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TINNITUS: A COMMON AND MANAGEABLE COMPLAINT

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Background

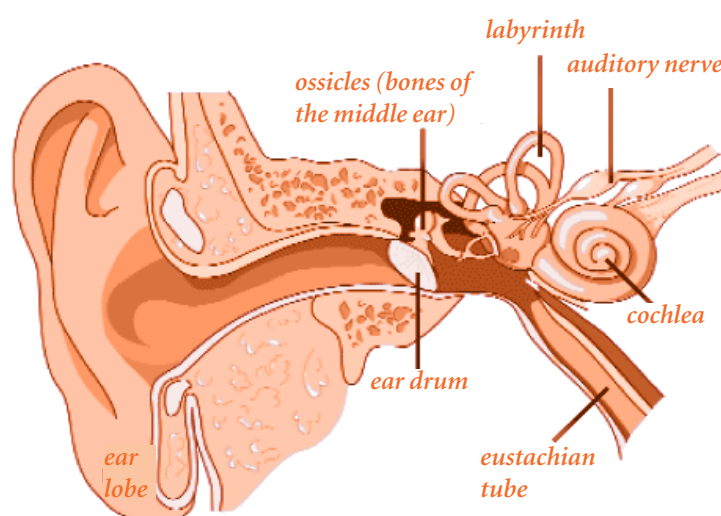
Tinnitus is a common symptom with persistent tinnitus being experienced by approximately 10% of the population in the United Kingdom (UK).¹ Prevalence increases with age and hearing loss, and a significant proportion of tinnitus patients will complain of hyperacusis (reduced sound tolerance).

McFadden² defined tinnitus as, 'The conscious experience of sound that originates in the head'. Jastreboff³

proposed a new definition, 'The perception of sound that results exclusively from activity within the nervous system without any corresponding mechanical, vibratory activity within

the cochlea, and not related to external stimulation of any kind'.

It is important to understand that most people who experience tinnitus are not



Anatomy of the inner ear

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Tinnitus: A Common and Manageable Complaint

troubled by it but, in some, the tinnitus can have a marked effect on their lives. However, the common trend is that the patient habituates to the tinnitus signal over a period of time, but the habituation process may be hindered, if there is a strong negative meaning, fear, worry or concern attached to the tinnitus.

The mechanisms of tinnitus are outside the scope of this paper but it is noteworthy that in distressful tinnitus there are usually two mechanisms: the physiological mechanism causing the tinnitus and the psychological mechanism causing the distress. Most of the distress is probably linked to the 'fight-or flight' response.

Characteristics of Tinnitus

Tinnitus is commonly described as ringing, whistling, buzzing or hissing but more complex sounds and many different noises can also be described. It can be constant, intermittent, or transient and it may be perceived in one or both ears or in the head. The tinnitus can be pulsatile in nature or continuous.

Investigation

A full medical and otological history should be taken with particular emphasis placed on the onset of the tinnitus and any associated risk factors at the time of the onset. A full noise exposure history should be taken including industrial, military and leisure noise. A full drugs history should be taken including prescribed, homeopathic and analgesic medication, as some have a side effect of tinnitus. Identify any underlying stress, anxiety or depression as these may be the triggers that induced tinnitus awareness.

The characteristics of the tinnitus should be carefully noted because both unilateral and pulsatile tinnitus require further investigation to exclude potential serious or treatable pathology, although tinnitus is generally not caused by serious pathology.

Sufficient time should be given for the patient to describe the effects that the tinnitus has on them and any worries, fears or concerns that they have about the tinnitus and the prognosis. These issues should be carefully addressed during the counselling that forms an extremely important part of the treatment. A questionnaire, such as the Newman Tinnitus Handicap Inventory (THI)⁴ only takes

a few minutes to complete and is very useful in assessing the impact that the tinnitus has on the individual.

The minimum investigations should include otoscopy and pure tone audiometry. Any blockage in the ears should be removed and the patient reassessed to find out whether this was causing the tinnitus.

Treatment

After the history and examination have been performed, a careful explanation of the diagnosis should be presented to the patient with a strong emphasis on the fact that the natural course of tinnitus leads to habituation. An explanation that tinnitus is a common symptom and that improvement is usual can be invaluable. It should be made clear that the aim of the treatment is to remove the distress caused by the tinnitus. Written information is useful so that the patient can read details over again which will reinforce the initial session.

Treatment options include information, counselling, sound enrichment, relaxation training with stress reduction, and cognitive behavioural therapy (CBT). Psychology services should be considered for any underlying anxiety and depression. Evidence shows that psychological processes as well as audiological processes are present when the patient does not habituate to the tinnitus signal.⁵ Both of these processes need addressing when treating the patient.

Any otological or systemic conditions identified should be treated as usual. Ear protection should be strongly advised if the patient is exposed to excessive noise. If there is a hearing loss that is both acknowledged by the patient and is aidable, then hearing aids should be fitted with an emphasis on using them as devices to enrich sounds going into the auditory system and to prevent the patient from straining to hear. The earmoulds should be as open as possible to avoid the patient experiencing a blocked feeling in the ears (occlusion effect) as this may lead to an increase in tinnitus awareness. The patient should be encouraged to avoid silence and to use low level natural sounds to refocus them away from their tinnitus. It is possible to purchase specific sound enrichment devices and pillow speakers to assist with problems encountered with sleep. Advice

around improving sleep and relaxation will also be extremely useful to many.

If the hearing is normal or near normal, the use of wearable sound generators may be helpful. These look like hearing aids but produce a low level wide band noise. Again, the earmoulds should be made as open as possible. The patient is encouraged to wear them for several hours each day, especially at quieter times. The patient will be required to wear them until habituation has been facilitated and this may take a year or two.

Follow-up appointments are essential to reinforce the information given at the initial session, to ensure that the patient is following the management plan and provide further advice and support. It is useful to reassess the tinnitus using the Newman THI to document improvement in tinnitus annoyance.

National support groups such as the British Tinnitus Association in the UK, together with local tinnitus support groups, can provide additional information and support to patients.

Research

Functional MRI (fMRI) scans are being used to look at changes in the brain in response to the tinnitus signal and the results of these studies should lead to a better understanding of the mechanisms of tinnitus. Several small scale studies using repetitive transcranial magnetic stimulation (rTMS) have had some promising results and research continues in this area. Recent research suggests somato-sensory neurons may play a part in the pathogenesis of tinnitus. There are drugs related to hair cell growth in the cochlea described in the article on presbycusis (page 28) that might be useful in the treatment of tinnitus in the future.

Conclusion

Tinnitus is a common complaint that can be managed with a very good success rate. Quite often the patient only requires reassurance about the future and the prognosis is invariably good. Listen to the patient, be supportive and provide information. A tinnitus management programme that addresses both the audiological and psychological issues will probably be the most effective.

Tinnitus: A Common and Manageable Complaint

References

1. Epidemiology of tinnitus. In: Tinnitus Handbook. Davis A, El Rafaie A, Singular Publishing Group, San Diego (2000).
2. Tinnitus: Facts, Theories and Treatments. McFadden D. National Academic Press, Washington, DC (1982).
3. Tinnitus as a phantom auditory perception: theories and clinical implications. Jastreboff PJ. In: Mechanisms of Tinnitus. Vernon J, Moller AR (Eds), Allyn & Bacon, Boston, MA (1995).
4. Development of the Tinnitus Handicap Inventory. Newman CW et al. *Arch Otolaryngol Head Neck Surg.* 1996; **122** (2): 143-148.
5. Changing Reactions to Tinnitus. McKenna L, Andersson G. *The Hearing Review.* August, 2007. □

Dizziness

DIZZINESS

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Dizziness is a common symptom, sometimes very mild, or can be incapacitating. The five end organs of balance within the labyrinth are clearly related to the end organs of hearing and, in fact, the vestibular and cochlea-end organs share the same nerve into their respective nuclei within the brain stem. Normal balance is a combination of proprioception in the feet, visual acuity in the eyes and, finally, the vestibular apparatus. The basis of balance is a normally functioning vestibular ocular reflex. If the reflex is working poorly there will be a feeling of imbalance. The clue to managing the patient who is dizzy is always in the history. A careful history must always be taken, essentially to identify what may have triggered an attack of dizziness.

Benign Paroxysmal Positional Vertigo

The most common condition presenting as dizziness is **benign paroxysmal positional vertigo** (BPPV). This condition is characterised by dizziness on moving the head quickly or, classically, when turning over in bed at night. This dizziness is short lived. The hearing is usually symmetrical and the Weber test (see Glossary) is central. This condition is the result of displaced otoliths within the semicircular canal. The diagnosis is confirmed using the Dix-Hallpike manoeuvre, essentially laying the patient flat with their head to one side and neck extended. Fatiguable nystagmus to the right or left will confirm the

diagnosis. This condition has been shown to respond to physical therapy rather than medication.

The Epley manoeuvre is now universally used to treat this condition with remarkable success. The patient is laid flat with neck extended and then rolled over onto the side that sets off the dizziness. This technique can be repeated several times, shaking up the crystals in the semicircular canals. The nystagmus accompanying the Dix-Hallpike manoeuvre must be fatiguable. If the nystagmus is not fatiguable then a central problem may be suspected. BPPV is common and easily treated.

Dizziness and Medical Conditions

Common medical conditions are also responsible for dizziness. **Diabetes** should always be excluded as a cause of dizziness. **Irregular heartbeat** and **postural hypotension** may also be underlying causes of dizziness. Often forgotten is vision and it is important to establish that vision is satisfactory. If the hearing is asymmetrical in a dizzy patient, then the possibility of an **acoustic neuroma** must be considered. The dizziness is often episodic and there is often accompanying tinnitus. Most acoustic neuromas are small and very slow growing and, now, with sophisticated MR (magnetic resonance) scanning, tumours can be observed over a long period of time. Only when symptoms become overwhelming is intervention considered. The symptoms mimic another condi-



Dizziness

tion called **Ménière's disease**. This is a progressive condition with long periods of respite (inactivity) and the symptoms of dizziness, tinnitus and deafness have to be treated as they become troublesome. Dizziness is often treated with medication, such as prochlorperazine, and deafness with a hearing aid. Usually one ear is affected but the other ear is often normal. Many patients nowadays are on many medications. Some drugs, such as the mycins are well recognised as causing dizziness, but many drugs are reported as having side effects of dizziness. The interaction of many drugs are just not known. All balance rehabilitation will be centred on the good ear.

Another common cause of dizziness which is often forgotten is **migraine**, with poor perfusion of the brain and, sometimes, **small transient ischaemic attacks** present as dizziness. Migraine with its accompanying vertigo often responds well to simple management, like giving up caffeine and chocolate.

Tests of Balance

There are many sophisticated tests of

balance available, but clinical tests are usually sufficient, using electro-nystagmography to look at eye movements in the dark. More recently, an elective test called a VEMP has been developed. This is an evoked myogenic response, and is useful in identifying damage to the vestibular nerve caused by a virus, usually resulting in a labyrinthitis with severe vertigo, accompanied by vomiting. Simple tests in the clinic, along with the history, should give the clue to the underlying problem. Romberg's test and the Unterberger test are routinely used and give a good idea of vestibular activity. Remembering that the cerebellum is the co-ordination centre of the brain, tests of cerebellar function, including past pointing, give a good idea of the overall cerebellar function.

Rehabilitation for Dizziness

Vestibular rehabilitation in the form of physiotherapy is the mainstay of treatment nowadays. Essentially, if you repeat the activity that makes you dizzy, in time the brain will compensate.

Surgery is a possibility in managing the dizzy patient, particularly those with Ménière's disease.

Many patients believe that when they become dizzy they have a brain tumour and, of course, this has to be excluded as a cause of dizziness. Stemetil [prochlorperazine] can be prescribed as a lozenge, tablet or a suppository in an acute attack, but most medications for dizziness have long term side effects. The dizzy patient is a challenge but the history always gives the clue to the cure.

References

1. Textbook of Audiological Medicine: Clinical Aspects of Hearing and Balance. Luxon LM, Furman JM, Martini A, Stephens SDG (Eds.). Martin Dunitz, London (2003).
2. Practical Management of the Balance Disorder Patient. Shepard NT, Telien SA. Singular Publishing Group, San Diego and London (1996).
3. Rehabilitation Strategies for Patients with Vestibular Deficits. Shumway-Cook A, Horak FB. *Neurol Clin North Amer.* 1990; 8: 441-457.
4. Role of Vestibular Adaptation in Vestibular Rehabilitation. Herdmann SJ. *Otolaryngol Head Neck Surg.* 1998; 119: 49-54.

Glossary

Acoustic neuroma (Vestibular Schwannoma): Affecting the vestibular portion of the 8th cranial nerve, it is a benign primary intracranial tumour of the myelin-forming cells.

Dix-Hallpike test (Nylen-Barany test): A diagnostic manoeuvre to identify benign paroxysmal positional vertigo (BPPV) - the Dix-Hallpike test rotates the posterior semicircular canal in the plane of gravity of the patient. The patient sits upright with legs extended - the head is rotated by approximately 45 degrees - the clinician helps the patient to lie down backward quickly with the head held at approximately 20 degrees of extension. The patient's eyes are observed for about 45 seconds - after a latent period of around 5-10 seconds, nystagmus may occur. Rotational nystagmus is positive for BPPV.

Epley manoeuvre (particle/canalith repositioning manoeuvre): A series of four specific movements of the head and body used to move microscopic debris out of the posterior semicircular canal in the inner ear. The Epley manoeuvre can help 'spinning' and dizziness on moving the head, characteristic of benign paroxysmal positional vertigo (BPPV).

Ménière's disease: A disorder of the inner ear that can affect hearing and balance. It is characterised by episodes of dizziness and tinnitus and progressive hearing loss, usually in one ear.

Nystagmus: Pathological nystagmus is a form of involuntary eye movement, characterised by alternating smooth pursuit in one direction and saccadic movement in the other direction. It is the result of damage to one or more components of the vestibular system.

Past pointing: A test of the integrity of the vestibular apparatus and of cerebellar function. The patient is seated, then asked to touch the examiner's index finger. The examiner's finger being held about half a metre away. Once the finger has been touched the patient is asked to close their eyes and touch the tip of their own nose. This is repeated with the other hand. If there is a problem, the patient's finger will overshoot the nose consistently and a central problem must be suspected.

Romberg's test: The patient stands with feet together and eyes closed for up to a minute. The basis of the test is that balance comes from a combination of proprioception (position sense), vestibular input and vision. With vision 'removed' (closed eyes), the presence of vestibular disorder (cerebellar function) and/or proprioceptive dysfunction will result in loss of balance.

Unterberger test (Unterberger's stepping test): The patient is asked to walk on the spot ('in place') with eyes closed. If the patient rotates to one side there is a defect of the vestibular apparatus.

VEMP test: Vestibular Evoked Myogenic Potentials refer to electrical activity recorded from neck muscles in response to intense auditory clicks and reflects the stimulation of the vestibular labyrinth.

Weber test: A quick screening test for hearing which can detect unilateral (one-sided) conductive hearing loss and unilateral sensorineural hearing loss.

1. Strike a 256 or 512 Hz tuning fork softly
2. Place the vibrating fork on the top of the patient's head - at equal distance between the ears
3. Ask the patient if the sound is heard better in one ear or the same in both ears
 - a) if the hearing is normal, the sound is symmetrical
 - b) Sound localises towards the poor ear with a conductive loss
 - c) Sound localises towards the good ear with a sensorineural loss

ATFALUNA SOCIETY FOR DEAF CHILDREN

Persons with Disabilities Most at Risk after Gaza Conflict, Warns CBM Partner

The recent conflict in Gaza will hit the most vulnerable hardest, and those with new physical disabilities and psychological trauma require urgent identification, warns Atfaluna Centre for the Deaf.

The situation in Gaza, like any other humanitarian crisis, has affected especially the most vulnerable: the elderly, women, children and Persons with Disabilities. Bombs, rubber bullets and flying wreckage parts can cause physical injury or permanent damage to sight or hearing, while those who experience the effects of conflict can suffer a lasting psychological impact.

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NEWS UPDATE – JUNE, 2008

Very Dear Friends,
It will be with a collective sigh of relief that teachers here at the Atfaluna School for the Deaf will bid farewell to the 07-08 academic year, for this year has been one to match no other in the School's 16-year history.

It's almost one year now since the embargo was put into effect - which allows for little more than basic food supplies, medicines, and extremely limited petrol to enter the Gaza Strip. More than 1.5 million people, including 750,000 children under the age of 14, have seen the economy of the Gaza Strip devastated, families destroyed, and scores of children hungry and ill. The embargo and its inherent 'sealed' borders, that do not allow people or goods to enter or leave the Gaza Strip, have forced factory after factory, business

after business to close their doors for lack of raw materials, spare parts, or equipment: the printer has no ink, the builder no cement, the seamstress no cloth, the baker no butane gas, the carpenter no wood, the mechanic no spare parts, and the list goes on. Streets once jammed with traffic are nearly empty apart from the occasional shuttle taxi fuelled with the local solution to diesel fuel - used or new cooking oil - which sputters and spits its way across town, toxic fumes choking us and making our eyes water.

At Atfaluna, we had no choice but to give the children a one-month 'advance' on their summer vacation while we tried in vain to obtain diesel fuel for the school buses. Paper is in short supply, as are school books, art supplies, and a great many other items. Many of the children couldn't use their hearing aids, hearing aid batteries being amongst the items included in the embargo. Teachers often had to carry out classroom activities in dim classrooms due to frequent power outages and no fuel with which to turn on the generator. It seems we spend many of our days in hot pursuit of a canister of butane gas for cooking the children's meals, locating a supply of photocopy paper, a tube of glue, or some threads for the sewing class. It's been tough going, that's for sure, but we can also feel a sense of pride that, somehow or other, we managed to get through yet another year. And that's what it's all about here in the Gaza Strip: just getting through the day, the year, a lifetime even, and trying not to think too much about the future lest we lose that all-important hope that things will get better, become somehow more normal, somehow less painful.

In spite of the difficulties and frustrations, there were many happy times and some very special moments. Most of the time, it was business as usual in the Atfaluna School. One of the 'fun' things we did this year - very much an initiative of the children - was to create the Atfaluna Palestinian *Debka* Dance Troupe. Thirteen-year-old Mahmoud, a small, good-natured student who lives in the Shati Refugee Camp, was one of several deaf students who astounded trainers in the try-outs and went on to become the troupe's leader. The hearing trainers who had prepared them-

selves for a real challenge (How could a child who could not hear learn to dance and keep the beat?) were astounded by the enthusiasm, hard work, and ability of the four girls and three boys. Contrary to what many may think, most deaf people do enjoy music and 'feel' the rhythm in their own way. After months of hard work, the troupe made its debut at this year's graduation ceremony - always a joyful occasion and a real cause for celebration. The hearing and deaf audience cheered and clapped in time as Mahmoud led his troupe by means of eloquent hand signals orchestrating stops, starts, and turns to the beat of *Debka* music and a strong *tubla* beat. For the deaf children, all of this was much more than it might seem. To the children it represented an empowerment of sorts for the deaf community of Gaza. Dance - an art almost exclusively belonging to the hearing world - had finally gained its entry into the world of the deaf of Gaza. And there it will stay. Another chapter, another year, another success-story-of-sorts for the deaf of Gaza.

Twenty-three students graduated from Middle School this year. One glance at the faces of the students and their parents told it all. It was a tough year, it's true, but the children's achievements and the pride clearly sketched on the faces of their parents and teachers have made it all worth it.

This year student enrollment reached 275. This number is expected to reach 300 next year. We hope to be able to graduate 15 students next year.

On behalf of the children, their teachers, their parents, I would like to thank each and every one of you for partnering with us in giving these children their rights as children: an opportunity to grow, to learn, and to live in an environment of security and respect... no matter what.

With kindest regards, I remain

Sincerely,

Geraldine (Gerry) Shawa
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TINNITUS: HOW YOU CAN HELP YOURSELF!

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Overview for the Professional

Although there are several options available to assist health care professionals in treating tinnitus, for most tinnitus patients there is no cure. A wide variety of counselling and sound therapies are available, and most are likely very helpful (for a recent review of different procedures, see Tyler¹). In many situations, it will be necessary for the patient to take an active role in either coping or accepting tinnitus. In addition, there are tinnitus sufferers who are not yet ready for formal counselling and sound therapy procedures. Thus, many patients would benefit from information and activities to facilitate helping themselves. Several self-help books are available for tinnitus patients,²⁻⁸ and suggestions have been made for producing brochures⁹ and even providing information on the internet.¹⁰

The purpose of the following article is to provide a model of both the information that might be included, as well as an example of how patients can be encouraged to participate in a positive self-help approach. The article is structured so that it may be given as a handout to the patient, since that is the final product we are attempting to demonstrate.

Conclusions for the Professional

As a tinnitus health care provider, it is your responsibility to assist your patients in 'learning to live with tinnitus'.¹² One important opportunity you have is to provide them with information and guid-

ance so that they can help themselves. We have provided an overview of some basic information that can be shared. You can produce your own handout or brochure, and also direct your patients to one of the self-help books that are available. It remains important to verify experimentally that such approaches are helpful, and this might include determining which sub-group of patients benefit most, and which medium (brochures, books, internet) are most helpful. In closing, we note that it is always important to let the patient know that we are here for them should they wish to return for further discussion of their tinnitus, should that be necessary.

The reader has permission from the authors and publisher to reproduce or copy the following article (pp 23-26) for distribution to tinnitus sufferers, as long as appropriate citations are given.

References

1. Tinnitus treatment: Clinical protocols. Tyler RS (Ed). New York: Thieme; 2006.
2. Living with tinnitus. Davis P. Rushcutters Bay, NSW: Gore & Osment; 1995.
3. Living with tinnitus: Dealing with the ringing in your ears. Hallam RS. Wellingborough, Northamptonshire: Thorsons; 1989.
4. Tinnitus: A Self-Management Guide for the Ringing in Your Ears. Henry JL, Wilson PH. Boston: Allyn and Bacon; 2002.
5. The Consumer Handbook on Tinnitus. Tyler RS (Ed). Auricle Inc.: Sedona; 2008.
6. Tinnitus rehabilitation by retraining: A workbook for sufferers, their doctors, and other health care professionals. Kellerhals B, Zogg R. Basel: Karger; 1999.
7. Tinnitus: A guide for sufferers and professionals. Slater R, Terry M. London: Croom Helm; 1987.
8. Tinnitus: What is that noise in my head? Saunders J. Auckland, NZ: Sandalwood Enterprises; 1992.
9. Tinnitus Self-Treatment. Sizer DI, Coles RRA. In: Tinnitus Treatment: Clinical Protocols. Tyler RS (Ed). New York: Thieme; 2006, pp 23-28.
10. Cognitive Behavioral Therapy with Applied Relaxation. Andersson G, Kaldö V, Tyler RS. In: Tinnitus Treatment: Clinical Protocols. New York: Thieme; 2006, pp 96-115.
11. Tinnitus activities treatment. Tyler RS, Gehringer AK, Noble W, Dunn CC, Witt SA, Bardia A. In: Tyler RS (Ed). Tinnitus treatment: Clinical protocols. New York: Thieme; 2006, pp 116-131.
12. Establishing a Tinnitus Clinic in Your Practice. Tyler RS, Haskell, GB, Gogel SA, Gehringer AK. *Am J Audiol* 2008; 17; 25-37.

ABSTRACT

Many tinnitus sufferers are told they need to learn to live with it. In some areas there may be no local services that provide competent counselling and sound therapy.

In other cases, a sufferer might simply choose to help themselves.

We provide a detailed example of a programme to facilitate a self-help approach to tinnitus.

This includes:

1. A description of tinnitus.
2. Comments about what causes tinnitus.
3. A description of treatments available.
4. A discussion about things they can do to help themselves.
5. Advice on seeking professional help.
6. Strategies for assessing claims of new treatments.
7. A positive discussion of hopeful future directions and approaches.

Clinical Protocols. Tyler RS (Ed). New York: Thieme; 2006, pp 23-28.

10. Cognitive Behavioral Therapy with Applied Relaxation. Andersson G, Kaldö V, Tyler RS. In: Tinnitus Treatment: Clinical Protocols. New York: Thieme; 2006, pp 96-115.
11. Tinnitus activities treatment. Tyler RS, Gehringer AK, Noble W, Dunn CC, Witt SA, Bardia A. In: Tyler RS (Ed). Tinnitus treatment: Clinical protocols. New York: Thieme; 2006, pp 116-131.
12. Establishing a Tinnitus Clinic in Your Practice. Tyler RS, Haskell, GB, Gogel SA, Gehringer AK. *Am J Audiol* 2008; 17; 25-37.

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TINNITUS: HOW YOU CAN HELP YOURSELF!

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1. Introduction

What on earth is this? This might be the question that people can have when they first notice a sound from inside of their own head. Tinnitus is the perception of a sound in the ear or head, in the absence of an external sound. It is frequently called 'ringing in the ears', but people describe tinnitus in many different ways (e.g., buzzing, cricket, hissing and more). The sound may be constant or intermittent, may occur in one or both ears, and may vary in pitch and loudness. People with tinnitus often report problems in four general areas:

- Thoughts and Emotions
- Hearing
- Sleep
- Concentration

These difficulties can lead to problems at work, among family and friends, and interfere with social outings and hobbies. But as everyone is different, the way one is affected by tinnitus is different. There are many things you can do to lessen and even eliminate the problems that some people first associate with tinnitus.

One of the first things you can do when you are concerned about tinnitus is to acquire some knowledge about what it is, what causes it, and what treatments are available.

2. What is Tinnitus?

Tinnitus is not a disease, but a symptom.

Lots of people have 'tinnitus', but it is likely that it has many different causes and there are many different mechanisms responsible for it. It will probably need many different treatments or cures. So, basically, tinnitus is when you perceive an external sound, but there really isn't a sound there outside of your head. It is not a phantom sound; it is a real sound that you hear.

Tinnitus does indicate that something is wrong with your auditory system. While a number of theories exist, the actual mechanism responsible for coding tinnitus in your nervous system is unknown. And remember, because tinnitus is a symptom, there might be many different mechanisms responsible for tinnitus.

We do know that when you hear real sounds in the environment, a bird chirping or someone's voice, it causes activity in the hearing nervous system. This activity starts in the cochlea (the peripheral sensory organ of hearing) and is carried by nerve fibres through your brainstem up to the brain. When the hearing region of your brain is active, the brain can send signals such as, 'I hear a bird', or that man just asked, 'How are you today?' Tinnitus arises because, in the absence of external sounds, the hearing nerve fibres become active. The cause of this hyperactivity might be in the cochlea, the brainstem, or the higher brain. Wherever it originates, the spontaneous nerve activity works its way up the brain. The brain signals 'I hear a ringing', or 'I hear a cricket', even when there is no ringing or cricket out there. Of course, if you become anxious, depressed, or concerned about your tinnitus, other areas of the brain, called the autonomic nervous system, or the amygdala, also become activated.

3. What Causes Tinnitus?

There are many different causes of tinnitus. For many, the cause is unknown. The most common cause is noise exposure (protect your ears from noise - it can make your tinnitus worse). Tinnitus can be a side effect of taking medications. It can even occur as part of the normal ageing process. It can also co-exist with various ear problems, such as Ménière's disease.

Noise induced hearing loss and noise induced tinnitus often go hand in hand. Environmental sounds that can cause noise induced hearing loss can also cause tinnitus. There are three factors that contribute to noise induced tinnitus. First is the noise level. The higher the noise level, the more likely you will get tinnitus. Second is the duration of noise exposure. The longer the duration of your exposure, the more likely you will get noise induced tinnitus. Having brief periods of rest (quiet periods), between noise exposures, is likely to reduce the chance of noise induced tinnitus. Third is the presence of impulsive sounds. The presence of impulses in a sound is known to make the sound more hazardous to your hearing. This is the reason why music can cause hearing loss and tinnitus, just like other forms of sound (or noise). Usually music is composed of impulsive sounds, sometimes fluctuating drastically, and if a person listens to loud music for a long time, tinnitus might be induced.

Generally speaking, anything that causes hearing loss can also cause tinnitus. In the general population, about 1 person in 100 has a troublesome tinnitus, so it is quite common! In the older population, about 1 in 10 or even 1 in 5 people have problematic tinnitus. However, far more people experience tinnitus but are not disturbed by it.

4. What Treatments are Available?

There is no cure for tinnitus, at least not yet (more about this under 'Hope').

4.1 Medications

There are no medications that are widely agreed upon to treat tinnitus; no well controlled studies with appropriate measurements that have been repeated by others. There are medications for the general treatment of sleep, depression and anxiety, and these are used by some tinnitus sufferers successfully. Medications (even aspirin) can cause tinnitus. Sometimes you might be able to stop taking a medication prescribed for you, and your tinnitus might go away. However, if someone has prescribed the medication for you, it is essential you discuss this with your

health care provider before you stop taking the medication.

4.2 Surgery

There are rare forms of tinnitus that might arise behind your eardrum in the middle ear cavity. These are caused by muscles twitching or from blood vessel abnormalities. Sometimes these can be remedied with an operation. Also rare is a hearing/balance nerve tumour. It is very rarely a dangerous tumour but can be surgically removed if necessary. *See your physician.*

4.3 Hearing Aids

Tinnitus is almost always accompanied by hearing loss. If your hearing loss is sufficient and you are having trouble with communication, you will probably benefit by using hearing aids. Many people are reluctant to admit to their hearing loss, but when they hear so much better with their hearing aids, they don't want to be without them. Hearing is critical to our socialization as well as communication.

Hearing aids can help tinnitus by:

- Improving your communication and therefore relieving you of some of the stress of trying to listen very carefully
- Amplifying some background sound, which can provide relief to many tinnitus sufferers.

Furthermore, your audiologist can set or adjust your hearing aids to maximize the likelihood that they will help you with your tinnitus. *See your audiologist!*

Patients who have both hearing loss and tinnitus are often encouraged to manage their hearing loss first. As hearing loss can often be dealt with through amplification and communication may be easier, some patients report that dealing with their tinnitus is more manageable.

4.4 Other Wearable Devices that Produce Noise or Music

In addition to hearing aids, there are other wearable devices intended to help tinnitus patients. First, there are noise generators that look like hearing aids, only instead of amplifying sound, they produce a low-level 'sssshhhhhhhhh'

sound. For many with tinnitus, the low-level background noise reduces the loudness or prominence of the tinnitus. It also gives the patient some control. Second, there are hearing aids that are combined with a noise generator in the same unit. These are for people with communication difficulties due to hearing loss, who also wish to use the background noise. Third, there is a new approach that uses noise and especially altered music. Both sounds are frequency shaped, based on your hearing loss. There are two phases to the program along with a specific counselling package. *See your audiologist.*

4.5 Counselling and Sound Therapy

There are many different approaches to what is generally referred to as Counselling and Sound Therapy. These are usually administered by an audiologist and/or a psychologist. The goal is usually not to make your tinnitus go away. Instead, the idea is that:

- You don't notice your tinnitus as often
- When you do notice your tinnitus, it is not as troublesome
- When it is troublesome, you have some coping strategies.

Counselling typically examines the reactions one has to the tinnitus and discusses strategies in learning how to respond to tinnitus in a more positive way. Often, patients are experiencing difficulty related to their hearing, sleep, concentration, and overall emotional well-being. Many of the counselling procedures examine how you react to things you are concerned about, and discuss how you can change your reactions. Some procedures examine your thoughts and beliefs about tinnitus, whereas others might emphasize acceptance.

Sound therapy is the use of background sound to reduce the prominence of the tinnitus or to reduce its loudness. Hearing aids and the wearable devices mentioned above are part of sound therapy. Sound therapy can be used to **partially mask** an individual's tinnitus, in which the patient hears both their tinnitus and the background sound. It can also be used to **totally mask** a patient's tinnitus in some situations. You need to be cautious that the noise is not damaging or making your tinnitus worse.

Non-wearable devices can also be used in sound therapy. These include radios, televisions, music playback devices and specific sound machines (for example, some produce the sound of waves or waterfalls). Some devices can be used at bedtime to facilitate sleep (and have accessories designed to go under your pillow).

4.6 Other Treatments

There are many other treatments that have been offered, and there will be many more in the coming months. Remember, there is no cure. No treatments have been shown to cure tinnitus. There is no evidence to indicate that acupuncture is helpful. The usefulness of dietary supplements is not clear. Some of these treatments might help some patients. Remember, there are different types of tinnitus that might need different treatments. However, in our opinion, most of the scientific community would agree that there is insufficient evidence to agree that any should be seen as a cure. Furthermore, some 'treatments' can even be harmful.

5. Things You Can Do!

In this section, we discuss some things for you to do on your own. They are based on what we refer to as Tinnitus Activities Therapy (e.g., Tyler et al¹¹) and have evolved from our tinnitus management programme, from the 1980s. There are also several excellent self-help books for tinnitus, including ones by Hallam,³ Henry and Wilson,⁴ Davis² and Tyler.⁵ There are also some chapters written for professionals to motivate their patients.^{9,10}

5.1 Thoughts and Emotions

The way you think about your tinnitus can influence how you react to it. Some people hear their tinnitus in the background, consider it insignificant, and don't seem to have a negative reaction to it. Others consider the tinnitus to be quite intrusive, focus on their tinnitus and become anxious or frustrated. One important first step is to make sure you understand what tinnitus is, what causes it, and what treatments are available.

One way of thinking about tinnitus is to understand that you cannot change the tinnitus, but you can change the way you react to it. Consider a door bell. You

hear it ring, and hear someone crying as a result of a car accident outside your home. The next day, the door bell rings, and a neighbour complains about your tree that fell on her property. Later, the door bell rings again. What thoughts and feelings do you have? The next day, the door bell rings and it's a friend you have not seen in many years. Later, the door bell rings again. Someone has sent you flowers! Later, the door bell rings again. What thoughts and feelings do you have now? In all these situations, it is the same door bell, only your reactions are different.

Tinnitus is a sound, but it need not threaten you. Can you find ways to make your tinnitus less loud or less prominent by using sound therapy? Can you learn different ways of interpreting the importance of your sound? Can you learn different ways of reacting? These thoughts, of course, are easier said than done, and we all have different ways of thinking and reacting.

You could also examine the importance you have placed on tinnitus in your life. For some, it is eventually helpful to stop reading and talking about tinnitus. Are there some things you can do to stop focusing your attention on your tinnitus?

All of us should get involved in new activities that will bring us enjoyment. Most people who have tinnitus are able to live happy and satisfying lives. If you think your tinnitus is preventing you from leading a productive life, you might want to consider talking to a psychologist or audiologist about your tinnitus and its impact on your life.

5.2 Hearing

As mentioned earlier, hearing loss often accompanies tinnitus. Additionally, tinnitus can also interfere with your hearing. There are some things you can do to improve your hearing that should be generally helpful with your tinnitus as well. Even if your hearing loss and communication difficulties do not yet warrant a hearing aid, there are strategies and activities you can do to improve your hearing.

In dealing with a hearing difficulty, there are many factors that can affect how well one hears in certain situations. It is important for you to determine what

factors are affecting your hearing.

- Is there too much background noise?
- Am I too far away from the person talking?
- Can I see their face and facial expressions?

Hearing aids will help you hear better if you have more than a mild hearing loss. If you have a profound loss, you might even be a candidate for a cochlear implant. Many tinnitus sufferers using cochlear implants report that the implant helps their tinnitus, as well as helping them to hear better. Additionally, assistive listening devices are usually aimed at increasing the speech signal and/or decreasing the influence of background noise. Eliminating any excess background noise from the environment is beneficial, and may be done in various ways. In general, the kinds of things that you can do are:

- Let people know you have a hearing loss, and ask them to speak clearly before the conversation even starts
- Look at the talker's mouth, lip-reading is difficult but it can help all of us
- When you don't understand, ask the talker for clarification; be specific (e.g., I heard you say, "...went to the store...", but that's all.)
- Move around so you are close to the speaker, can see their face, and are away from the noise.
- Turn off noise sources, if possible. Noise is often the biggest problem.

Use as many of these strategies as possible. You will often find that communication can be much easier.

5.3 Sleep

Difficulty sleeping is one of the biggest complaints reported by tinnitus patients. Problems can involve falling asleep, staying asleep, or waking too early in the morning. It is important to realize that in the general adult population (without tinnitus) sleep problems are very common. Most of us would benefit from

practicing good sleep hygiene. Strategies that can help to facilitate sleep include:

- Avoiding caffeine, tobacco, and large meals before bedtime
- Creating a bedroom that will promote sleep by ensuring that your bedding is comfortable and removing all items that might distract you from sleeping
- Maintaining a consistent wake-up schedule and avoiding daytime napping
- Exploring relaxation strategies, such as imagery training and progressive muscle relaxation, and using them before bed and during the night when sleep problems arise.

For people with tinnitus, playing low-level sound in the background can be one of the most beneficial techniques to help with sleep. You may need to experiment to find the sound that will work best for you. Try to find a sound that will be soothing and does not have large fluctuations in volume. Some examples include nature sounds, quiet instrumental music, or even the sound of a fan or air purifier. The key is to find a sound that will decrease the prominence of your tinnitus, without being so loud or distracting that it keeps you awake. Some sound machines or music players can be set to turn off after a certain amount of time. However, if you should awaken during the night, you might be bothered by your tinnitus, if your bedroom is quiet. We often recommend that our patients try to leave sound on all night, so they will not need to worry about adjusting the sound in the middle of the night.

If you find that your sleep problems are significantly affecting your ability to function, it is always good to consult with your physician about any possible medical tests or treatment that might be needed.

5.4 Concentration

The ability to concentrate is important in completing many tasks, and when we are unable to stay focused we are likely to become frustrated and take longer to complete the activity. Some people with tinnitus complain that tasks such

as reading or staying focused at work are more difficult because they find their tinnitus to be a distraction.

Strategies for improving concentration often involve removing the distractions that are interfering with your ability to focus, whether the cause is tinnitus or some other factors affecting your attention. If concentration is a concern for you, some things to consider include:

- Choose a comfortable, quiet, and distraction-free environment in which to work
- Make sure you feel physically well enough to focus on the task at hand (i.e., avoid being tired, hungry, or sick when you sit down to complete a task)
- Use low level sound to decrease the prominence of your tinnitus
- Take frequent breaks and find ways to reward yourself when you have completed activities
- Stay actively engaged in the task you are working on by using techniques such as taking notes, organizing the information, or asking questions.

Although many of these strategies seem to apply to the school or workplace, do not be afraid to try them, even when reading a book for personal enjoyment. Give yourself a little time and practice and you will probably find that concentration will become easier once you are no longer consciously focusing your attention on your tinnitus.

6. Seeking Professional Help

While trying to help yourself with these notes and other ideas, please don't forget that it is important to get a comprehensive evaluation by an audiologist and a physician. Sometimes tinnitus is an important symptom of some other disease in its early stages. For example, symptoms of Ménière's disease include spells of dizziness, fluctuating hearing loss and tinnitus. The treatments include medications, special diets, and sometimes surgery. Although rare, it might be important to determine if you have a hearing/balance nerve tumour (acoustic neuroma or vestibular Schwannoma). Usually the tumour occurs with unilat-

eral tinnitus and an asymmetrical hearing loss.

7. Assessing 'New' Treatments

We realize that you will probably hear about a new treatment next week and wonder, 'Will this be the one that gets rid of my tinnitus forever?' Probably not. So what should you do when you hear about a new treatment? You should be sceptical. Things reported in the press, or that you read on the internet, are not well monitored, if at all. Sometimes a 'cure' that cannot be replicated even finds its way into the scientific literature.

When we hear of a new cure for tinnitus, we carefully ask:

- Is it reported in a refereed scientific journal?
- Is it reasonable, based on what we know about tinnitus and human physiology?
- Was it a controlled study?
- Was tinnitus measured adequately? Has the study been replicated by another independent group?

You should also know that the search for the magic pill, trying numerous unhelpful treatments and spending time and effort going from one treatment to another, can have serious negative effects. When you hear about a new treatment, *visit your audiologist or otologist!*

8. Hope

There are lots of things you can do to help with your tinnitus right now. There is no cure at present, but there might be in the near future. Remember there are probably many sub-groups of tinnitus. As we determine how to divide these sub-groups, there might very well be a treatment for your sub-group.

We have some preliminary data suggesting that one sub-group of tinnitus patients has very severe tinnitus that is very loud and present all the time. Another sub-group might be patients whose tinnitus changes daily, as well as those whose tinnitus is made worse in noise. It may be possible that drug A will not work for the first sub-group, but is effective for the second sub-group.

We have already mentioned that cochlear implant patients with tinnitus quite often report that their tinnitus is reduced when using their implant. In fact, there have been many studies showing that electricity presented to the cochlea can eliminate tinnitus in some patients. We predict that within five years there will be devices like this available for tinnitus sufferers. It will definitely help some of you!

9. Summary

Our intention in this paper is to encourage you to think about what *you* can do for your tinnitus. Understanding some of the basic information is the first step. Tinnitus is probably some increase in spontaneous neural activity. It might have started in the cochlea, but wherever it started, it probably results in increased spontaneous neural activity in the hearing part of the brain. Your tinnitus is not a phantom sound, it is real. Tinnitus probably has many causes; and this is important because it is likely to have many cures.

There is at present no cure for tinnitus. Medications can help with depression, sleep and anxiety. Surgery can help in a few rare instances of 'middle ear' tinnitus. Hearing aids should help you if you have a communication difficulty, but they also often help with your tinnitus. Many counselling and sound therapy programmes are available, usually offered by audiologists or psychologists. You can help yourself, and we suggest activities in the areas of thoughts and emotions, hearing, sleep and concentration.

New treatments should be approached with caution. That said, there are now numerous researchers around the world exploring new approaches to treating tinnitus. There will, hopefully, be new treatments in five years. *See your audiologist, physician or psychologist for help.*

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UPDATE ON PRESBYACUSIS

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Introduction

Presbycusis or age-related hearing loss (ARHL) is the 'the natural failure of hearing with advancing years, caused by degenerative changes in the internal ear'.¹ It is a common condition, increasingly prevalent with age and with the rate of decline accelerating with advancing age.^{2, 3} In 1999, the World Health Organization estimated that 580 million people over the age of 60 suffered from hearing loss worldwide. By 2020, it is anticipated that this number will have increased by 75% resulting in over one billion people of 60 years or older being affected.⁴

The condition is characterised by bilateral, symmetrical changes leading from an initial high to low frequency sensorineural hearing loss (SNHL). Zwaardemaker, who originally described the condition, noted this when producing a series of notes in octaves via Galton's whistles for children and the elderly. It was noted that the highest octaves could not be heard by the elderly and it was concluded that high frequency hearing loss occurred in this group.⁵

The complexity of the underlying processes involved in presbycusis are now being realised and it is noted that the progression and age-related onset of this condition are very variable, suggesting a multifactorial aetiology. Both extrinsic factors, such as noise exposure and intrinsic factors, such as systemic conditions and genetics are thought to play a part in the resulting SNHL.

Pathophysiology

Ageing results in histological, electrophysiological and molecular changes in the cochlea. Histological studies have repeatedly found degenerative changes in the stria vascularis, spiral ganglion cells, inner hair cells, and outer hair cells that are associated with the severity of hearing loss.⁶

Schunknecht⁷ subdivided these changes into sensory ARHL (high frequency loss; loss of sensory cells), stria or metabolic (flat descending threshold pattern; atrophy of stria vascularis), neural ARHL (loss of word discrimination; loss of cochlear neurons) and cochlear conductive or mechanical ARHL (unknown pathology). However, many patients show a mixture of these pathologies.⁸

Aetiology

Extrinsic factors thought to contribute to ARHL include noise exposure, ototoxic medication, chemical exposure and medical conditions.

Four studies have investigated the progression of ARHL in isolated communities with relatively low levels of noise exposure.⁹⁻¹² These cross sectional studies of the Mabaan tribe of Sudan,⁹ an isolated hill dwelling tribe in India,¹⁰ Orkney Islanders¹¹ and Kalahari Bushmen¹² found better preservation of hearing into old age. Furthermore, animal studies have demonstrated that noise exposure earlier in life leads to an increased vulnerability to ARHL,¹³ with specific genes conferring increased susceptibility to this within species.¹⁴

Ototoxic medication such as aminoglycosides and platinum based chemotherapy agents may accelerate presbycusis in older subjects. This may be related to increased use of these medications in this group and elevated drug levels in blood due to altered renal and hepatic function.⁸ Industrial chemicals are also known to cause a higher prevalence of high frequency hearing loss, including toluene, trichloroethylene, styrene and xylene.^{15, 16}

Several medical conditions, including diabetes and cardiovascular disease have been shown to have an association with ARHL. Diabetic patients are known to have a higher incidence of SNHL.¹⁷ Early onset high frequency SNHL compared to age matched controls¹⁸ and DNA mitochondrial mutations leading to both late onset diabetes and SNHL have been described.^{19, 20} Female patients with cardiovascular disease have been shown to be at increased risk for developing ARHL, with the gender difference thought to



Presbycusis

Photo: AuDNet, Inc

be related to hormonal differences.²¹ Animal studies²² have supported these findings with the proposed underlying mechanism related to cochlea hypoxia.²³

Intrinsic factors, in the form of genetic factors have been the subject of much recent research interest. Using inbred mice, Erway²⁴ et al were able to demonstrate recessive alleles at three loci which contributed to the development of ARHL. Age-related hearing loss 1 (*Ahl1*) gene was subsequently mapped to chromosome 10 and was found to overlap with the modifier of the deaf waddler locus (*mdfw*) region in 10 strains of inbred mice including C57BL/6J, 129P1/ReJ, BALB/cByJ, A/J, BUB/BnJ, C57BR/cdJ, DBA/2J, NOD/LtJ, SKH2/J and STOCK760. The gene was demonstrated to elevate hearing thresholds in middle-aged and old mice at high frequencies.²⁵⁻²⁷ Mice that were then genetically engineered to be identical to the C57BL/6J strain in all but *Ahl1* were found to be protected against early onset hearing loss. However, older mice still developed hearing loss. It is, therefore, proposed that more than one loci contributes to the hearing loss changes in these mice.⁸ Noben-Trauth et al²⁸ were able to demonstrate that this gene may be allelic to Cadherin 23 and, thus, the latter may be an important gene in ARHL, as well as congenital hearing loss. Subsequent studies identified *Ahl2* and *Ahl3* on chromosome 5 and 17, respectively, in certain sub-species of mice.²⁹⁻³¹

Prevention and Treatment

Prevention of presbycusis should address predisposing factors and would include:

- Education to raise awareness of the consequences of noise exposure
- Legislation to restrict noise exposure
- Combining ototoxic medications with protective agents, such as antioxidants and free radical scavengers in high risk groups
- Legislation to protect 'at risk' workers exposed to hazardous industrial chemicals
- Optimisation of the care of those with diabetes and cardiovascular disease.

At present the mainstay of treatment remains provision of hearing aids with amplification of sounds. However, problems remain with poor speech recognition and with differentiation of sound in noisy environments.

Promising future interventions include gene therapy and stem cell implantation and there have been promising results in animal models. In gene therapy, the introduction of *Math1*, a gene responsible for the development of hair cells in the cochlea, has been demonstrated to lead to the re-growth of hair cells which resulted in improvement in thresholds.³² Stem cells implanted in the inner ear have been demonstrated to survive, migrate, differentiate and extend nerve projections in the auditory system of adult mammals.³³

Conclusion

ARHL is an increasingly prevalent condition which results in a deterioration in quality of life, communication problems and, subsequently, affects socio-economic status. It is caused by degenerative changes in the cochlea, as a result of multifactorial extrinsic and intrinsic contributions. Further investigation into the genetic factors in humans is important - and exciting areas for future interventions include gene and stem cell therapy.

References

1. Butterworths Medical Dictionary. Critchley M. 2nd Ed., Butterworth and Co., London (1990).
2. Hearing in Adults. Davis A. Whurr Publishers, London (1995).
3. Longitudinal study of hearing. Davis AC, Ostri B, Parving A. *Acta Otolaryngol Suppl.* 1991; **476**: 12–22.
4. World Health Organization (accessed at <http://www.who.int/en/>).
5. Der Verlust au hohen Tonen mit zunehmendem Alter. Ein neues Gesetz. Zwarardemaker H. *Arch Ohr Nas und Kehlkopfheilkunde.* 1874; **32**: 53–56.
6. Presbycusis: A Human Temporal Bone Study of Individuals with Downward Sloping Audiometric Patterns of Hearing Loss and Review of the Literature. Nelson E G, Hinojosa R. *Laryngoscope.* 2006; **116**(9); Supplement Part 3: 1–12.
7. Cochlear pathology in presbycusis. Schuknecht HF, Gacek MR. *Ann Otol Rhinol Laryngol.* 1993; **102**: 1–16.
8. The complexity of age related hearing impairment: contributing environmental and genetic factors. Van Eyken E, Van Camp G, Van Laer L. *Audiol Neurotol.* 2007; **12**(6): 345–358.
9. Presbycusis study of a relatively noise free population in the Sudan. Rosen S, Bergman M, Plester D, El-Mofty A, Satti MH. *Ann Otol Rhinol Laryngol.* 1962; **71**: 727–743.
10. Hearing of Todas of South India. Kapur YP, Patt AJ. *Arch Otolaryngol Head Neck Surg.* 1967; **85**: 400–406.
11. Hearing thresholds in an island population in North Scotland. Kell RL, Pearson JCC, Taylor W. *Int Audiol.* 1970; **9**: 334–339.
12. The acuity of hearing in the Kalahari Bushmen. A pilot survey. Jarvis JF, Van Heerden HG. *J Laryngol Otol.* 1967; **81**: 63–68.
13. Acceleration of age-related hearing loss by early noise exposure: evidence of a misspent youth. Kujawa SG, Liberman MC. *J Neurosci.* 2006; **26**: 2115–2123.
14. Vulnerability to noise-induced hearing loss in 'middle-aged' and young adult mice: a dose response approach in CBA, C57BL, and BALB inbred strains. Ohlemiller KK, Wright JS, Heidebreder AF. *Hear Res.* 2000; **149**: 239–247.
15. Effect of industrial solvents on hearing. Johnson AC, Nylen PR. *Occup Med.* 1995; **10**: 623–640.
16. Audiometric findings in workers exposed to low levels of styrene and noise. Morata TC, Johnson AC, Nylen P, et al. *J Occup Environ Med.* 2002; **44**: 806–814.
17. The effect of diabetes on sensorineural hearing loss. Kakarlapudi V, Sawyer R, Staeker H. *Otol Neurotol.* 2003; **24**: 382–386.
18. A 5-year prospective study of diabetes and hearing loss in a veteran population. Vaughan N, James K, McDermott D, et al. *Otol Neurotol.* 2006; **27**: 37–43.
19. The diabetes-associated 3243 mutation in the mitochondrial tRNA(Leu(UUR)) gene causes severe mitochondrial dysfunction without a strong decrease in protein synthesis rate. Janssen GM, Maassen JA, van Den Ouweland JM. *J Biol Chem.* 1999; **274**: 29744–29748.
20. Hearing threshold in patients with diabetes mellitus. Kurien M, Thomas K, Bhanu TS. *J Laryngol.* 1989; **103**: 164–168.
21. The association between cardiovascular disease and cochlear function in older adults. Torre P 3rd, Cruickshanks KJ, Klein BE, et al. *J Speech Lang Hear Res.* 2005; **48**: 473–481.
22. Age-dependent modifications of expression level of VEGF and its receptors in the inner ear. Picciotti P, Torsello A, Wolf FI, et al. *Exp Gerontol.* 2004; **39**: 1253–1258.
23. Correlation of cochlear blood supply with mitochondrial DNA common deletion in presbycusis. Dai P, Yang W, Jiang S, Gu R, Yuan H, Han D, Guo W, Cao J. *Acta Otolaryngol.* 2004; **124**: 130–136.
24. Genetics of age-related hearing loss in mice. 1. Inbred and F1 hybrid strains. Erway LC, Willott JF, Archer JR, et al. *Hear Res.* 1993; **65**: 125–132.
25. A major gene affecting age-related hearing loss in C57BL/6J mice. Johnson KR, Erway LC, Cook SA, et al. *Hear Res.* 1997; **114**: 83–92.
26. A major gene affecting age-related hearing loss is common to at least ten inbred strains of mice. Johnson KR, Zheng QY, Erway LC. *Genomics.* 2000; **70**: 171–180.
27. Hearing loss associated with the modifier of deaf waddler (mdfw) locus corresponds with age-related hearing loss in 12 inbred strains of mice. Zheng QY, Johnson KR. *Hear Res.* 2001; **154**: 45–53.

28. Association of cadherin 23 with polygenic inheritance and genetic modification of sensorineural hearing loss. Noben-Trauth K, Zheng QY, Johnson KR. *Nat Genet.* 2003; **35**: 21–23.
29. Ahl2, a second locus affecting age-related hearing loss in mice. Johnson KR, Zheng QY. *Genomics.* 2002; **80**: 461–464.
30. Ahl3, a third locus on mouse chromosome 17 affecting age-related hearing loss. Nemoto M, Morita Y, Mishima Y, et al. *Biochem Biophys Res Commun.* 2004; **324**: 1283–1288.
31. Fine mapping of Ahl3 affecting both age-related and noise-induced hearing loss. Morita Y, Hirokawa S, Kikkawa Y, et al. *Biochem Biophys Res Commun.* 2007; **355**: 117–121.
32. Auditory hair cell replacement and hearing improvement by Atoh1 gene therapy in deaf mammals. Izumikawa M, Minoda R, Kawamoto K, et al. *Nat Med.* 2005; **11**: 271–276.
33. Cell replacement therapy in the inner ear. Hu Z, Ulfendahl M. *Stem Cells Dev.* 2006; **15**: 449–459.



Book Review

TINNITUS: SOURCE READINGS (1841-1980)

Robert T Sataloff, Dimiter I Dentchev, Mary J Hawshaw (Eds.)

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This book is a compendium of historical but current literature on the subject of **tinnitus**, pre-dating the 20th century. The authors blamed the sluggish knowledge in the management of tinnitus on deficient research interests. In contrast, they presented the rich clinical acumen of the 19th century practitioners and showed very little improvement to what is already known on the subject. In providing a summary of historical but interesting and inspiring literature, the authors hope to stimulate more research which would lead to improvements in the current management of tinnitus.

The book chapters are of unequal length but the layout is easy to follow. Chapter 1, which is the 'Overview of Tinnitus', provided a very good introductory background on the aetiology and management of this condition. The second chapter, on the 'Receptors in the Auditory Pathway', is a summary of the basic science of neurotransmission and an essential component in its understanding and future research needs. Chapters 3 to 7 outline the 140 years historical review of the case reports which dominated the

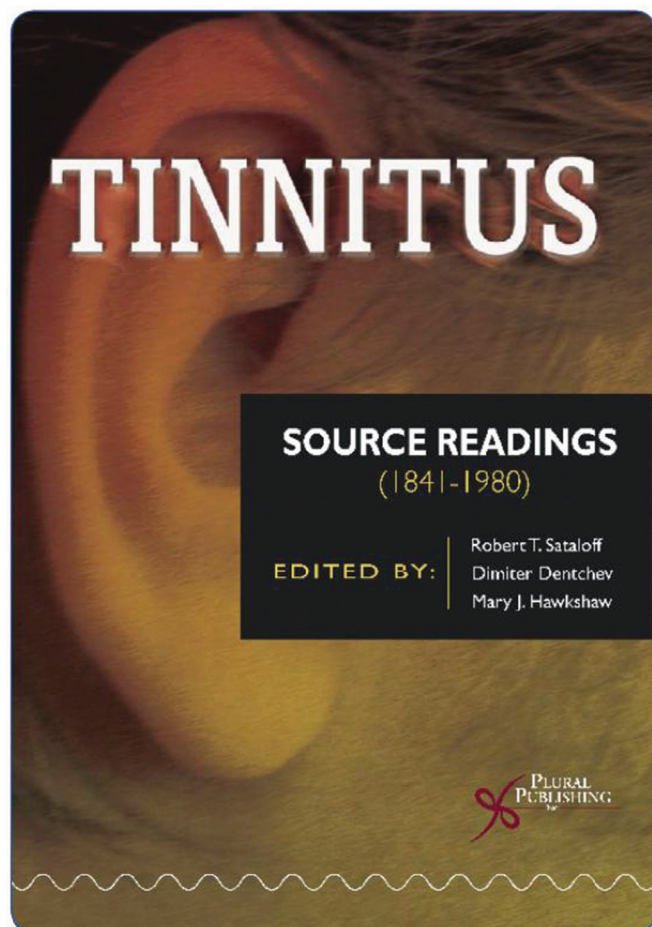
publications in the 19th century. The first case report was from the *Lancet*, in 1841, and the last one, in 1897, was published in *Laryngoscope*. Extensive publications on the management of tinnitus dominated the early and mid 20th century database and ranged from the anticoagulant treatment of sudden deafness (*J Laryngol.* 1964; **78**: 583-586) to a subject which 'everybody talks about it but nobody does anything about it' (*Eye, Ear, Nose Throat Monthly.* 1965; **44**: 311).

I would have loved to see a list of the Source Articles discussed in this book

for ease of reference. Notwithstanding, this is a welcome addition to the subject of tinnitus, which has more or less remained elusive to practitioners in this field for more than a century.

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COMMUNITY EAR AND HEARING HEALTH: ISSUE NO. 6 CHRONIC SUPPURATIVE OTITIS MEDIA

Thank you for your useful articles about Chronic Suppurative Otitis Media (CSOM) in Issue No. 6 of the Journal. They clearly emphasise that CSOM management is still not very effective.

We cover a target population of 15000 mainly poor and indigenous people in the Western Ghats mountains of South India. Twenty years ago, CSOM was very common in children but we have seen an obvious reduction in incidence in the last 20 years. This reduction could be due to improved primary health care access, with aggressive health promotion in villages and schools and the early management of acute suppurative otitis media. Improvements in socio-economic standards would also have contributed to this decline but this area of South India has not received much of the benefits of India's economic boom and, in many ways, economically, remains only marginally better off than 20 years ago.

I have concerns about recommending the use of ciprofloxacin ear drops. In our area, typhoid is not uncommon and is often multi-drug resistant, needing quinolones as the first line of therapy. We have, therefore, restricted quinolone use to only well defined situations - to prevent increase in resistance among *Salmonella typhi* to these drugs. Widespread use of quinolones in CSOM may lead to increase in drug resistance because some of this drug will reach the alimentary canal through the Eustachian tube. The evidence that quinolones improve short term outcomes in CSOM is not adequate to conclude that they make a long term difference to CSOM outcome, because we often succeed in drying up wet ears, only to see them discharging again later. The need to continue ear 'toilet' and possible topical medications long term is one reason why CSOM is very difficult to treat - because parents often stop the treatment too early. In this situation, the modified once in 2-4 weekly instillation of antibiotic- steroid ointments by health workers after ear 'toilet' may be more successful. This method was described by Teaching Aids at Low Cost (TALC) in their tape-slide program on ear disease many years ago and, more recently, in the Australian Northern Territory Disease

Control Bulletin Vol. 9, No. 4, December 2002, pp 9-13. Here, 0.5 to 1.5ml of an antibiotic - steroid ointment (e.g., Sofradex, Celestone VG, Kenacomb Otic) is instilled into the outer ear canal using a 2ml syringe and a 16 G plastic IV cannula inserted just inside the external auditory meatus, directing the stream of ointment up along the roof of the canal to fill the canal. The tragus is then 'pumped' with a finger to gently force the ointment into the middle ear. Ointments rather than drops must be used because ointments release antibiotics over a longer period of time. This instillation is repeated every 3-4 weeks by a health worker. Concerns over ototoxicity of aminoglycoside topical ear medications long term are acknowledged, but not supported by good evidence despite their widespread use in indigenous communities in Australia.

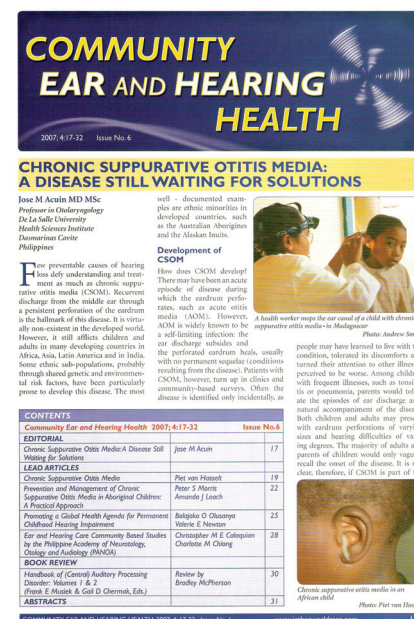
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Dr Piet van Hasselt responds:

As Dr Ramasamy has observed in his own region, the incidence of CSOM has declined over the years by public health measures, like health education, sanitation and clean water and, not least, good Primary Health Care. In the meantime, we still have to deal with many cases of CSOM. Dr Ramasamy has raised an important issue about patients' adherence to treatment and the need for a formula that prolongs the contact time of the active ingredients of the ototopical medicine with the middle ear mucosa and the ear canal skin. Ointments, however, contain ingredients that leave remnants one wouldn't necessarily want in the middle ear. An alternative, I have tried myself, is making a gel of ear or eye drops by adding hydroxypropylmethylcellulose powder (HPMC) for single treatment of external otitis, as well as CSOM.^{1,2} With 3% HPMC one gets a



gel that can be instilled with a syringe. With 0.3% HPMC (used in artificial eye tears) one gets viscous drops that can be instilled in the usual way. HPMC doesn't leave any residue in the middle and outer ear.

There is indeed a growing concern about increasing bacterial resistance against fluoroquinolones. Aggravating this situation is the use of the same kinds of antibiotics, both topically as well as systemically. The reason that topical fluoroquinolones, like ciprofloxacin and ofloxacin, have generally replaced aminoglycosides is their lack of ototoxicity and the fact that they are more effective than aminoglycosides³ and usual ototopical antiseptics like boric acid, spirit and povidone iodine. Ideally, one needs to find an antiseptic that has an effective concentration, is not (oto)toxic, irritant or painful. The above mentioned antiseptics don't fall into this category. The need for corticosteroids is questionable. Instead of experience-based or peer-based medicine, we need to practice evidence-based medicine. In this respect, many more randomised studies are needed comparing different ototopicals, formulas and ways of administration.

Piet van Hasselt MD
Editorial Board Member
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References

1. Treatment of chronic suppurative otitis media with ofloxacin in hydroxypropyl methylcellulose ear drops: a clinical/bacteriological study in a rural area of Malawi. Van Hasselt P, Van Kregten E. *Int J Pediatric Otorhinolaryngol.* 2002; **63**: 49-56 (Please contact pvhasselt@planet.nl for a PDF copy).
2. Randomized controlled trial on the treatment of otitis externa with one per cent silver nitrate gel. Van Hasselt P, Gudde H. *J Laryngol Otol.* 2004; **118**: 93-96 (Please contact pvhasselt@planet.nl for a PDF copy).
3. Effectiveness of ototopical antibiotics for chronic suppurative otitis media in Aboriginal children:

a community-based, multicentre, double-blind randomised controlled trial. Couzos S, Lea T, Mueller R, Murray R, Culbong M. *Med J Aust.* 2003; **179**: 185-190. (Full text on http://www.mja.com.au/public/issues/179_04_180803/cou10214_fm.html).

Letter from Costa Rica

COMMUNITY EAR AND HEARING HEALTH

An extract from a letter sent to Professor Valerie Newton (Editorial Board Member) in May 2008

I would like to comment that I find the *Community Ear and Hearing Health* (CEHH) very nicely done. It covers issues of global interest and remains user friendly and appropriate for developing nations and their universal interest.

I find it more balanced than other publications aimed at the 'developing world'. The topic oriented Issues touch on very current and important fields and I find the 'Abstract' section very useful - to be aware of particular publications, where Journals may not be readily available.

The management of Occupational Audiology in the last issue was especially good and I have made the link available for our colleagues in the field here in Costa Rica.

I would like to recommend that you consider ways to advertise CEHH more effectively and to promote its existence among the audiological community in the developing world.

I have not been able to hear about CEHH from any other source than the direct channel of our contact. I think there is a wealth of resources there and it should be promoted more aggressively.

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We ask our readers to consider ways in which we can promote the Community Ear and Hearing Health Journal. Please introduce the Journal to your colleagues and contacts around the world.
Editor



Abstract

Migraine associated with auditory-vestibular dysfunction

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The association between hearing and balance disorders with migraine is known since the times of the ancient Greeks, when Aretaeus from Cappadocia in 131 BC, made an accurate and detailed description of this occurrence during a migraine episode. We present a broad review of migraine neurotological manifestations, using the most recent publications associated with epidemiology, clinical presentation, pathophysiology, diagnostic methods and treatment for this syndrome.

Aim: To describe the clinical entity: 'Migraine associated with auditory-vestibular dysfunction', in order to help otorhinolaryngologists and neurologists in the diagnosis and management of such disorder.

Final Remarks: There is a strong association between neurotological symptoms and migraine, and the auditory-vestibular dysfunction-associated migraine is the most common cause of spontaneous episodic vertigo (non-positional). Symptoms may vary broadly among patients, making it a diagnostic challenge to the otorhinolaryngologist. This entity usually presents with positional or spontaneous vertigo spells, lasting for seconds

or days, associated with migraine symptoms. A better understanding of the relationship between central vestibular mechanisms and migraine mechanisms, besides the discovery of ionic channel disorders in some cases of migraine, ataxia and vertigo, may lead to a better understanding of migraine pathophysiology associated with audio-vestibular disorder.

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Deafness in the developing world: the place of cochlear implantation

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Introduction: This paper attempts to review changes in the lives of hearing-impaired patients within the developing world, brought about by globalisation and development. The paper also explores limitations to improved care and addresses the collective moral responsibility of developed nations.

Methods: Analysis of literature.

Results: Within developing nations, large populations have emerged with a similar pattern of problems, access to information and aspirations as those living in developed nations. However, marked differences in income have persisted. These trends have resulted in a relative increase in the proportion of the hearing-impaired population in need of

cochlear implantation, while at the same time restricting their access to such treatment.

Conclusions: The emergence of global markets and media and a shared sense of destiny amongst the people of this planet should translate into a concerted, worldwide effort to assist the deaf in developing countries. Much more can be done within existing resources and frameworks to improve the quality of these peoples' lives.

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COMMUNITY EAR AND HEARING HEALTH

Aim

- To promote ear and hearing health in developing countries

Objectives

- To facilitate continuing education for all levels of health worker, particularly in developing countries
- To provide a forum for the exchange of ideas, experience and information in order to encourage improvements in the delivery of ear and hearing health care and rehabilitation.

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