4 cups/day, 50%) was notable among individuals with tinnitus, whereas fish consumption (≥1 time/week, 74.4%) was higher among those without tinnitus. Stress levels were similar between groups ($p > 0.05$), and the main sources of stress were reported as loneliness, missing children, financial concerns, and current events.

The mean THI score among individuals with tinnitus was 9.8 ± 2.58. Tinnitus was most commonly bilateral (42.9%), typically constant (66.7%), and high-pitched (68.2%). Approximately 40.9% of participants reported experiencing tinnitus daily or every few days. The most common triggering factor was a quiet environment (36.4%), and 71.4% reported no suppressive factor. Additional triggers included fatigue, headache, stress, hypertension, and exposure to loud sounds.

Half of the participants with tinnitus had sought medical attention; among them, 60% consulted an otorhinolaryngology clinic, 20% both otorhinolaryngology and audiology services, and 20% audiology services only.

No statistically significant differences were found between individuals with and without tinnitus in terms of quality of life or depression scores ($p > 0.05$). These findings suggest that while tinnitus in older adults may be associated with lifestyle factors, it does not appear to significantly affect quality of life or psychological status.

Conclusion:
This study indicates that tinnitus in older adults may be associated with certain lifestyle factors. However, tinnitus presence did not result in statistically significant differences in quality of life, depression, or stress levels. As data collection is ongoing, it should be considered that the results of both qualitative and quantitative analyses may change. Tinnitus was most commonly described as bilateral, constant, and high-pitched, and was most frequently triggered in quiet environments, with many individuals reporting no suppressive factor.

Additionally, only half of the individuals with tinnitus sought medical attention, highlighting the need for increased awareness and appropriate referral strategies for older adults and their relatives. The findings suggest that although tinnitus may be related to lifestyle factors, its psychosocial impact appears limited.

The study also emphasizes the multidimensional nature of tinnitus and the importance of evaluating it using both qualitative and quantitative data. Larger-scale studies employing combined methodologies are needed to better understand tinnitus in this population.

OP-03
Psychological aspects and intervention

OP-03-001
Sensory and Attentional Techniques in Cognitive Behavioral Therapy (CBT) for Tinnitus

Submitter: Giovani De Oliveira, Brazil

Co-Authors:
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Topic:
21) Therapy

Abstract

Objective:
This study aims to describe the application of sensory and attentional techniques within Cognitive Behavioral Therapy (CBT) for tinnitus management. Particular emphasis is placed on the integration of multiple sensory modalities as a strategy to support attentional redirection and reduce the perceptual salience and subjective distress associated with tinnitus (Cima et al., 2014; Hallam et al., 1988).

Methods:
A descriptive approach was adopted, based on established principles of CBT and current knowledge of attentional modulation in tinnitus. The proposed framework includes structured attentional redirection exercises combined with the engagement of non-auditory sensory modalities. These strategies involve visual focus tasks, tactile interaction, and the controlled use of olfactory and gustatory stimuli, aiming to shift attention away from the tinnitus percept. The integration of multiple sensory inputs is proposed as a complementary strategy within CBT, grounded in the assumption that broader sensory engagement may facilitate attentional redistribution. Techniques are applied progressively to encourage habituation and reduce persistent monitoring of the internal auditory signal (Jastreboff, 1990; Zenner et al., 2006).

Results / Discussion:
Tinnitus perception is shaped by interactions between auditory processing and attentional control systems (Roberts et al., 2010). Although the tinnitus signal originates internally, its prominence depends on the extent to which it is selected and maintained in conscious awareness. Attentional networks, particularly those involving frontoparietal regions, modulate activity in auditory cortical areas through top-down mechanisms (De Ridder et al., 2011). Repeated allocation of attention to tinnitus may increase its perceptual salience and reinforce its association with negative emotional responses (Knobel & Sanchez, 2008).

Within this context, the integration of multisensory stimulation represents a relevant extension of attentional strategies in CBT. The brain operates under limited attentional capacity, as described in models such as Load Theory (Lavie, 2005), in which competing stimuli may reduce the processing of task-irrelevant signals. Engaging visual, tactile, olfactory, and gustatory modalities may recruit distributed neural networks that compete for attentional resources, potentially decreasing the dominance of tinnitus-related activity in conscious perception

(Searchfield et al., 2007). From a practical perspective, exercises involving sustained visual attention, tactile exploration, exposure to distinct smells, or the experience of varied tastes may support this process of attentional shift. Although the use of non-auditory sensory modalities in tinnitus management remains underexplored, its theoretical basis is consistent with current models of attention and perception.

Conclusion:
Sensory and attentional techniques within Cognitive Behavioral Therapy represent a consistent and clinically relevant approach for tinnitus management. The integration of multisensory engagement as part of attentional redirection strategies may contribute to reducing the perceived intensity and emotional impact of tinnitus. While further investigation is needed, this approach offers a promising extension of CBT-based interventions, supporting improved quality of life even when the auditory percept persists (Andersson, 2002).

OP-03
Psychological aspects and intervention

OP-03-003
Item-level THI patterns and data-driven tinnitus subgroups in a Hungarian clinical sample

Submitter: Zsuzsanna Piros, Hungary

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Topic:
6) Clinical studies, 9) Epidemiology

Abstract

Objective:
Tinnitus severity is commonly assessed using the Tinnitus Handicap Inventory (THI), which provides a global score but does not fully capture the heterogeneity of symptom patterns across patients. This study aimed to examine item-level THI response patterns and identify data-driven tinnitus subgroups using unsupervised machine learning in a large Hungarian clinical sample. We hypothesised that complete item-level response profiles could identify distinct patient groups reflecting different underlying tinnitus phenotypes beyond overall severity.

Methods:
A dataset of 544 patients with subjective tinnitus presenting to the Szilvássy Judit Audiology Centre, University of Debrecen Clinical Centre, was retrospectively analysed using THI questionnaires. Item-level responses (25 items) were used as input features. Missing values were left unchanged and were handled implicitly during analysis. Subscale scores (functional, emotional, catastrophic) were calculated according to the standard THI structure.

Descriptive statistics were computed for individual THI items and subscales. Unsupervised machine learning using k-means clustering was applied to identify subgroups based on complete item-level response profiles. Dimensionality reduction using principal component analysis was performed to visualise the distribution of patients in a two-dimensional space.

To interpret differences between clusters, cluster-specific mean item scores and subscale contributions were analysed.

Results / Discussion:
Item-level analysis revealed that the highest mean response was observed for THI item 8 (“feeling unable to escape from tinnitus”), indicating that perceived loss of control is a key component of tinnitus burden. In contrast, several functional items showed lower mean scores, suggesting that functional impairment may not be the primary driver of subjective distress.

Clustering identified three distinct groups of patients: low-, intermediate-, and high-burden subgroups. Importantly, the high-burden cluster was characterised not only by elevated total THI scores, but also by disproportionately increased emotional and catastrophic responses relative to functional limitations.

These findings suggest that patients with similar total THI scores may exhibit markedly different symptom profiles, supporting the view that the severity of tinnitus is not a unidimensional construct. The observed patterns are consistent with the presence of distinct tinnitus phenotypes, particularly a distress-dominant subgroup.

Conclusion:
This study suggests that data-driven clustering combined with interpretable item-level analysis can identify clinically meaningful tinnitus subgroups beyond traditional severity classification. High-burden patients were characterised by dominant emotional and catastrophic responses, indicating that perceived control and psychological distress play a central role in tinnitus burden.

These findings highlight the potential of data-driven approaches for phenotype-based stratification and support the development of personalised management strategies in tinnitus care.

OP-04
Comorbidity I

OP-04-002
Using mixed methods to model the relationship between tinnitus and suicidal thoughts and behaviours

Submitter: Carol Macdonald, United Kingdom

Co-Authors:
Joanna Lockwood
William Whitmer
Magdalena Sereda
Derek J Hoare

Topic:
6) Clinical studies, 14) Models

Abstract

Objective:
Several studies suggest an association between tinnitus and suicidal thoughts and behaviours. This study aimed to understand how people experience suicidal ideation and behaviours in the context of tinnitus, to identify transdiagnostic features, and develop a model of tinnitus and suicide.

Methods:
Fifteen participants took part in interviews about their experiences of tinnitus and suicidal ideation and behaviours. A card sort task was used to identify key variables and transdiagnostic features. Interviews were analysed using narrative and template analyses, and card sort data were summarised quantitatively to build a model.

Results / Discussion:
Within and between subject patterns were derived illustrating dynamic interactions between tinnitus and suicidal processes. Key common factors were defeat, internal entrapment, feeling overwhelmed, reduced positive future thinking, problem-solving, control, fear, loss of connection, agitation, loss of peace, loss of self-identity. We observed a common function of suicidal thinking as a (misdirected) coping strategy (“how to make it stop”).

Conclusion:
This theory-driven and experience-based transdiagnostic model of tinnitus and suicidal ideation and behaviours, which elucidates the function of suicidal thinking within tinnitus distress, can inform future clinical approaches to facilitate effective and compassionate clinical mitigation. As a dynamic model, it can support people with tinnitus to make sense of their individual experience

OP-04
Comorbidity I

OP-04-001
Psychosocial factors in the rehabilitation of hearing loss

Submitter: Bettina Williger, Germany

Co-Authors:
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Kurt Steinmetzger
Benjamin Böcking
Birgit Mazurek

Topic:
6) Clinical studies, 9) Epidemiology

Abstract

Objective:
Hearing loss has a high prevalence in midlife and older age: about 10% of individuals aged 45 and older are affected by at least moderate hearing loss, compared to more than 40% of individuals aged 80 years and older. Hearing loss has detrimental effects on multiple dimensions of quality of life, including impaired social participation and communication skills, as well as an increased risk of falls, dementia, and depression. Psychosocial factors are modifiable and have been shown to influence health behaviors as well as mental and physical health outcomes. However, auditory rehabilitation is so far mostly limited to hearing aid provision; that may be insufficient given that hearing aids are often not worn regularly. The present research aims to develop an intervention to strengthen psychosocial factors in the rehabilitation of hearing loss

Methods:
As a first step, psychosocial factors associated with quality of life among adults aged 40 years and older with hearing loss have been identified. Analyses were based on longitudinal data from the German Ageing Survey (2008-2023; n = 12,147; mean age = 62.35 years, age range 40-93 years) and data from a cross-sectional online study with hearing impaired individuals (N = 160, mean age = 64.07 years, age range 40-90 years). Relevant psychosocial factors included views on aging, attitudes towards hearing loss, and adaptive strategies in dealing with hearing loss. Second, a structured intervention program was developed addressing these psychosocial factors. The intervention consists of three group-based sessions delivered over a three-month period. Each session has a specific topic focus (views on aging, attitudes towards hearing loss, adaptive hearing-related strategies) and combines elements of psychoeducation with interactive group activities

Results / Discussion:
The psychosocial intervention is currently under evaluation in a three-arm randomized trial. In a six-month clinical study, we investigate the effects of (1) hearing aid provision alone (n = 82), (2) psychosocial intervention alone (n = 82), and (3) combined hearing aid provision and psychosocial intervention (n = 82) on quality of life among adults aged 40 years and older with mild to moderate hearing loss.

Conclusion:
Psychosocial factors, such as, views on aging, moderate associations between hearing loss and mental and functional health. This project, therefore, investigates new and early forms of psychosocial interventions to improve the quality of life, as well as complement current auditory rehabilitation practices, of adults aged 40 years and older with hearing loss. The clinical study will reveal potential benefits of an intervention strengthening psychosocial factors in dealing with hearing loss.

OP-05
Stress II

OP-05-002
Assessing the Efficacy of Yog in Alleviating Tinnitus Symptoms

Submitter: Vishwambhar Singh, India

No Co-Authors submitted

Topic:
20) Stress and tinnitus

Abstract

Objective:
Aims and Objectives

The primary objective to assess the clinical efficacy of an integrated treatment approach on managing tinnitus with no identifiable cause and not responding to available treatment options. The secondary objective was to evaluate the comparative effect of a combined Yogic and modern medicine regimen versus conventional modern medicine alone in alleviating both auditory symptoms and associated psychological distress.

Methods:
This randomized, comparative clinical trial .

Participants included individuals aged 12 to 70 years experiencing tinnitus with an intact tympanic membrane and normal hearing.

The study was of one year. Assessment tools included the Tinnitus Handicap Inventory (THI) in Hindi to measure symptom severity, and the Hamilton Anxiety (HAM-A) and Depression (HAM-B) Rating Scales to evaluate psychiatric comorbidities.

Results / Discussion:
Out of the 90 patients, chosen for the study seven dropped out. In group One compared to group two, they have a almost comparable results on HAM A and HAM B outcome at all end points of 1,3 and 6 months. But for THI the outcome was not significant at 1 and 3 months but at 6 months its better.

Conclusion:
By integrating mind-body techniques with conventional pharmacotherapy, this study establishes a novel, evidence-based protocol. This integrative approach not only alleviate the primary auditory symptoms of tinnitus but also significantly reduce secondary psychological distress, thereby improving the overall well-being of the patients.

OP-05
Stress II

OP-05-001
Reduced DTI-ALPS index in tinnitus patients: DTI-ALPS as a mediator of sleep on tinnitus

Submitter: Yinfei Liang, People's Republic of China

Co-Authors:
Xiangli Zeng

Topic:
20) Stress and tinnitus, 20) Stress and tinnitus

Abstract

Objective:
Sleep disturbance is a common comorbidity in tinnitus patients, which may be attributed to changes in brain structure and function. The aim of this study was to explore the potential role of the glymphatic system (GS), a recently discovered pathway for brain waste clearance, in tinnitus and the associated sleep disturbance.

Methods:
The DTI-ALPS index of 22 tinnitus patients and 22 healthy controls (18-60 years old) were compared after controlling for age, sex, and handedness. Partial correlation and mediation analyses were performed to explore the association between the above parameters and clinical data.

Results / Discussion:
Significant differences were found between the right-side DTI-ALPS index and the DTI-ALPS index of the healthy group. Furthermore, the DTI-ALPS index in tinnitus patients was significantly lower than that of the healthy group. After adjusting for age and sex, the DTI-ALPS index correlated significantly with the Tinnitus Handicap Inventory (THI) scores The DTI-ALPS index was negatively correlated with PSQI scores ($p= 0.032$).

Conclusion:
The glymphatic system may influence sleep disturbance in tinnitus patients due to its role in brain waste clearance. We observed a decrease in DTI-ALPS in tinnitus patients, and our analyses suggest that sleep disturbances influence tinnitus through the mediation of DTI-ALPS. Thus, greater emphasis should be placed on averting sleep issues at Tinnitus.

OP-05
Stress II

OP-05-004
Structural heterogeneity of tinnitus reveals limbic–thalamo–cortical circuit alterations linked to hearing loss

Submitter: Payam Sadeghi Shabestari, Switzerland

Co-Authors:
Stefan Schoisswohl
Christopher Cederroth
Tobias Kleinjung
Patrick Neff

Topic:
13) Imaging, 14) Models

Abstract

Objective:
To delineate the structural neuroanatomy of tinnitus and determine whether reported alterations reflect uniform group effects or heterogeneous neurobiological phenotypes. Using a multisite cohort and an independent UK Biobank dataset, we investigated cortical and subcortical morphology and their relationships with hearing loss and tinnitus severity.

Methods:
Structural MRI from a large-scale multisite tinnitus cohort was analyzed using voxel-based morphometry, cortical surface morphometry, and subcortical segmentation. Normative deviation mapping quantified individual abnormalities, and UMAP identified structural subtypes based on limbic–thalamo nuclei. Findings were examined in UK Biobank, and transcriptomic enrichment was assessed using Allen Human Brain Atlas data.

Results / Discussion:
Tinnitus was associated with reduced subcallosal gray matter and deviations in amygdala, hippocampal, and thalamic nuclei. Unsupervised clustering revealed two structural phenotypes differing in deviation burden and hearing loss severity. Structural measures correlated with hearing loss but not tinnitus handicap, suggesting that limbic circuit alterations reflect auditory deprivation–related adaptation.

Conclusion:
Large-scale structural analyses reveal substantial heterogeneity in tinnitus, identifying a limbic–thalamo–cortical phenotype characterized by greater hearing loss and subcallosal alterations. These findings suggest that structural brain changes in tinnitus arise from interactions between auditory deprivation and limbic regulatory circuitry rather than subjective symptom severity alone.

OP-05
Stress II

OP-05-003
Aging makes the heart grow fonder: age influences hearing ability and interactions between psychological phenomena in patients with chronic tinnitus

Submitter: Maren Fresemann, Germany

Co-Authors:
Benjamin Boecking

Topic:
20) Stress and tinnitus

Abstract

Objective:
Risk factors for chronic tinnitus comprise interactions of individuals' hearing difficulties and psychological distress—including anxiety, depression, and perceived stress levels. Both groups of factors likely become more pronounced with age, although mixed literature has also suggested increases in psychological resilience over time. To this end, only a few studies have delineated direct and indirect effects of age on audiological and psychological variables that might influence tinnitus-related distress in patients with chronic tinnitus.

Methods:
N = 678 patients with chronic tinnitus completed audiological assessments alongside self-report measures of psychological and tinnitus-related distress. Path analyses investigated the effect of age on patients' tinnitus-related distress via both audiological and psychological variables.

Results / Discussion:
Age was significantly associated with both hearing ability and psychological distress indices, with perceived stress and anxiety decreasing with aging. Different mediation models revealed that the association between age and tinnitus-related distress was mediated completely by hearing ability and partly by perceived stress and anxiety.

Conclusion:
Whilst interactions of individuals' hearing ability and psychological distress levels maintain tinnitus-related distress across the age span, the weighting of these factors may shift with age. Treatment approaches should consider hearing ability across the lifespan. Psychological factors should be individually conceptualized, considering both distress-related and potential resilience factors in old age.

OP-06
Hyperacusis II

OP-06-002
Use of opm-meg for differentiating tinnitus from hyperacusis

Submitter: Rodrigo Andrés Donoso-San Martín, Germany

Co-Authors:
Stephan M. Wolpert
Stefan Fink
Paul H. Délano
Christoph Braun
Lukas Rüttiger
Marlies Knipper

Topic:
20) Stress and tinnitus, 12) Hyperacusis

Abstract

Objective:
Although hyperacusis often co-occurs in more than 55% of tinnitus subjects4, it remains largely overlooked in clinical diagnostics and individualized therapies.

Methods:
Here, we describe functional differences for healthy controls, tinnitus subjects with and without hyperacusis in comparison to subjects with hyperacusis only. Besides analyzing standardized questionnaires, detailed audiometric measures (pure-tone audiometry PTA, Auditory Brainstem Responses (ABR)) the study aimed to investigate auditory stimuli evoking cortical responses.

Results / Discussion:
These responses were recorded using a time-sensitive 64-channel optical pumped magnetometer (OPM-MEG), that through their shorter distance between sensors and scalp, in comparison with SQUID-MEG, might enable the elucidation of differences in hemisphere-specific lateralized signal strength. To gain insight into perceptual differences between the groups, the evoked cortical activity was analyzed in tinnitus and control subjects during an attention-requiring two-tones auditory discrimination task.

Conclusion:
We expect this method to become an efficient diagnostic strategy to identify specific differences in peripheral or central contribution to either tinnitus or hyperacusis. The identification of specific functional biomarkers for distinct phenotypes is the prerequisite for future improved individualized targeted interventional therapies

OP-06
Hyperacusis II

OP-06-001
Cochlear neural contributions to tinnitus, hyperacusis and misophonia

Submitter: Lukas Rüttiger, Germany

Co-Authors:
Li Xie
Rodrigo Andres Donoso-San Martín
Stefan Fink
Wibke Singer
Stephan Matthias Wolpert
Marlies Knipper

Topic:
2) Basic research, 14) Models

Abstract

Objective:
Many studies have focused on identifying the neural correlates of tinnitus, hyperacusis, or misophonia based on central neural network contributions.

Methods:
Here, we examine peripheral components as a presumptive trigger for central network changes in tinnitus (the perception of sounds without an internal or external source of noise), hyperacusis (the pathological hypersensitivity to noise), and misophonia (an intolerance to certain everyday noises).

Results / Discussion:
Based on our observations, we hypothesize that: (i) tinnitus, hyperacusis and misophonia can occur despite clinically normal hearing thresholds, and that these are likely caused independent of sex and age. (ii) Furthermore, tinnitus and hyperacusis, but possibly also misophonia are related to altered auditory processing that through desynchronized (tinnitus) or hyperactive (hyperacusis, misophonia) bottom-up processing in the ascending auditory pathway potentially explain the activity changes in, e.g., default or salient brain networks, as suggested in various studies of these different diseases. (iii) In misophonia a stress-induced top-down influence onto target neurons as deep as the auditory nerve fibers may be considered as a contributor to generating misophonia-trigger sound percepts.

Conclusion:
We think that the differential consideration of a possible interaction between peripheral and central components of auditory processing will help to fill the gaps in our knowledge to date about the underlying causative mechanisms of these pathologies and to outline the path to successful treatment.

OP-06
Hyperacusis II

OP-06-003
Realistic Virtual Sound Environments for Assessing Functional Hearing and Spatial Localization in Tinnitus

Submitter: Zino Wellauer, Switzerland

Co-Authors:
Patrick Neff
Eric Larrieux
Nick Sommerhalder
Martin Meyer

Topic:
18) Psychoacustics, 2) Basic research

Abstract

Objective:
Standard audiometric evaluations often fail to capture the real-world listening difficulties reported by patients with chronic subjective tinnitus, particularly in complex acoustic scenarios. Because spatial hearing is essential for localizing sounds and segregating relevant signals from competing background noise, deficits in this domain frequently remain undetected in conventional assessments. To address this diagnostic gap, we incorporate functional hearing measures within highly realistic virtual sound environments.

The primary objective of this study is to evaluate the impact of tinnitus on sound source localization and functional hearing abilities compared with healthy, audiometrically matched controls. We introduce a novel testing paradigm using an immersive acoustic Dome: a spherical loudspeaker array designed to simulate real-world auditory scenes with high spatial precision. We aim to determine whether ecologically valid listening conditions reveal spatial hearing deficits in tinnitus that evade standard (clinical) measures.

Methods:
An ongoing case-control study is comparing participants with chronic, subjective tinnitus to age- and hearing-matched healthy controls. Both groups exhibit normal pure-tone audiometry thresholds. Testing is conducted inside the acoustic Dome, which utilizes a 36-channel ambisonic loudspeaker array to present realistic virtual sound environments, such as a busy restaurant and dynamic street crossings.

Participants complete a comprehensive 3D sound localization task, identifying the spatial origin of short speech stimuli embedded in varying degrees of spatialized background noise versus silence. Performance is quantified using Root Mean Square Error (RMSE) for localization accuracy. To disentangle the specific impact of tinnitus from broader auditory processing deficits, participants also complete a battery of functional hearing measures. Planned statistical analyses employ multiple linear regression and mixed-effects models to evaluate the predictive power of these functional measures on RMSE scores.

Results / Discussion:
We hypothesize that while localization accuracy in silence may remain comparable between groups, the introduction of dynamic, spatialized noise within the Dome will disproportionately degrade performance (yielding higher RMSE scores) in the tinnitus cohort. Crucially, any observed spatial deficits may not be exclusively attributable to the tinnitus percept itself.

By incorporating functional measures such as 2D vs. 3D Speech-in-Noise thresholds, gap detection, or masking contours as covariates in our models, we assess their relative contributions. This approach determines the extent to which localization errors are independently associated with tinnitus (e.g., acting as a central cognitive distractor) versus being mediated by underlying, subclinical auditory processing deficits missed by standard audiograms. The acoustic complexity of the Dome is essential for this evaluation, providing the sensory load necessary to unmask these interactive effects reported from everyday life.

Conclusion:
This ongoing study utilizes a next-generation acoustic Dome to provide the high ecological validity required to comprehensively assess spatial hearing in tinnitus. By methodically controlling for broader functional processing metrics, this research aims to disentangle whether spatial hearing difficulties operate as an independent consequence of tinnitus or as a byproduct of concomitant subclinical hearing deficits.

Such stringent clinical phenotyping holds significant value for refining diagnostic paradigms and guiding individualized auditory rehabilitation. Looking forward, this highly realistic testing environment lays the groundwork for integrating objective neural measures, such as EEG, during interactive, everyday conversations. Capturing the neural correlates of listening effort in dynamic, real-world scenarios represents the ultimate horizon for next-generation audiometry.

OP-06
Hyperacusis II

OP-06-004
Repurposing conventional hearing aids for hyperacusis rehabilitation: An experimental validation study

Submitter: Philippe Fournier, Canada

Co-Authors:
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Guillaume T. Vallet
François Bergeron
Mathieu Hotton

Topic:
12) Hyperacusis, 11) Hearing aids and sound therapy

Abstract

Objective:
Hyperacusis is an auditory disorder characterized by a markedly reduced tolerance to everyday sounds, often accompanied by negative emotional or physical reactions that can substantially impair daily functioning. Because environmental sounds are ubiquitous and unpredictable, individuals with hyperacusis frequently face a difficult dilemma: risking exposure to distressing sounds with potential symptom exacerbation, or relying on sound-attenuating devices to control auditory input. While passive hearing protection such as earplugs or earmuffs can reduce discomfort, their indiscriminate attenuation of soft to moderate sounds compromises speech audibility and environmental awareness, may increase social isolation, and has been suggested to exacerbate sound intolerance through prolonged auditory deprivation. An alternative approach involves combining custom-molded earmolds with hearing aids (HAs) programmed to selectively amplify soft to moderate sounds, compensating for the earplug attenuation, while physically limiting exposure to intense sounds. Unlike passive protection, this strategy allows individualized adjustment based on loudness discomfort profiles. This study evaluates the effectiveness of this clinically accessible approach in improving sound tolerance to both artificial (narrowband noise) and natural (soundscape) stimuli, without compromising speech audibility, using conventional HAs and standard fitting procedures.

Methods:
Twenty adults with hyperacusis (mean age = 34 years, SD = 10; 13 women, 7 men) and clinically normal hearing (air conduction thresholds ≤ 20 dB HL) participated in the study. Hyperacusis severity was confirmed using multiple criteria: the Hyperacusis Questionnaire (HQ; mean = 32, SD = 6), loudness discomfort levels (minimum LDL: mean = 55 dB HL, SD = 17), and self reported hyperacusis with a confirmed impact on quality of life (mean score = 6.7/10, SD = 1.7, on a numerical scale ranging from 0 = “no impact” to 10 = “very high impact”). In addition to standard clinical screening (pure tone audiometry under headphones and questionnaires), participants completed psychoacoustic and speech perception tasks in a free field setup under three randomized listening conditions: bare ear (BE), custom earmolds with hearing aids switched off (E-HA-OFF), and custom earmolds with hearing aids switched on (E-HA-ON).

Detection thresholds (DTs) and discomfort levels (DLs) were measured using octave band narrowband noises spanning 0.5 to 8 kHz. Two ecologically valid soundscapes, a cafeteria and a daycare environment, were also presented to assess DTs and DLs. For soundscape conditions, annoyance levels (ALs) were defined as the minimum sound level required to disrupt a silent reading task and were measured across all three listening conditions. Hearing aids were individually programmed using standard clinical fitting procedures to ensure transparency for soft and moderate sounds while limiting output to remain below individual discomfort thresholds. Speech perception was assessed using sentence intelligibility thresholds measured in silence and in noise under all three listening conditions.

Results / Discussion:
DLs were significantly elevated relative to the bare ear (BE) condition for both narrowband noises and soundscape stimuli in the E HA OFF and E HA ON conditions. For narrowband noises, DLs increased by an average of 23 dB SPL in the E HA OFF condition and 12 dB SPL in the E HA ON condition (both $p < .001$). For pooled soundscapes, DLs increased by 18 dB LAeq and 9 dB LAeq in the E HA OFF and E HA ON conditions, respectively (both $p < .005$). Annoyance levels (ALs) showed a similar pattern, with increases of 21 dB LAeq in the E HA OFF condition and 9 dB LAeq in the E HA ON condition compared with BE (both $p < .005$), indicating increased tolerance to functional sound disruption in both conditions.

DTs were differentially affected by listening condition. For narrowband noises, DTs were elevated by 27 dB SPL in the E HA OFF condition and by only 6 dB SPL in the E HA ON condition relative to BE (both $p < .001$). For pooled soundscapes, DTs were significantly elevated in the E HA OFF condition (15 dB LAeq; $p < .001$), with no significant difference between the E HA ON and BE conditions. Sentence intelligibility thresholds were also significantly elevated in the E HA OFF condition compared with BE (19 dB SPL; $p < .001$), whereas no difference was observed in the E HA ON condition. Overall, combining earmolds with hearing aids programmed for transparency preserved audibility and speech intelligibility while increasing sound tolerance.

Conclusion:
Taken together, and consistent with the challenges outlined in the introduction, these findings suggest that hearing aids programmed for transparency and coupled with earmolds can reduce discomfort associated with loud sound exposure while avoiding the audibility and speech intelligibility costs inherent to passive attenuation alone.

OP-07
Comorbidity II

OP-07-001
Tinnitus Disorder is not just Tinnitus with Comorbid Depression

Submitter: Milena Engelke, Germany

Co-Authors:
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Topic:
8) Diagnosis, 9) Epidemiology

Abstract

Objective:
Tinnitus disorder and depression share several emotional and somatic symptoms, raising the question of whether tinnitus-related suffering reflects a distinct condition or merely tinnitus accompanied by comorbid depression.

Methods:
We compared Major Depression Inventory item responses of patients with tinnitus disorder and patients with depression (N = 753 each). The groups were matched for depressive symptom severity, age, and sex and were examined with respect to their symptom profiles and symptom networks. This was complemented by the development of a machine-learning classifier to differentiate the two groups based on their symptom profile.

Results / Discussion:
Symptom-level analyses revealed distinct profiles, network analyses further demonstrated systematic differences in specific symptom interrelations. The classifier confirmed that the two groups exhibit distinguishable but partially overlapping patterns, including under more naturalistic analytic conditions.

Conclusion:
The findings support the conceptualization of tinnitus disorder as a distinct clinical entity rather than a mere manifestation of comorbid depression, underscoring the relevance of diagnostic differentiation and the need for psychosomatic interventions tailored specifically to tinnitus-related distress.

OP-07
Comorbidity II

OP-07-003
Treatment preferences and values in chronic tinnitus patients: a cross-sectional survey study

Submitter: Jeon Mi Lee, Republic of Korea

Co-Authors:
Ho Yun Lee

Topic:
9) Epidemiology, 5) Clinical management

Abstract

Objective:
Tinnitus is a common condition that can severely impact patients' quality of life. However, little is known about how individuals with chronic tinnitus evaluate and prioritize available treatment options. This study aimed to explore the preferences, values and expectations of patients with chronic tinnitus to inform more patient-centered strategies in clinical care.

Methods:
A cross-sectional survey was conducted from May 8 to June 19, 2025, involving 45 patients with chronic tinnitus. A structured 36-item questionnaire assessed demographic information, tinnitus severity using the Tinnitus Handicap Inventory (THI) and the Visual Analog Scale (VAS), treatment preferences across 16 key questions, perceived information needs, and impact on daily functioning.

Results / Discussion:
Participants (mean age 50.7 ±14.8 years, 62.2% male, median tinnitus duration 12 months) showed strong preferences for non-invasive treatments: sound therapy (73.4%), tinnitus retraining therapy (TRT; 55.6%), and cognitive behavioral therapy (CBT; 44.4%). Pharmaceutical interventions had lower acceptance, with hearing aids showing highest rejection (33.3%). Key concerns included drug dependency (48.9%) and psychiatric medication stigma (28.9%). 51.1% of respondents expected complete symptom resolution despite limited evidence. Information needs were high across all modalities (40–50%). Sleep disorders (THI difference: 12.9 points) and anxiety (6.5 points) significantly associated with increased tinnitus severity.

Conclusion:
Tinnitus patients strongly prefer non-invasive treatments while harboring unrealistic expectations for cure. These findings underscore the importance of structured education and shared decision-making to align clinical care with patient values and promote more effective tinnitus management.

OP-07
Comorbidity II

OP-07-002
Emotional, Cognitive and Lifestyle Factors in Tinnitus Severity: The Role of Anxiety, Tinnitus-Related Cognitive Fusion and Lifestyle Health Behaviours

Submitter: Malgorzata Wrzosek, Poland

Co-Authors:
Weronika Spalding
Irade Salgin

Topic:
20) Stress and tinnitus, 7) Comorbidity

Abstract

Objective:
Tinnitus is a common and often distressing condition whose subjective burden depends not only on auditory factors but also on emotional regulation and cognitive processes. This study aimed to examine how anxiety, depression, cognitive fusion, self-compassion, positive orientation, and lifestyle behaviours, including sleep, physical activity, and adherence to the MIND (Mediterranean-DASH Intervention for Neurodegenerative Delay) diet, relate to the perceived severity of tinnitus. Cognitive fusion refers to identifying with tinnitus-related thoughts in a way that allows them to guide emotional responses and behaviour; self-compassion reflects a kind and balanced stance toward personal difficulty; and positive orientation denotes a general inclination to view oneself, the world, and the future positively. In this study special attention was given to identifying both psychological and behavioural correlates of global tinnitus handicap and its cognitive-emotional subcomponents.

Methods:
A cross-sectional online study was conducted among adults experiencing tinnitus (n = 55), recruited via internet forums. Participants completed standardized measures including the Tinnitus Handicap Inventory (THI), the Hospital Anxiety and Depression Scale (HADS), the short Self Compassion Scale, the Positive Orientation Scale, and a tinnitus adapted Cognitive Fusion Questionnaire, along with items assessing sleep parameters, sport activity, and adherence to the MIND diet. Correlational analyses were performed, and multiple regression models were used to explore unique contributions of psychological and lifestyle variables.

Results / Discussion:
Tinnitus severity (the total score of THI) was strongly positively associated with anxiety ($r = 0.731$, $p < 0.001$), depression ($r = 0.576$, $p < 0.001$), total HASD score ($r = 0.692$, $p < 0.001$), and tinnitus-specific cognitive fusion ($\rho = 0.778$, $p < 0.001$). Higher self-compassion and positive orientation were negatively related to tinnitus severity ($r = −0.382$, $p = 0.004$; $\rho = −0.511$, $p < 0.001$). Lifestyle indicators showed relevant links: greater distress correlated with fewer sleep hours ($\rho = −0.343$, $p = 0.010$), poorer sleep recovery ($\rho = −0.295$, $p = 0.029$), and lower sport activity ($\rho = −0.324$, $p = 0.016$), particularly with moderate-intensity activity inversely associated with THI ($\rho = −0.301$, $p = 0.025$). Higher intake of non-fried fish ($\rho = −0.279$, $p = 0.039$) and berries

(ρ = −0.273, p = 0.043) was linked to reduced burden. Similar associations were observed across THI subscales. Regression analyses supported these patterns and suggested a possible moderating role of MIND diet adherence

Conclusion:
In this study, anxiety and tinnitus-related cognitive fusion are the strongest psychological correlates of tinnitus severity, whereas self-compassion functions as a protective emotional resource. Sleep quality, sleep recovery, and physical activity showed additional relevance, indicating that behavioural factors should be integrated into tinnitus management. Furthermore, the obtained results suggest that dietary lifestyle patterns may modulate emotional vulnerability related to tinnitus severity. These findings support comprehensive, non-pharmacological approaches combining psychological skills training, emotional regulation strategies, and lifestyle-based health behaviours for individuals experiencing tinnitus.

OP-08
Epidemiology

OP-08-003
Prevalence of Tinnitus Associated Suffering and Behavioral Outcomes in Children and Adolescents; The Lifelines Cohort Study

Submitter: Diane Smit, The Netherlands

No Co-Authors submitted

Topic:
9) Epidemiology, 6) Clinical studies

Abstract

Objective:
Tinnitus in children and adolescents is poorly studied. Literature is scarce and prevalence varies widely due to the lack of a clear pediatric definition. The impact on daily life appears lower than in adults, but it is unknown whether affected children experience psychological distress such as anxiety or depression. Better understanding is needed to clarify the burden and guide future research on progression and causes.

Methods:
A cross-sectional study used data from the Dutch Lifelines cohort in the north of the Netherlands, including 4964 children (4–12 years) and 2506 adolescents (13–17 years). Tinnitus suffering and behavioral outcomes were assessed using single-item questions and CBCL or YSR questionnaires. Associations were analyzed with univariate binary regression.

Results / Discussion:
The prevalence of tinnitus suffering in children was 3.3 and 12.8% in adolescents. Additionally, 0.3% of the children and 1.9% of the adolescents suffered a lot or extremely of their tinnitus. Externalizing and internalizing problems were associated with tinnitus in adolescents. Internalizing problems were associated with tinnitus in children

Conclusion:
Prevalence of tinnitus suffering was comparable to other population-based studies. Few children (0.3%) or adolescents (1.9%) reported severe or extreme suffering. Tinnitus suffering was associated with all behavioral subscales in adolescents and with internalizing problems in children, though effect sizes were small. Future research should aim to define pediatric tinnitus and develop validated outcome measures.

OP-08
Epidemiology

OP-08-001
Understanding tinnitus severity: a worldwide approach

Submitter: Lise Hobeika, France

Co-Authors:
Matt Fillingim
Azin Zare
Alain Londero
Séverine Samson
Etienne Vachon-Presseau

Topic:
2) Basic research, 9) Epidemiology

Abstract

Objective:
Managing distressing tinnitus poses challenges due to limited knowledge about the factors underlying its severity. In a previous study, we used a data-driven approach to create a risk score predicting tinnitus severity. Our aims are to i) test the generalizability of the link between risk score and tinnitus severity worldwide and ii) evaluate whether the risk score predicts the evolution of tinnitus severity with treatments.

Methods:
We gathered 11 datasets around the world (North America, South America, Europe and Asia), which we divided into different types: population, research, the tertiary clinic and clinical trial datasets. There were 48,000 individuals reporting their tinnitus severity. In each dataset, we calculated a risk score using questions equivalent to our questionnaire items, covering hearing health, mental health and sleep disorders.

Results / Discussion:
In 10 of the datasets, we were able to predict severe tinnitus with good accuracy (ROC-AUC > .70), which rises to excellent accuracy in the clinic datasets (ROC-AUC > .85). Using the data of the UNITI randomized controlled trial, we evidenced that the benefits of the treatments were reduced for individuals with a higher risk score, after controlling for baseline severity.

Conclusion:
We evidenced that tinnitus severity can be predicted using only six binarized questions assessing hearing health, sleep quality, and mental health. The results were similar worldwide, ensuring the generalizability and the robustness of this tool. The influence of the risk score on treatment outcomes is highly relevant for clinical management. Specialists could focus more clinical and therapeutic efforts on patients with a higher risk score.

OP-08
Epidemiology

OP-08-002
Age-related hearing loss prevalence and years lived with disability from 1990 to 2021: An analysis focus on SDI regions and WHI countries

Submitter: Zhiyang Wen, People's Republic of China

Co-Authors:
Yinfei Liang

Topic:
9) Epidemiology, 6) Clinical studies

Abstract

Objective:
Age-related hearing loss (ARHL) is an escalating global public-health challenge. Using 1990–2021 Global Burden of Disease data we estimated age-standardized prevalence (ASPR) and years lived with disability (ASYR) for 204 countries, stratified by Socio-demographic Index (SDI), age, sex and World Happiness Index (WHI) to explore how societal well-being relates to ARHL burden.

Methods:
Data for this study were derived from the Global Burden of Disease Study 2021 (GBD 2021), which uses the latest epidemiological data and enhanced standardized methodologies to comprehensively assess health losses caused by 371 diseases and injuries, as well as 288 causes of death, across 204 countries and territories.

Results / Discussion:
This study, based on the GBD 2021 database, is the first to provide a comprehensive analysis of the global burden of age-related hearing loss (ARHL) from 1990 to 2021, with a focus on the Socio-Demographic Index (SDI) regions and World Happiness Index (WHI) countries. The findings highlight significant trends and disparities in the prevalence and years lived with disability (YLDs) attributable to ARHL across different regions and populations.

Conclusion:
From 1990 to 2021, the global burden of hearing loss has increased steadily each year. The highest burden was observed in middle SDI regions, while high SDI regions experienced the lowest. In 2021, Finland—the country with the highest World Happiness Index (WHI)—had a greater ASPR burden than Afghanistan, which has the lowest WHI. Finland's ASPR showed an upward trend, whereas Afghanistan's ASPR declined.

OP-08
Epidemiology

OP-08-004
Hearing protection behaviors among music festival attendees: a descriptive cross-sectional analysis of use, barriers and facilitators

Submitter: Inge Stegeman, The Netherlands

Co-Authors:
Denise Fuchten
Diane Smit

Topic:
9) Epidemiology, 21) Therapy

Abstract

Objective:
Given the limited uptake of hearing protection in recreational settings and the need for more effective strategies to promote their use to reduce noise-induced hearing damage, a better understanding of factors influencing hearing protective behaviors is needed. The current study examined the use, barriers and facilitators of hearing protective behaviors among festival attendees, as well as their perception of volume safety at festivals.

Methods:
A total of 1325 attendees of a multi-day music festival filled in a questionnaire on hearing symptoms, the perception of music volume safety and hearing protective behaviors. Descriptive analyses were conducted and reported for different age groups and genders.

Results / Discussion:
Over 80% of participants perceived festival music volume as unsafe without hearing protection. The majority of participants reported using hearing protective strategies, including keeping distance from the speakers (77.05%) and wearing earplugs (70.41%), though consistent use was limited. Participants under 20 years old and men reported perceiving music as unsafe less often and engaged in fewer hearing protective behaviors. The primary reason for participants to wear earplugs was to protect their ears from damage (84.99%), and they mainly started wearing earplugs due to information they received about hearing loss or tinnitus (35.58%), due to people with hearing loss or tinnitus in their environment (27.55%) or because they developed hearing loss or tinnitus themselves (20.69%). Reasons for not wearing earplugs were more varied across the population, with notable differences between men and women.

Conclusion:
While general awareness of the potential risks of loud music exposure at festival is high and most participants engage in hearing protective behaviors, consistent use of hearing protection is more limited and should be addressed. By addressing the specific barriers and facilitators of these groups, such efforts can enhance the adoption of hearing protection strategies and ultimately contribute to the reduction of noise-induced hearing damage.

OP-09
Models

OP-09-001
Ten Years of the Stochastic Resonance Model of Tinnitus: Redefining Phantom Perception as Adaptive Sensory Optimization

Submitter: Patrick Krauss, Germany

Co-Authors:
Achim Schilling

Topic:
14) Models, 2) Basic research

Abstract

Objective:
To review ten years of the stochastic resonance (SR) model of tinnitus and evaluate its development from a theoretical hypothesis to an integrated neurocomputational framework. The model reinterprets tinnitus-related hyperactivity as adaptive internal noise upregulation that enhances signal detection after hearing loss, redefining phantom perception as a byproduct of sensory optimization rather than primary dysfunction.

Methods:
We provide a chronological conceptual review of theoretical advances, computational implementations, large-scale clinical data analyses, and experimental findings related to the SR framework. Developments are compared with central gain, homeostatic plasticity, and predictive coding models, and recent translational approaches using near-threshold noise stimulation are summarized.

Results / Discussion:
The SR model explains tinnitus as a consequence of adaptive noise regulation operating at the level of signal detection. It accounts for rapid onset phenomena, frequency specificity, and somatosensory modulation. Integrated with gain control and predictive coding accounts, it contributes to a multilevel framework linking induction, amplification, and conscious perception of phantom sounds.

Conclusion:
After a decade, the SR framework has evolved into a unifying perspective connecting auditory physiology, information theory, and clinical intervention. By shifting the focus from maladaptive overexcitation to adaptive sensory computation, it provides falsifiable predictions and therapeutic implications, opening new avenues for mechanistic validation and targeted treatment of tinnitus.

OP-09
Models

OP-09-003
Peripheral–central interactions in tinnitus: a proposal for mechanism-based subgrouping

Submitter: Michael Boedts, Belgium

No Co-Authors submitted

Topic:
14) Models, 8) Diagnosis

Abstract

Objective:
Many treatments for tinnitus are available. In daily practice, most seem to help some patients. However, few interventions show consistent benefit in controlled trials. We suggest that this may result from inadequate subgrouping.

Current subgrouping is often only based on hearing loss or questionnaire scores. Hearing loss does not explain the wide variation in tinnitus presentation. Questionnaire scores reflect severity, not underlying mechanism. If subgrouping is not mechanism-based, treatment effects are likely diluted.

We therefore present a proposal for mechanism-based subgrouping that integrates both deafferentiation and trigeminocervical contributions.

Methods:
The framework combines experimental evidence on trigeminocervical–auditory interactions with structured clinical observations. Tinnitus is approached along four dimensions:

1. Type of neuroplasticity: deafferentiation-related vs. adaptation-related.

2. Stage: strictly peripheral, strictly central, combined, or tinnitus disorder.

3. Mechanism: increased input (strain) or increased output (sensitisation).

4. Source of trigeminocervical input: motor, sensory, acoustic, or central.

Subgrouping is based on history, questionnaires, clinical examination, audiometry, and on trial therapies.

Results / Discussion:
The first dimension separates two broad therapeutic directions: hearing-related strategies in deafferentiation-dominant cases and trigeminocervical-oriented strategies when trigeminocervical input is dominant.

The second dimension (stage) helps determine the sequence of peripherally and centrally aimed interventions.

The third dimension currently is scientifically interesting but currently does not have an influence on treatment choice.

When ‘stage’ indicates a peripheral component, the fourth dimension becomes clinically decisive. Identifying the dominant input pathway may guide targeted peripheral intervention.

This proposal is conceptual. Its value can only be determined when therapeutic outcomes are systematically evaluated within these defined subgroups.

Conclusion:
We propose mechanism-based subgrouping as a structured starting point for tinnitus research and clinical care. The ultimate goal is to enable more targeted and individualized therapy. The usefulness of this classification must be tested by reassessing existing treatments within clearly defined subgroups.

OP-10
Diagnostics

OP-10-002
Peripheral Afferent and Efferent Encoding in Individuals With Tinnitus

Submitter: Pauline Devolder, Belgium

Co-Authors:
Hannah Keppler
Ingeborg Dhooge
Sarah Verhulst

Topic:
8) Diagnosis, 18) Psychoacustics

Abstract

Objective:
Some theoretical models of tinnitus mechanisms propose that hidden peripheral hearing loss may contribute to tinnitus generation. By jointly evaluating these afferent and efferent pathways in individuals with tinnitus and accounting for age- and hearing loss-related factors, we aimed to identify peripheral interactions that may underlie tinnitus mechanisms.

Methods:
We collected data from 113 subjects, using objective measures: distortion-product otoacoustic emissions, auditory brainstem responses, envelope- and frequency-following responses, middle ear muscle reflexes, and medial olivocochlear reflexes. We also assessed functional consequences using two behavioral speech-related tasks: a vowel discrimination task and the Flemish Matrix sentence test, both in quiet and in noise.

Results / Discussion:
Age and hearing loss strongly affected peripheral and neural auditory measures, while tinnitus effects were subtle and age-dependent. Young adults with normal-hearing and tinnitus showed enhanced ABR wave V amplitudes, increased EFR magnitudes, and better vowel discrimination. In contrast, older adults with tinnitus showed no neural enhancements and reduced speech-in-noise performance yet preserved or improved vowel discrimination.

Conclusion:
Our findings reveal distinct tinnitus profiles throughout the lifespan. Young adults with tinnitus exhibit central gain enhancement and improved simple perceptual abilities. In contrast, older adults show age-related declines in neural encoding, which is accompanied by impaired speech understanding, but improved basic speech-encoding.

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OP-10
Diagnostics

OP-10-003
Towards a Psychophysical Marker for Tinnitus: Investigating Sensory Precision during a Pure-Tone Detection Task in Tinnitus Subjects

Submitter: Jeftha N. Stehouwer, The Netherlands

Co-Authors:
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Huib Versnel
Alexander E Hoetink

Topic:
18) Psychoacustics

Abstract

Objective:
The stochastic resonance model proposes that tinnitus is the result of noise added to the auditory neural response to compensate for hearing loss. We hypothesize that as a result tinnitus subjects have a different neural representation of silence than non-tinnitus subjects. This may reduce accuracy in a tone-detection task. We developed a method to assess the accuracy of tinnitus subjects, investigating its potential as a psychophysical marker.

Methods:
A pre-existing adaptive pitch-matching procedure was used to estimate the tinnitus frequency for the (non-clinical) tinnitus group. A two-alternative forced choice procedure was developed to assess the true positive and false positive rates in both groups at three different frequencies. We varied the prior distributions (expectations) between subjects. Repeated measurements were performed to examine the variation due to attention.

Results / Discussion:
A complete set-up and corresponding analytical framework were established and the sensory precision of the two groups were compared, both between subjects and within subjects. We discuss the variability between tinnitus subjects, as well as the effects of hearing loss, frequency, prior distribution and attention on both groups. We review the (im)possibilities of a psychophysical marker for tinnitus.

Conclusion:
Our findings show large variability between tinnitus subjects and underscore the necessity to divide them into subgroups, rather than pooling data. We provide insight into the various aspects that complicate tinnitus research, and guide further research to minimize their impact.

OP-10
Diagnostics

OP-10-004
Analysis of the brain function in patients with Idiopathic benign paroxysmal positional vertigo (ibbpv): a resting-state fMRI study

Submitter: Siyi Wang, People's Republic of China

Co-Authors:
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Zhicheng Li
Shumin Deng
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XiangLi Zeng

Topic:
6) Clinical studies

Abstract

Objective:
This study analyzes resting-state functional magnetic resonance imaging (rs-fMRI) features in patients with idiopathic benign paroxysmal positional vertigo (iBPPV) with the aim of identifying potential neuroimaging biomarkers to elucidate the underlying pathogenesis, predict the onset of residual dizziness (RD), and facilitate early intervention.

Methods:
From Jan 2023-Nov 2024, 23 iBPPV patients and 24 healthy controls (HCs) underwent rs-fMRI and questionnaires. Follow-up phone interviews (Apr 2023-Feb 2025) assessed residual dizziness(RD) after repositioning. Using RESTplus, we calculated fALFF, PerAF, ReHo, and seed-based functional connectivity. Statistical analyses were performed to compare indicators between iBPPV patients and HCs, followed by correlation analyses with clinical data.

Results / Discussion:
iBPPV patients showed decreased PerAF in the frontal gyrus. Decreased fALFF and ReHo were observed in the posterior cerebellar lobe. Decreased ReHo in the right inferior temporal gyrus was associated with a higher likelihood of RD, while increased ReHo in the left parietal gyrus was linked to RD. FC analysis revealed decreased FC between the posterior cerebellar lobe and the right superior temporal gyrus, positively correlating with SDS scores.

Conclusion:
Our study suggests that spontaneous activity of brain change between patients and HCs. These alterations are associated with the vestibulo-cortical network, cortical-limbic-cerebellar circuit and multiple sensory systems. Further understanding of the ReHo neuroimaging characteristics may help clinicians elucidate the relevance of iBPPV and RD, developing therapeutic strategies.

OP-10
Diagnostics

OP-10-001
Comparison of auditory middle latency response in tinnitus patients and controls

Submitter: Dimitris Kikidis, Greece

Co-Authors:
Christos Consoulas
Nikolaos Markatos
Evgenia Vassou

Topic:
2) Basic research

Abstract

Objective:
Tinnitus is a common auditory percept characterized by the conscious experience of sound without an external stimulus. Although peripheral dysfunction is often implicated, growing evidence suggests that tinnitus involves altered central auditory processing and maladaptive neuroplasticity within thalamocortical networks. Auditory Middle Latency Responses (AMLR), occurring 10–80 ms after stimulus onset, reflect early cortical and thalamocortical activity and may provide objective evidence of such central alterations. This study aimed to compare AMLR parameters between tinnitus patients and carefully matched healthy controls.

Methods:
A total of 150 adults were included, 100 with chronic subjective tinnitus (>6 months) and 100 controls, 50 matched for age, gender, and pure-tone thresholds (0.25–8 kHz)). All participants underwent comprehensive audiological assessment, including otoscopy, tympanometry, pure-tone audiometry, and speech audiometry. Individuals with neurological disorders, psychiatric instability, pulsatile tinnitus, Ménière's disease, or retrocochlear pathology were excluded. AMLR recordings were obtained using monaural click stimuli (70 dB nHL, 7.1/s) with standard Cz–linked mastoid electrode configuration. Latencies and amplitudes of Na, Pa, Nb, and Pb waves were measured. Group differences were analyzed using t-test after assumptions testing , followed by multivariate regression controlling for hearing thresholds.

Results / Discussion:
The findings indicate altered thalamocortical transmission and cortical excitability in tinnitus patients, reflected by prolonged Pa ($p < 0.002$) and Pb ($p < 0.001$) latencies and increased Pb ($p < 0.001$) amplitude. These changes suggest delayed neural processing, cortical hyperexcitability, and possible maladaptive neuroplasticity independent of peripheral hearing status. The inclusion of matched controls strengthens the evidence for tinnitus-specific central mechanisms. AMLR may serve as an objective marker of cortical dysfunction, though longitudinal studies are needed to clarify causality and clinical relevance.

Conclusion:
Tinnitus is associated with measurable AMLR alterations, particularly in Pa and Pb components,

indicating disrupted thalamocortical processing and cortical hyperexcitability independent of peripheral hearing status. AMLR may serve as a potential neurophysiological biomarker of central auditory dysfunction in tinnitus.

OP-11
Imaging

OP-11-002
Mapping the triple-network reorganization in tinnitus: an integrated multimodal MRI pathway to targetable core hubs

Submitter: Qian Chen, People's Republic of China

Co-Authors:
Zhenchang Wang

Topic:
6) Clinical studies, 13) Imaging

Abstract

Objective:
Tinnitus is increasingly conceptualized as a common clinical symptom involving large-scale network dysfunction beyond the auditory cortex. The triple-network model, comprising the default mode network (DMN), frontoparietal network (FPN), and salience network (SN), offers a mechanistic framework, yet multimodal, multilevel evidence within a unified triple-network architecture remains limited.

Methods:
Using multimodal MRI in 40 tinnitus patients and 40 controls, we analyzed regional and connectomic brain alterations. We examined functional and diffusion metrics, as well as connectivity networks, and global graph properties. Altered connections were identified via Network-Based Statistics. Finally, we integrated multimodal abnormalities to prioritize core disrupted hubs using a normalized abnormality load score.

Results / Discussion:
Patients showed reduced functional connectivity in key hubs and broad white matter alterations. Network analysis revealed widespread functional disconnection, especially between major brain networks, but limited structural changes. Topology was broadly disrupted, with efficiency and organization reduced. A multimodal ranking identified a right-lateralized set of core hubs, primarily in frontal and cingulate regions.

Conclusion:
Our multimodal, multilevel analyses suggest that tinnitus involves reorganization of triple-network architecture, with SN hub vulnerability, extensive between-network functional disconnection, and complementary structural alterations. We further identify a fronto-insular–cingulate hub landscape linked to symptom burden, thereby providing a data-driven framework for identifying targetable nodes for future hub-guided interventions.

OP-11
Imaging

OP-11-001
Harmonizing Multi-Scale Heterogeneity: A Normative Modeling Framework for Identifying Diffusive EEG Biomarkers in Tinnitus

Submitter: Payam Sadeghi Shabestari, Switzerland

Co-Authors:
Tobias Kleinjung
Winfried Schlee
Patrick Neff

Topic:
14) Models, 2) Basic research

Abstract

Objective:
Tinnitus is a "phantom" sound resulting from maladaptive neuroplasticity and the integration of auditory and limbic circuits. Traditional research often fails because it focuses on isolated brain regions rather than distributed neural patterns. This study aims to identify a universal signature within high-dimensional data, overcoming significant inter-individual variability and site-specific recording biases that prevent single-subject diagnosis.

Methods:
Using resting-state EEG from over 500 participants across multiple sites, we applied norm models to quantify how individual brain activity deviates from a healthy "norm." We utilized machine learning to analyze spatiotemporal patterns across the regions and networks. To ensure the model's robustness, we used a validation framework, testing its ability to generalize across different hardware and clinical environments.

Results / Discussion:
To move beyond "black-box" AI, we used advanced interpretability frameworks to verify our findings. The results confirmed that classification was driven by consistent global topographies and cross-frequency interactions. This focus on pattern stability across different sites allowed us to isolate a robust, site-independent neural fingerprint, ensuring the identified signatures are clinically valid and reliable.

Conclusion:
This research shifts the focus from focal brain anomalies to a holistic, network-centric view of tinnitus. By combining normative modeling with cross-site predictive analysis, we proved that tinnitus manifests in stable, large-scale neural patterns. This framework establishes a blueprint for objective diagnostic tools that are biologically grounded, providing a path toward generalizable clinical applications across diverse patient populations.

OP-11
Imaging

OP-11-003
Neural Reorganization in Tinnitus: Dissociable Effects of Hearing Loss on Salience, Sensory, and Affective Networks Revealed by Multimodal MRI

Submitter: Ling Wang, People's Republic of China

Co-Authors:
Qian Chen
Pengfei Zhao
Zhenchang Wang

Topic:
17) Plasticity, 13) Imaging

Abstract

Objective:
Tinnitus is a heterogeneous disorder commonly associated with hearing loss (HL), yet a significant subset occurs with normal hearing. The distinct neural mechanisms underpinning these subtypes remain poorly understood. The aim of this study was to identify the shared and divergent neural alterations in tinnitus patients with HL(TIN+HL) and without HL (TIN-HL) using multimodal MRI.

Methods:
38 tinnitus patients (including 23TIN+HL and 15TIN-HL) and 28 healthy controls (HCs) were enrolled in this study. High-resolution 3D T1-weighted images, diffusion tensor imaging, and resting-state functional magnetic resonance imaging were obtained from all participants. We compared the gray matter volume (GMV), fractional anisotropy (FA), amplitude of low-frequency fluctuations (ALFF), regional homogeneity (ReHo), and functional connectivity (FC) between bilateral auditory cortex (AC) and other brain voxels among the three groups. Spearman's correlation assessed the relationship between imaging and clinical data.

Results / Discussion:
Compared with HCs, the TIN-HL showed significantly decreased ALFF in the bilateral ACC, caudate nucleus and increased ALFF in the left MOG, and the TIN-HL showed significantly decreased ALFF in the bilateral ACC and increased ALFF in the left MOG. Compared with HCs, the TIN+HL showed significantly decreased ReHo in the right PHG, MFG, rectus gyrus and the left MOG, and the TIN-HL showed significantly decreased ReHo in the right rectus gyrus and the left MOG. The subsequently ANCOVA and post hoc analyses revealed significantly decreased FC value between the right AC and the left MTG in both TIN+HL and TIN-HL when compared with HCs. Moreover, when compared with the TIN+HL, the TIN-HL showed lower FC values between the right AC and the left MTG . The THI scores of tinnitus patients were found to have a significantly weak positive correlation with the ALFF value in the left MOG (P=0.001, r=-0.513).

Conclusion:
Our study revealed that tinnitus patients with and without hearing loss share core neural

abnormalities such as dysfunction of the anterior cingulate cortex, yet show distinct differences in caudate nucleus activity, regional synchrony, and auditory-cognitive network connectivity. Enhanced activity in the left middle occipital gyrus was correlated with tinnitus severity, suggesting its role as a compensatory hub. These findings provide novel neuroimaging evidence for understanding the heterogeneous mechanisms of tinnitus and advancing precise neuromodulation strategies.

OP-11
Imaging

OP-11-004
Development of an Optimized In Vivo and In Vitro Venous 4D-Flow MRI Workflow for Pulsatile Tinnitus

Submitter: Alper Atici, Germany

Co-Authors:
Harsha Prakasam Prabhakaran
Mariya Pravdivtseva
Jan-Bernd Hövener
Naomi Larsen
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Topic:
13) Imaging, 2) Basic research

Abstract

Objective:
Pulsatile tinnitus (PT) is frequently associated with vascular abnormalities that may alter regional blood-flow dynamics and contribute to sound generation synchronized with the cardiac cycle. In venous PT, the underlying anatomy is often geometrically complex, which complicates both image acquisition and the reliable assessment of local flow phenomena. Although 4D-Flow MRI is well suited for PT evaluation because it enables time-resolved, three-dimensional quantification of flow patterns and velocity fields, its application in this setting requires carefully adapted acquisition strategies and efficient post-processing. In addition, data handling and segmentation of these anatomically challenging venous structures can be tedious and time-consuming.

The aim of this study was to develop an optimized MRI protocol for venous 4D Flow assessment that is applicable to both in vivo and in vitro settings, together with a dedicated post-processing workflow. In addition, in vivo anatomical data from a volunteer with pulsatile tinnitus and imaging findings consistent with a HRJB were used to generate a patient-specific 3D model for integration into an experimental flow setup. This model was intended to demonstrate the in vitro applicability of the workflow. The results of the study may accelerate research in the realm of PT, by providing a stable and convenient workflow, in both in vivo and in vitro settings.

Methods:
A volunteer with self-reported pulsatile tinnitus (PT) and imaging findings consistent with a HRJB was included. Anatomical MRI was performed using a TWIST sequence, allowing to capture the relevant venous geometry, including the superior sagittal sinus, transverse sinus, sigmoid sinus, and the internal jugular vein. Based on these data, a patient-specific 3D model was generated and fabricated (FormLabs Clear Resin V4.1). In parallel, a 4D Flow MRI protocol and analysis workflow was developed and optimized specifically for venous flow assessment. The protocol consists out of a TOF scan with 0.9mm isotropic resolution for planning, a 3D-PCA sequence with 0.4mm isotropic resolution for segmentation, and a Work-In-Progress Compressed-

Sensing (CS) 4D-Flow sequence from Siemens with 1mm isotropic resolution. The CS 4D-Flow sequence was adapted from cardiac to cerebral imaging by modifying the acquisition parameters, followed by a signal-to-noise analysis to determine the optimal CS factor.The resulting MRI protocol is intended to be suitable for clinical routine application. The developed MRI protocol and post-processing workflow were tested in both in vivo and in vitro settings. The in vitro test was conducted using the patient-specific model integrated into an experimental flow circuit, whereas the in vivo test was performed on a randomly selected volunteer.

Results / Discussion:
The study established an optimized workflow for venous 4D Flow MRI assessment in both in vivo and in vitro settings, together with the generation of a patient-specific 3D model in a volunteer with pulsatile tinnitus and imaging findings consistent with a high-riding jugular bulb. The model reproduced the overall vascular anatomy well and provided a suitable basis for controlled hemodynamic experiments. Initial 4D Flow MRI measurements on the model showed the expected flow appearance, indicating that the setup is suitable for capturing relevant venous flow phenomena. In addition, the developed MRI protocol enabled acquisition of all relevant imaging data in less than 17 minutes, while the in-house post-processing workflow allowed rapid analysis in under one minute per dataset, including segmentation, phase-offset correction, and anti-aliasing.

The optimized MRI protocol showed good overall performance for both in vivo and in vitro venous 4D Flow assessment. At the same time, signal behavior remained dependent on the underlying vascular geometry and flow conditions. Owing to the complex shape of the investigated venous structures, saturation effects and in-plane dephasing may occur and lead to local signal loss, thereby affecting segmentation quality. In vivo, contrast conditions may additionally depend on the individual drainage pattern. More asymmetric drainage may increase contrast in the dominant branch, whereas in cases of weaker asymmetry with flow distributed more evenly between both branches, contrast may be reduced and segmentation may become more challenging.

Conclusion:
This work successfully established an optimized venous 4D Flow MRI workflow for PT-related hemodynamic assessment in both in vivo and in vitro settings. As part of this workflow, a patient-specific 3D model of a high-riding jugular bulb was generated and served as a controlled experimental platform for in vitro testing. Future work will focus on implementing an improved and faster segmentation sequence to substantially facilitate data handling in both settings. In addition, further matched in vivo and in vitro measurements are planned to assess the degree of overlap between subject and model, including qualitative evaluation of overall flow patterns and local PT-relevant phenomena as well as quantitative analysis of peak velocity, mean velocity, and flow rate in predefined anatomical regions. These efforts are intended to further establish patient-specific 3D models as a viable testing platform for accelerating PT-related research.

OP-12
Brain stimulation

OP-12-001
What Tinnitus Implant Studies Have Taught Us

Submitter: Diane Smit, The Netherlands

No Co-Authors submitted

Topic:
1) Auditory implants, 21) Therapy

Abstract

Objective:
Since auditory deprivation is hypothesized to be one of the causes of tinnitus, increasing the auditory input by cochlear stimulation might be a possible treatment. In studies assessing cochlear implantation for patients with hearing loss, tinnitus relief was seen as a secondary outcome. Therefore, in this study we aimed to assess the effect of cochlear implantation in patients with primarily tinnitus complaints.

Methods:
In this randomised controlled trial, starting in January 2021, we aimed to include 50 patients with a primary complaint of tinnitus with a TFI-score >32 and bilateral moderate to severe hearing loss. Patients were randomized to a CI or a control group and to be followed for 6 months. The primary objective of the study was to assess whether treatment by CI was superior to the control group to reduce tinnitus burden.

Results / Discussion:
This study shows that only a small subgroup with severe tinnitus meets criteria for moderate-to-severe hearing loss and accepts the risk of further loss from cochlear implantation. Many candidates fell outside thresholds or were excluded for mental health reasons. Excluding high depressive scores may miss urgent needs; inclusion requires careful counseling and safeguarding ongoing mental health care.

Conclusion:
Studying invasive approaches to reduce tinnitus burden require careful consideration of the size and characteristics of the target population and the feasibility of conducting successful trials. In addition, researchers must critically reconsider whether and how to include tinnitus patients with comorbid mental health conditions.

OP-12
Brain stimulation

OP-12-002
Auricular ultrasonic vagus nerve stimulation: effectiveness of blinding and occurrence of adverse effects in healthy volunteers and tinnitus patients

Submitter: Bas Labree, United Kingdom

Co-Authors:
Marcus Kaiser
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Derek J. Hoare
Poppy Hinton
Magdalena Sereda

Topic:
3) Brain stimulation

Abstract

Objective:
Vagus Nerve Stimulation (VNS) using electric currents has been trialled for tinnitus, with mixed results. VNS using ultrasound may be superior, as it overcomes some of the technical difficulties of electrical VNS. To facilitate future clinical trials, these two studies aimed to 1) investigate the effectiveness of blinding using a sham device and 2) record any adverse effects, in both healthy volunteers and tinnitus patients.

Methods:
In these single-blind randomised controlled crossover studies, 20 healthy volunteers and 20 tinnitus patients received a 30 min session of true U-VNS and a 30 min session of sham stimulation 1 week apart. The effectiveness of blinding and the occurrence of adverse effects were measured using self-report questionnaires.

Results / Discussion:
James' Blinding Index showed that blinding using the sham device was highly effective in both healthy volunteers and tinnitus patients. The adverse effects reported by both groups were mild, transient, and mostly related to sensations on the skin immediately under the transducer of the device.

Conclusion:
The high level of blinding effectiveness that can be achieved for U-VNS by using a sham device and the absence of serious adverse effects will pave the way for, and inform the design of, future clinical trials of U-VNS for tinnitus.

OP-12
Brain stimulation

OP-12-004
Repetitive Transcranial Magnetic Stimulation for Tinnitus: Evaluating Treatment Effectiveness, Sham-superiority and the relevance of stimulation parameters in a Real-World Cohort

Submitter: Stefan Schoisswohl, Germany

Co-Authors:
Milena Engelke
Andreas Reißmann
Berthold Langguth

Topic:
3) Brain stimulation, 21) Therapy

Abstract

Objective:
The present study aims to not only evaluate the effectiveness of repetitive transcranial magnetic in the treatment of tinnitus and but also to identify technical stimulation parameters associated with treatment response.

Methods:
For this purpose, data from patients treated with rTMS at the Center for Neuromodulation in Regensburg, Germany between 2003 and 2026 will be pooled and systematically analyzed.

Results / Discussion:
This large real-world dataset includes a diverse set of applied stimulation protocols, allowing for an investigation of overall effectiveness, a comparison of active versus sham stimulation, and an evaluation of which stimulation parameters are associated with clinical improvement.

Conclusion:
The findings of this analysis are expected to provide important insights for the optimization of rTMS protocols and may improve the clinical applicability of rTMS in the treatment of tinnitus.

OP-12
Brain stimulation

OP-12-003
State-dependent digital neuro-regulation for chronic subjective tinnitus: feasibility, acceptance, and preliminary clinical outcomes of an adaptive saMD platform

Submitter: Carlos Cuilty Siller, Mexico

Co-Authors:
Sergio Mora PhD Israel de La Cruz MD

Topic:
21) Therapy, 3) Brain stimulation

Abstract

Objective:
To evaluate feasibility, patient acceptance, and preliminary clinical outcomes during the initial deployment of this state-dependent digital neuro-regulation platform.

Methods:
We conducted a prospective, real-world deployment study involving the first 100 adults with chronic subjective tinnitus (≥6 months duration). Participants were recruited through digital channels and outpatient referrals and used the Beyond Tinnitus™ application for 12 weeks on iOS or Android devices.

Results / Discussion:
This initial deployment demonstrates high feasibility and strong patient acceptance of a state-dependent digital neuro-regulation approach. Low technical dropout and high completion rates suggest that platform usability is compatible with the cognitive and attentional constraints commonly observed in tinnitus populations.

Conclusion:
Initial real-world data suggest that a state-aware, adaptive digital neuro-regulation platform for chronic tinnitus is feasible, well tolerated, and associated with clinically meaningful symptom improvement. These findings support the hypothesis that timing-sensitive intervention may enhance therapeutic impact.

OP-13
Basic research

OP-13-001
Microaudiometry and tinnitusgram compared to conventional audiometry and acufenometry for chronic tinnitus diagnostic assessment: preliminary results

Submitter: Ektor Onishi, Brazil

Co-Authors:
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Flavia De Barros
Anna Carolina De Barros
Fatima Branco-Barreiro
Danilo Fernandes

Topic:
6) Clinical studies, 8) Diagnosis

Abstract

Objective:
Chronic tinnitus often occurs despite normal conventional audiometry. The "hidden hearing loss" hypothesis suggests subtle inter-frequency cochlear "notches" as the etiological substrate. Automated microaudiometry (AMA-PTA) could identify lesions to guide frequency-specific sound therapies. This study compares AMA-PTA, tinnitus pitch/loudness matching, and conventional audiometry to characterize losses and psicoacustic measurements.

Methods:
Cross-sectional study of 18 patients (26 ears) with chronic tinnitus and normal or mild hearing loss. Assessments included conventional/high-frequency audiometry, visual analogic scale, pitch matching and loudness, AMA-PTA, and tinnitusgram. Statistical analysis utilized summary measures, Student's t-test, Mann-Whitney, Pearson's Chi-Square, and Fisher's Exact tests via JASP (v.0.14.1.0) to evaluate audiological and clinical data.

Results / Discussion:
Study of 18 subjects: 72% (N=13) female, 28% (N=5) male; 39% unilateral, 61% bilateral tinnitus with mean age of 39.2. AMA-PTA and conventional audiometry correlated moderately to strongly above 1000Hz ($p < 0.05$). Tinnitusgram showed higher frequency and more intense loudness (8383Hz/14dBNS) vs. acufenometry (6663Hz/5dBNS; $p<0.001$). AMA-PTA identified hearing loss zones missed by conventional exams, with superior resolution for cochlear tonotopy

Conclusion:
This preliminary study explored the feasibility and clinical applicability of a novel tinnitus evaluation method. Both microaudiometry and the tinnitusgram were feasible; however, their performance and added value remain uncertain. Further research with a larger sample is essential to establish the reliability, validity, and broader clinical utility of these tools in practice.

OP-13
Basic research

OP-13-002
Neuronal activity in response to notched noises in the inferior colliculus of awake mice: putative mechanisms of offset responses and Zwicker tone

Submitter: Arnaud J. Noreña, France

Co-Authors:
Chun-Jen Hsiao
Alex Galazyuk

Topic:
2) Basic research, 17) Plasticity

Abstract

Objective:
Sensory systems are well adapted to process specific spectral features of sounds, such as a spectral gap in broadband stimuli. Spectral notches can be added to the stimulus spectrum due to filtering by the outer ear, and can be used as monaural cues for localizing sound sources. In addition, broadband sounds with spectral notch are known to produce an auditory illusion, called the Zwicker Tone (ZT), which is perceived immediately after stimulation and whose pitch corresponds to the frequency of the spectral notch. The ZT can be interpreted as a transient tinnitus. The present study aimed to further investigate neural responses during and after notched noise (NN) presentation in the inferior colliculus of awake mice.

Methods:
Single-unit activity was recorded in inferior colliculus of awake mice during and after white noise and notched noise presentation.

Results / Discussion:
We show that neural (single-cell spiking) activity can be strongly suppressed during NN stimulation, while neural offset responses are dramatically enhanced immediately after NN stimulation. These effects were greater when the centrer frequency of the notch corresponded to the neuron's best frequency, and depended on the notch width and stimulation level. It is important to note that these neural responses differ from a maximum effect on a continuum; rather, they result from strong non-linearity.

Conclusion:
The results are consistent with the mechanisms described for post-inhibitory rebound in the central auditory system: NN could hyperpolarize the membrane potential through lateral inhibition during NN presentation, which can then activate several cationic conductances, leading to a rebound of neural activity after NN presentation. It appears that the auditory system is specifically adapted to process spectral contrasts in the acoustic environment, and that offset responses and ZT are merely by-products of this mechanism.

OP-13
Basic research

OP-13-005
Neuro-Topological Swarm-Intelligence (NTSI) for Decoding Maladaptive Plasticity in Chronic Tinnitus.

Submitter: Umesh Gangadhar, India

Co-Authors:
P Kumar
J Singh

Topic:
2) Basic research, 2) Basic research

Abstract

Objective:
Chronic tinnitus remains a clinical enigma characterized by phantom auditory perception and maladaptive cortical reorganization. Conventional treatments often fail due to the highly individualized nature of neural "noise." This study introduces the Neuro-Topological Swarm-Intelligence (NTSI) framework, a first-of-its-kind biomedical technology designed to map and suppress the specific neural manifolds responsible for tinnitus perception in under-resourced clinical settings.

Methods:
A longitudinal study analyzed 640 patients across Northern India using a decentralized AI architecture: Topological Feature Extraction: We utilized Persistent Homology (a branch of Topological Data Analysis) to identify "holes" and "loops" in functional connectivity maps derived from portable, high-density EEG. Swarm-Intelligence Synthesis: A Federated Swarm-Learning protocol allowed for real-time model updates across multiple rural nodes without compromising patient data privacy. The "Auditory Digital Twin": We created individualized computational models that simulated the patient's specific Subcortical-Cortical Gating dysfunction, allowing for the "in-silico" testing of personalized notched-sound therapies before clinical application.

Results / Discussion:
The NTSI framework achieved a 89.6% accuracy in classifying tinnitus severity (Tinnitus Handicap Inventory scores) based solely on baseline neural topology. Crucially, the "Auditory Digital Twin" predicted the efficacy of customized acoustic neuromodulation with a correlation coefficient of $r = 0.84$ compared to actual 6-month clinical outcomes. The analysis identified a unique "Neural Congestion Signature" in the dorsal cochlear nucleus, which acted as a robust biomarker for treatment resistance.

Conclusion:
This research transitions tinnitus management from generalized sound masking to Precision Neural Decoding. By utilizing swarm-intelligence and topological analysis, the NTSI framework provides a scalable, innovative solution for identifying the "biological fingerprint" of tinnitus. This

technology offers a world-first blueprint for delivering high-complexity neuro-biomedical interventions to remote populations, effectively bridging the gap between advanced computational neuroscience and community-based audiology.

OP-13
Basic research

OP-13-004
Predicting speech reception thresholds in individuals with tinnitus

Submitter: Józef Mackowiak, Poland

Co-Authors:
Andrzej Wicher
Mathieu Lavandier

Topic:
14) Models, 2) Basic research

Abstract

Objective:
The primary objective of this study is to evaluate the effectiveness of two auditory models in predicting the speech reception threshold (SRT) in noise for individuals with tinnitus. The foundational model, developed by Lavandier et al. (2021), was originally designed to estimate SRTs for individual listeners with normal hearing and hearing loss. However, this established framework does not explicitly account for tinnitus-related auditory factors. Consequently the aim was to compare the original model against an extended version incorporating a tinnitus-specific auditory mechanism.

Methods:
The study assesses the predictive performance of the original model and the extended tinnitus model. We evaluated both models' capacity to predict SRTs across experimental groups with varying degrees of hearing loss, comparing groups with and without tinnitus to quantify predictive accuracy and identify condition-specific deviations in simulated estimations.

Results / Discussion:
The findings reveal a clear divergence in model efficacy. The foundational model accurately predicts the SRT for subjects without tinnitus. For subjects experiencing tinnitus, the extended model demonstrates improvements, giving a higher correlation and a lower prediction error compared to the original framework. Despite this enhanced overall accuracy, a specific limitation persists: both for the original and the tinnitus-extended models that overestimate the differences in SRT between distinct hearing loss groups within the tinnitus group. This could be due to the simplified audiograms used to characterize the hearing loss group not providing sufficiently detailed input data for the models to fully account for hearing loss. It could also indicate that the interaction between hearing impairment and tinnitus might introduce more complex variables into speech perception that are not yet fully captured.

Conclusion:
The predictive performance of the extended model on the group of subjects with tinnitus was greater than that of the original model alone, offering a more robust approach to estimating SRT for people with tinnitus.

OP-13
Basic research

OP-13-003
Use machine learning classification model to determine tinnitus-related neural activity

Submitter: Jinsheng Zhang, USA

Co-Authors:
Linda Zhu
Hao Luo

Topic:
2) Basic research, 2) Basic research

Abstract

Objective:
Efforts are made to identify a reliable biomarker for diagnosing tinnitus. In animal studies, behavioral evidence of tinnitus associated with hyperactivity often shows in the forms of higher firing rate, however, with a significant difference across individuals. That is, firing rates alone may not be the only factor in determining tinnitus. We set out to adopt an integrated approach, leveraging machine learning (ML) to examine spike rates and spike patterns, to separate animals with and without tinnitus.

Methods:
In this study, local field potentials (LFPs) from the dorsal cochlear nucleus (DCN), inferior colliculus (IC), and auditory cortex (AC) of rats with/without tinnitus were recorded. The neural activity were analyzed and ML-processed (75% used for model training, 25% used for validation). ML algorithms were used to analyze the following features: spike firing rate, amplitude, prominence and width. The ML algorithms included Decision trees, Discriminant Analysis, Logistic Regression, Support Vector Machine, K-Nearest Neighbors, Ensemble, Neural network, and their validation accuracy was compared. The importance of the four features in model building was assessed using various ranking algorithms, such as Minimum Redundancy Maximum Relevance (mRMR) and the Chi-squared test.

Results / Discussion:
Our results demonstratd that the ML can identify presence of tinnitus with an accuracy of over 90% in several methods, including the Ensemble, SVM, k-nearest neighbors (KNN), and tree-based models. Among these, the bagged tree algorithm demonstrated the highest accuracy. Additionally, the neural signals measured in the DCN are the best fit for machine learning, among the three auditory brain structures. The results showed that spike rate may not be the only indicator of tinnitus, which echoes some studies showing large variable results when associating tinnitus presence with changes in spike firing rate. The study also demonstrated that with the advancement of machine learning and AI application, new information contained in neural activity may be revealed to better reflect presence or absence of tinnitus.

Conclusion:
Firing rate, spike amplitude, and prominence are the three most important input features. The

neural signals measured in the DCN are the best fit for machine learning, among the three auditory brain structures. The machine learning model may be further developed to an effective tool for identifying a biomarker of tinnitus.

OP-14
Perspective

OP-14-001
Towards a personalized and hybrid carepath for tinnitus patients

Submitter: Erwin George, The Netherlands

Co-Authors:
Jana Devos
Katja Hellingman

Topic:
5) Clinical management, 6) Clinical studies

Abstract

Objective:
Tinnitus is an unsolved neurootological problem, affecting the quality of life of millions of people worldwide. Its heterogeneity, with differences in perception, causes, distress, and treatment response, makes patient management challenging. Current one-size-fits-all approaches often leave patients unsatisfied. This project aims to redesign tinnitus care to be more personalized and hybrid, addressing the limitations of current standardized care pathways.

Methods:
Our multidisciplinary clinical team provides standardized stepped care for about 650 patients each year, combining diagnostics with treatment specifically fitted to each patient's individual needs. The current project focuses on further subprofiling, based on quantative data concerning hearing loss and tinnitus complaints of more than 4,500 patients. Moreover, qualitative data are collected via interviews to identify wishes and needs of patients and practitioners (GP, ENT, Audiology) for a future hybrid care path. Finally, the requirements for a personalized tool for tinnitus patients are explored, based on subgroup-specific symptoms, needs, and preferences.

Results / Discussion:
Results show that tinnitus severity is related to hearing loss and to psychiatric symptoms (anxiety and/or depression). Patients often express feeling 'lost' or 'unheard' in the first weeks after the onset of tinnitus complaints, and emphasize the need and desire for psychoeducation that is more tailored to their specific needs, preferably at a much earlier moment in time than currently provided.

Conclusion:
Quantitative and qualitative mixed research methods are necessary to improve tinnitus management in a clinical setting and help to improve patient empowerment, deliver tailored care and set a foundation for a more effective, patient-centered and digitally integrated tinnitus care pathway.

OP-14
Perspective

OP-14-004
Low Intensity Noise Tinnitus Suppression (LINTS) in double-blinded, placebo controlled clinical study

Submitter: Konstantin Tziridis, Germany

Co-Authors:
Holger Schulze

Topic:
20) Stress and tinnitus, 11) Hearing aids and sound therapy

Abstract

Objective:
There is no causal treatment for tinnitus. Based on our “Erlangen model” of tinnitus development, we treated adult tinnitus patients with individually tailored, non-masking low intensity bandpass noise to reduce the loudness and burden of their tinnitus (Low Intensity Noise Tinnitus Suppression, LINTS).

Methods:
Audiograms, tinnitus parameters and TQ scores determined of 72 tinnitus patients without hearing aid (HA) experience . Assignment to “treatment only” (TO) or “placebo and treatment” (PT) groups. PT patients: HA with white noise for two weeks, correct LINTS for additional 4 weeks TO patients: immediate correct LINTS for 4 weeks. Biweekly, audiograms, TQ scores & tinnitus parameters obtained. Long-term effects acquired 4 weeks after treatment end.

Results / Discussion:
After 2 & 4 treatment weeks, significant decrease in TQ score in the TO group was found; it was still present 4 weeks after the end of treatment. In individual cases, LINTS completely suppressed the tinnitus. The PT group benefited significantly less, as the initial placebo treatment apparently counteracted the noise effects (4 weeks of treatment: $p=0.06$). Hearing thresholds were significantly different compared to pre-treatment in both groups.

Conclusion:
A customized LINTS treatment can suppress tinnitus during treatment. Optimal adjustment of the noise is crucial for the success of the treatment. Changes in hearing thresholds have to be investigated further but may be "training effects" only.

OP-14
Perspective

OP-14-002
The Hearing Triptych: An Integrative Framework Connecting Sound, Brain and Human Experience in Tinnitus

Submitter: Dyon Scheijen, The Netherlands

No Co-Authors submitted

Topic:
5) Clinical management, 21) Therapy

Abstract

Objective:
Tinnitus is commonly approached from distinct disciplinary perspectives, including auditory neuroscience, psychoacoustics and behavioral science. While each of these domains has contributed important insights, clinical practice consistently demonstrates that tinnitus-related distress cannot be fully explained by auditory signal properties or neural activity in isolation.

Patients with comparable audiometric profiles frequently report markedly different levels of distress and functional impairment. This discrepancy highlights a fundamental gap between measurable auditory characteristics and lived experience.

Existing models, including the neurophysiological model of tinnitus, network-based approaches and behavioral frameworks such as fear-avoidance models, provide valuable but often fragmented insights. In clinical settings, these perspectives are commonly applied in parallel rather than as an integrated framework.

The aim of this study is to propose an integrative conceptual framework - the Hearing Triptych - that connects sound, brain and human experience in order to improve clinical understanding of tinnitus and its impact on functioning. Clinical observations within a specialized rehabilitation setting suggest that these perspectives may benefit from further integration.

Similar discrepancies between measurable sound characteristics and reported experience are also observed in other complex sound perception phenomena.

Methods:
The Hearing Triptych is proposed based on clinical observations within a specialized rehabilitation setting, combined with theoretical integration of established models from auditory neuroscience, network theory and behavioral science.

The framework conceptualizes tinnitus as an emergent phenomenon arising from dynamic interactions between three domains: (1) sound as a physical stimulus, (2) brain processes underlying perception, and (3) human experience, including attention, meaning and behavior.

To explore its clinical applicability, the framework is applied within a group-based tinnitus rehabilitation program. This program focuses on restoring functional capacity rather than eliminating the auditory percept, and includes components addressing attentional processes, cognitive-emotional responses and behavioral patterns such as avoidance.

The Triptych framework is used to interpret variability between patients, guide treatment processes and support clinical decision-making.

Results / Discussion:
The Hearing Triptych provides a coherent structure for integrating existing tinnitus models into a single clinical perspective. By explicitly linking auditory, neural and experiential domains, it offers an explanation for why similar auditory inputs can lead to widely differing patient experiences.

This perspective aligns with contemporary models of symptom perception as an emergent and context-dependent process, rather than a direct reflection of sensory input alone.

Clinically, this approach shifts the focus from reducing the tinnitus signal to modifying the interaction between the individual and the tinnitus experience. This has implications for treatment strategies, particularly in multidisciplinary and group-based settings where variability between patients becomes visible and therapeutically relevant.

Conclusion:
The Hearing Triptych may offer an integrative and clinically applicable framework that connects sound, brain and human experience in tinnitus.

Rather than introducing a new theoretical construct, it provides a structured way to connect and operationalize existing models within clinical practice.

This perspective supports a shift from symptom reduction to functional restoration, aligning tinnitus care with rehabilitation principles.

The framework may contribute to improved interdisciplinary communication and a more coherent approach to understanding and treating tinnitus.

OP-14
Perspective

OP-14-003
Do Smart Earbuds Reduce Everyday Noise Annoyance? Evidence from Immersive Soundscape Testing

Submitter: Philippe Fournier, Canada

Co-Authors:
Maxime Doyon
Pierre H. Bourez
Guillaume T. Valet
François Bergeron
Mathieu Hotton

Topic:
2) Basic research, 11) Hearing aids and sound therapy

Abstract

Objective:
The World Health Organization identifies environmental noise as one of the leading non chemical threats to human health, second only to air pollution. Exposure to everyday noise can induce annoyance, irritability, and reduced cognitive performance, even in individuals without hearing disorders. To mitigate these effects, consumer grade smart earbuds (SE) incorporating passive attenuation, transparency modes, and active noise cancellation (ANC), such as Apple AirPods, have become increasingly widespread. Despite their popularity, the effectiveness of these technologies in realistically complex acoustic environments remains insufficiently validated. The objective of this study was to evaluate and compare the effects of different SE listening modes on noise detection, annoyance, and discomfort using immersive, ecologically valid soundscapes representative of everyday life.

Methods:
Twenty two normal hearing adults (mean age = 29 years, SD = 10; 15 women, 7 men) without hyperacusis, misophonia, or any decreased sound tolerance condition participated in the study. Participants were seated at the center of a multichannel loudspeaker array capable of reproducing realistic and immersive auditory environments. Two soundscapes—a cafeteria and a daycare—were presented at an initially inaudible level and gradually increased in 2 dB steps. Participants indicated when the sound was first detected (detection threshold, DT), when it began to interfere with a silent reading task (annoyance level, AL), and when it became uncomfortable (discomfort level, DL). Measurements were performed under four randomized listening conditions: bare ears (BE), earbuds worn but inactive (EO), transparency mode (TM), and active noise cancellation mode (ANC).

Results / Discussion:
Compared with the bare ear (BE) condition, detection thresholds (DTs) were elevated by an average of 9, 4, and 22 dB LAeq in the earbuds turned off (EO), transparency mode (TM), and active noise cancellation (ANC) conditions, respectively (all $p < .001$). These increases indicate

reduced detectability of the soundscapes across all listening conditions, with the largest effect observed for ANC, suggesting greater attenuation of low level environmental sounds. Annoyance levels (ALs) were also increased by 11, 7, and 22 dB LAeq in the EO, TM, and ANC conditions, respectively (all $p < .005$), indicating that higher sound levels were required to interfere with task performance and suggesting reduced functional noise disturbance. Discomfort levels (DLs) also showed significant increases, rising on average by 9, 8, and 16 dB LAeq for the EO, TM, and ANC conditions, respectively, compared with BE (all $p < .001$), consistent with increased tolerance to higher sound levels under both passive and active noise reduction.

Conclusion:
Preliminary findings suggest that active noise cancellation produces larger shifts in noise detection, annoyance and discomfort levels than transparency mode or passive attenuation alone in realistic sound environments. These effects are consistent with a combination of passive attenuation and active noise suppression mechanisms. Transparency mode, while preserving access to environmental sounds, was associated with smaller changes in annoyance and discomfort levels. Together, these results indicate that smart earbuds, particularly when using ANC, can meaningfully alter the perceptual and functional impact of everyday noise in normal hearing individuals.

OP-15
Therapy I

OP-15-004
Therapeutic sound preferences and short-term effects of a mobile sound therapy application in tinnitus patients: a proof-of-concept study

Submitter: Ho Yun Lee, Republic of Korea

Co-Authors:
Soonchul Kwon
Taesoo Park

Topic:
11) Hearing aids and sound therapy, 5) Clinical management

Abstract

Objective:
Evidence guiding therapeutic sound selection for tinnitus remains limited. This study used a mobile application to profile sound preferences, evaluate the short-term effect of preferred sounds on tinnitus, and explore AI-generated sound as a therapeutic option.

Methods:
Twenty-one chronic tinnitus patients used an application offering 11 sounds in four categories: broadband noise, filtered noise (individualized to audiometric profile), binaural beats, and AI-generated sound. In an exploration phase, participants freely explored all sounds with automatic session logging. In an evaluation phase, each selected a preferred sound and rated listening comfort and pre–post tinnitus loudness on a VAS.

Results / Discussion:
Participants completed 843 sessions (mean 40.1±24.9) across all 11 sounds (Shannon entropy 0.97). Binaural beats were most explored (33.5%) but least preferred (13.6%); filtered noise was most preferred (40.9%), revealing exploration–preference dissociation. Tinnitus loudness trended toward improvement (Hodges–Lehmann 0.00, 95% CI 0.00–0.45; p=0.063); 6/21 (28.6%) improved (dz=0.42), with comfort correlated with improvement (ρ=0.44, p=0.045).

Conclusion:
Mobile applications can effectively profile heterogeneous sound preferences in tinnitus patients. The observed effect size (dz=0.42) provides a basis for sample size estimation in future trials (paired/crossover n≈45; parallel RCT≈89 per arm at 80% power). AI-generated sound, selected by 19.0% of participants with numerically comparable outcomes, warrants further investigation as a personalized therapeutic option.

OP-15
Therapy I

OP-15-001
Mobile therapeutic application for chronic tinnitus: A randomized, double-blind, sham-controlled trial

Submitter: Koichiro Wasano, Japan

Co-Authors:
Taiji Kawasaki
Kaoru Ogawa

Topic:
6) Clinical studies, 5) Clinical management

Abstract

Objective:
Chronic tinnitus significantly reduces quality of life through sleep problems and psychological distress. Although Cognitive Behavioral Therapy (CBT) is the recommended first-line treatment, access is limited by the need for specialized therapists. Digital therapeutics (DTx) may overcome these barriers. This study developed a prototype mobile app combining educational counseling and CBT and evaluated its efficacy and safety for chronic tinnitus.

Methods:
A sham-controlled, double-blind randomized trial was conducted at three medical institutions in Japan. Sixty patients (mean age 57.8; 55% female) with mild-to-severe chronic tinnitus were assigned to an Active or Sham app for 16 weeks with 8-week follow-up. The primary endpoint was change in THI at week 16. Secondary outcomes included TFI, tinnitus annoyance and control, anxiety, depression, and insomnia.

Results / Discussion:
At week 16, the Active group showed greater THI improvement than the Sham group (-16.8 vs. 3.6; $p < 0.001$), with 70% achieving clinically meaningful improvement. Significant benefits were also observed in TFI, annoyance, anxiety, and insomnia and persisted during follow-up. No serious adverse events occurred, suggesting the DTx app effectively delivers standardized CBT without traditional resource limitations.

Conclusion:
The use of a novel tinnitus therapeutic app delivering educational counseling and CBT elements resulted in substantial and lasting improvement in tinnitus-related distress and functional impairment. This therapeutic mobile app may serve as an effective, safe, and standardized intervention for individuals with chronic tinnitus, offering a viable solution to improve patient access to evidence-based care.

OP-15
Therapy I

OP-15-003
Effectiveness of hearing aids, masking and counselling for tinnitus therapy in hearing loss sudden sensorineural

Submitter: Israel De La Cruz Avila, Mexico

Co-Authors:
Carlos Cuilty

Topic:
11) Hearing aids and sound therapy, 21) Therapy

Abstract

Objective:
To assess the benefits of amplifying hearing aids and tinnitus masking using the Tinnitus Reaction Questionnaire (TQ), Tinnitus Handicap Inventory (THI) and Visual Analogue Scale (VAS) in combination with counselling.

Methods:
A retrospective evaluation of the clinical outcomes of 185 tinnitus patients fitted with hearing aids was undertaken. The primary outcome measure was the TQ-THIR VAS, with a secondary subjective measure of tinnitus masking.

Results / Discussion:
Participants who achieved masking with their hearing aids had a greater reduction in THI-TQ-VAS scores. Masking was more likely to be achieved when participants had good low-frequency hearing and the tinnitus pitch fell within the hearing aid frequency range.

Conclusion:
The results support that the use of hearing aids with masking and counseling for tinnitus management may be a significant contributor to hearing aid success, implying that high-frequency amplification may be effective in acute tinnitus.

OP-15
Therapy I

OP-15-002
Evolving tinnitus care in the UK with an audiologist-delivered CBT-based treatment

Submitter: Carol Macdonald, United Kingdom

Co-Authors:
Magdalena Sereda
Amr El Refaie
Derek J Hoare

Topic:
21) Therapy, 5) Clinical management

Abstract

Objective:
The objective of this study was to evaluate a 3-day training course developed to support delivery of a manualised CBT-based treatment for tinnitus (TinMan) by audiologists. We evaluated the use of treatment components in clinical practice to inform future training and the design a randomised controlled trial of TinMan versus usual care.

Methods:
Sixteen audiologists attended the training course and completed a post-course evaluation. Eight participants also took part in a semi-structured interview to evaluate the training, their use of the treatment processes and components, and to discuss the practicalities of a multi-site clinical trial of the treatment. Interview data were analysed using content and thematic analysis approaches.

Results / Discussion:
Participants were strongly positive about their training experience, reporting confidence and competence to engage patients, individualise treatment, and deliver the intervention components. Barriers to delivery included pre-existing service processes, lack of time, and lack of supervision and support. In some cases, treatment was delivered partially, with more piecemeal use of components.

Conclusion:
The current study demonstrated the potential for audiologists to deliver a CBT-based treatment protocol and individualise treatment via collaborative assessment and formulation with relational competences, confidence, and preparedness. However, delivery of the treatment with high fidelity within a randomised controlled trial will require significant support, adjustments to current processes, and structured, routine supervision.

OP-16
Pharmacology

OP-16-002
Hormone Replacement Therapy for Chronic Tinnitus in Menopausal Women: A Retrospective Cohort of 57 Cases and Symptom Outcomes

Submitter: Ta-Ching Chan, Taiwan

Co-Authors:
Jen-Tsung Lai

Topic:
6) Clinical studies, 21) Therapy

Abstract

Objective:
Chronic tinnitus is common in peri-/postmenopausal women and may be modulated by hormonal fluctuation. We evaluated whether low-dose hormone replacement therapy (HRT) improves tinnitus distress and related symptoms in menopausal women with chronic tinnitus.

Methods:
Retrospective cohort of 57 menopausal women with tinnitus ≥ 1 year treated with low-dose HRT (Kuang Tien General Hospital, 2015–2017) and followed ≥ 3 months. Outcomes: THI, tinnitus VAS, sleep/menopause symptom scores, audiometry, and adverse events.

Results / Discussion:
THI improved from 57.80 to 16.39 and VAS from 7.9 to 2.6 (both $p < 0.001$). Sleep and menopausal symptoms also improved ($p < 0.001$). Hearing thresholds showed no significant change. No major adverse events; minor breast fullness/spotting occurred. Some non-responders suggested other drivers (e.g., stress/migraine).

Conclusion:
Low-dose HRT was associated with substantial reduction in tinnitus handicap/severity and improved sleep/menopause symptoms without audiometric worsening in this 57-case cohort. Findings support HRT as an option for selected menopausal women; prospective trials should define candidates, duration, and relapse prevention.

OP-16
Pharmacology

OP-16-001
CGRP Pathway Modulation in Inner Ear Migraine: Rationale, Emerging Evidence, and Early Clinical Signals

Submitter: Jen-Tsung Lai, Taiwan

Co-Authors:
Ta-Ching Chan

Topic:
16) Pharmacology, 6) Clinical studies

Abstract

Objective:
Inner ear migraine phenotypes (tinnitus, aural fullness, fluctuating hearing loss, vertigo, hyperacusis) frequently overlap, yet treatment evidence is fragmented. We summarize migraine-directed therapy effects, introduce CGRP biology, review emerging CGRP-pathway clinical evidence (strongest in vestibular migraine), and present preliminary case-based clinical signals in inner ear migraine.

Methods:
Narrative synthesis emphasizing recent randomized trials and quantitative summaries of CGRP-pathway therapies in vestibular migraine, plus early-stage evidence in other otologic phenotypes. We integrate these data with phenotype-based clinical reasoning and summarize our center's preliminary experience using CGRP-targeted therapy in carefully phenotyped inner ear migraine cases.

Results / Discussion:
CGRP blockade has placebo-controlled RCT support in vestibular migraine, with additional signals from meta-analytic and real-world studies. Evidence for other otologic phenotypes (Ménière-like disease, tinnitus, hyperacusis) remains limited and hypothesis-generating. Our phenotype-selected cases showed rapid symptom relief and reduced fluctuation after CGRP-targeted therapy.

Conclusion:
CGRP-pathway modulation is best supported for vestibular migraine and is biologically plausible for inner ear migraine, but cochlear-specific efficacy is unproven. Prospective trials should enrich for recurrent/fluctuating phenotypes and prespecify endpoints: dizzy days/DHI, low-frequency PTA and speech measures, relapse/time-to-relapse, and PROs (THI/TFI, hyperacusis scales, aural fullness VAS).

OP-16
Pharmacology

OP-16-004
Clinical predictors of placebo response in tinnitus: a pooled analysis of three clinical studies

Submitter: Ricardo Figueiredo, Brazil

Co-Authors:
Andréia Azevedo
Guilherme Figueiredo
Lara Salviano
Norma Penido

Topic:
16) Pharmacology, 6) Clinical studies

Abstract

Objective:
To evaluate the magnitude of the placebo effect in tinnitus and to identify demographic and clinical predictors of placebo response.

Methods:
allocated to placebo arms from three clinical studies on tinnitus. Clinical data included sex, age, tinnitus laterality, periodicity, duration, baseline Tinnitus Handicap Inventory (THI), and baseline visual analogue scale (VAS). Placebo response was defined as a reduction of at least 8 points in THI after three months. Responders and non-responders were compared using non-parametric tests and categorical analyses.

Results / Discussion:
A total of 59 patients were included. A clinically meaningful placebo response (ΔTHI ≥ 8) was observed in 21 patients (35.6%) after three months. The magnitude of THI change varied substantially among individuals, ranging from marked improvement to symptom worsening. No significant associations were found between placebo response and age, sex, tinnitus laterality, periodicity, tinnitus duration, baseline THI, or baseline VAS.

Conclusion:
Placebo treatment resulted in clinically meaningful improvement in more than one-third of tinnitus patients. The absence of clear clinical predictors highlights the complex and heterogeneous nature of placebo responsiveness in tinnitus and underscores the importance of adequately designed placebo-controlled trials and stratification strategies in tinnitus research.

OP-16
Pharmacology

OP-16-003
Bupivacaine injections in trigeminocervical muscles in tinnitus: exploratory observations to refine mechanism-based subgrouping

Submitter: Michael Boedts, Belgium

Co-Authors:
Anja Taevernier

Topic:
14) Models, 6) Clinical studies

Abstract

Objective:
Subgrouping is essential in tinnitus research. Within our working model, trigeminocervical input may contribute to tinnitus in selected patients. However, important questions remain unanswered: which trigeminocervical pathways are involved? Which dermatomes or muscles play a role? Is the relevant input sensory, motor, proprioceptive, or a combination? Are the same structures involved across patients, or does this vary?

To refine subgrouping, we explored whether temporary trigeminocervical modulation alters tinnitus in defined clinical subtypes.

Methods:
In a retrospective descriptive case series, patients with tinnitus received targeted injections of bupivacaine 0.5% in selected trigeminal and upper cervical territories and muscles. Injection sites were chosen pragmatically, based on available literature, clinical examination, and symptom location (“follow the pain”).

Tinnitus was classified as continuous or variable according to our staging model. Outcomes were based on short-term patient-reported changes. No objective measures were systematically obtained.

Results / Discussion:
Temporary improvement was mainly observed in patients with variable tinnitus, whereas continuous tinnitus without accompanying symptoms showed little or only limited change.

Within our model, variable tinnitus is consistent with an active sensitisation process in a peripheral–central trigeminocervical loop. Continuous tinnitus without additional symptoms may represent a more consolidated central state with limited susceptibility to transient peripheral modulation. Continuous tinnitus accompanied by peripheral symptoms may reflect ongoing strain or increased input into the trigeminocervical system.

The differential response pattern in this series is congruent with this staging model.

Conclusion:
This case series does not introduce a new treatment. Rather, it represents an exploratory step toward refining mechanism-based subgrouping. Even partial or temporary responses provide information about underlying pathways.

Such structured exploratory interventions may help clarify which trigeminocervical inputs are relevant, improve staging, and gradually strengthen the validity of the subgrouping model. Whether this framework ultimately supports targeted therapy will depend on future controlled validation.

OP-16
Pharmacology

OP-16-005
The potential effects of vitamin D3 on primary subjective tinnitus

Submitter: András Molnár, Hungary

Co-Authors:
Panayiota Mavrogeni
Aphrodite Mavrogenis
Stefani Maihoub

Topic:
6) Clinical studies, 8) Diagnosis

Abstract

Objective:
This study aimed to analyse vitamin D3 levels in both a tinnitus group and a control group.

Methods:
350 patients with primary subjective tinnitus and 347 participants serving as a control group were examined. All patient underwent otorhinolaryngological examination, audiological testing and laboratory testing, including measurements of 25-hydroxyvitamin D3 levels.

Results / Discussion:
The prevalence of low 25-hydroxyvitamin D3 levels was significantly ($p<0.00001$) higher in the tinnitus group (53.2%) compared to the control group (31.7%). Furthermore, when comparing the specific levels of 25-hydroxyvitamin D3 between the tinnitus and control groups, a statistically significant difference was observed ($p<0.00001$), with lower levels found in the tinnitus group. Additionally, according to a logistic regression model, lower levels of 25-hydroxyvitamin D3 significantly predicted the occurrence of tinnitus ($p=0.000$; OR: 0.132, 95% CI = 0.066–0.264). Additionally, it was found to be associated with moderately severe and severe tinnitus ($p=0.021$; OR: 1.800, 95% CI=0.806–4.022) and the development of chronic tinnitus ($p=0.001$; OR: 0.717, 95% CI=0.384–1.340). Moreover, ROC analysis indicated that 25-hydroxyvitamin D3 is a significant predictor of tinnitus ($p=0.000$, 95% CI = 0.702–0.815), showing a sensitivity of 75.8%.

Conclusion:
The notably lower levels of 25-hydroxyvitamin D3 suggest its potential role in the development of tinnitus. Additionally, proper supplementation of vitamin D3 could lead to new therapeutic approaches for managing tinnitus.

OP-17
Therapy III

OP-17-003
Why do hearing aids reduce tinnitus-related distress? psychological predictors and mechanisms

Submitter: Tabea Schiele, Germany

Co-Authors:
Benjamin Boecking
Birgit Mazurek

Topic:
11) Hearing aids and sound therapy

Abstract

Objective:
Hearing aids (HAs) can reduce tinnitus-related distress in individuals with chronic tinnitus and hearing loss. However, previous research on audiological predictors could not sufficiently explain why treatment outcomes vary across patients. Guided by a vulnerability-stress framework, this study examined whether psychological factors, i.e. depression severity, tinnitus-related fear, personality traits, as well as their interactions predict tinnitus-related distress following HA use.

Methods:
Data stems from the multicenter "Unification of Treatments and Interventions for Tinnitus Patients (UNITI)" study. Fifty-five participants with chronic tinnitus and mild-to-moderate hearing loss used HAs over the course of a 12-week treatment phase. Depression severity (PHQ-9), tinnitus-related fear (FTQ), and personality traits (BFI-2) were assessed at baseline. Tinnitus-related distress (THI, TFI) was measured at baseline, week 6, and week 12.

Results / Discussion:
Higher baseline depression severity and tinnitus-related fear were associated with higher tinnitus-related distress at follow-up (TFI). Personality traits and vulnerability-stress interactions showed no significant effects.

Conclusion:
Affective symptoms at baseline appear more relevant for tinnitus-related distress following HA use than stable personality traits or their interactions, highlighting the importance of assessing and addressing affective symptoms during the fitting process.

OP-17
Therapy III

OP-17-001
Psychological Associations Underlying the Evaluation of Everyday Sounds in Chronic Tinnitus: A Qualitative Study

Submitter: Christina Baniotopoulou, Germany

Co-Authors:
Benjamin Böcking
Birgit Mazurek

Topic:
18) Psychoacustics, 6) Clinical studies

Abstract

Objective:
Tinnitus is a multifactorial condition influenced by auditory, psychological, and contextual factors. Increasing evidence suggests that patients' interpretation of sound plays a critical role in tinnitus-related distress. However, little is known about how individuals with chronic tinnitus evaluate neutral everyday sounds and which psychological processes underlie these evaluations. Our study aimed to investigate the associations and meaning attribution processes that shape the emotional valence assigned to neutral auditory stimuli in chronic tinnitus patients, with a focus on identifying underlying psychological mechanisms.

Methods:
Nine patients with chronic tinnitus participated in a qualitative study using a structured listening exercise followed by semi-structured interviews. Participants were exposed to seven neutral everyday sounds and asked to evaluate them in terms of emotional valence. Subsequently, sound-evoked associations were explored in depth. Interviews were transcribed and analyzed using Mayring's qualitative content analysis. Categories were developed inductively to identify recurring patterns in how participants attributed meaning and emotional valence to the presented sounds.

Results / Discussion:
Three main categories of psychological associations influencing sound evaluation were identified: affective responses, episodic memory, and other associative processes. Affective associations included both immediate emotional reactions and more complex affective interpretations. Episodic memory associations reflected the role of personal experiences triggered by sounds, often shaping valence in a context-dependent manner. Neutral sounds frequently evoked strong emotional reactions by acting as retrieval cues for autobiographical memories.

These findings indicate that sound evaluation in tinnitus is not purely sensory but is strongly modulated by underlying and mostly automatic associations and memory-driven processes. This aligns with psycho-audiological models emphasizing the role of cognitive-emotional networks in tinnitus perception and distress. In this context, the observed associative patterns

may reflect broader vulnerability-linked mechanisms, whereby auditory stimuli can activate emotionally salient memories and pre-existing cognitive-affective dispositions. Such processes suggest that tinnitus-related distress may, in part, arise from the interaction between current perceptual input and previously encoded emotionally meaningful experiences, and thus expecting higher-order thematic patterns reflecting individualized vulnerability factors. Our data could therefore suggest that neutral auditory stimuli, including the tinnitus sound, acquire emotional salience via memory and associative processes, highlighting a mechanism for persistent distress beyond auditory perception alone.

The results further suggest that altered meaning attribution to sound may contribute to maladaptive auditory processing in tinnitus, highlighting the importance of considering individualized associative networks when conceptualizing and treating tinnitus.

Conclusion:
The evaluation of everyday sounds in chronic tinnitus patients is shaped by complex psychological associations, particularly affect and episodic memory. Neutral sounds can acquire strong emotional valence through associative processes, highlighting a potential mechanism contributing to tinnitus-related distress. These findings support the integration of cognitive-emotional frameworks into tinnitus models and interventions. Targeting maladaptive sound associations may represent a promising direction for personalized therapeutic approaches in tinnitus management. These findings could also add to the understanding of tinnitus as a psychologically meaningful phenomenon rather than purely sensory. Identifying the cognitive-affective and memory-driven associations underlying tinnitus may inform individualized case conceptualizations and targeted interventions, emphasizing modification of maladaptive associative networks to reduce chronic distress.

OP-17
Therapy III

OP-17-004
Electrically Evoked Auditory Perception in Normal-Hearing and Single-Sided Deafness Individuals: Implications for Non-Invasive Tinnitus Stimulation

Submitter: Hongmei Hu, Germany

Co-Authors:
Niklas Mellerke
Arnd Meiser
Christoph Siegfried Herrmann
Andreas Radeloff

Topic:
3) Brain stimulation, 2) Basic research

Abstract

Objective:
Electrical stimulation of the auditory system is a longstanding and highly debated topic in hearing research. Since Volta's (1800) observation that electric current applied via electrodes can elicit auditory sensations, numerous studies have investigated the nature and origin of such electrically evoked percepts. Previous studies have shown distinct differences in electrically evoked percepts between individuals with normal hearing and those with deafness.

Historically, electrical stimulation has been explored for both advancing fundamental insights into auditory processing and for clinical applications, including the diagnosis and treatment of ear disorders, hearing loss, and tinnitus.

The tACSitus (Transcranial Alternating Current Stimulation for Tinnitus) project aims to evaluate the feasibility of non-invasive external electrical stimulation as a novel intervention for tinnitus and to support the development of a clinically applicable electrical stimulation device.

Methods:
Electrically evoked auditory perceptions were examined across five electrode configurations: ear canal–ear canal, ear canal–ipsilateral mastoid, ear canal–contralateral mastoid, ear canal–preauricular region, and mastoid–preauricular region. Testing was performed in participants with normal hearing and those with single-sided deafness to characterize response differences, quantify auditory nerve activation, and identify optimal electrode positioning and stimulation parameters.

We hypothesized that electrically evoked pitch percepts in deaf ears differ substantially from those in normal-hearing listeners, likely arising from direct electrical activation of auditory nerve fibers whose spatial distribution along the basilar membrane determines the spectral properties of the perceived sound.

Results / Discussion:
Previous investigations have shown that normal ears display a ‘’square-law’’ relationship between electrical stimulation frequency and perceived pitch, such that the perceived tone is one octave higher than the frequency of the stimulating current. This effect is potentially mediated by electrostatic transduction in the middle ear. However, individuals lacking tympanic membranes also perceive electrically evoked sounds, indicating the involvement of multiple mechanisms.

Studies in ears without tympanic membranes have identified two distinct response profiles: pure tones exhibiting linear stimulus-frequency dependence, where perceived pitch matches the fundamental frequency of the alternating current with no contribution from the second harmonic, and buzzing sensations largely independent of stimulation frequency. These findings support two separate underlying mechanisms: an electrostatic middle ear pathway in intact ears, and direct activation of the auditory nerve in deaf or surgically altered ears, consistent with place-based theories of hearing.

By systematically comparing perceptual responses across electrode configurations and listener groups, the present study has the potential to refine mechanistic interpretations of electrically evoked hearing and provide empirical support for improved non-invasive stimulation strategies in tinnitus management.

Conclusion:
Preliminary results from the present study reveal substantial individual variability, with perceived pitch and loudness influenced by electrode configuration and stimulation parameters, such as frequency and current. Results of the ongoing data collection will be presented at the conference.

OP-17
Therapy III

OP-17-002
Evaluating the Efficacy of Sound Therapy for Tinnitus: Preliminary Results from a Randomized, Double-blind, Placebo-controlled Trial – The AFREPA study

Submitter: Philippe Fournier, Canada

Co-Authors:
Marie-Josée Fraysse

Topic:
6) Clinical studies, 11) Hearing aids and sound therapy

Abstract

Objective:
Chronic tinnitus affects over 20% of the population and can be highly debilitating. Sound therapies—such as amplification, sound generators, or a combination of both—are commonly used to alleviate tinnitus-related handicap and distress. However, despite their widespread clinical use, robust evidence supporting their efficacy remains limited due to methodological weaknesses in previous studies. The objective of this study was to rigorously evaluate the effects of sound therapy on chronic tinnitus using a randomized, placebo-controlled design.

Methods:
In collaboration with AFREPA, a multicenter, randomized, double-blind, placebo-controlled trial was conducted in patients with chronic tinnitus and mild hearing loss (Tinnitus Handicap Inventory [THI] > 38; pure-tone average [PTA] < 35 dB HL at 0.5, 1, 2, and 4 kHz). A total of 145 participants were randomly assigned to one of three groups: (1) placebo, (2) sound generator alone, or (3) sound generator combined with amplification. Outcomes related to tinnitus handicap and distress were assessed over the study period, specifically at 6 weeks and 12 weeks.

Results / Discussion:
This trial addresses major limitations of prior research by directly comparing sound therapies against a placebo under rigorous methodological conditions. By including both sound generator–only and combined amplification conditions, the study allows for a clearer understanding of the specific and added benefits of amplification in this population. The double-blind and multicenter design substantially reduces the risk of bias and strengthens the validity of the findings.

Conclusion:
This study represents the first randomized, double-blind, placebo-controlled trial to compare sound therapies for chronic tinnitus. The preliminary results, which will be presented, have the potential to provide stronger evidence regarding the efficacy of sound therapy and to inform future clinical guidelines and standards of care for patients with chronic tinnitus and mild hearing loss.

OP-17
Therapy III

OP-17-005
Otic ganglion – access point to somatosensory tinnitus

Submitter: Guido Mühlmeier, Germany

Co-Authors:
E. Biesinger
M. Tisch

Topic:
21) Therapy

Abstract

Somatosensory input from the head and neck area may cause tinnitus. Therapy should be focused on temporomandibular disorders (TMD) and cervical spine dysfunctions (CSD), if these have an effect on loudness, character and pitch of tinnitus. As masticatory muscles are innervated by the trigeminal nerve, local anesthesia of the otic ganglion may help to improve tinnitus.

In the out-patient practice, 65 acute tinnitus patients (45% female, 51.3 ± 12,6 years) reported of influence of jaw and head movements on their tinnitus and were therefore treated by one to three transoral injections of 2% lidocaine placed near the otic ganglion on one or both sides and by neural therapy of the neck muscles with 1% procaine.

Patients received 1.9 injections on the otic ganglion (single-sided 1.8 and double-sided 2.1) in combination with trigger point neural therapy of neck muscles, predominantly on the right side. 96% of the patients responded immediately on symptoms like TMD, restriction of head rotation, projected fontal headache or infra-orbital mid-face pain. 82% reported of improvement on their tinnitus in follow-up, reducing severity scales from 2.4 to 1.7 ($p<0.08$). TMD and CSD play important roles in somatosensory tinnitus. The link between the trigeminal nerve and the cochlea derives from the dorsal cochlear nucleus. For effective and elementary help of these patients, the awareness of the examiner for trigeminal disorders, TMD and CSD as well as the technical expertise for otic ganglion local anesthesia, skills in manual medicine and neural therapy are essential.

OP-18
Therapy II

OP-18-004
The impact of stapes surgery on tinnitus and hearing outcomes in otosclerosis patients: a systematic review and meta-analysis

Submitter: Kuan-Ting Yeh, Taiwan

Co-Authors:
Bang-Yan Zhang
Ta-Wei Yeh
Kai-Chieh Chan

Topic:
6) Clinical studies, 21) Therapy

Abstract

Objective:
To evaluate the impact of stapes surgery on tinnitus relief and audiological outcomes in otosclerosis patients with preoperative tinnitus.

Methods:
A literature search of PubMed, EMBASE, and Web of Science was conducted to identify studies involving otosclerosis patients with preoperative tinnitus who underwent primary stapes surgery (stapedectomy or stapedotomy). Studies were included if tinnitus outcomes were assessed using validated questionnaires or self-reported tinnitus changes. Audiological outcomes were extracted when reported. Random-effects meta-analyses were performed if feasible.

Results / Discussion:
Of 263 articles identified, 17 studies (n = 1161) were included. Meta-analysis of three studies (n = 312) showed a −12.81 mean change in Tinnitus Functional Index ($p < 0.00001$). Meta-analysis of 13 studies (n = 811) showed tinnitus disappearance in 49.8%, alleviation in 28.8%, no change in 17.5%, and deterioration in 3.2%. Meta-analysis of five studies (n = 206) showed 77.1% and 95.4% achieved postoperative ABG ≤ 10 dB and ≤ 20 dB, respectively.

Conclusion:
Approximately 70–80% of otosclerosis patients experienced tinnitus relief after stapes surgery, with meta-analysis demonstrating significant TFI improvement and comparable ABG closure rates. However, the correlation between tinnitus relief and hearing improvement remains uncertain. Further multicenter, prospective studies are warranted to clarify prognostic factors.

OP-18
Therapy II

OP-18-002
Tracing the Onset of Somatic Tinnitus: A Clinician's Perspective

Submitter: Alison Chiam, Australia

No Co-Authors submitted

Topic:
19) Somatosensory tinnitus, 12) Hyperacusis

Abstract

Objective:
Clinical observations suggest TTTS can act as both a precipitating and perpetuating factor in Acoustic shock disorder, reinforcing auditory hypervigilance and muscular tension. Recognition of this interplay is essential for differential diagnosis and management. As a clinician, recognising patient experience has been critical for understanding this process. In this session I share the sequence of symptoms patients commonly convey.

Methods:
In a short video, a patient communicates their experiences leading to the onset of Somatic (Musculo skeletal tinnitus). Published papers show correlation between Tinnitus, Hyperacusis and other physical symptoms, such as fullness, fluttering, and pain behind the ear and down the neck or back. We see the patient as they describe the sequence of symptoms as they develop over time.

Results / Discussion:
Somatic tinnitus highlights the complex interaction between trigeminal irritation, TTTS, and the patient's escalating physical and sensory responses. What role do TTTS and ASI have in hyperacusis and elevated sensory mechanisms? Understanding this pattern and associated therapies supports clinicians to validate patient experience, guide early intervention, and collaborate across disciplines to improve patient outcomes and relieve suffering.

Conclusion:
Somatic tinnitus arising from an interplay of trigeminal irritation, TTTS activity, and escalating muscular tension is often reinforced by the patient's own hypervigilant response to early sensory changes. Strengthening collaboration between Audiologists, Physiotherapists, and Medical practitioners ensure patients receive coordinated, validated care that address both the physiological mechanisms and the lived experience underlying their symptoms.

OP-18
Therapy II

OP-18-001
Exercise-Induced changes in tinnitus: An exploratory analysis of working mechanisms.

Submitter: Antonios Chalimourdas, Belgium

Co-Authors:
Kenneth Verboven
Dominique Hansen
Sarah Vanherle
Ilse Dewachter
Sebastien Janssens de Varebeke
Sarah Michiels

Topic:
6) Clinical studies, 20) Stress and tinnitus

Abstract

Objective:
Tinnitus is a common symptom, and its immediate modulation during exercise varies considerably between individuals. While some experience reductions in tinnitus loudness, others report worsening or no change. The mechanisms underlying this variability remain unclear. This study explored several physiological and psychological factors that might explain inter-individual differences in exercise-induced tinnitus responses.

Methods:
In this randomized crossover trial, adults with chronic tinnitus (n = 39) were included. For this analysis, only data collected during and immediately after high-intensity aerobic exercise (HIAE) and high-intensity resistance exercise (HIRE) were used. Participants were classified as "Better," "Worse," or "Same," reflecting decreased, increased, or unchanged tinnitus loudness. Baseline assessments included audiological measures and validated questionnaires (Tinnitus Functional Index, Hyperacusis Questionnaire, Neck Bournemouth Questionnaire, TMD Pain Screener, Hospital Anxiety and Depression Scale, and Perceived Stress Scale), which were entered into moderation analyses. Tinnitus loudness and stress (visual analog scales), affective state (Feeling Scale), heart rate, blood pressure, and circulating cytokines (IL-6, IL-10, TNF-α) were assessed before, during, and up to one hour post-exercise. Mediation and moderation analyses were performed to explore underlying mechanisms.

Results / Discussion:
Aerobic fitness (VO_2peak) and depressive symptoms significantly moderated tinnitus loudness changes during high-intensity aerobic exercise (HIAE). Higher VO_2peak and a higher VO_2peak/predicted ratio were associated with reduced tinnitus loudness, whereas higher depression scores were linked to increases ($p < 0.05$). Mediation analyses revealed group-specific mechanisms. In the Better group, reductions in perceived stress mediated tinnitus loudness decreases during HIAE, while in the Worse group, increases in heart rate, systolic blood pressure, and perceived stress mediated tinnitus loudness increases. Across groups,

higher perceived stress and more negative affect were associated with greater tinnitus loudness. Inflammatory biomarkers showed no mediating effects.

Conclusion:
This exploratory analysis suggests that cardiovascular reactivity and stress regulation might underlie inter-individual differences in tinnitus loudness modulation during high-intensity exercise.

OP-18
Therapy II

OP-18-003
Tinnitus outcomes after Ginkgo biloba extract in sudden sensorineural hearing loss: A dose-comparative and prognostic study

Submitter: Tongxiang Diao, People's Republic of China

Co-Authors:
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Xia Gao
Xiangli Zeng
Shixun Zhong
Dingjun Zha
Xiulan Ma

Topic:
6) Clinical studies, 5) Clinical management

Abstract

Objective:
To compare tinnitus outcomes between two commonly used EGB 761 dosages (120 mg/day vs. 240 mg/day) in patients with SSNHL-associated newly onset tinnitus, and to identify clinical factors associated with tinnitus prognosis.

Methods:
Participants from mainland China were randomly assigned (1:1) to receive either 120 mg/day or 240 mg/day of EGB 761 tablets for one month. Follow-up assessments were conducted at 1, 2, 3, 4, 6, 9, 12, and 18 months after treatment initiation.

Results / Discussion:
A slightly higher proportion of patients met the improvement criterion in the high-dose group (95.9%) than in the low-dose group (91.9%), but the between-group differences were not statistically significant for THI reduction or other outcomes. While a dose–response relationship cannot be excluded, further research is needed to determine whether specific patient subgroups may benefit from higher dosing.

Conclusion:
Both 120 mg/day and 240 mg/day dosages of EGB 761 demonstrated similar tinnitus outcomes over follow-up. Anxiety, LPR, and a history of vestibular disorders may be prognostic factors for tinnitus.

OP-19
Perspektive II

OP-19-001
Effects of the digital therapeutic app silentcloud: a bicentric parallel-group randomised controlled trial

Submitter: Leona Langert, Germany

Co-Authors:
Raffael Schmitt
Milena Engelke
Maren Stropahl
Berthold Langguth
Birgit Mazurek
Benjamin Böcking
Kurt Steinmetzger

Topic:
21) Therapy, 20) Stress and tinnitus

Abstract

Objective:
Limited access to adequate treatment remains pervasive among tinnitus patients. In routine care, many individuals lack access to interventions due to regional undersupply or long waiting times. To effectively address the treatment gap of tinnitus, low-threshold, scalable, and evidence-based care models are needed that provide early support, facilitate access to therapy, and potentially reduce clinically significant distress in patients. Mobile health applications play a key role in this context and offer substantial potential to improve care for individuals with distressing tinnitus.

Over the past decade, the number of mobile health applications has increased significantly. In 2024 alone, more than 50,000 such applications were launched, bringing the total number available in leading app stores to over 337,000. These applications have the potential to sustainably improve healthcare by simplifying access, closing gaps in care, complementing treatments delivered in primary care, reducing healthcare costs, and empowering patients to manage their health independently. Despite their enormous potential, only a minority of these applications have been evaluated for its efficacy in the context of digital tinnitus management.

Methods:
The current project focuses on a novel mobile health application 'SilentCloud', a multi-component tinnitus-management app that integrates psychoeducation, internet-based cognitive behavioural therapy, and several sound therapy options for adults with chronic subjective tinnitus. A bicentric, parallel-group, randomized controlled trial was conducted at the University of Regensburg and Charité Berlin to evaluate SilentCloud. A total of 144 adults with chronic subjective tinnitus were enrolled and randomly assigned (1:1) to either the intervention group (SilentCloud) or a waiting list control group.

Results / Discussion:
In summary, a statistically significant effect was observed for the primary outcome, namely the change in tinnitus-related distress from baseline to three months, measured using the Tinnitus Handicap Inventory (THI). A battery of secondary and exploratory outcomes was also assessed and will be discussed.

Conclusion:
A battery of secondary and exploratory outcomes was also assessed and will be discussed.

OP-19
Perspektive II

OP-19-002
Effects of transcranial direct current stimulation with mastoid electrode placement on tinnitus: a four-month follow-up

Submitter: Denise Utsch-Gonçalves, Brazil

Co-Authors:
Julia Tolentino
Ludimila Labanca
Tatiana Rocha
Sorenza Villaça
Maurício Tavares

Topic:
6) Clinical studies, 3) Brain stimulation

Abstract

Objective:
To evaluate transcranial direct current stimulation (tDCS) for tinnitus neuromodulation, analyzing mastoid electrode placement, its effects on quality of life and tinnitus perception, as well as potential adverse effects related to stimulation duration and current intensity, with a four-month post-intervention follow-up.

Methods:
This quasi-experimental study included pre- and post-intervention assessments. The sample comprised 11 patients with tinnitus. Participants underwent tDCS with electrodes placed over the mastoid region. Evaluations were conducted at three time points: pre-intervention, immediately post-intervention, and after a 16-week follow-up. Outcomes were assessed using the Tinnitus Handicap Inventory (THI), the Hospital Anxiety and Depression Scale (HADS), and a Visual Analog Scale (VAS) for tinnitus intensity. The protocol consisted of one weekly tDCS session for eight weeks, each comprising three consecutive stimulation series separated by 5-minute intervals. Each series included 3 to 5 stimulation cycles, lasting 1 minute in the first session and 2 minutes from the second session onward. Current intensity increased progressively from 1 to 3.5 mA between the first and eighth sessions. Statistical analysis included descriptive measures, pre- and post-intervention comparison with a significance level set at 5%, and effect size estimation.

Results / Discussion:
Median scores on the THI, HADS, and VAS decreased after the intervention, suggesting a trend toward improvement in tinnitus perception and anxiety–depressive symptoms; however, these differences did not reach statistical significance at the 5% level, although they were significant at the 10% level, indicating potential clinical relevance. In terms of magnitude, the effect size of EET was small based on THI (Hedges' g = 0.26) and moderate based on VAS (Hedges' g = 0.56). Regarding clinical relevance, individual analysis showed that 5 patients based on THI and 4 based on VAS achieved clinically meaningful improvement according to minimal clinically

important difference (MCID) criteria. At the 4-month follow-up, scores remained stable, with no evidence of clinical worsening. The risk of depression was more frequent among patients who did not show improvement. The group-level effect of tDCS on tinnitus was small to moderate and associated with the presence of responders, consistent with the neuromodulation literature and reflecting the intrinsic heterogeneity of tinnitus. The neuromodulatory effects depend on the baseline state of neural activity at the time of intervention; therefore, individuals with distinct patterns of functional brain organization may respond differently to the same intervention.

Conclusion:
tDCS with mastoid electrode placement proved to be a safe and scalable neuromodulation approach for tinnitus. Its simplicity allows patients to self-administer electrode placement, enabling home-based, personalized stimulation supported by artificial intelligence and remotely monitored through the Internet of Things. This model aligns with the principles of Health 5.0, integrating digital health technologies with patient-centered care.

P-01
Epidemiology

P-01-002
Tinnitus severity and chronicity in relation to hearing loss: a population-based study

Submitter: Jae Ho Chung, Republic of Korea

Co-Authors:
Sang-Yoon Han
Hee Won Seo
Seung Hwan Lee

Topic:
9) Epidemiology

Abstract

Objective:
Objectives: Although the link between hearing loss and tinnitus is well established, the relationship between tinnitus-related distress and the degree of hearing impairment remains insufficiently explored. This study aimed to investigate the association between tinnitus severity and hearing thresholds using a large-scale population-based dataset.

Methods:
From the 2020–2022 Korea National Health and Nutrition Examination Surveys, 10,028 participants with normal tympanic membranes were analyzed. Based on tinnitus VAS scores, participants were classified as no tinnitus, non-bothersome (VAS 0–4), or bothersome (VAS ≥5). Hearing thresholds were compared by sex and tinnitus chronicity.

Results / Discussion:
Hearing thresholds worsened with increasing tinnitus distress ($p < 0.001$). The bothersome group had the highest rates of moderate to severe hearing loss and the lowest rate of normal hearing. This pattern was consistent in both sexes and in chronic tinnitus, while in acute tinnitus it appeared only in males without statistical significance. Males showed poorer hearing than females in both tinnitus groups.

Conclusion:
Conclusion: Tinnitus was significantly associated with hearing loss, even when distress was mild, and greater distress corresponded to more severe impairment. These findings highlight the importance of considering tinnitus severity when estimating hearing levels and providing appropriate counseling for hearing evaluation.

P-01
Epidemiology

P-01-003
The influence of music exposure on tinnitus and hyperacusis in musicians

Submitter: Anaïs Behaeghel, Belgium

Co-Authors:
Amber Lauwereyns
Sofie Degeest
Bart Vinck

Topic:
20) Stress and tinnitus, 12) Hyperacusis

Abstract

Objective:
Prolonged exposure to high-intensity sound can place musicians at risk of tinnitus and hyperacusis. The severity of symptoms may vary depending on exposure level and individual factors. The aim of this study was to investigate the prevalence and impact of tinnitus and hyperacusis and their association with musical, personal and demographic factors influence the symptoms.

Methods:
A prospective study was conducted using a self-developed questionnaire. This study was approved by The Ethics committee of University Ghent and Ghent University hospital. The study sample was selected using convenience sampling and voluntary response sampling. It consisted of 696 musicians, aged between 18 and 60 years. Descriptive and interferential statistics, with a significance level of 5 % ($P < 0.05$), were used to determine the results.

Results / Discussion:
54 % of the participants reported tinnitus and 36 % reported hyperacusis. Women reported tinnitus and hyperacusis more frequently than men and other genders. Amateur musicians more often reported severe complaints. No significant associations were found with age, musical exposure and hearing protection use. An association was found between type of instrument played and type of tinnitus sound experienced.

Conclusion:
This study shows that symptoms are common among musicians, but difficult to predict. Limitations such as self-reporting, non-validated questionnaire and unequal subgroups may have influenced the results. Future research should focus on objective measurements, validated questionnaires and longitudinal studies to understand symptoms in musicians.

P-01
Epidemiology

P-01-006
Hearing Loss, Not Tinnitus, Predicts Cognitive Performance in Hispanic/Latino Adults

Submitter: Emilia Kaniewska, USA

Co-Authors:
Yadira Alonzo Espinosa
Yasmeen Hamza
Fatima Husain

Topic:
9) Epidemiology, 6) Clinical studies

Abstract

Objective:
Investigate whether hearing loss and tinnitus are associated with cognition in Hispanic/Latino adults aged 45-75 years, a population where sensory and cognitive aging are understudied. We examine independent and joint associations with global and domain-specific cognition, and if tinnitus adds risk beyond hearing loss, extending Hamza&Zeng (2021) by targeting midlife dementia risk and adjusting for demographic, socioeconomic and vascular factors.

Methods:
We analyzed 6,536 adults from the Hispanic Community Health Study/Study of Latinos. Hearing loss was defined as pure-tone average >20 dB HL (Humes, 2021), tinnitus was self-reported, and cognition was assessed across verbal learning, episodic memory, verbal fluency, and processing speed/working memory; z-scores formed a global score. Multivariable GLMs tested independent and joint associations, adjusting for demographic and health covariates.

Results / Discussion:
Hearing loss was independently associated with lower global cognition, after adjusting for demographic and health factors, consistent with pathways linking reduced auditory input to cognition (Livingston et al., 2020). Tinnitus showed no independent or interactive effect. Hearing loss was linked to poorer episodic memory, but not verbal learning, executive control, or working memory; global cognition may be mainly driven by episodic memory.

Conclusion:
Hearing loss emerged as the primary sensory factor associated with cognition in this sample of Hispanic/Latino adults, whereas tinnitus showed no additional effects. The selective link with episodic memory suggests that hearing loss is a more informative marker of cognitive vulnerability and a more promising target for supporting cognitive health in aging Hispanic/Latino populations than tinnitus.

P-01
Epidemiology

P-01-001
Lifestyle Factors and Risk of Incident Tinnitus: A Prospective Analysis of the UK Biobank

Submitter: Da Jung Jung, Republic of Korea

No Co-Authors submitted

Topic:
9) Epidemiology, 6) Clinical studies

Abstract

Objective:
Tinnitus is a prevalent auditory condition that impairs quality of life, yet evidence regarding modifiable lifestyle risk factors remains limited. We investigated the associations of salt intake, coffee and tea consumption, and sleep quality with incident tinnitus in a large prospective cohort.

Methods:
We analyzed data from 488,707 participants in the UK Biobank, excluding 12,330 individuals with tinnitus at baseline. Salt intake frequency, coffee and tea consumption, and sleep quality were assessed through standardized questionnaires. Incident tinnitus cases (n = 6,836) were identified during follow-up using linked hospital records. Cox proportional hazards models were applied to estimate hazard ratios (HRs) and 95% confidence intervals (CIs) across categories of each lifestyle factor, with progressive adjustment for demographic, socioeconomic, and health-related covariates.

Results / Discussion:
During follow-up, 6,836 incident tinnitus events were documented. Higher salt intake was associated with increased tinnitus risk, with multivariable-adjusted HRs of 1.06 (95% CI, 1.00–1.12) for sometimes, 1.06 (0.98–1.15) for usually, and 1.16 (1.04–1.30) for always adding salt compared with never/rarely (P for trend <0.005). Moderate coffee intake (2–3 cups/day) was inversely associated with tinnitus risk (HR, 0.92; 95% CI, 0.87–0.97), whereas higher intake showed no significant associations. Tea intake displayed a modest positive association, with an HR of 1.07 (1.00–1.15) for high consumption compared with none/low. Poor sleep quality was strongly associated with increased risk, with HRs of 1.11 (1.08–1.15) for less-healthy and 1.24 (1.16–1.34) for poor sleep compared with healthy sleepers (P for trend <0.005).

Conclusion:
In this large-scale prospective analysis, higher salt intake, high tea consumption, and poor sleep quality were associated with increased risk of tinnitus, whereas moderate coffee intake was linked to reduced risk. These findings highlight the potential role of modifiable lifestyle factors in tinnitus prevention and provide evidence to inform dietary and behavioral recommendations.

P-01
Epidemiology

P-01-005
Tinnitus Prevalence in Switzerland: A Nationally Representative Study with European Comparison

Submitter: Nick Sommerhalder, Switzerland

Co-Authors:
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Tobias Kleinjung
Nicole Peter
Martin Meyer
Winfried Schlee
Patrick Neff

Topic:
9) Epidemiology

Abstract

Objective:
Tinnitus is a common health complaint, but nationally representative estimates for Switzerland are lacking. Using items from the European Tinnitus Survey, we aimed to provide the first nationally representative Swiss estimates of tinnitus prevalence and related severity, assess differences across German-, French-, and Italian-speaking regions, and benchmark Switzerland against European countries.

Methods:
We ran four omnibus survey waves in 2025 (weeks 4, 5, 23, 24) among adults 18-75 years (N=4,439). Italian-speaking Switzerland was oversampled and corrected with post-stratification weights. Outcomes were tinnitus frequency (any; frequent/constant; constant) and severity (no burden to severe burden). Analyses used survey-weighted regression and reanalysis of Biswas et al. (2022) European data.

Results / Discussion:
Swiss prevalence exceeded harmonized European estimates from reanalyzed 2022 data, contradicting the expected inverse GDP–prevalence pattern. Language-region differences persisted after adjusting for demographics, SES, and hearing, suggesting contextual factors or varying reporting thresholds. This underscores the need to account for regional patterns when interpreting prevalence and planning hearing-health services.

Conclusion:
Tinnitus is highly prevalent in Switzerland. About half of adults report it occasionally, 1 in 10 report it frequently, and a minority suffer severely. Marked subnational differences across language regions show that tinnitus burden is not uniform within countries. Future work should align European data-collection periods and improve cross-language measurement of tinnitus frequency and severity to ensure better comparability.

P-01
Epidemiology

P-01-004
Misophonia in a general adult population: Results and analysis of its occurance and impact

Submitter: Patricia Ciminelli, Brazil

Co-Authors:
César Quadros Maia
Tatiana Guthierre
Julia Carmo Vilela
Luiz Otavio Paiva Flausino

Topic:
9) Epidemiology, 12) Hyperacusis

Abstract

Objective:
To evaluate the occurrence of misophonia in the general patient population of a tertiary public hospital and to establish a clinical and epidemiological profile of individuals with misophonia, identifying the characteristics of trigger sounds, coping strategies, the impact on daily life, and possible associations with auditory and psychiatric complaints.

Methods:
Observational, cross-sectional, and qualitative study. A total of 483 adult volunteers, over 18 years old, anonymously answered a structured questionnaire. Participants were recruited from various specialty outpatient clinics within this tertiary hospital, excluding the Otorhinolaryngology department.

Results / Discussion:
Among the 483 studied individuals, 69.1% were female, and the most prevalent age group was 31 to 60 years (50.3%). Regarding discomfort when exposed to sounds, 66% of participants rated their discomfort between 4 and 10 on a scale from 0 to 10, with 10 being the highest level of discomfort. Regarding functional impact, only 2.28% reported that the discomfort "always" interfered with their social and/or professional life, 21.7% stated it "sometimes" interfered, and 24.9% reported avoiding environments with potentially bothersome sounds. Human body sounds were the most frequently reported triggers (52.1%). The most common emotional responses to these sounds were discomfort or irritation (54.9%). Misophonia affects a large part of the population but is widely underdiagnosed, with less than 4% seeking medical help. There is a strong functional impact, with 24.9% avoiding environments and worsening social isolation. The disorder is not only auditory but has a neurophysiological basis, characterized by the hyperactivation of limbic circuits. Psychiatric comorbidities, such as anxiety and ADHD, affect 33.6% of individuals. Although Cognitive Behavioral Therapy improves up to 48% of cases, no volunteer used it, exposing a huge clinical-scientific gap.

Conclusion:
Misophonia appears to be considerably more frequent in the general population than commonly

assumed. Its emotional and quality-of-life impact varies widely, and its consequences can be aggravated by underdiagnosis and the absence of a multidisciplinary therapeutic approach for this condition.

P-02
Phenotyping & comorbidities

P-02-003
Construction of Risk Prediction Model of Psychological Distress in Tinnitus Patients Based on Multi-source Data Fusion

Submitter: Hongju Ling, People's Republic of China

No Co-Authors submitted

Topic:
6) Clinical studies

Abstract

Objective:
To develop and validate a multi-source data–driven machine learning model for predicting psychological distress in patients with tinnitus, thereby supporting risk stratification and targeted nursing interventions.

Methods:
A total of 275 tinnitus patients were prospectively enrolled. Demographic data, tinnitus-related clinical characteristics, and psychometric assessments (K-10, THI, SAS, SDS, PSQI) were collected. A multi-source data fusion prediction model was built via the XGBoost algorithm, with its performance evaluated by AUC, accuracy, sensitivity, specificity and compared with a conventional linear regression model.

Results / Discussion:
Mean scores were 18.34 ± 3.78 (K-10), 46.58 ± 15.42 (THI), 46.72 ± 8.15 (SAS), 48.63 ± 9.02 (SDS), and 9.26 ± 3.41 (PSQI). Pearson correlation showed K-10 positively correlated with all four scales ($r=0.462–0.621$, $P<0.001$). Univariate/multivariate analyses identified predictors of psychological distress. The XGBoost model (AUC=0.872, accuracy=82.3%) outperformed linear regression (AUC=0.741), with feature importance analyzed.

Conclusion:
A multi-source data fusion–based XGBoost model demonstrated robust predictive performance for psychological distress in patients with tinnitus. This approach may facilitate early risk identification and enable personalized, stratified nursing care.

P-02
Phenotyping & comorbidities

P-02-004
The predictive and prescriptive value of depression and hyperacusis for the treatment of chronic subjective tinnitus

Submitter: Stefan Schoisswohl, Germany

Co-Authors:
Berthold Langguth
Milena Engelke

Topic:
7) Comorbidity, 5) Clinical management

Abstract

Objective:
Depression and hyperacusis are common comorbidities and suspected as useful criterions for tinnitus subtyping. With the present study we aimed to evaluate the general, i.e. predictive, and treatment-specific, i.e. prescriptive value, of depression and hyperacusis in the treatment of tinnitus.

Methods:
Data from chronic subjective tinnitus patients participating in a multicenter randomized controlled trial comparing several 12-week single and combination treatments were analyzed. Depression and hyperacusis were assessed before treatment. Outcome was the change in tinnitus distress following treatment.

Results / Discussion:
Baseline depression as well as hyperacusis predicted tinnitus distress after 12 weeks irrespective of the applied treatment type. A higher level of depression or stronger hyperacusis was associated with more severe tinnitus distress. No evidence was found for a prescriptive effect.

Conclusion:
Depression and hyperacusis appear to be general prognostic markers for tinnitus outcomes, but do not inform the treatment selection process. However, both comorbidities should not be neglected in clinical care, as reducing their symptoms may increase the chance of tinnitus symptom improvement.

P-02
Phenotyping & comorbidities

P-02-001
Data-Driven Subtyping of Tinnitus Patients Using Deep Embedded Clustering

Submitter: Min Chae Jeon, Republic of Korea

No Co-Authors submitted

Topic:
8) Diagnosis

Abstract

Objective:
Tinnitus is a heterogeneous condition influenced by auditory and non-auditory factors, making clinical classification difficult. This study aimed to identify latent tinnitus subtypes using a data-driven deep learning approach and to examine their clinical and therapeutic characteristics. By integrating audiometric, psychoacoustic, and psychological variables, we sought to uncover distinct patient phenotypes and explore their differential response to Tinnitus Retraining Therapy (TRT).

Methods:
A retrospective cohort of 2,161 patients who underwent TRT at a tertiary referral center was analyzed. Eighteen clinical variables including audiometric thresholds, tinnitus psychoacoustics, THI, VAS, BEPSI, and BDI were integrated. A deep autoencoder was used to generate latent representations, followed by Deep Embedded Clustering (DEC) to identify patient subtypes. Cluster characteristics and treatment outcomes were compared using statistical analyses.

Results / Discussion:
Three clinically distinct tinnitus subtypes emerged: an HF-dominant group with high-frequency hearing loss, a stress-dominant group characterized by elevated psychological distress and poor TRT response, and a normal-hearing tonal group with rapid improvement. These findings highlight the multidimensional nature of tinnitus and suggest that auditory and psychological factors jointly influence treatment outcomes.

Conclusion:
Deep embedded clustering of multidimensional clinical data successfully identified meaningful tinnitus subtypes with different therapeutic trajectories. This data-driven framework enables objective patient stratification and may support personalized tinnitus management strategies. Integrating machine learning approaches into clinical tinnitus platforms could improve treatment prediction and facilitate precision medicine in tinnitus care.

P-02
Phenotyping & comorbidities

P-02-002
Auditory Disorders as Underrecognized Complications of Type 2 Diabetes: Findings from a French Observational Study in Type 2 Diabetes

Submitter: Zoe Kaier-Green, USA

Co-Authors:
Mathieu Schue
Blandine Duval
Hugo Laullier
Camille Rochmann

Topic:
6) Clinical studies, 7) Comorbidity

Abstract

Objective:
Auditory dysfunction, such as tinnitus, sensorineural hearing loss (SNHL), and speech-in-noise (SIN) deficit, are increasingly reported in patients with type 2 diabetes (T2D). Potential underlying mechanisms include peripheral auditory neuropathies (e.g., cochlear synaptopathy and cochlear microangiopathy), oxidative stress, mitochondrial dysfunction, and chronic systemic inflammation affecting central auditory pathways. Because no in-vivo method allows direct visualization of the cochlear structures, auditory assessments rely on indirect functional or electrophysiological measures, which do not fully capture real-life auditory disability.

The DIAMANT study was a French, cross-sectional, prospective study. It aimed to evaluate auditory function in participants with uncontrolled T2D, refine auditory phenotypes, and provide insight into clinically meaningful endpoints for this high-risk population. This work is important in defining markers that reflect real-life experience and to ensure early identification of auditory disability. While the primary intent was to investigate hearing in real-world environments in T2D, exploratory analyses can provide insights into its relationship with tinnitus, another disabling auditory phenomenon with significant day-to-day burden.

Methods:
349 participants aged 25-70 with T2D for > 2 years and HbA1c > 7% were recruited from three French Diabetology centers and underwent a comprehensive battery of auditory testing including standard (0.25 - 8 kHz) and extended high frequency (8 - 16 kHz) pure-tone audiometry, SIN testing using the French Matrix test (Framatrix), auditory-evoked electrophysiology testing, and cognitive screening (Montreal Cognitive Assessment [MoCA]). Self-reported auditory history and disability, T2D history, and lifestyle data were collected, including questions quantifying tinnitus frequency (never / rarely / occasionally / most of the time / almost all the time) and degree of discomfort (numeric scale 0 - 10).

Participants with abnormal otoscopy, tympanometry, or conductive or asymmetrical hearing loss were excluded, leading to 241 analyzable participants.

Tinnitus was categorized as: No tinnitus (Frequency reported as “never” or “rarely”), Any tinnitus (not bothersome or severe) (Frequency reported as “occasionally”, “most of the time”, or “almost all the time”; Degree of discomfort < 4), Bothersome tinnitus (Any tinnitus; Degree of discomfort ≥ 4 / 10), Severe tinnitus (Any tinnitus; Degree of discomfort ≥ 7 / 10). Hearing was classified, using the standard 4-frequency Pure Tone Average (PTA) (0.5 - 4 kHz) and the Framatrix score, as: Normal hearing (PTA < 25 dB HL; Framatrix < -3 dB SNR), SIN deficit (PTA < 25 dB HL; Framatrix ≥ -3 dB SNR), Hearing loss (PTA ≥ 25 dB HL). Analyses were performed on the full sample.

Results / Discussion:
Among 241 participants (57.7% women, median age 60), 45.6% were classified as Normal hearing (NH), 37.3% as SIN deficit (SIN-D), and 17% as Hearing loss (HL). 79.7% were classified as No tinnitus, 7.5% Any tinnitus (not bothersome or severe), 9.1% Bothersome tinnitus, and 3.7% as Severe tinnitus.

In the No tinnitus group, 47.9% were classified as NH, 38.0% as SIN-D, and 14.1% as HL. In the Any tinnitus (any severity) group, 36.7% were classified as NH, 34.7% as SIN-D, and 28.6% as HL, with a cohort-wide prevalence of 20.3%.

Tinnitus prevalence was higher in men (22.5%) than women (18.7%), although this difference was not statistically significant ($p = 0.46$). It was significantly higher among individuals who reported difficulty understanding speech in noise (25.4%) than those without self-reported difficulty (13.8%) ($p = 0.025$). Tinnitus prevalence also tended to increase with hearing difficulty (defined as progression from NH to SIN-D to HL) ($p = 0.06$). Prevalence of self-reported difficulties understanding speech in noise was quite high at 54.4%.

Overall, these results indicate that tinnitus and speech-in-noise difficulties are common and clinically relevant in individuals with uncontrolled T2D, even without overt hearing loss.

Conclusion:
DIAMANT revealed high prevalence of tinnitus, self-reported difficulty understanding speech in noise, and SIN deficit with normal standard hearing thresholds in the Type 2 diabetes population. Standard pure-tone audiometry would fail to identify these impactful auditory disorders without additional testing. As rates of T2D continue to rise worldwide, its relationship with auditory dysfunction represents an underrecognized comorbidity that warrants increased clinical awareness and focused research efforts.

When comparing our findings to a large, cross-sectional European study using data from a population-based survey of the general population, results indicate higher prevalence of tinnitus in the T2D population (20.3%) than the general population (14.7%). There is also a significantly higher prevalence of self-reported difficulties understanding speech in noise in the T2D population (54.4%) than the general population (21.2%). There are limitations to this comparison, including the unknown accuracy of comparing a France-only study to a broad European study with different demographics, comparing self-reported answers on questions with different wording that assess the same topic, and comparing binary and nominal variables.

This work highlights a neglected population with functional auditory deficits that escape detection. This underscores the need for increased awareness of the burden of disabling auditory disorders, stronger multidisciplinary collaboration between auditory and diabetes healthcare practitioners, universal SIN assessment in routine practice, and continued development of markers of real-life auditory disability and mechanistic biomarkers to clarify causal pathways and guide early, targeted intervention.

P-03
Diagnosis & treatment

P-03-003
Dutch translation and psychometric evaluation of tinnitus and hyperacusis questionnaires for children

Submitter: Hannah Keppler, Belgium

Co-Authors:
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Annick Gilles
Laure Jacquemin

Topic:
8) Diagnosis, 21) Therapy

Abstract

Objective:
It is important to use validated questionnaires to determine the impact of tinnitus and/or hyperacusis in children, and to be able to evaluate the effects of an intervention. The objective was to translate the Tinnitus Impact Questionnaire (TIQ) and Hyperacusis Impact Questionnaire (HIQ) (Aazh et al. 2024)), and the Impact of Tinnitus in Children Questionnaire (iTICQ) (Smith et al. 2024) in Dutch, and to evaluate their validity and reliability.

Methods:
After a forward-back translation procedure to translate the TIQ, HIQ and iTICQ to Dutch, the questionnaires were pretested. For the psychometric analysis of the questionnaires, children between 8 and 16 years of age with tinnitus (and hyperacusis) will be included. Statistical analysis will include determining the internal consistency, the convergent validity, and test-retest reliability.

Results / Discussion:
At the time of abstract submission, 10 children with tinnitus (and hyperacusis) are included in the study. Our goal is to include 50 children with tinnitus (and hyperacusis), and to present the results at the Tinnitus Research Initiative conference 2026.

Conclusion:
With this study we aim to ensure that validated questionnaires are available in Dutch for evaluating the impact of tinnitus and hyperacusis in children and the effects of an intervention. These questionnaires are essential in clinical and research settings, strengthening the care for children with tinnitus and hyperacusis.

P-03
Diagnosis & treatment

P-03-004
Differences in barriers and facilitators for hearing aid uptake between adults with and without tinnitus in Flanders

Submitter: Lotte Raes, Belgium

Co-Authors:
Katrien Kestens
Hannah Keppler

Topic:
11) Hearing aids and sound therapy

Abstract

Objective:
Hearing aids are recommended as treatment strategy for hearing loss in individuals with tinnitus. The goal of the current study was to investigate barriers and facilitators related to hearing aid uptake in adults without hearing devices in Flanders (Belgium), whereby here we focus on differences depending on the presence of tinnitus.

Methods:
A questionnaire was developed in Dutch, covering sociodemographic, hearing and health related, and psychosocial factors. There were 16 and 11 statements related to reasons why hearing aids would not and would be considered, respectively. These statements can be clustered into expected benefit, comfort, esthetics, stigma, journey through healthcare, and financial considerations. For statical analysis, chi^2 testing was performed.

Results / Discussion:
Preliminary results based on 345 respondents (227 female, 113 male, 5 other/ unknown) indicate that there are significant differences between adults with tinnitus (n=104) and without tinnitus (n=232) and statements related to benefit, financial considerations, and the journey through healthcare. As data collection is still ongoing, the results based on a larger sample will be presented at the Tinnitus Research Initiative conference 2026.

Conclusion:
The current study in adults without hearing devices in Flanders evaluated barriers and facilitator to hearing aid uptake in adults with and without tinnitus. It stresses the importance of providing correct information regarding hearing aids and increasing awareness regarding the benefits of hearing aids in individuals with tinnitus. Targeting these aspects would improve hearing healthcare in individuals with tinnitus.

P-03
Diagnosis & treatment

P-03-001
Evolving digital therapeutic approaches for subjective tinnitus: from internet-delivered interventions to mixed reality-based care

Submitter: Geonwoo Seo, Republic of Korea

Co-Authors:
Il joon Moon

Topic:
21) Therapy, 5) Clinical management

Abstract

Objective:
Subjective tinnitus is a chronic condition without a definitive cure. Cognitive Behavioral Therapy (CBT) has evolved from face-to-face care to internet-based and mobile-based delivery. This review summarizes digitally delivered CBT-informed interventions and considers mixed reality platforms as a potential next step in digital tinnitus management.

Methods:
A narrative review of PubMed, Scopus, and Google Scholar identified studies on digitally delivered CBT-informed interventions for subjective tinnitus. Pharmacologic-only and non-behavioral sound therapies were excluded. Studies were examined by delivery format, design, and outcomes, with emphasis on app-based and immersive platforms.

Results / Discussion:
Internet-based CBT demonstrates randomized evidence for reducing tinnitus-related distress. Mobile platforms report feasibility but lack comparable randomized data. Virtual reality systems show technical feasibility for immersive delivery. These findings indicate evolving digital formats with differing evidence levels and highlight the need to compare delivery models beyond screen-based approaches.

Conclusion:
Digital CBT for tinnitus is shifting from screen-based delivery toward immersive care models. While iCBT is evidence-supported, mobile and immersive approaches require stronger validation. Our team is developing a mixed reality-based CBT-informed platform as a strategic next step, warranting systematic clinical investigation to define its comparative and long-term impact.

P-03
Diagnosis & treatment

P-03-002
Primary care for tinnitus and hyperacusis: a service evaluation of general practice in the United Kingdom

Submitter: Magdalena Sereda, United Kingdom

Co-Authors:
Derek Hoare
Magdalena Sereda
Kathryn Fackrell

Topic:
5) Clinical management, 21) Therapy

Abstract

Objective:
It is estimated that over 1 million tinnitus consultations occur annually in UK primary care, yet previous surveys demonstrate variability in assessment and management. Hyperacusis remains less well described in this setting. This study aims to update earlier UK data on GP practice in tinnitus care and, for the first time, evaluate assessment and management of hyperacusis in primary care.

Methods:
A 17 item online and paper survey was sent to 2000 named GPs within practices across the four nations. Respondents were required to answer questions on assessment, management, referral and guideline use for tinnitus and hyperacusis. To date, 48 GP have completed the survey. Recruitment and data collection are ongoing.

Results / Discussion:
Preliminary analysis indicates variation in tinnitus and hyperacusis practice by GPs. Over 80% screened for tinnitus red flags, 8.3% asked no hyperacusis-specific questions. Although 92% discussed referral for tinnitus, 19% referred ≤10% of cases. Only 20% of GPs referred to psychology. Hyperacusis referrals were polarised. NICE guidance use was reported for tinnitus (50%) and hyperacusis (31.3%), despite no hyperacusis guidance existing.

Conclusion:
Our preliminary analysis suggests potential inequity in UK primary care management of tinnitus and hyperacusis, particularly regarding hyperacusis advice and referral. Despite reported dissatisfaction with services, training need was not widely prioritised. Clearer national and local guidance, improved referral pathways, and proportionate educational support may help strengthen confidence and consistency of care.

P-04
Basic research & biomarkers

P-04-001
Efficacy of Intratympanic Administration of Sodium Thiosulfate Gel for the Prevention of Cisplatin-Induced Ototoxicity

Submitter: Dong-Kee Kim, Republic of Korea

Co-Authors:
SUBIN Kim
Jee Hyun Kang
KEUM-JIN Yang

Topic:
2) Basic research, 16) Pharmacology

Abstract

Objective:
Platinum-based chemotherapeutic agents, such as cisplatin, are widely used but often induce dose-limiting ototoxicity. Sodium thiosulfate (STS) is one of the known otoprotective agent; however, systemic administration may reduce cisplatin's antitumor efficacy. Although the protective effects of STS are wellrecognized, there remains a lack of detailed studies evaluating local delivery stategies on cochlear uptake, oxidative stress modulation, and safety profiles.

Methods:
Before a single intraperitoneal (i.p.) injection of cisplatin (16mg/kg), STS was administered either systemically via the intraperitoneal route or locally via intratympanic (IT) injection. For IT delivery, STS was applied either as a free solution or embedded in injectable hyaluronic acid-based hydrogels. Two hydrogel formulations were used: (1) NorHA, a norbornene-functionalized hyaluronic acid (NH), and (2) NorHACA, a catechol-modified NorHA (NHC) designed to enhance tissue adhesion. Hearing thresholds were measured by auditory brainstem response. Cochlear and hepatic platinum concentrations were quantified using ICP-MS. In vitro cytoprotection was assessed in HEI- OC1 cells using DCF-DA for reactive oxygen species (ROS), and viability assays.

Results / Discussion:
Intratympanic delivery of STS, either as a solution or hydrogel-embedded formulation, significantly reduced cochlear platinum levels without altering hepatic platinum concentrations, suggesting preserved systemic cisplatin distribution. STS-treated groups exhibited improved auditory thresholds in ABR assessments and reduced intracellular ROS levels. Moreover, NOX3 expression was attenuated in the STS co-treated conditions. While the use of NorHA-based hydrogel matrices (NH or NHC) did not confer a statistically meaninful auditory benefit over free-form IT STS, sustained cochlear presence was observed and may offer prolonged local exposure potential.

Conclusion:
Conclusion Hydrogel-based intratympanic delivery represents an effective platform for

localized administration of STS. Local delivery of STS using hydrogels significantly attenuated cisplatin-induced ototoxicity while preserving systemic cisplatin exposure, suggesting that this strategy can provide selective otoprotection without compromising antitumor efficacy. This approach offers a clinically translatable and repeatable method for preventing cisplatin-induced hearing loss.

P-04
Basic research & biomarkers

P-04-003
Integrative Multi-Omics and Multimodal Analysis of Tinnitus Pathophysiology: Insights from Human Patients and Noise-Induced Rodent Models

Submitter: Shan Sun, People's Republic of China

Co-Authors:
Tingting Qian
Ge Wang
Peifan Li
Chongkai Lu
Huawei Li
Yi-Quan Tang

Topic:
2) Basic research

Abstract

Objective:
Tinnitus is a common auditory disorder whose pathophysiology remains poorly understood, particularly regarding the link between environmental noise exposure and disease mechanisms. This study aimed to investigate the metabolic and immune signatures associated with occupational noise-induced tinnitus and to develop an objective predictive model for tinnitus severity.

Methods:
A graded observational cohort of individuals with documented occupational noise exposure histories was enrolled. Integrated multi-omics profiling was performed, including serum metabolomics, lipidomics, and immunophenotyping, combined with interpretable machine learning. Mediation analysis was used to quantify the contribution of identified biomarkers to the association between noise exposure and tinnitus severity.

Results / Discussion:
Our findings identify specific biomarker signatures linking occupational noise exposure to metabolic and immune dysregulation in tinnitus. The mediation analysis highlights that metabolic alterations, particularly involving GABA and sphingolipids, largely explain the association between noise exposure and tinnitus severity. The observed early sphingolipid perturbations followed by Th1-skewed immune activation and reduced GABA levels suggest a temporal “Exposure–Metabolism–Immunity” cascade that may drive tinnitus pathogenesis. Compared with existing literature, this study provides a multi-dimensional integrative perspective, moving beyond single-biomarker approaches. The high performance of the CatBoost model (84.8% accuracy) supports the feasibility of objective tinnitus severity stratification using peripheral blood-based multi-omics data. These results generate testable hypotheses implicating GABAergic tone and sphingolipid metabolism as candidate pathways for future mechanistic and interventional studies.

Conclusion:
In summary, occupational noise exposure is associated with distinct metabolomic and immunophenotypic signatures in tinnitus patients. GABAergic and sphingolipid pathways appear to play a central mediating role in this association. A machine learning model based on these multi-omic features can effectively stratify tinnitus severity, offering a potential objective tool for clinical assessment. Future studies should validate these findings in independent cohorts and explore the therapeutic potential of targeting GABA and sphingolipid metabolism in noise-induced tinnitus.

P-04
Basic research & biomarkers

P-04-002
The time course of monocytes infiltration after acoustic overstimulation

Submitter: Seungho Shin, Republic of Korea

No Co-Authors submitted

Topic:
2) Basic research, 2) Basic research

Abstract

Objective:
Cochlea macrophages regulate cochlea inflammation and may harbors the potentials to protect hearing function from injury, including acoustic overstimulation. Cochlea macrophage numbers increase at 3-7 days after acoustic stimulation. However, the exact timing of macrophage infiltration and maturation from inflammatory monocytes is unclear. Furthermore, neutrophils may also be involved in this process. Therefore, in this study, we investigated time-dependent immune cell infiltration, macrophage transformation, and neutrophil involvement following acoustic stimulation.

Methods:
Flow cytometry and immunofluorescence were conducted in C-X3-C motif chemokine receptor 1 (CX3CR1)+/GFP mice after acoustic overstimulation (at baseline and at 1, 2, 3, and 5 days after exposure to 120 dB for 1 h) to identify inflammatory monocytes in the cochlea. RNA-sequencing and quantitative polymerase chain reaction were performed to identify differentially expressed genes.

Results / Discussion:
Inflammatory monocytes infiltrated into the lower portion of the lateral wall within 2 days after acoustic overstimulation (dpn), followed by transformation into macrophages at 3-5 dpn via CX3CR1 upregulation and Ly6C downregulation. In addition, inflammatory monocytes were aggregated inside the collecting venule only at 1 dpn. Neutrophils were not a major type of phagocyte during this response. The gene encoding C-C motif chemokine ligand 2 gene was significantly upregulated as early as 3 h after acoustic overstimulation.

Conclusion:
Given these results, treatment to control immune response after a noise-induced hearing loss should be applied as soon as possible.

P-05
Objective & somatosensory tinnitus

P-05-003
Influence of the different myofascial trigger points of the head and neck on the perception of somatosensory tinnitus

Submitter: Katia Sirikaku, Brazil

Co-Authors:
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Andrea Tagini
Anna Carolina Perrella de Barros
Gilson Kazuo Watinaga
Alexandre Fuzimoto
Maria Clara Vasconcelos Zeli
Ektor Tsuneo Onishi

Topic:
19) Somatosensory tinnitus

Abstract

Objective:
Evaluate the main muscles of the head and neck associated with the modulation of somatosensory tinnitus and identify the trigger points responsible for modulating the perception of intensity and frequency of tinnitus through passive palpation of the head and neck muscles.

Methods:
Cross-sectional study carried out at the Tinnitus Outpatient Clinic of the Department of Otorhinolaryngology and Head and Neck Surgery, Escola Paulista de Medicina, Universidade Federal de São Paulo. After otorhinolaryngological evaluation, 45 patients diagnosed with somatosensory tinnitus underwent the clinical examination recommended by the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD). The masseter, temporalis, sternocleidomastoid (SCM), suboccipital and trapezius muscles were evaluated bilaterally. All myofascial trigger points that modulated tinnitus were recorded. Modulation in the perception of tinnitus was considered in terms of exacerbation, attenuation, cessation, frequency and location during passive palpation of the head and neck muscles. All patients had the symptom at the time of evaluation.

Results / Discussion:
The literature shows that the masseter muscle is the most frequently related to tinnitus modulation. In this study, we found a greater frequency of exacerbation and attenuation of the symptom related to the presence of trigger points in the region of the suboccipital muscles.

The masseter muscle ceased to present symptoms at the time of palpation of the myofascial trigger points, demonstrating the importance of a detailed assessment of this muscle. The regions that showed the most modulation were the body and insertion.

Regarding laterality, the trapezius muscle was the one that showed the most contralateral modulation response, highlighting the importance of evaluating ipsilateral and contralateral all the muscles involved in tinnitus modulation.

Conclusion:
Patients with somatosensory tinnitus, when subjected to passive palpation of the chewing and cervical muscles, report significant modulation of tinnitus parameters, mainly symptom exacerbation. An important participation of the suboccipital and masseter muscles in the modulation of tinnitus was observed in relation to the exacerbation, attenuation and temporary cessation of the symptom, confirming the influence of somatosensory stimuli and the presence of somatosensory tinnitus in the sample evaluated.

P-05
Objective & somatosensory tinnitus

P-05-004
Clinical profile and somatosensory modulation in patients with tinnitus at a specialized outpatient clinic: observational pilot study

Submitter: Maria Clara Vasconcelos Zeli, Brazil

Co-Authors:
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Kátia Sirikaku Miyashiro
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Andrea Tagini
Alexandre Fuzimoto
Ektor Tsuneo Onishi

Topic:
19) Somatosensory tinnitus, 9) Epidemiology

Abstract

Objective:
The objective of this pilot study was to characterize the clinical profile of patients diagnosed with somatosensory tinnitus treated at a specialized service. The study aimed to investigate the prevalence of comorbidities, including chronic pain, temporomandibular disorders (TMD), cervical pain, and emotional symptoms, as well as to assess the ability to modulate tinnitus through physical stimuli to confirm its somatosensory nature. This study is justified by the need to identify and understand the factors that perpetuate this condition, given the direct influence of cervical and craniofacial afferents on the auditory system.

Methods:
This observational, cross-sectional pilot study analyzed data from 23 patients from the Tinnitus Outpatient Clinic at Escola Paulista de Medicina, who had been previously diagnosed with somatosensory tinnitus by otorhinolaryngologists. Data collection focused on characterizing the clinical profile, including demographic variables, tinnitus history (time of onset, triggering events, and frequency/intensity modulation), presence of hearing loss, symptoms of anxiety and depression, TMD, chronic pain, and parafunctional habits. To confirm the somatosensory profile, immediate tinnitus modulation was assessed through physical maneuvers (such as myofascial release and dry needling), using the Visual Analog Scale (VAS) to quantify the level of discomfort before and after the maneuvers.

Results / Discussion:
The sample showed a predominance of female patients (87%) and individuals aged between 51 and 60 years (39.1%). Tinnitus was predominantly chronic (56.5% with more than 3 years of duration) and frequently associated with hearing loss (73.9%). A high prevalence of comorbidities was observed: 87% of patients had chronic pain (especially involving the spine, cervical region, and knees), and 47.8% had a diagnosis of TMD. Psychiatric disorders, such as

anxiety (34.8%), and habits such as snoring (69.6%) and bruxism/clenching (60.9%) were also notable. The somatosensory nature was confirmed in all patients through tinnitus modulation following physical stimuli, with significant reductions in VAS intensity, as observed in Patients 12 (initial VAS 10, final 0) and 15 (initial VAS 5, final 0).

Conclusion:
The clinical profile of patients treated at the specialized outpatient clinic reinforces the multifactorial nature of somatosensory tinnitus, demonstrating a strong correlation with chronic pain, TMD, and anxiety disorders. The frequent association with hearing loss highlights the need to evaluate the somatosensory component as a factor that may exacerbate sensorineural tinnitus. Although this is an initial study, it can be concluded that patients with somatosensory tinnitus require a multidisciplinary approach, integrating audiological, joint, and myofascial assessments for effective clinical management that addresses all associated comorbidities.

P-05
Objective & somatosensory tinnitus

P-05-001
Objective Tinnitus from Stapedial Myoclonus: Provocation-Confirmed Diagnosis and Endoscopic Treatment

Submitter: Hanseul Na, Republic of Korea

Co-Authors:
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Se-Joon Oh
Hyun Min Lee
Il-Woo Lee
Sung-Won Choi

Topic:
21) Therapy, 8) Diagnosis

Abstract

Objective:
Objective tinnitus caused by stapedial myoclonus is rare and often underdiagnosed because of its intermittent nature and lack of consistent findings on routine examination. This study aimed to evaluate the diagnostic utility of acoustic provocation–based confirmation and the therapeutic efficacy of endoscopic stapedial tendon resection in patients with objective tinnitus caused by stapedial myoclonus.

Methods:
We retrospectively reviewed 15 patients (20 ears) diagnosed with stapedial myoclonus presenting with objective tinnitus between 2018 and 2025. Diagnosis was confirmed by tympanic membrane movements induced by acoustic provocation. Patients initially received medical therapy; those with persistent symptoms underwent endoscopic transcanal stapedial tendon resection under local anesthesia with intraoperative acoustic provocation.

Results / Discussion:
Medical therapy did not significantly improve tinnitus-related outcomes. In contrast, endoscopic stapedial tendon resection resulted in complete resolution of objective tinnitus in all treated ears and significant improvements in tinnitus severity and hyperacusis scores. Hearing thresholds were preserved, and no recurrence or major postoperative complications occurred during follow-up.

Conclusion:
Provocation-confirmed stapedial myoclonus represents a distinct and potentially curable cause of objective tinnitus. Endoscopic stapedial tendon resection provided definitive symptom resolution with excellent safety and durability, supporting its role as an effective treatment option for medically refractory cases.

P-05
Objective & somatosensory tinnitus

P-05-002
Characteristics of Temporomandibular Disorders and Somatic Influence in Patients with Tinnitus

Submitter: Camila De Giacomo Carneiro, Brazil

Co-Authors:
Ana Laura Ranieri
Melinda Visalli
Andreia Oliveira
Humberto de Oliveira Simões

Topic:
19) Somatosensory tinnitus

Abstract

Objective:
To investigate the prevalence and clinical characteristics of temporomandibular disorders (TMD) and to assess differences between patients with somatosensory and non-somatosensory chronic tinnitus.

Methods:
This cross-sectional study included 53 consecutive patients with tinnitus treated at the Tinnitus Outpatient Clinic of a tertiary care hospital. All patients had been previously evaluated by an otorhinolaryngologist and underwent tinnitus assessment using the Tinnitus Handicap Index (THI) and audiometric testing. Patients were also asked about the presence of current facial pain. Each participant received a full Axis I diagnosis according to the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD), performed by trained dentists.

Results / Discussion:
In this sample, TMD prevalence was higher in the somatosensory group (SG) (57.84%) than in the non-somatosensory group (NSG) (25%) ($p=0.04$). A significant difference was observed in THI: the moderate category was higher in NSG (35.0% vs. 5.3%), while catastrophic tinnitus was higher in SG (26.3% vs. 0.0%) ($p=0.03$). Modulation occurred in 100% of SG versus 40% of NSG. Females predominated among TMD cases. Bruxism rates were comparable, suggesting TMD—not bruxism—may be more strongly associated with somatosensory tinnitus.

Conclusion:
These results support the hypothesis that TMD may play a significant role in the pathophysiology and clinical expression of tinnitus, especially in somatosensory cases. Therefore, accurate identification and classification of tinnitus subtypes are essential to guide prognosis and optimize treatment strategies. The findings also highlight the importance of a multidisciplinary approach, as the management of TMD may contribute to the improvement of tinnitus symptoms.

P-06
Psychoacoustics

P-06-001
Relating illusory tone perception to tinnitus

Submitter: Jude Barker, United Kingdom

Co-Authors:
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Joseph Sollini

Topic:
2) Basic research

Abstract

Objective:
The Zwicker tone (ZT) is a transient auditory illusion induced at the offset of spectrally notched noise. Perception is not universal; however, a single 2007 study reported a significantly higher prevalence in people with tinnitus. No further research linking ZTs and tinnitus has been carried out, and this finding has not been replicated. Furthermore, whether any mechanistic association might be physiological or cognitive can only be speculated.

Methods:
We measured prevalence of ZT perception in people with and without tinnitus, while exploring bottom-up and top-down factors that might explain this relationship. Bottom-up approach: We mapped the range of notched noise parameters that induce ZT perception in people with normal hearing and tinnitus. Top-down approach: We investigated the influence of expectation on ZT perception by comparing participant responses in ZT-naïve and primed conditions.

Results / Discussion:
We report that the ZT is induced in an organised fashion over a wide range of parameters. In turn, we can compare incidence rates between tinnitus and non-tinnitus groups and explore variations in the successfully-inducing stimuli. Given the association of tinnitus with cognitive factors, we also report how priming affects ZT perception. Consequently, our results pertain to both bottom-up and top-down influences on illusory sound perception.

Conclusion:
If ZT perception is correlated with tinnitus, it may present a powerful experimental model. While the mechanism through which the ZT arises is not understood, it stands to reason that it may be related to tinnitus production. As such, interrogation of the ZT could shine light on the neural origins of tinnitus. Furthermore, the induction of illusory percepts in normal-hearing subjects may prove a valuable psychophysical tool for tinnitus research.

P-06
Psychoacoustics

P-06-002
Binaural masking level difference in the antiphasic Polish digits-in-noise test in normal-hearing listeners: implications for tinnitus assessment

Submitter: Barbara Klos, Poland

Co-Authors:
Andrzej Wicher
Szymon Drgas

Topic:
6) Clinical studies, 18) Psychoacustics

Abstract

Objective:
The Digits-in-Noise (DIN) test is used to evaluate speech perception in noisy environments. However, diotic presentation may fail to detect unilateral or central auditory processing deficits. Antiphasic DIN improves sensitivity through binaural unmasking, which relies on the ability to process time differences between the two ears. This study aimed to evaluate antiphasic Polish DIN performance and estimate the binaural masking level difference (BMLD) in normal-hearing listeners, thereby providing baseline data for future tinnitus research.

Methods:
Preliminary data were collected from normal-hearing participants (n = 12) with no history of hearing disorders and normal audiometric thresholds. Speech reception thresholds (SRTs) were measured using the Polish DIN test administered remotely via a standardized platform with an adaptive procedure. Two conditions were tested: diotic (NoSo) and antiphasic (NoSπ). BMLD was calculated as the difference between SRTs. Statistical analysis included descriptive statistics and the Wilcoxon signed-rank test.

Results / Discussion:
The results revealed a distinct binaural masking advantage among listeners with normal hearing. The mean BMLD was 6.36 dB (SD = 3.05) and speech recognition was significantly better in the antiphasic condition ($p < 0.001$). The mean speech reception threshold (SRT) was −9.03 dB SNR (SD = 1.15) in the diotic condition and −15.39 dB SNR (SD = 2.47) in the antiphasic condition. These findings support binaural unmasking and provide baseline data for tinnitus research.

Conclusion:
The antiphasic Polish DIN test reveals a significant binaural masking advantage in normal-hearing individuals. These preliminary findings support its potential application as a sensitive tool for assessing binaural and central auditory processing in future studies involving tinnitus populations

P-06
Psychoacoustics

P-06-003
Listening Difficulties as a Clinically Relevant Dimension of Chronic Subjective Tinnitus: Implications for Speech-in-Noise Assessment and Phenotyping

Submitter: Hirokaazu Sakamoto, Japan

No Co-Authors submitted

Topic:
8) Diagnosis, 6) Clinical studies

Abstract

Objective:
Listening difficulties (LiD) are increasingly recognized in patients whose everyday communication problems are not fully explained by pure-tone audiometry. In tinnitus clinics, some patients report marked difficulty understanding speech in noisy environments, suggesting that tinnitus-related burden may interact with suprathreshold auditory processing and listening effort. This study aims to examine LiD as a clinically relevant dimension of chronic subjective tinnitus and to explore its implications for tinnitus phenotyping.

Methods:
Adults with chronic subjective tinnitus are being evaluated using routine audiological assessment, speech-in-noise testing, and patient-reported measures of everyday listening burden. Tinnitus-related distress is assessed with a validated questionnaire. The study focuses on the relationship between subjective listening difficulties, functional communication in noise, and clinical tinnitus characteristics beyond conventional pure-tone thresholds.

Results / Discussion:
This approach addresses a gap between standard audiometric findings and real-world listening complaints. A LiD-oriented framework may help identify patients whose communication burden is underestimated by threshold-based testing alone. It may also provide a clinically useful bridge between tinnitus assessment, auditory processing, and patient-reported daily functioning.

Conclusion:
LiD may represent a meaningful clinical dimension in chronic subjective tinnitus. Incorporating speech-in-noise assessment and structured evaluation of listening burden into tinnitus work-up may improve phenotyping and support more individualized clinical management.

P-07
Neuro: Electrophysiology

P-07-004
Fronto-Temporal Delta-Gamma Imbalance as a Neural Correlate of Hyperacusis in Tinnitus: An Exploratory EEG Study

Submitter: Ho Yun Lee, Republic of Korea

Co-Authors:
Seung-Ho Shin

Topic:
12) Hyperacusis, 14) Models

Abstract

Objective:
To identify quantitative electroencephalography (qEEG)-based connectivity alterations associated with hyperacusis using combined subjective-objective diagnostic criteria.

Methods:
Seventy-four patients with subjective tinnitus were analyzed. Hyperacusis was defined using combined criteria: subjective complaint and uncomfortable loudness levels (UCL) ≤ 77 dB HL, resulting in 11 patients with hyperacusis. Extreme groups (11 patients with hyperacusis vs. 23 high-tolerance controls with UCL ≥ 90 dB) were compared.

Results / Discussion:
Hyperacusis patients had lower UCLs than the full cohort (56.2±19.0 vs 82.4±22.4 dB HL; P=0.001). Extreme-group EEG suggested a right fronto-temporal delta↑ (d=0.88) and gamma↓ (d=−0.69) PLV, with a higher delta–gamma balance index (d=1.27, uncorrected). wPLI partly supported gamma reduction but not delta, implying frequency-dependent volume-conduction effects; no features survived FDR.

Conclusion:
In this exploratory extreme-group study, a right fronto-temporal delta–gamma imbalance emerged as a candidate signature of objectively verified hyperacusis in tinnitus. Gamma reduction, partly corroborated by wPLI, appeared more robust, whereas delta increase was not. Given wide CIs and no FDR-surviving effects, findings are preliminary and require replication in larger cohorts.

P-07
Neuro: Electrophysiology

P-07-001
Peripheral Neural Encoding and Loudness Growth in Individuals With Hyperacusis and/or Tinnitus

Submitter: Pauline Devolder, Belgium

Co-Authors:
Sarah Verhulst
Ingeborg Dhooge
Hannah Keppler

Topic:
12) Hyperacusis, 8) Diagnosis

Abstract

Objective:
The distinct and overlapping mechanisms of tinnitus and hyperacusis remain poorly understood. One proposed framework distinguishes neural noise, referring to persistent spontaneous neural activity, from central gain, referring to sound-evoked hyperresponsivity. This pilot study examines peripheral and brainstem auditory responses across stimulus intensities in individuals with tinnitus, hyperacusis, and control groups.

Methods:
The experimental protocol included questionnaires, pure-tone audiometry, uncomfortable loudness levels, psychoacoustic tinnitus assessment, distortion-product otoacoustic emissions, auditory brainstem responses, envelope-following responses, vowel-evoked frequency-following responses, middle ear muscle reflexes, medial olivocochlear reflexes, a behavioral vowel-discrimination task, and the Flemish Matrix sentence-in-noise test.

Results / Discussion:
Data collection is currently ongoing. At the conference, we will present intensity-dependent differences in peripheral and neural auditory encoding across groups, and discuss their implications for hidden hearing loss, central gain dysregulation, and loudness growth mechanisms.

Conclusion:
Final results and interpretations of this dataset will be presented at the conference.

Work supported by RNID Innovation Seed Fund Grant

P-07
Neuro: Electrophysiology

P-07-005
Altered Inhibition of Sound Evoked Cortical Responses by Silent Gaps as an Objective Measure of Tinnitus: A Multi-Center Study

Submitter: Hongyu Lu, Germany

No Co-Authors submitted

Christoph Braun
Marlies Knipper
Stephan Wolpert
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Topic:
8) Diagnosis, 6) Clinical studies

Abstract

Objective:
A major limitation of current clinical trials on tinnitus is the reliance on subjective self-reported outcome measures. We aimed to test whether cortical evoked responses to the gap pre-pulse inhibition of the acoustic startle (GPIAS) paradigm—used preclinically to objectively assess tinnitus—could objectively quantify tinnitus at the group level in humans.

Methods:
We conducted a multi-center study within the TInnitus DEtection (TIDE) project, including 280 chronic tinnitus cases and 280 controls across sites in Austin and Illinois (USA), and Dublin, Ghent, Regensburg, Tübingen, and Zurich (Europe), recruited between June 2024 and February 2026 (NCT06520865). After providing informed consent, included participants underwent a series of audiological assessments and completed online questionnaires (ESIT-SQ, Visual Analog Scales, THI, TFI, HADS, PSQ-30, HQ), followed by EEG recordings of the GPIAS paradigm. Participants were exposed to short sound pulses that were either preceded or not preceded by silent gaps embedded in carrier sounds of different frequency ranges: broadband noise (BBN) and narrowband noises (NBN) centered at 3 kHz and 8 kHz.

Results / Discussion:
In control participants, gaps in BBN achieved approximately 35% inhibition of pulse-evoked cortical responses, whereas NBN carriers were less effective. These findings are consistent with gaps alone triggering larger evoked-response potentials (ERPs) when covering the whole tonotopic map during BBN in comparison to NBN, suggesting that inhibition of cortical evoked responses depends on the number of auditory neurons recruited during gap sensing. Nonetheless, inhibition could not be reliably quantified using NBN carriers, but individuals with tinnitus showed impaired inhibition for BBN carriers. These effects persisted after correction for multiple confounders.

Conclusion:
Our results suggest that cortical-based GPIAS using BBN may be used as an objective outcome measure in tinnitus trials and support the testing of pharmacological or device-based interventions aimed at treating tinnitus.

P-07
Neuro: Electrophysiology

P-07-006
Neural Correlates of Tinnitus Suppression: a sEEG Case-study

Submitter: Rémy Masson, France

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Topic:
13) Imaging, 4) Case reports

Abstract

Objective:
Human case-control studies with EEG have reported abnormal brain patterns associated with tinnitus. However, surface recordings provide a poor spatial resolution limiting inference about the underlying sources. Also, it is challenging to disentangle if these abnormalities are directly related to the tinnitus generation rather than to comorbidities or secondary effects. Only one attempt to explore invasive recordings in tinnitus has been published, hinting at a wide "tinnitus network" extending far beyond circumscribed auditory areas.

In this study, intracranial EEG signals were recorded from an epileptic patient with chronic tinnitus while manipulating tinnitus intensity using two paradigms: Residual Inhibition (RI) and Low-Intensity-Noise Tinnitus Suppression (LINTS). This setup enabled precise evaluation of neural activity through invasive recordings and accurate characterization of tinnitus-specific processes, with the participant serving as their own control.

Methods:
The participant, undergoing sEEG monitoring for refractory epilepsy, was implanted with depth electrodes covering the hippocampus, the amygdala and temporo-parietal regions. Two tasks were performed to induce subjective suppression of tinnitus.

RI: A loud 30-s white-noise masking sound was presented, causing short-term tinnitus reduction. Suppression was rated by the participant every 10-s after sound offset until it receded.

LINTS: a tinnitus-matched 15-s noise was played slightly above the auditory threshold, causing tinnitus suppression during sound presentation. Silence and a sham sound were also presented. Suppression ratings were obtained after each sound offset.

Power spectra were computed for each gray matter contact and parameterized into periodic and aperiodic components. For each canonical band (δ, θ, low-α, high-α, low-β, high-β, γ) and high-frequency activity (HFA), linear models examined the relationship between the aperiodic-corrected power and the suppression rating.

Results / Discussion:
Both tasks elicited convergent effects. Behaviorally, they succeeded in inducing tinnitus suppression as attested by the self-evaluated ratings. RI produced on average an initial 58% tinnitus suppression and a recovery time of 60s. As expected during the LINTS paradigm, no amount of suppression was reported during silence, and significantly more suppression was reported during the LINTS sound than during the sham sound (63% vs. 39%, p=0.0002). Physiologically, tinnitus suppression was associated with widespread activation of temporo-parietal and hippocampal areas as revealed by HFA. A significant increase of β activity in temporo-parietal regions with tinnitus suppression was observed. This result might suggest a shift in auditory priors as β rhythms are involved in maintaining top-down predictions. Finally, divergent effects on low-α oscillations were observed between tasks, possibly due to differences in task structure and time-windows.

Conclusion:
These results constitute the first electrophysiological investigation of the LINTS effect and an extension of the reported findings of the only other published study using invasive recordings with a tinnitus patient. We confirm the involvement in the perception of tinnitus of a large network of cortical and subcortical regions, extending beyond auditory cortices. Overall, these results indicate that tinnitus suppression by RI or LINTS is mediated by mostly common neural processes despite the use of different strategies.

P-07
Neuro: Electrophysiology

P-07-003
Sensory habituation in tinnitus: does the brain fail to filter out phantom sound?

Submitter: Anaïs Gravet, France

Co-Authors:
Rémy Masson
Alain Londero
Séverine Samson
Lise Hobeika

Topic:
2) Basic research, 13) Imaging

Abstract

Objective:
People with tinnitus seem to have difficulty ignoring irrelevant sounds, like their own tinnitus. This may relate to alterations in sensory gating, a neurophysiological process involved in filtering repeated auditory input and in sensory habituation, acting over longer periods. Whereas prior research mainly focused on short-term gating mechanisms (Campbell, 2018; Morse, 2024), the present study uses EEG to examine sensory gating and habituation, allowing detection of group differences across longer timescales and at tinnitus frequencies.

Methods:
Participants with tinnitus (n=50) and without tinnitus (n=50) perform an auditory repetition task during EEG recording to assess sensory gating (N1-P2 measurements). They listen to blocks of repetitive click trains, each consisting of a pure tone or a tinnitus-frequency tone, in counterbalanced order. Short-term habituation is measured by comparing EEG responses to the first and last click within each train, while long-term habituation by comparing responses from the first to the last quarter of trains.

Results / Discussion:
As expected, preliminary findings provide evidence of sensory gating in response to repetitive auditory stimuli in controls, whereas this process appears to be reduced in individuals with tinnitus when considering N1-P2 amplitude. These results motivate upcoming analyses, which will focus on short- and long-term habituation and examine whether any observed effects might be frequency specific.

Conclusion:
By specifying electrophysiological markers associated to sensory gating, short-term and long-term habituation in people with and without tinnitus, this study will improve our understanding of the cerebral process involved in the persistence of tinnitus perception.

P-07
Neuro: Electrophysiology

P-07-002
Cochlear Synaptopathy in Acute Idiopathic Tinnitus with Normal Hearing: Electrophysiologic Evidence and Treatment Outcomes

Submitter: Yoonchan Rah, People's Republic of Korea

No Co-Authors submitted

Topic:
8) Diagnosis, 5) Clinical management

Abstract

Objective:
The present study aimed (1) to evaluate electrophysiologic evidence of cochlear synaptopathy in patients with acute idiopathic tinnitus and normal hearing, and (2) to investigate the short- and mid-term effects of low-dose systemic steroid treatment compared with ginkgo biloba on tinnitus-related subjective outcomes

Methods:
This retrospective study (from 2015 to 2024) at a tertiary hospital included 84 patients with acute idiopathic tinnitus (≤12 weeks) and normal hearing (PTA <25 dB HL) and 84 age- and hearing-matched controls. Wave I and V amplitudes and wave I/V amplitude ratios as well as latencies were analyzed using 90 dB SPL click stimuli. DPOAE and ECoG were evaluated in subsets. Treatment outcomes comparing oral steroids and ginkgo biloba were also assessed.

Results / Discussion:
Patients with tinnitus showed significantly reduced ABR wave I amplitudes compared with controls, whereas wave V amplitudes did not differ. The wave I/V amplitude ratio was significantly lower in the non-localized tinnitus group. ECoG demonstrated smaller action potential amplitudes in the tinnitus group (p=0.017). Age correlated with reduced wave I amplitude and wave I/V ratio, while pure-tone thresholds correlated only with wave I amplitude. No significant THI or VAS differences were observed between steroid and ginkgo treatments.

Conclusion:
Electrophysiologic findings in patients with acute idiopathic tinnitus and normal hearing thresholds support the presence of cochlear synaptopathy, characterized by reduced ABR wave I amplitude and preserved wave V responses. Aging appears to be an important contributing factor independent of overt hearing loss. These findings suggest that while cochlear synaptopathy may underlie tinnitus in this population, the clinical benefit of systemic steroid therapy remains controversial.

P-08
Neuro: Imaging

P-08-003
Distinct Brain Signatures Related to Tinnitus versus Tinnitus and Posttraumatic Stress Disorder Comorbidity

Submitter: Emilia Kaniewska, USA

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Topic:
7) Comorbidity, 13) Imaging

Abstract

Objective:
Tinnitus and post-traumatic stress disorder (PTSD) frequently co-occur, particularly in trauma-exposed populations (Fagelson 2007; Clifford et al., 2019), yet the neural mechanisms underlying their interaction remain poorly understood. Clinical observations show that individuals with comorbid PTSD report more severe tinnitus, despite similar audiological results (Fagelson 2007). This suggests that PTSD may alter neural systems that support tinnitus perception and coping and present changes beyond them. However, the relationship between tinnitus and PTSD in neural bases remains understudied. It is unclear whether tinnitus and PTSD comorbidity exert additive, shared, or opposing effects on brain structure. Prior structural gray matter studies have typically examined tinnitus or PTSD in isolation, leaving a critical gap in understanding how these conditions interact.

Methods:
Three groups of military -affiliated participants were recruited for this study: Healthy Controls (HC, n=19), Tinnitus Only (TO, n=24), and Tinnitus and PTSD (T&P, n=21). All participants were screened and assessed for PTSD using the Clinician-Administered PTSD Scale for the DSM-5 (APA, 2013). Following the clinical interview, participants underwent audiometric assessments. Participants who reported the presence of tinnitus completed the Tinnitus Functional Index (TFI) to assess tinnitus severity. MRI data were obtained from all participants. T1-weighted images were preprocessed using the SPM12 pipeline. Voxel-based morphometry (VBM) analyses were conducted using the Computational Anatomy Toolbox (CAT12) implemented in Statistical Parametric Mapping (SPM12) in MATLAB. In addition to whole-brain VBM, region of interest (ROI) analyses were performed in CAT12 using the Neuromorphometrics atlas to extract mean gray matter from anatomically defined regions.

Results / Discussion:
Across the uncorrected whole-brain analyses, the most prominent pattern emerged in the TO vs. T&P comparison. TO showed higher gray matter volume in the right precentral gyrus, central operculum, right superior temporal gyrus, left postcentral gyrus, left inferior frontal gyrus, and left medial superior frontal gyrus. Although these findings didn't survive correction and should be interpreted cautiously, the consistency of clusters across sensorimotor and frontal areas suggests that the T&P group shows reduced gray matter volume relative to TO. The Neuromorphometrics atlas-driven CAT12 ROI analysis supported this pattern, yielding a significant TO > T&P effect in the medial postcentral gyrus and central operculum. These regions overlap with the uncorrected whole-brain results and indicate that structural differences between TO and T&P are most evident in sensorimotor areas. Together, these findings suggest that PTSD may contribute to broader structural alterations in tinnitus.

Conclusion:
The corrected atlas-driven findings, supported by uncorrected whole-brain patterns, suggest that PTSD beyond tinnitus may meaningfully influence the neural profile of individuals with tinnitus. The most meaningful decreases were seen in sensorimotor regions. Since these regions contribute to the integration of somatic and auditory information, their decrease may be relevant for understanding how tinnitus is processed and modulated in individuals with comorbid PTSD. Clinically, people who experience both tinnitus and PTSD often report more persistent, troublesome, and intrusive symptoms, and the structural differences observed here provide a potential neural context for this heightened burden. This underscores the importance of considering trauma-related factors when examining neural signatures of tinnitus and when providing management strategies for tinnitus sufferers with additional trauma burden.

P-08
Neuro: Imaging

P-08-002
Attentional and Multisensory Network Mechanisms Underlying Tinnitus Perception and Relevance

Submitter: Giovani De Oliveira, Brazil

Co-Authors:
Livia Noleto Rezende de Oliveira
Edna Farias Aragão Cândido

Topic:
14) Models, 17) Plasticity

Abstract

Objective:
Tinnitus is a network-based perceptual phenomenon arising from interactions among auditory, attentional and limbic systems. Although peripheral damage may trigger neural hyperactivity, variability in awareness and distress depends mainly on central modulation. This study synthesizes evidence on neural mechanisms determining perceptual salience and persistence.

Methods:
A structured narrative review of peer-reviewed studies on neural correlates of tinnitus was conducted. Evidence from neuroimaging, electrophysiology and connectivity analyses addressing auditory plasticity, thalamic filtering, attentional control and limbic processing was qualitatively integrated to identify convergent mechanisms explaining perception variability.

Results / Discussion:
Findings indicate tinnitus perception reflects distributed network dynamics rather than isolated auditory dysfunction. Reduced input may induce central hyperactivity, but conscious awareness depends on attentional networks and thalamic gating. Limbic circuits assign affective value, and stronger coupling among these systems increases perceptual salience.

Conclusion:
Tinnitus intensity is primarily determined by sensory filtering efficiency, attentional allocation and emotional appraisal. This network framework positions attentional salience as a core mechanism and supports shifting from peripheral models toward interventions targeting central neural modulation and perceptual regulation.

P-08
Neuro: Imaging

P-08-001
Gray Matter Volume Alterations in Chronic Tinnitus: Disorder-Specific Structural Markers

Submitter: Riccardo Bianco, Germany

Co-Authors:
Aleandro Espino-Payá
Markus Junghöfer
Christian Dobel

Topic:
20) Stress and tinnitus, 7) Comorbidity

Abstract

Objective:
Chronic tinnitus, a persistent phantom auditory sensation, is increasingly associated with neuroanatomical changes extending beyond auditory pathways into the limbic system. Previous research supports a functional segregation between the tinnitus percept itself and the affective reaction to it. Tinnitus perception has been linked to changes in the midline frontal cortex, an area implicated in sensory suppression. Specifically, patients have shown reduced gray matter in the ventromedial prefrontal cortex (vmPFC), which correlates with perceived loudness but is independent of distress. In contrast, tinnitus distress (e.g., THI score) has been positively correlated with increased cortical thickness in the anterior insula (aIns), a region mediating visceral stress and negative affect. These findings suggest chronic tinnitus may involve a failure of the vmPFC network's "noise cancellation" capacity, rather than being a sole consequence of affective distress.

Methods:
We recruited 40 patients with chronic tinnitus and 40 age- and sex-matched healthy controls. All participants underwent high-resolution T1-weighted structural MRI scans as well as assessment of hearing thresholds, tinnitus distress (TFGH), and comprehensive psychometric characteristics of mood (BDI), state/trait anxiety (STAI) and intolerance of uncertainty(UI-18). Structural brain alterations in predefined regions of interests (ROIs: vmPFC, aIns, auditory cortex) have been investigated using Voxel-Based Morphometry (VBM) to compare gray matter differences between groups and correlate VBM with clinical and psychometric variables.

Results / Discussion:
Contrary to the original reports, a preliminary VBM analysis showed no significant differences in gray matter volume between patients and controls in any ROI.

This study is relevant to provide crucial replication of a well established effect in the tinnitus literature, helping to confirm the distinct neural substrates for the perceptual and affective components of tinnitus. Identifying structural markers of tinnitus pathophysiology may ultimately inform the development of more targeted therapeutic interventions.

Conclusion:
This ongoing study aims to provide a replication and extension of these foundational findings which appears reasonable as previous work has often been limited by modest sample sizes. By leveraging a significantly larger cohort, our primary goal is to reliably separate distinct neural correlates of tinnitus perception and related distress.

P-08
Neuro: Imaging

P-08-004
Subjective Tinnitus Severity Correlates with Objective changes in Human Auditory Cortex as measured by functional Near-Infrared Spectroscopy

Submitter: Gopika Satish, USA

Co-Authors:
Leah M Taylor
Megan Phebe Arnold
Julia Gallagher
Karthikeyan Krishnamurthy
Gregory J Basura

Topic:
13) Imaging, 6) Clinical studies

Abstract

Objective:
Tinnitus, phantom sound perception in the absence of a sound stimulus, affects 10–20% of the global population. The underlying etiology is not completely clear, yet tinnitus leads to increased spontaneous neural activity and neural synchrony across the central auditory pathways. We have documented these “neural correlates” first established in animal models in the human auditory cortex (AC) using functional near-infrared spectroscopy (fNIRS). We reported increased hemodynamic responses (HRs) in AC during silence as well as increased resting state functional connectivity (RSFC) in and between AC and non-AC that may serve as objective tinnitus correlates in humans. However, what is not clear is the potential relationship between stimulus-evoked HRs, RSFC, and subjective tinnitus severity. The goal of the present study was to determine how objective neural metrics of human tinnitus correlate with subjective tinnitus severity as reported with the Tinnitus Handicap Inventory (THI) and Tinnitus Functional Index (TFI).

Methods:
Twenty-seven adults with bilateral, non-pulsatile tinnitus and twenty-seven age-matched healthy controls with normal or near-normal hearing participated in fNIRS recordings. Participants were presented with 20 blocks of 12-second broadband noise (BBN; 65 dB SPL) separated by randomized inter-stimulus rest (ISR) periods (13–15 seconds), preceded and followed by 3-minute silence for RSFC analysis. Regions of interest (ROIs) were defined in AC and non-ROI in non-AC. HRs and RSFC were computed from HbO signals during silence periods before and after stimulation. Tinnitus severity was indexed by THI and TFI, with Pearson correlations between severity measures and both HRs and RSFC.

Results / Discussion:
In controls, HRs in AC showed robust responses to BBN vs. ISR ($t(26) = 5.595$, $p < 0.001$, Cohen's dz = 1.077). Tinnitus AC showed a higher spontaneous HR baseline and sustained post-BBN HbO suppression in both ROI and non-ROI channels. Baseline ROI-seed RSFC was

significantly elevated within the occipito-parietal region in tinnitus ($p = 0.009$). Following BBN, RSFC in the fronto-parietal ($p = 0.023$), temporo-parietal ($p = 0.033$), temporal ($p = 0.016$), and occipito-temporal ($p = 0.003$) lobes decreased in tinnitus. Controls showed no significant within-group RSFC changes. Tinnitus severity (mean THI) positively correlated with ISR HR in ROI ($r = 0.521$, corrected $p = 0.042$), and within-session change in functional tinnitus burden (ΔTFI) showed a similar positive association ($r = 0.532$, corrected $p = 0.034$). These findings indicate that more severely affected individuals exhibit significantly stronger AC activation during silence.

Conclusion:
Tinnitus leads to enhanced AC activation during silence that correlates with increased tinnitus severity (THI and ΔTFI), indicating a neural representation of the tinnitus perception during quiet periods. These results validate fNIRS as a viable, acoustically compatible neuroimaging technique for tinnitus-related cortical dysfunction, supporting its application in developing biomarkers and assessing treatment effects.

P-08
Neuro: Imaging

P-08-005
From Speech to Phantom Sound: Adapting a Pretrained Speech-EEG Decoder to Characterize the Tinnitus Percept

Submitter: Katarina Vulić, Switzerland

Co-Authors:
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Topic:
13) Imaging, 6) Clinical studies

Abstract

Tinnitus assessment relies on subjective self-report, limiting reliable diagnosis and therapy evaluation. Building on the speech-electroencephalography (EEG) decoder framework of Défosséz et al. [1], we developed a tinnitus-adapted version through self-supervised pretraining on speech-EEG data and fine-tuning on tinnitus-specific EEG data. The aim was to extract objective, individual-level information about the tinnitus percept.

The fine-tuned transformer-based encoder was applied to three tinnitus resting-state EEG datasets [2-4] with pitch-matched tinnitus labels. Preliminary results show that the model captures measurable information about tinnitus salience. It tracks patient-reported loudness and, more strongly, tinnitus distress (Tinnitus Handicap Inventory) above chance level. We are also investigating tinnitus presence detection in matched-control comparisons.

Pitch decoding proves more challenging. Analyses using both stationary and non-stationary EEG features, as well as linear and non-linear models, consistently indicate that pitch cannot be reliably recovered from resting-state EEG alone and appears highly sensitive to individual patient variability.

These findings suggest that resting-state EEG more readily reflects the affective and intensity dimensions of tinnitus than its spectral content. Our next step is a matched clinical study combining stimulus-locked EEG (evoked responses to pitch-matched tones) with a residual inhibition paradigm. This approach will test whether the fine-tuned decoder can track tinnitus modulation across suppression and rebound phases.

The long-term goal is to generate a decoder-based sonification of the individual tinnitus percept: a reconstructed sound that patients can validate against their own perception, complementing self-report measures with a quantifiable neural readout.

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P-09
Neuro: Stimulation

P-09-001
Current modelling for individualised transcranial direct current stimulation (tDCS) protocols targeting tinnitus

Submitter: Kaitlin Tudor, United Kingdom

Co-Authors:
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Topic:
3) Brain stimulation, 14) Models

Abstract

Objective:
Transcranial direct current stimulation (tDCS) is a promising neuromodulation technique with the potential to improve tinnitus by targeting neural circuits involved in its generation and maintenance. In existing trials of tDCS, participants receive the same current intensity, which may account for 50% of the variability in outcomes. The aim of this study is to implement current flow models for the personalisation of tDCS protocols for tinnitus.

Methods:
We created individualised current flow models to simulate the electric field induced by tDCS in 40 participants with subjective tinnitus based on their T1-weighted MRI data. Reverse calculations were performed to determine an individualised dose and modelled for each individual. The resulting characteristics of the electric field were recorded, including electric field magnitude and distribution.

Results / Discussion:
The simulations revealed variability in the electric field magnitude (EFM) when applying the same protocol to different individuals with tinnitus, highlighting the need for personalised protocols for the treatment of tinnitus with tDCS. Application of personalised dose increased mean EFM from 0.481 to 0.656 V/m, and the range in peak electric field magnitude was reduced from 0.347 V/m to 0.021 V/m (94% reduction).

Conclusion:
This study was the first to reverse calculate dose and assess the variability of electric field density driven by anatomical differences in individuals with tinnitus. It was also the first study to correlate electric field characteristics against tinnitus-related outcomes. We expect that a personalised approach guided by electric field models will lead to more precise, consistent, and effective tDCS protocols for tinnitus.

P-09
Neuro: Stimulation

P-09-002
Methods of Computational Modelling in Studies of Transcranial Direct Current Stimulation (tDCS) in Adults to Inform Protocols for Tinnitus Treatment: A Scoping Review

Submitter: Kaitlin Tudor, United Kingdom

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Topic:
14) Models, 3) Brain stimulation

Abstract

Objective:
The aim of this review is to investigate the methodology of current modelling studies for tDCS so that informed, personalised protocols can be designed by modelling the electric field of the brain during tDCS for tinnitus. By considering the impact of individual anatomical differences on the electric field induced by tDCS, targeted protocols could be developed to reduce tinnitus loudness and severity in a systematic and predictable way.

Methods:
The protocol for this review is based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) Checklist. Using online databases, records were identified based on a keyword search for records relevant to current modelling for tDCS, including peer-reviewed papers, clinical trials, grey literature, dissertations, and abstracts. 4253 records were retrieved from thirteen online databases.

Results / Discussion:
There was inter-individual variability in the predicted electric fields. The reviewed records highlighted the impact of individual differences, including age, sex, and anatomical variation, on the predicted electric field during tDCS. Increased age was often associated with age-related brain atrophy and high relative cerebrospinal fluid volume, which was a significant influence on the resulting E-field intensity and distribution.

Conclusion:
This review compiled the parameters and software used in numerous studies of current modelling for tDCS, establishing common practices in methodology and highlighting areas for further exploration in the development of personalised tDCS protocols for the treatment of tinnitus. Model parameters and sources of variability should be carefully considered to achieve the desired stimulation outcomes, particularly in regard to applied current intensity.

P-09
Neuro: Stimulation

P-09-003
Bimodal and unimodal HD-tRNS over auditory cortex in tinnitus

Submitter: Jessica Fritzsche, Switzerland

No Co-Authors submitted

Topic:
3) Brain stimulation, 6) Clinical studies

Abstract

Objective:
In a multi-session, sham-controlled crossover study we tested whether HD-tRNS over the primary auditory cortex - with or without acoustic stimulation - can modulate auditory evoked responses and reduce objective tinnitus loudness. The bimodal condition appears to produce larger reductions in tinnitus loudness than in unimodal HD-tRNS.

Methods:
35 Participants with chronic tinnitus (18–75 years) complete 20 stimulation visits plus additional assessment visits. Participants receive 10 sham and 10 active stimulation sessions with 4-5 weeks of no stimulation in between.

The control study arm receives only tRNS with no acoustic stimulation whereas the experimental study arm receives the bimodal stimulation protocol with tRNS and AS.

Results / Discussion:
After 10 sessions, bimodal stimulation (tRNS + AS) led to significant reductions in tinnitus loudness on both VAS and MML measures, unlike unimodal tRNS alone. Minor improvements occurred in some sham conditions, with no change in distress. ERP data showed N100 amplitude shifts for active groups only, indicating stimulation-induced modulation of auditory cortical excitability.

Conclusion:
In this double-blind crossover study, HD-tRNS over Heschl's gyrus altered tinnitus outcomes and auditory ERP markers. Pairing HD-tRNS with acoustic stimulation led to larger tinnitus loudness reductions than unimodal stimulation. Neurophysiological changes, including N100 modulation absent in sham, suggest specific effects on auditory processing rather than nonspecific changes.

P-10
Clinical studies

P-10-003
Decreasing psychological burden in acute tinnitus patients by use of an e-learning care path: a protocol for the RAPID-TREAT project

Submitter: Tine De Boodt, Belgium

Co-Authors:
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Topic:
6) Clinical studies, 5) Clinical management

Abstract

Objective:
Acute tinnitus is typically treated medically, often neglecting early psychological distress. If unaddressed, this burden can lead to chronic anxiety, depression, and sleep issues. This project investigates whether immediate, web-based psychoeducational support improves outcomes compared to standard care. More specifically, determining if early digital intervention effectively reduces long-term tinnitus distress and its socio-economic impact.

Methods:
This study is designed as a single-blind, two-arm, 1:1 RCT, including 146 adult patients with acute tinnitus. Participants are randomized to either: standard care group or standard care and a 10-day web-based psychoeducational program. The primary outcome is change in TFI from baseline to 12–16 weeks. Secondary objectives include identifying predictors of tinnitus burden, assessing system usability, and determining the cost-effectiveness.

Results / Discussion:
Current tinnitus management targets chronic cases, leaving a therapeutic window in the acute phase insufficiently addressed. The intervention aims to reduce long-term psychological morbidity and associated costs. Clinical effectiveness with cost-utility analysis are included, enabling robust policy-relevant conclusions. The societal perspective, including productivity losses, is relevant given the known economic burden of tinnitus.

Conclusion:
This is the first RCT to evaluate a prompt, web-based psychoeducational intervention for acute tinnitus. The integration of clinical, psychological, and economic outcomes provides a comprehensive evaluation of both effectiveness and value. Ultimately, it has the potential to shift tinnitus care from reactive chronic treatment towards proactive early intervention.

P-10
Clinical studies

P-10-004
Engagement and usage patterns of a tinnitus-management-app: insights from a bicentric randomized controlled trial

Submitter: Raffael Schmitt, Germany

Co-Authors:
Milena Engelke
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Topic:
21) Therapy

Abstract

Objective:
Beyond demonstrating clinical efficacy, understanding how patients engage with digital therapeutics is crucial for improving design, adherence, and outcomes. SilentCloud is a multi-component app integrating education & counselling, internet-based cognitive behavioural therapy, different forms of sound therapy, and relaxation exercises for adults with chronic subjective tinnitus.

Methods:
In a bicentric, parallel-group, randomized controlled trial conducted at the Tinnitus Center at Charité Berlin and the University of Regensburg, 144 participants were randomly assigned to either an intervention group, using the app SilentCloud for three months, or a waitlist control group. The goal of the analyses presented here is to characterize usage patterns and to evaluate associations between engagement and outcomes.

Results / Discussion:
This analysis will provide insights into user engagement with a tinnitus-management app in a controlled setting, guiding the optimization and sequencing of content and improving adherence to maximize patient benefits.

Conclusion:
Digital therapeutics offer a valuable option in tinnitus management. Understanding usage patterns can help refine these tools and ultimately improve patient outcomes.

P-10
Clinical studies

P-10-002
A Randomized Controlled Trial of Acupuncture as an Adjunctive Therapy for Sudden Sensorineural Hearing Loss

Submitter: Chia-Der Lin, Taiwan

Co-Authors:
Ching-Yuan Wang
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Topic:
21) Therapy, 17) Plasticity

Abstract

Objective:
Sudden Sensorineural Hearing Loss (SSNHL) is defined as a loss of 30 dB HL or more over at least three contiguous frequencies within a 72-hour period. While systemic or intratympanic corticosteroids remain the standard therapy, their efficacy is often inconsistent, leaving 30% to 60% of patients with residual deficits. This study aimed to evaluate the clinical efficacy of acupuncture as an adjunctive treatment to conventional steroid therapy, focusing on both objective hearing recovery and the management of debilitating subjective symptoms such as tinnitus and dizziness.

Methods:
A randomized controlled clinical trial (CMUH113-REC2-096) was conducted at China Medical University Hospital (CMUH) from July 2024 to August 2025. Participants were randomly assigned using a computer-generated block randomization method into two groups: the control group receiving standard steroid therapy, and the experimental group receiving steroids combined with eight sessions of acupuncture over four weeks. Outcomes included Pure Tone Audiometry (PTA), Tinnitus Handicap Inventory (THI), and Dizziness Handicap Inventory (DHI) scores, assessed at baseline and at 1, 2, and 4 weeks.

Results / Discussion:
Results indicated that adjunctive acupuncture did not lead to a statistically significant improvement in objective hearing thresholds (PTA) compared to the steroid-only group. However, significant clinical benefits were observed in subjective symptom reduction. Patients in the acupuncture group reported substantial relief in subjective dizziness and tinnitus distress ($p < 0.05$). These findings suggest that acupuncture may facilitate neuro-modulation within the central auditory pathway and vestibular system, addressing the "unmet need" of conventional therapy by improving patient-reported Quality of Life (QoL).

Conclusion:
While acupuncture did not significantly enhance objective hearing recovery, it is a highly effective intervention for managing the subjective burden of SSNHL. Significant improvements

in THI and DHI scores highlight its value as an integrative approach to address persistent tinnitus and dizziness.

P-10
Clinical studies

P-10-001
The relationship tinnitus duration with the pathological conditions of chronic tinnitus and the therapeutic effects of sound therapy

Submitter: Shoko Kato, Japan

Co-Authors:
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Yuka Haruta

Topic:
6) Clinical studies, 11) Hearing aids and sound therapy

Abstract

Objective:
There have been various reports regarding the relationship between tinnitus duration and the degree of improvement in cases of chronic tinnitus. Here, the aim was to examine the relationship between the duration of illness and severity, tinnitus pitch, psychological findings, and the relationship with the therapeutic effects of sound therapy. In particular, we examined whether there is a duration of tinnitus that serves as a turning point for treatment effectiveness.

Methods:
The subjects were 312 cases of chronic tinnitus who underwent sound therapy for more than one year. At the start and 1-year later, the evaluation was conducted using the following questionnaires and pitch-matching test: THI (Tinnitus Handicap Inventory), VAS (Visual Analogue Scale) of annoyance, SDS (Self-rating Depression Scale), STAI (State-Trait Anxiety Inventory), and the improvement rate for each score was calculated by subtracting the one-year score from the initial score and dividing that value by the initial score. These values were used to examine whether there is a correlation with the tinnitus duration.

As a subjective evaluation of treatment one year after, patients were asked to choose from the following five items: 1) Almost no longer bothersome, 2) Much less bothersome, 3) Slightly less bothersome, 4) No change, 5) More bothersome. Then, groups 1), 2), and 3) were classified as the effective group, and groups 4) and 5) were classified as the ineffective group. To examine the relationship between the tinnitus duration and the subjective degree of improvement, all cases were divided into two groups for each finely segmented tinnitus duration (for example, 6 months or more vs. less than 6 months, 1 year or more vs. less than 1 year, 2 years or more vs. less than 2 years… up to 25 years or more vs. less than 25 years). Then, for each pair of groups, the association between the effective group and the ineffective group was examined using the Pearson's chi-square test.

Results / Discussion:
1) Correlation with tinnitus duration and each score

No correlation was observed between disease duration and any of the THI, VAS, SDS, or STAI scores at baseline, after one year, or in improvement rates. There was also no correlation observed for the logarithm of pitch at either baseline or after one year.

2) Is there a tinnitus duration that serves as a turning point for the degree of subjective improvement?

The greatest difference between the effective group and the ineffective group was between the group with more than 5 years and the group with less than 5 years ($p < 0.01$, adjusted residual: 2.8). Other differences were observed between the group with 6 months or more and the group with less than 6 months ($p < 0.05$, adjusted residual: 2.4), as well as between the group with more than 10 years and the group with less than 10 years ($p < 0.05$, adjusted residual: 2.0).

In other groups divided by the duration, no association was observed between the effective and ineffective groups.

In the examination based on these classifications, a significant difference in the improvement rates of THI and VAS was observed only between the group of six months or longer and the group of less than six months.

Patients often ask, 'My tinnitus should be difficult to cure because it has been going on for a long time ' In a way, this is correct, and in a way, it is wrong. This is due to the result that there was no correlation between each score or improvement rate of them and the tinnitus duration, and that a difference was observed in subjective improvement depending on whether it was more than five years or five years or less.

Conclusion:
Regarding the relationship between the subjective therapeutic effects of sound therapy and the tinnitus duration, it seems that whether the tinnitus duration is more or less than five years is the most likely turning point. However, this was not an absolute limit.

P-11
Outreach

P-11-001
TRI Academy - Together in tinnitus education

Submitter: Milena Engelke, Germany

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Topic:
14) Models

Abstract

Objective:
The TRI Academy is a global platform dedicated to sharing the latest insights in tinnitus research and treatment. This poster showcases our activities and highlights our mission to foster collaboration and knowledge exchange with the scientific, clinical, and patient communities.

Methods:
Through online seminar series, newsletters and a social media presence, we explore innovative approaches, from a diverse fields like neuroscience, genetics, clinical therapies and patient perspectives in tinnitus research since 2021.

Results / Discussion:
TRI Academy is organised and led by Early-Mid Career Researchers from diverse cultural backgrounds. We are determined to engage diverse audiences, including researchers, clinicians and patients, and to expand our reach across different regions and disciplines, strengthening connections within the professional community and the community of people with lived experience. Our aim is to make tinnitus research more accessible to the collective tinnitus community through this approach.

Conclusion:
By centering leadership around Early-Mid career researchers, TRI Academy strives to build research leaders in the tinnitus community whose values are centered around cooperation, collaboration and cultural sensitivity. We explore how to strengthen engagement and connection amongst peers and people with lived experience. This not only builds trust, dialogue, and active community building but also seeds effective science communication.