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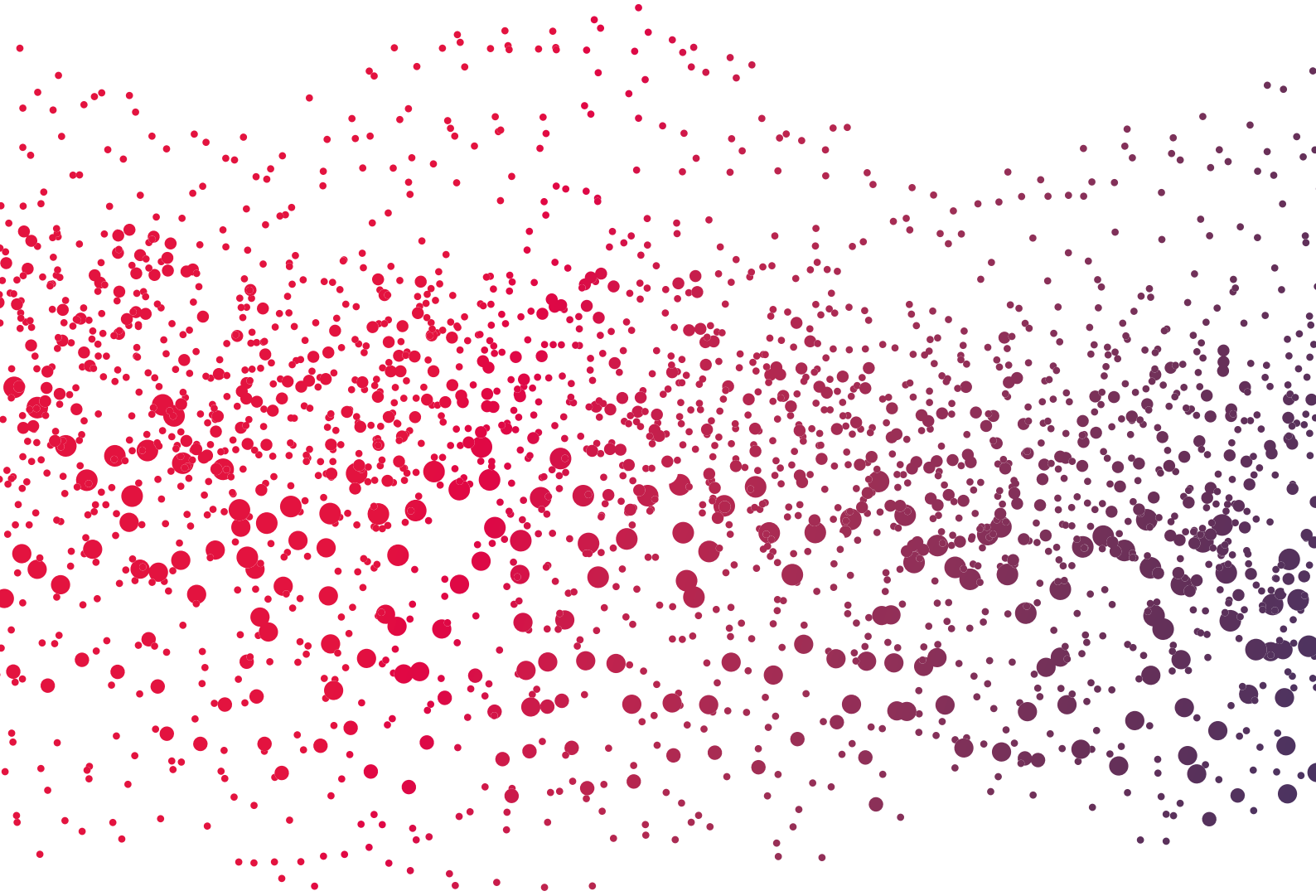

Does Coronavirus Affect the Audio-Vestibular System?

Hearing Aid Amplification Reduces Communication Effort of People with Hearing Impairment and Their Conversation Partners

Music is More Enjoyable with Two Ears, Even if One of Them Receives a Degraded Signal Provided by a Cochlear Implant

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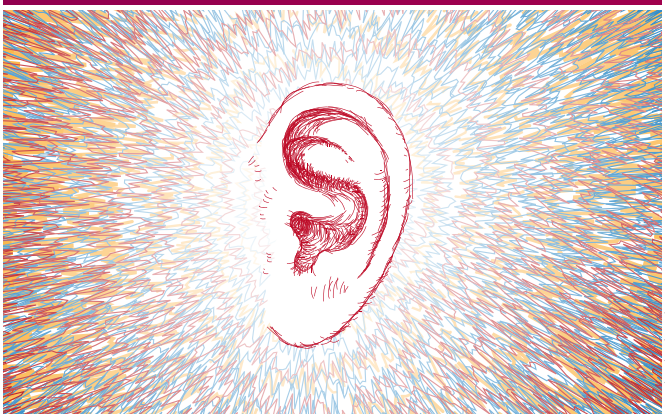
EDITORIAL



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The Amplifon Centre for Research and Studies, CRS, houses one of the finest private libraries in the field of audiology and otorhinolaryngology, offering the sector's most important international journals. Every quarter, a team of Amplifon Audiologists from around the globe select the most relevant publications in the field of Otology and Audiology and make a comprehensive review. The Amplifon Centre for Research and Studies coordinates the development of this quarterly review. We are happy to share these reviews with you.

In this issue we start with two article reviews on COVID-19 and hearing loss. Many viral infections are known to be a potential cause of hearing loss. In the treatment of sudden hearing loss, antiviral agents are used, although their effectiveness has been challenged in multiple systematic reviews and meta-analyses. Some recently published case studies have shed light on possible links between COVID-19 and hearing loss. Almufarrij, Uus & Munro, carried out a rapid systematic review on the effects of coronavirus on the audio-vestibular system. They conclude that there are indeed reports which have confirmed the impact of COVID-19 on the audio-vestibular system, but these reports are scarce, demonstrating only minor symptoms, and of poor quality. More high-quality research is needed on the acute and long-term effect of COVID-19 on hearing loss, before this relation can be confirmed. What if it is not COVID-19 per se but the treatment which is related to hearing loss? Chloroquine and hydroxychloroquine, medication which is used as a treatment for malaria, are evaluated as potential treatment for patients with severe COVID-19 symptoms. Although the effectiveness of this medication for COVID-19 is still under discussion, there are indications that this medication is used in many intensive care units. Unfortunately, both chloroquine and hydroxychloroquine are ototoxic, and the risk is all the higher that, as Almufarrij et al. report, the suggested dose of chloroquine for COVID-19 infection is considerably higher than the usual dosage for malaria treatment.

The relation between COVID-19 has not yet been confirmed at this stage, but the treatment can be ototoxic. Therefore, patients who are treated with chloroquine and hydroxychloroquine or use it preventively should receive adequate audiological screening and monitoring.

Mark Laureyns,
Global International CRS &
Medical Scientific Research Manager

DOES CORONAVIRUS AFFECT THE AUDIO-VESTIBULAR SYSTEM? A RAPID SYSTEMATIC REVIEW

Almufarrij I., Uus K. & Munro K.

International Journal of Audiology (2020): 59(7), 487–91.

By Lorenzo Notarianni – Italy

The primary objective of this rapid systematic review was to research literature for evidence of measurable changes in hearing status associated with Coronavirus infection. Of the initial 2,371 records identified, only five case reports and two cross-sectional studies met the inclusion criteria. More studies are needed to investigate the acute effects of COVID-19 on the audio-vestibular system before firm conclusions can be drawn.

Along with the more widely-known clinical manifestations of Covid 19 there have been numerous reports of central and peripheral nervous system manifestations such as cerebrovascular disease, impaired consciousness and impaired vision. However, it is not yet clear whether these are a complication of COVID-19 or pharmacological side effects. Since Coronavirus can cause peripheral neuropathy, such as sensory neuropathy, it is reasonable to hypothesise that COVID-19 could potentially cause auditory neuropathy spectrum disorder (ANSD). In addition, there have been reports of COVID-19 being associated with Guillain Barre Syndrome (GBS).

For this rapid systematic review, the target population consisted of patients diagnosed with coronavirus (i.e. SARS-CoV-2, Middle East respiratory syndrome [MERS] or severe acute respiratory syndrome [SARS]). The authors carried out a systematic literature search on PubMed as well as on the databases available in the Cochrane Library so as to identify relevant studies. They also referred to grey literature which they collected via a number of engines, portals and registries This yielded a total of 2,371 records (after removing duplicates), and after successive screening, seven met the eligibility criteria for the qualitative review.

• *FINDINGS*

- **Hearing loss** (HL) was reported in four studies (N=23 patients). In particular, three studies focused on the types and severity of HL of patients infected with SARS-CoV-2: **binaural sensorineural HL**, although it is unclear whether this was a pre-existing condition and the paper provides no further details; **unilateral mild-to-moderate conductive HL** due to acute otitis media; and significantly poorer hearing thresholds at 4–8 kHz and **lower amplitude transient evoked otoacoustic emissions (t-OAE's)** – results achieved by comparing two cohorts of patients (asymptomatic SARS-CoV-2 vs. control).
- **Tinnitus** was reported in four studies (N=8 patients), but no further information on tinnitus characteristics and impact was provided.
- **Rotatory vertigo** (N=7) was reported in two studies. Moreover, unspecified dizziness was reported in several studies as a clinical feature of COVID-19, however, it was not possible to determine whether this was vestibular.
- **Other ear-related symptoms** were reported in two studies, such as otalgia (N=359).
- **Otitis externa** was reported in one study (N=1), and otitis media was documented in another (N=1).

No reports of hyperacusis emerged from the research.

• *CONCLUSION*

Audio-vestibular symptoms were reported in less than 1% of subjects with COVID-19, which could be explained by the fact that these symptoms are uncommon or that attention has thus far focused on the life-threatening symptoms of Covid 19. All studies identified for this systematic review lack specific details on the pre-exitance of audio-vestibular symptoms prior to the COVID-19 infection, which, according to the authors of the review, reduces the ability to interpret and synthesise these results. The authors also raise the issue that the medical treatment of COVID-19, for which hydroxychloroquine and chloroquine were used frequently in high doses, may have caused tinnitus and hearing loss. This medication is known to be ototoxic.

• *COMMENTS*

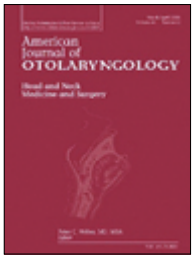
The methodology chosen by the authors ("rapid systematic review") is appropriate for the prompt production of information (in this specific paper over a period of only three weeks) which can help health care professionals to

select the best medical treatment during crises, as was the case with the SARSCoV2 pandemic. Because the spread of the virus was so rapid, it is understandable that reports of audio-vestibular symptoms in confirmed COVID-19 cases are as yet extremely rare, and those publications which do exist lack in quality and in number of participants. It is possible that, as the Covid 19 emergency recedes and the demands and burden upon public health systems lessen, focus will likely shift from life-threatening concerns towards the possible consequences of the virus on the audio-vestibular system. The authors conclude by stating that more in-depth and higher quality studies are required to understand the effects and risks of coronavirus, be they temporary or long term, as well as its associated treatments on the audio vestibular system. The authors will update this systematic review. •

CRITICAL NOTE

This paper offers interesting insight in addressing the lesser-known potential effects of Covid 19 on the audio vestibular system, at a stage when the clinical field is still primarily concerned with the life-threatening risks of the virus.

AUDIOLOGICAL PROFILE OF ASYMPTOMATIC COVID-19 PCR-POSITIVE CASES



Mustafa MWM.

American Journal of Otolaryngology (2020): 41(3), 102483.

By Lorenzo Notarianni – Italy

The main purpose of this paper was to compare transient evoked otoacoustic emission Amplitudes (TEOAEs) and audiometric thresholds between asymptomatic COVID-19 PCR-positive cases and non-infected persons in order to address the impact of this new viral infection on the auditory system. The author concludes that even when asymptomatic, COVID-19 infection may possibly have a detrimental impact on cochlear hair cell function. The mechanism of these effects requires further research.

On January 30, 2020, the World Health Organization officially recognised and declared the COVID-19 epidemic a serious public health emergency of international proportions. Based on the incubation period of the disease, symptoms of respiratory illness can manifest 2-14 days after exposure, including fever, cough, fatigue in addition to which a small population of patients experienced gastrointestinal symptoms. The elderly and people with comorbidities are more susceptible to infection and subject to serious sequelea, such as acute respiratory distress syndrome (ARDS) and hyperactive immune response known as cytokine storm. Viral infections can cause inflammatory responses and damage to inner ear structures. Virus-induced hearing loss (HL) is typically sensorineural, although conductive and mixed HL can also be observed. For example, this is the case of HIV which can lead to conductive HL because of bacterial and fungal infections following the immunosuppression caused by that virus. Virally-induced HL can vary greatly depending on the type of virus, and can cause direct damage to inner ear structures, such as inner ear hair cells and the organ of Corti (as seen in measles). A large proportion of positive Covid-19 subjects at laboratory settings are asymptomatic but can develop symptoms at a later stage of the illness. Conversely, there are also cases of patients who remain asymptomatic throughout the whole duration of clinical monitoring.

The test group recruited for this research was comprised of 20 confirmed positive cases for COVID-19 presenting none of its known symptoms, they were monitored for a duration of two weeks. Recruited subjects were all aged between 20 and 50 in order to avoid typical age-related hearing issues. All patients with definite COVID-19 symptoms or a history of HL or of any known cause of HL were excluded from the study. The control group was made up of 20 normal hearing (NH) subjects, with no history of HL, and had audiometric thresholds at or better than 15 dB HL.

Both groups were submitted to the following battery of tests at the 14th day after being confirmed COVID-19 positive but asymptomatic:
1- Detailed history taking and otological examination.
2- Basic Audiological evaluation. Air conduction thresholds were measured for frequencies from 250 to 8000 Hz. Bone conduction thresholds were obtained for frequencies from 250 to 4000 Hz.
3- Immittance evaluation to exclude the presence of middle ear pathology.
4- Transient evoked otoacoustic emissions (TEOAEs), which were considered present when the reproducibility and stability was>80%.

The test group demonstrated having worse high frequency pure-tone thresholds (4000, 6000 and 8000 Hz) andTEOAE amplitudes, which provides evidence that COVID-19 infection negatively affected the hair cells in the cochlea in these subjects. However, the underlying mechanisms of these phenomena have not yet been identified and require further research.
The results of the present study provide evidence that the absence of major Covid 19 symptoms may hide unknown impacts on delicate sensory organs such as the cochlea and on cochlear hair cell functions. •

CRITICAL NOTE
The extremely contagious nature of Covid-19 has put tremendous pressure on national health care systems and, understandably, the major focus has been on the more immediate and better-known life-threatening risks of the virus. This has obviously had an effect on the quantity of research which has been undertaken up until now on the effects of Covid-19 on the audio vestibular systems. Although this paper was produced in the midst of the crisis, it successfully highlights and demonstrates that this topic warrants further research.

OUTCOME PARAMETERS IN SPEECH AUDIOMETRY:

RETROSPECTIVE ANALYSIS OF DATA AND REPORTING QUALITY IN CLINICAL STUDIES

Morgenstern J., Lailach S., Zahnert T., et al.

European Archives of Oto-Rhino-Laryngology (2020): 277, 66

By Reddy Sivaprasad – India

In this study, the authors carried out a comprehensive review of otological publications which used speech audiometry parameters as outcome measures. They observed significant variations in testing methods and materials as well as an alarming rate of under reporting of the outcome measures, with some instances of studies in which no guidelines were used.

Speech audiometry is used in various clinical settings and is crucially important for diagnosis, counselling and planning interventions. The American Academy of Otolaryngology-Head & Neck Surgery (AAO-HNS) proposed guidelines on speech audiometry application and documentation (1995) in conductive hearing loss (CHL) and vestibular schwannoma. In 2012, AAO-HNS published minimal reporting standard on pure-tone and speech audiometry. Despite these guidelines, there still remains a great heterogeneity in speech audiometry administration and documentation, which is often an impediment for interpreting published research. The aim of the study under review was to examine the variability of speech audiometry outcome parameters in published research.

The authors conducted a retrospective study of existing literature published in medical journals (English and German) from 2012 to 2016 on speech audiometry test material and procedures, used in diagnosis and intervention planning of ontological diseases and disorders. After thorough review, data from 279 studies were included. The parameters extracted from these studies were: study design; statistics; pathology; intervention; speech audiometry material; presentation level; scoring methods; pure-tone audiometry measures; AAO-HNS guideline compliance, etc.

The authors found:

1. across studies, two different presentation levels are used to identify the word recognition score (WRS): fixed 65 dB SPL and 40 dB SL (used mostly in the US). The former method is more useful in comparing pre-op and post-op performance for CHL. The latter method is usually used in comparing post-op improvement in cerebellopontine angle (CPA) tumours.
2. some studies still use monitored live voice (MLV) to present speech stimuli. The authors argued that MLV should not be used in publications as it has many variables.
3. WRS was an outcome measure in 90% of all studies, with significant variation in material and presentation level.
4. 50% of all studies did not clearly present speech audiometry outcomes post-intervention; 45% vestibular schwannoma studies did not clearly document the speech score outcomes.

Based on these findings, the authors call for adhering to guidelines such as those from AAO-HNS in administering speech audiometry and in reporting the scores. •

CRITICAL NOTE

This review highlights existing gaps in reporting of speech audiometry in medical publications involving diagnosis and intervention of otology disorders. Though there is a scope for improvement in the clarity of the research work presented in this paper, its findings should act as a reminder of the need for further research.

SYSTEMATIC REVIEW AND NETWORK META-ANALYSIS OF COGNITIVE AND/OR BEHAVIORAL THERAPIES (CBT) FOR TINNITUS

Landry EC., Sandoval XCR., Simeone CN., et al.

Otology & Neurotology (2020): 41(2), 153–66.

By Reddy Sivaprasad – India

This meta-analysis reviewed 19 randomised control studies in a novel way using both pairwise meta-analysis and Network Meta-analysis (NMA). The authors found that cognitive behavioural therapy (CBT) offers the best improvement in terms of quality of life, relief from depression and anxiety compared to other psychotherapy techniques. The study also found guided self-administered technique was better than face-to-face delivery of CBT.

Tinnitus is known to be a disabling condition often associated with a host of secondary problems such as anxiety, sleep disorders, depression, social isolation, etc. For this reason, various psychotherapies are used with chronic tinnitus patients, such as cognitive behavioural therapy (CBT). CBT is applied in three waves as described in the literature: the first deals with operant learning and conditioning; the second focuses on the processing of real-life information and applying the technique; the third is designed to enhance the first two waves by personalising and applying new strategies (mindfulness therapy, acceptance and commitment therapy, etc.).

A Cochrane Review (2000) found that while the CBT does not have any effect on the primary complaints of tinnitus, it does, however, improve secondary aspects such as quality of life and depression. However, this review, together with an updated review to be published in 2020, fails to provide a clear definition of CBT and did not isolate the influence of multiple other therapies used. The review

under study set out to analyse randomised control studies (RCT) which used CBT in all its forms as well as other closely related psychotherapies. In addition, because CBT was used in conjunction with other therapeutic methods in several studies, the authors used the network meta-analysis (NMA) method. This study had the objective of comparing the effective impact on tinnitus outcome for participants who received CBT treatment with participants who were still on the waiting list or who received other psychotherapies for tinnitus.

For their review, the authors used RCTs published till Feb 2018 reporting health-related quality of life (HRQOL) measures (primary outcome) and reduction in anxiety and depression (secondary outcome). All eligible studies were grouped into one of three categories: cognitive only; behavioural only; and mixed. A total of 19 studies (N=1,534 patients) met the selection criteria. The data from all these studies was analysed using the NMA method; data from only 12 of these studies (N=1,144 patients) was analysed using a pairwise meta-analysis due to incomplete data.

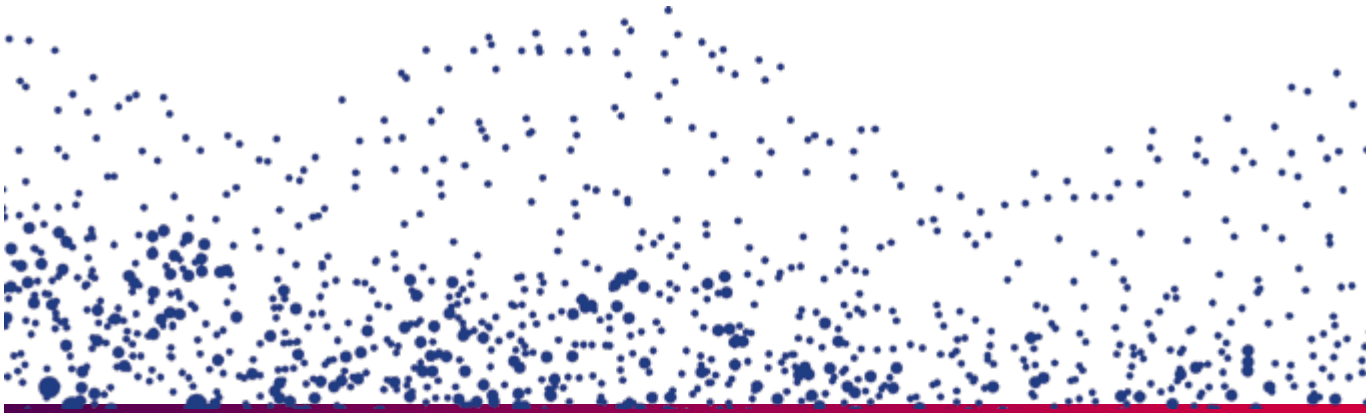
The pairwise meta-analysis showed that all cognitive and/or behavioural therapies resulted in better HRQOL scores and improved distress related to depression when compared to the waitlist control patients. However, the results indicate that these therapies did not yield significant improvements in the reduction of anxiety.

CRITICAL NOTE

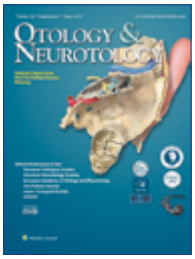
This study is the first of its kind to use the NMA to find effects of different psychotherapies and its delivery methods on the secondary effects of tinnitus. These findings may help in further strengthening existing guidelines and adapting therapeutic methods.

The network meta-analysis showed that CBT (whether guided self-administered or face-to-face) resulted in better HRQOL scores compared to a waitlist control condition. Further analysis showed that guided self-administered CBT resulted in improved scores in depression and anxiety when compared to face-to-face or waitlist controls. The ranking analysis showed that CBT was the most effective of all methods in improving the scores of HRQOL, depression and anxiety.

Based on the findings, the authors strongly recommended the use of CBT to improve quality of life, relief from depression and anxiety. They also recommended the use of guided self-administered CBT over the face-to-face delivery of CBT. One of the limitations of this study reported by the authors is that most of these studies were from the western hemisphere, therefore, generalising these findings to other geographies is not possible. •



SPATIAL HEARING AS A FUNCTION OF PRESENTATION LEVEL IN MODERATE-TO-SEVERE UNILATERAL CONDUCTIVE HEARING LOSS



Thompson NJ., Kane SLG., Corbin NE., et al.

Otology & Neurotology (2020): 41 (2), 167–72.

By Reddy Sivaprasad – India

This experimental study examined two spatial hearing abilities (special release from masking and sound localisation) in patients with permanent unilateral conductive hearing loss. The performance in both tasks improved with presentation level, based on which the authors highlight the importance of using amplification devices.

Spatial hearing helps in understanding conversations in noisy environments and also in sound localisation. Spatial hearing relies on both monaural and binaural sound cues and processing abilities. Spatial release from masking (SRM) and sound localisation are the two aspects of spatial hearing which require binaural processing of sound. SRM is the difference in speech recognition scores when the speaker and masker are spatially colocated compared with when they are spatially separated. SRM is seen in children as young as two years old and it evolves with age. Sound localisation is the ability to locate the source of sound based on cues such as interaural time difference and interaural intensity difference for low and high frequencies in that order. Localisation reaches maturity by the age of five or six. However, unilateral auditory deprivation during the 'sensitive period' associated with certain birth defects such as unilateral aural atresia, or with fluctuating conductive hearing loss, may impact spatial hearing abilities.

The aim of this study was to evaluate spatial hearing abilities in children and adults with permanent unilateral moderate to severe conductive hearing loss (UCHL). To that end, two groups of 12 subjects each were recruited: one group with UCHL (AC thresholds ranging from 55-80 dB HL); and the other with age-matched normal hearing (NH) subjects.

SRM was measured using a set of 11 loudspeakers, placed in an arc and equidistant from one another. Participants were placed directly in front of the central speaker (0 degrees). Sentences were presented from the front speaker, while speech babble was presented either in the right or in the left speaker (90 degrees). Both sentences and maskers were tested at 0 dB SNR (2 levels: 50 dB and 75 dB SPL).

CRITICAL NOTE

This interesting study provides a good starting point on the effects of chronic UCHL on spatial hearing abilities. It does however present some limitations, namely the homogeneity of the subjects – in terms of age, cause of HL, morbidity period etc. –, and also in terms of its sample size.

Mean SRM results for the UCHL group were 0.3 dB and 2.5 dB at 50 dB and 75 dB presentation levels, respectively. Mean SRM for the NH group were 7.4 dB and 8.2 dB at those same levels. The effect of HL and the presentation level was statistically significant in the UCHL group, whereas the same was not significant in the NH group.

Mean RMS error for localization was 6.5 and 6.6 degrees for the NH group and 51.3 and 20.2 for the UCHL group, both at 50 and 75 dB SPL presentation levels. The study found that the effects of presentation level and degree of hearing level were statistically significant.

In the UCHL group, the two spatial hearing abilities improved significantly with louder presentation levels. The authors strongly recommend the use of bone conduction hearing aids or other possible means to improve hearing which can in turn improve real-life hearing abilities. •

A CASE SERIES OF PATIENTS WITH CONCURRENT OTOSCLEROSIS AND SUPERIOR SEMICIRCULAR CANAL DEHISCENCE

Dewyer NA., Quesnel AM. & Santos F.

Otology & Neurotology (2020): 41, e172–81.

By Reddy Sivaprasad – India

This case series study presented eight subjects with concurrent otosclerosis and superior semi-circular dehiscence (SCD). All middle-aged subjects presented with typical otosclerosis symptoms. Post-operatively some of them presented with SCD symptoms and the diagnosis of SCD was possible only through CT scan. This study offers a detailed overview of options before surgeons in such cases.

Superior semi-circular dehiscence (SCD) is characterised by the absence of bone covering the semi-circular canal and exposing the membranous semi-circular canal, seen in the middle ear cavity. Though it is an inner ear condition, audiometry shows a pseudo-conductive/mixed hearing loss. Rarely, SCD can present concurrently with otosclerosis, which is also known to cause conductive hearing loss (CHL). While otosclerosis is often identified using audiometry results, SCD can only be detected with CT scans which are not routinely ordered, and is therefore likely to be missed at diagnosis stage. Patients with these concurrent conditions can still complain of CHL and other SCD symptoms post-otosclerosis surgery. This study offers a comprehensive overview of a series of eight case studies of patients with concurrent SCD and otosclerosis.

Case 1: 41/F with longstanding bilateral CHL. Audiological evaluation revealed the presence of Carhart notches and the absence of stapedial reflexes in both ears. The CT scan showed fenestral otosclerosis and SCD in both ears. Stapedotomy was performed first on the left year, and five later on the right ear. The air-bone gap (ABG) improved but persisted in both ears; no SCD related symptoms were found.

Case 2: 43/M presented with progressive HL and tinnitus. Audiograms showed mixed HL in both ears with large ABGs. CT scans showed SCD in the left ear as well as otospongiosis in both ears. When presented with these results, the patient chose to use amplification rather than surgery in order to avoid unmasking SCD symptoms.

Case 3: 60/F reported slowly progressive HL. Audiometry revealed the presence of CHL in the right ear. She underwent a stapedectomy and was fitted with aTeflon prosthesis. Post-op audiogram showed a persistent ABG along with new complaints: autophony, pulsatile tinnitus, etc. CT scan showed a large SCD in the right ear. After counselling the patient opted out of surgery and her vestibular symptoms resolved.

Case 4: 41/F who had already undergone two surgeries for otosclerosis in her right ear six years prior, presented with progressive HL, aural fulness, tinnitus and slight dizziness with head movement. The audiogram showed a supranormal bone conduction (BC) thresholds and a large ABG. The CT scan showed a right SCD, bilateral otosclerosis and a displaced prosthesis. She underwent a second revision surgery in that ear and symptoms subsided to a great extent, and she turned down surgical repair of her SCD.

Case 5: 40/M presented with progressive HL in both sides and constant tinnitus. He had already undergone a left stapedectomy four years prior. The CT scan showed a slightly displaced prosthesis and a small SCD in the left ear. Revision surgery was performed. Post-operatively, symptoms subsided in the left ear.

Case 6: 53/M reported six weeks of vertigo, occasional tinnitus and left CHL following a left stapedectomy. Audiogram showed CHL along with a Carhart notch. The CT scan revealed intact prosthesis, SCD and labyrinthitis in the left ear, as well as a tegmen tympani dehiscence with dura resting on the ossicles on the right ear. He refused surgery for his left SCD. Four years later, he reported disabling dizziness and sensitivity to loud sounds. Bony wax was used to plug the SCD on the left side. Post-operatively, he reported complete recovery from symptoms except HL.

Case 7: 58/M reported progressive bilateral HL. No other complaint was reported. He underwent a left stapedectomy. Post-op he complained of aural fulness, autophony and BC hyperacusis. The CT scan revealed bilateral SCD. Over the subsequent two years, his vestibular symptoms worsened and he opted out of surgery and chose hearing aids.

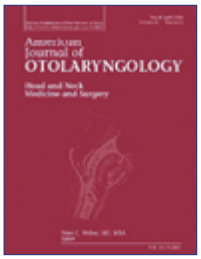
Case 8: 45/F complained of progressive HL in the right ear and of bilateral otosclerosis. She had undergone a left stapedectomy 19 years ago. Audiogram revealed a large CHL in the right ear. The CT scan showed a large SCD, bilateral otosclerosis and good prosthesis condition in the left. She underwent a right stapedectomy, and did not show any HL or vestibular symptoms post-op.

Based on their findings, the authors highlighted some similarities across these patients:
1. All of them presented progressive HL with or without tinnitus, like any typical otosclerosis patient;
2. Pre-op none of them reported typical SCD symptoms like aural fulness, BC hyperacusis or sound-induced vertigo;
3. Post-op audiograms showed typical SCD like upsloping of AC thresholds with large ABGs at low frequencies.

They concluded that CT scan is the only reliable way to detect concurrent SCD in patients with otosclerosis. They also noted that stapedectomy unmasks SCD symptoms in about half of these patients. Finally, the authors also underline the need for counselling and presenting all options to patients. •

CRITICAL NOTE
This is a well-documented series of rare concurrent disorders. It offers a sound overview of the challenges in diagnosing concurrent SCD as well as of the estimated risk of otosclerosis correction.

HEARING HANDICAP
IN ASIAN PATIENTS WITH DEMENTIA



Gyanwali B., Hilal S., Venketasubramaniand N., et al.

American Journal of Otolaryngology (2020): 41(2), 102377

By Reddy Sivaprasad – India

This case focuses on the Asian context, measuring hearing loss and hearing handicap between patients with mild dementia and a healthy controls. The prevalence of hearing handicap was higher in the dementia group compared to the controls.

Dementia is a common disorder seen in the elderly population which results in gradual loss of cognitive functions. Age-related sensory loss seen in the elderly is found to precipitate dementia. Age-related hearing loss (HL) is now considered as the modifiable risk factor of dementia, since it can be treated with amplification devices. Existing literature reports that the prevalence of HL among those with dementia is between 60-90% depending on the geographical location, genetic factors, ethnicity etc.

In the Asian context, the elderly population is growing in a number of countries such as Japan, Korea, China and Singapore. Focusing more particularly on the Singaporean context, the authors highlight that the number of elderly (above 65 years old) is estimated to increase from 1 in 8 in 2015 to 1 in 4 by 2030, with an estimated increase in the number of dementia patients from 53,000 in 2020 to 187,000 by 2050. The working hypotheses of this study were: [1] more patients with dementia have HL and hearing handicap compared to non-demented subjects and [2] HL and hearing handicap are associated with dementia.

Following a case-control methodology, subjects were recruited and divided into two groups: Experimental group (N=39) comprised of those subjects diagnosed with mild dementia (global Clinical Dementia Ration, CDR=1); and the Control Group, comprised of subjects (N=52) with no

cognitive deficits. All subjects underwent comprehensive physical, medical, neuropsychological – Mini Mental State Examination, (MMSE), Montreal Cognitive Assessment (MoCA) and CDR interview – and audiological – pure-tone audiometry (PTA), tympanometry and Amsterdam Inventory for Auditory Disability and Handicap (AIADH) – evaluations. The higher the AIADH score, the lower the hearing handicap.

Results showed that:
1. Patients with dementia were significantly older (mean age 78y/o vs 72y/o) and had very low AIADH scores (median score 75 vs 80) compared to the controls.
2. Patients with dementia had higher PTA (median 40 dB Vs 30 dB) compared to the controls.
3. Linear regression analysis showed that higher PTA was not associated with dementia (after adjusting for age and gender)
4. Linear regression showed that more patients with dementia had lower AIADH score compared to controls: 48% of subjects with dementia and 25% of subjects of the control group had disabling hearing loss. •

CRITICAL NOTE
This is a case-control study and therefore presents some major limitations which the authors highlight in their article. However, this study could be used as an indicator of the trends in aging populations in Asian societies.

HEARING AID AMPLIFICATION REDUCES COMMUNICATION EFFORT OF PEOPLE WITH HEARING IMPAIRMENT AND THEIR CONVERSATION PARTNERS

Beechey T., Buchholz J. & Keidser G.

Journal of Speech, Language and Hearing Research (2020): 63, 1299–311.

By Tali Bar-Moshe – Israel

This article addresses the dual benefits of HA uses for hearing impaired individuals as well as for their family, friends and other communication partners. Reducing speech efforts on the part of HL individual's conversation partners may help to avoid frustration, misunderstanding and encourage social communication.

In addition to communication problems experienced by people with hearing loss (HL), the partners with whom they communicate can also experience issues. The use of hearing aids (HA) is beneficial to HA wearers, as they increase speech understanding and ease of listening and reduce fatigue, as well as for their conversation partners, by reducing the need for communication efforts on their part and reducing the related fatigue and frustration.

This study explores the hypothesis that HA use reduces communication effort for both hearing impaired (HI) individuals and their normal-hearing (NH) conversation partners. The researchers investigated the levels of speech production modifications during conversation in five different acoustic environments of 15 pairs of subjects each made up of one NH young adult (age 20-45 y/o, M=29.0, SD=7.4) and one older adult (age 65-85 years, M=75.4, SD=4.9) with symmetrical sensorineural HL (average HL across 0.5, 1, 2, 4 kHz was 26.8 – 63.1 dB HL, M=43.3, SD=16.8; high frequency average HL - HFAHL across 2,3,4 kHz was 15.0 – 79.3 dB, M=58.1, SD=8.5). Each NH/HL pair was given a communication puzzle task which provided the basis for balanced conversation between the two participants. Each HL participant received directional HA amplification

through a master HA using the NAL-NL2 fitting formula so as to fit the gain according to their HL. Each pair took part in five conversations lasting five minutes each, each time with different virtual acoustic environments which covered a wide range of sound pressure levels: office (61.4 dBA); living room (67.3 dBA); Church (69.8 dBA); Café (77.3 dBA); and traffic (82.5 dBA). The conversations were recorded and analysed to compute the extent of speech modulations the NH partners made in terms of vocal level and speech spectrum as a function of both acoustic environment and the degree of High-Frequency Average Hearing Loss (HFAHL) of their partners.

The study showed that NH participants made smaller modulations to their speech when their HL conversation partners used HA amplification than during unaided conversation. These results emphasise the importance of hearing amplification for both HL individuals and their conversation partners in a wide range of acoustic environment. •

CRITICAL NOTE

This article addresses the dual benefits of HA uses for HL individuals as well as for their family, friends and other communication partners. Reducing speech efforts on the part of HL conversation partners may help to avoid frustration, misunderstanding and encourage social communication. It is important to include this information in HA counselling and make clients aware of the magnitude of the efforts their conversation partners are making when they are not using HAs. This information must also be presented to clients who do not acknowledge the benefit of their HAs and may help them realise that using HAs is important not only for them but also for all those in their social circle.

AUDITORY TRAINING TO IMPROVE SPEECH PERCEPTION

AND SELF-EFFICACY IN AGING ADULTS

Fostick L., Taitelbaum-Swead R., Kreitler S., et al.

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By Katrien Hoornaert- Belgium

Self-efficacy is positively influenced when speech perception improves. This can be achieved in aging adults through training (using computer-based auditory temporal training). It would be very interesting to test whether this training would have the same effect on people with hearing impairment, with or without a hearing aid.

Multiple studies have suggested that age-related deficits in speech recognition are related to degraded auditory temporal processing (ATP). This study investigates whether auditory temporal processing training results in improved speech perception and self-efficacy in aging adults.

A total of 82 participants aged between 60 and 83 years old with age-normal hearing took part in this study. They were randomly divided into three groups: no training; ATP-training; and non-ATP-training.

The training consisted of a task which subjects were required to be completed at least 10 times between day two and day 13.

ATP training consisted of a spatial temporal order judgement (TOJ) task (two successive sounds, left-right or right-left).

Non-ATP training consisted of an intensity discrimination task (two sounds, same loudness or different?). The same tasks were used for the testing.

Day 1: subjects were screened (hearing level and cognitive ability), they completed the full test battery (absolute threshold measurement, ATP task, non-ATP task and speech perception task) and the self-efficacy questionnaire.
Day 14: the full test battery
Day 90: the full test battery and the self-efficacy questionnaire.

The speech perception task consisted of a test in quiet, in narrowband speech spectrum noise and in wideband (white) noise.

The effect of the training appeared to be specific: the no-training group showed no difference on the tests; the non-ATP-training resulted in better results for the non-ATP task, not for the ATP-task nor the speech perception task. The ATP-training group performed better for the ATP-task and for the speech perception task, but not for the non-ATP task. On Day 90, the results appeared to be even better, so the process, which started with the training, continued even after the training had ended.

The authors conclude that self-efficacy is positively influenced when speech perception improves. •

CRITICAL NOTE

This study highlights that computer-based auditory temporal training is effective to improve speech perception in older adults with age-normal hearing. It would be very interesting to test whether this training would have the same effect on people with hearing impairment, with or without a hearing aid.

MUSIC IS MORE ENJOYABLE WITH TWO EARS, EVEN IF ONE OF THEM RECEIVES A DEGRADED SIGNAL PROVIDED BY A COCHLEAR IMPLANT

Landsberger DM., Vermeire K., Stupak N., et al.

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By Paul Van Doren – Belgium

Even though the signal was in mono-mode, the enjoyment was perceived as better with two ears. The same happened with participants with Single Sided Deafness (SSD) and a Cochlear Implant (CI), which means that even the music signal coming signal from the CI could add enjoyment. Vocoded input resulted in poorer results.

It is well known that Cochlear Implants (CI) can eliminate or distort many acoustic cues which are important for music enjoyment. One could ask whether in cases of cochlear implantation and Single Sided Deafness (SSD), the CI could have a negative influence on musical enjoyment as well.
This study presents three experiments designed to assess whether the combination of a natural and a distorted signal degrades enjoyment.
The researchers used a modified MUSHRA (MUltiple Stimuli with Hidden Reference and Anchor) method, with "100" being the reference score while listening only with one normal ear, "0" being the lowest and "200" twice as agreeable.This enabled the authors to document whether bimodal listening could offer an improvement.

EXP #1: Comparing an acoustic-hearing ear to a cochlear-implanted ear.
EXP #2: Comparing an acoustic-hearing ear to an acoustic-hearing ear with vocoded input.
EXP #3: Estimating music enjoyment difference between one and two ears.

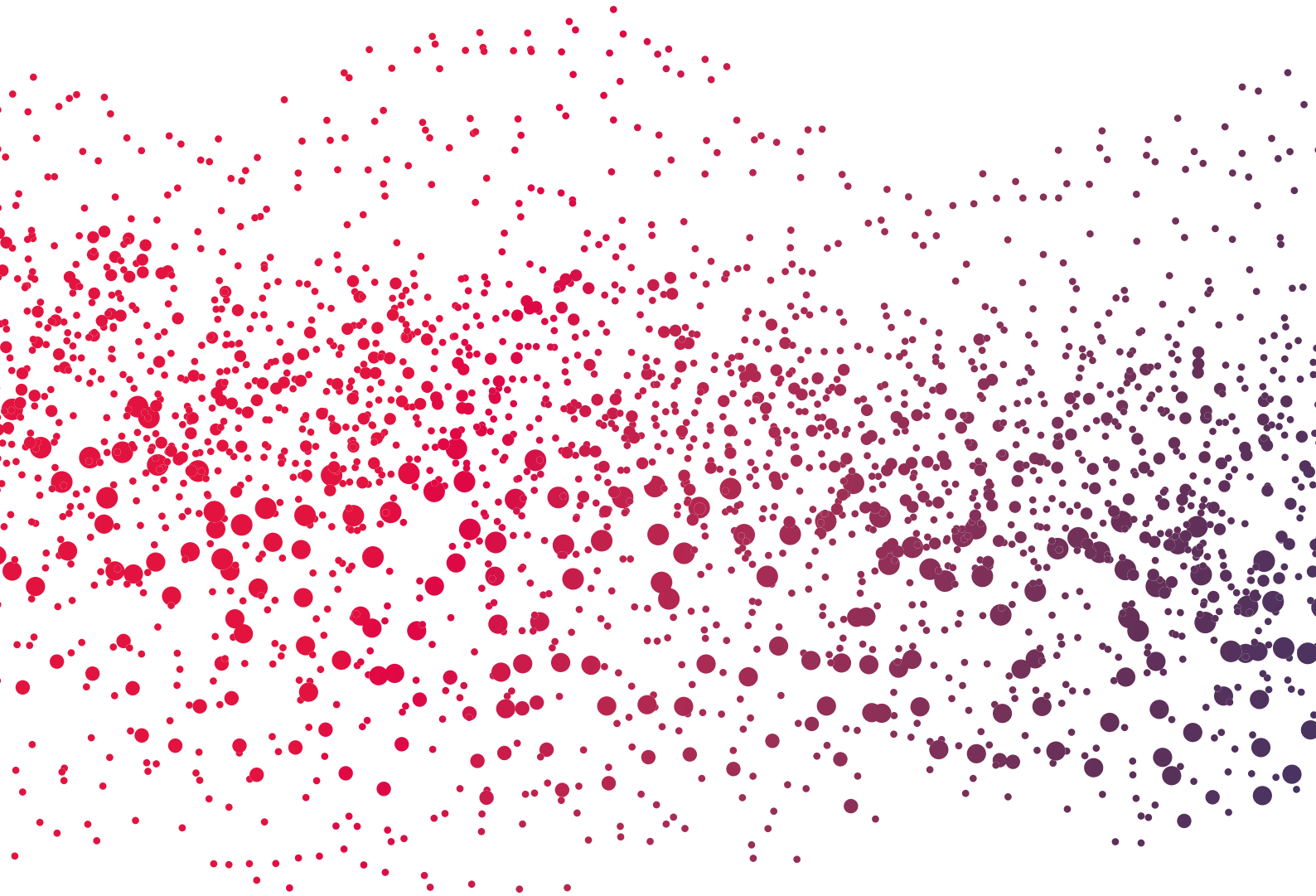
In these experiments, participants were required to evaluate two mono music fragments: "Rhapsody in Blue"; and "Ring of Fire".

Even though the signal was in mono mode, the enjoyment was perceived as better with two ears.
To the authors' surprise, the same happened with SSD and CI participants, which means that even the music signal coming from the CI could add enjoyment, while this signal was evaluated as very unpleasant, when evaluated in the CI-ear only.
The results were more visible for "Ring of fire" song, suggesting that an easy melody and voices are easier to appreciate than the more complex structure and multiple instruments in "Rhapsody in Blue". Vocoded input, on the other hand, resulted in worse outcomes. •

CRITICAL NOTE

It is suprising how the central auditory processing system can manage a signal, even if it is distorted. In the discussion, the authors suggest that the brain learns to cope with the signal provided through the CI to enhance the listening experience. Music signals coming from the vocoder did not deliver the same results and the experience was significantly less enjoyable.

It would be interesting to explore whether the same would happen in a bimodal mode (CI and HA) or even in asymmetric HL and stereo fitting of the HL.



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