

Tinnitus

revisiting the phantom sound

Beethoven, although he is better known for going deaf, was afflicted by tinnitus. So was the composer Smetana, who incorporated the note he heard into one of his string quartets. Michelangelo had it too, and wrote of his affliction: 'A spider's web is hidden in one ear, and in the other a cricket sings throughout the night'.

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What is tinnitus?

Tinnitus is a phantom noise, a sound without an external cause. There are two types:

- somatosensory tinnitus
- 'true' tinnitus.

Accurate figures on the prevalence of tinnitus are hard to find. However, approximately 10% of people in the general population have had tinnitus at some time, and 5% of these people are distressed by it. There is no consistent correlation between deafness and tinnitus – not every person with hearing loss has tinnitus; in addition, not every person with tinnitus has hearing loss, although most do.

The problem, therefore, is not the presence of tinnitus but the fact that the patient is bothered

by it. In the movie 'The Castle', living under an airport flight path was seen by the family to be a great boon and convenience, not a catastrophe!

Somatosensory tinnitus

Somatosensory tinnitus (objective tinnitus) arises from mechanical events in structures such as the internal jugular vein or the muscles of the middle ear. The sounds can be heard by other people if they are close enough to the patient or listening with a stethoscope.

Somatosensory tinnitus may be pulsatile if it is due to turbulent blood flow in (or adjacent to) the petrous temporal bone. Possible causes include:

- Paget's disease
- arteriovenous fistulas

IN SUMMARY

- Tinnitus is now considered to be a disorder of the processing of electrical activity in the auditory pathways of the central nervous system, rather than a disorder of the ear.
- When the presentation is persisting tinnitus in one ear, evaluation for a retrocochlear lesion must be carried out, even if the hearing is normal.
- Patients often worry that tinnitus might indicate a brain tumour or never go away. The basis of management is the rational reassurance that tinnitus is not indicative of any serious medical condition and that it can and will subside.
- Tinnitus management emphasises avoiding fluctuations in anything which may impact on tinnitus (including certain medications and excessively loud sounds or excessively quiet surroundings), and recognising and minimising stress.
- Referral to an ENT surgeon should be considered for a patient who has tinnitus that is unilateral, of recent or abrupt onset, or accompanied by balance or hearing difficulties. Referral should also be considered if there is no clear diagnosis and further investigation is needed, or if the patient requests a specialist assessment.

continued



Figure 1. MRI in axial view showing an acoustic neuroma in the left cerebellopontine angle. The tumour is 2 cm in diameter.

- glomus tumours
- raised intracranial pressure
- a 'kinked' internal jugular vein.

To detect pulsatile somatosensory tinnitus, it is necessary to palpate the neck and

auscultate the neck, cranium and eyes. Investigation is by high resolution CT of the skull base with contrast or by magnetic resonance angiography (MRA).

Nonpulsatile somatosensory tinnitus,

which patients generally describe as a 'clicking' sound, can arise from a flickering of the tensor tympani muscle attached to the malleus bone. It can also be caused by a grating sound from a rough temporomandibular joint.

What can GPs do for patients with tinnitus?

- Check that there is no obvious or easily treated cause or exacerbator of the tinnitus (such as wax or a middle ear disorder)
- Diagnose the likely cause and, if appropriate, reassure the patient about its benign nature.
- Give positive encouragement, such as 'spontaneous disappearance is possible', 'improvement is usual' and 'there are ways of helping – learning relaxation techniques is useful'.
- Avoid words such as 'incurable' or 'permanent', or saying things like 'you've got to live with it', which will only worsen the patient's perception of the tinnitus.
- Explain the harmful effects of worry, tension, fear and overattentiveness to the noises.
- Identify and rebut irrational fears, especially fears about an imagined serious illness.
- Encourage patients to make positive efforts not to think about the tinnitus. Explain how to use activities and environmental sounds such as air conditioning sounds, a radio or personal stereo, perhaps with an under-pillow speaker, to distract their attention from the noise and reduce its intrusiveness.
- Advise the patient about the availability of relaxation training and stress counselling.
- Provide advice about counselling and self-help services.

Source: The British Tinnitus Association

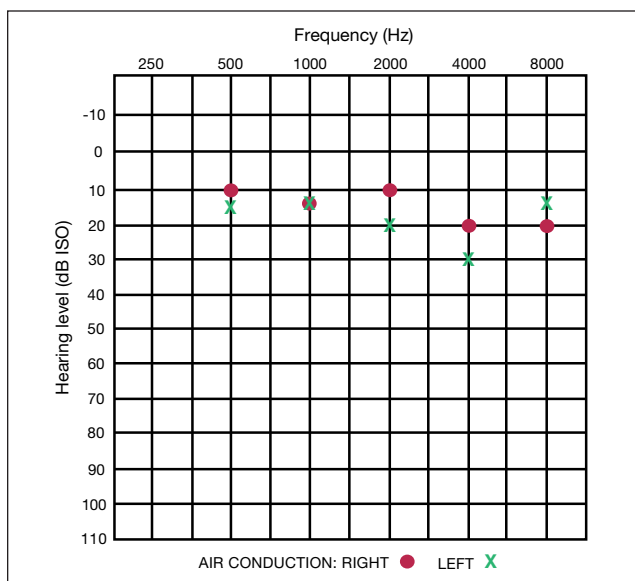


Figure 2. A pure tone audiogram demonstrating a difference in hearing of 10 dB at more than one frequency (2000 and 4000 Hz). This patient requires further investigation.

concerned with the causes and management of 'true' tinnitus.

What causes tinnitus?

'True' tinnitus is now considered to be a disorder of the processing of electrical activity in the auditory pathways of the central nervous system, rather than a disorder of the ear. Over the past few years there have been increasing neurophysiological and imaging data to support this theory.

Tinnitus is believed to be caused by a cascading abnormal signal resulting from damaged cochlear hair cells, cross-talk between auditory nerve fibres, or abnormalities of the cochlear nerve pathways (afferent or efferent) or cochlear nuclei in the brainstem. The abnormal signal is then detected from background neural electrical activity by pattern recognition in the subcortex – when a certain pattern of perception has been 'registered', that pattern can then be identified readily and 'heard' even if the original signal is much reduced. The pattern representing the tinnitus is then cross-referenced to the limbic and autonomic systems. If there is a link in the emotion-related limbic system, tinnitus will not simply be noted – rather, it will have a connotation (which is usually negative) and be distressing.

Behavioural models of tinnitus can be produced reliably. In laboratory animals, tinnitus-related neural activity is located at the dorsal cochlear nucleus, and aspirin causes an increase in spontaneous electrical activity in these areas that is independent of its cochleotoxic effects.

Functional MRI scanning in patients complaining of unilateral tinnitus shows asymmetrical electrical activity at the inferior colliculus, with the change in activity in the contralateral inferior colliculus. Positron emission tomography (PET) studies of humans demonstrate increased activity in the temporoparietal auditory association areas during tinnitus but not in the primary auditory cortex. This result is considered to be consistent

with subcortical processing of impulses in the auditory pathways. These subcortical areas have extensive connections to the autonomic nervous system and the limbic system.

Investigations for tinnitus

An audiogram is obviously mandatory for a patient who has unilateral tinnitus. An MRI scan with gadolinium and a serology test for syphilis are needed for a sensorineural asymmetry in hearing at one frequency of 15 dB or more or at two frequencies of 10 dB or more (Figure 2). A recent report of 1070 consecutive MRIs for asymmetrical hearing loss produced 944 normal results, and identified 56 acoustic neuromas and 27 other cerebellopontine angle tumours, 29 inner ear anomalies, nine brainstem infarcts and one case of multiple sclerosis.¹

A patient might present with ringing tinnitus after using a chainsaw or after a loud event such as a balloon bursting next to the ear. If there is a clear trigger, one can be very confident of predicting the gradual and possibly slow subsidence of the tinnitus without further investigation. After a week or so, an audiogram would be wise to look for any objective auditory damage; however, even damaged ears can improve sometimes.

Managing tinnitus

There is a natural tendency to adapt to consistent neural activity. Random unexpected changes in that activity inhibit this adaptation from occurring. Tinnitus management emphasises:

- avoiding fluctuations in anything which may impact on tinnitus, including certain medications and excessively loud sounds or excessively quiet surroundings
- recognising and therefore minimising stress.

After appropriate investigations (if any), the basis of management is the rational reassurance that tinnitus is not indicative of any serious medical condition and that

Tinnitus support groups

New South Wales

Australian Tinnitus Association (NSW)

Phone: 02 8382 3331

Email: info@tinnitus.asn.au

Queensland

Better Hearing Australia (Brisbane)

Phone: 07 3844 5065

Email: bhabris@gil.com.au

South Australia

Better Hearing Australia (SA)

Phone: 08 8232 2996

Email: betterhearingsa@dove.net.au

Hearing Solutions

Phone: 08 8203 8393

Email: hearing@guidedogs.org.au

Tasmania

Better Hearing Australia (Tasmania)

Phone: 03 6228 0011

Email: cmcghee@tassie.net.au

Victoria

Tinnitus Association of Victoria

Phone: 03 9510 1577

Email: bhavic@betterhearing.org.au

Western Australia

Australian Tinnitus Association (WA)

Phone: 08 9349 3436

Email: tinniwa@iinet.net.au

it can and will subside (see the box on page 32). If intended primarily for tinnitus, surgical interventions (such as injecting medications into the middle ear for absorption into the inner ear) only serve to reinforce the false notion that tinnitus distress is a peripheral physical problem and so will end up reinforcing the tinnitus.

A gradual awareness of ringing in the ears in quiet surroundings needs a clinical examination and a review of medications

Useful websites

American Tinnitus Association

www.ata.org

Tinnitus FAQ

<http://www.bixby.org/faq/tinnitus.html>

Oregon Tinnitus Data Archive

<http://www.ohsu.edu/ohrc-otda/>

Dr Jonathon Hazell, Tinnitus and Hyperacusis Centre, London, UK

<http://www.ucl.ac.uk/~rmjg101/rmidqa.htm>

Dr Pawal Jastreboff, Tinnitus & Hyperacusis Center, Emory University, Atlanta, USA

<http://www.tinnitus-pjj.com/>

Australian Department of Veterans' Affairs

<http://www.dva.gov.au/pensions/statement/tinnitus.htm>

Australian Society of Otolaryngology Head and Neck Surgery (related links page)

<http://www.asohns.org.au/related.htm>

Tinnitus Retraining and Hyperacusis

<http://www.tinnitus.org>

(both prescribed and nonprescribed), followed by reassurance. Remember that marijuana and other recreational drugs are increasingly associated with tinnitus.

Pharmacotherapies

Some medications have been found to reduce tinnitus. Intravenous lignocaine has been known for years to produce substantial improvement, and there now seems to be renewed interest in it. Unfortunately, the improvement is present only while lignocaine is in the bloodstream. Attempts to replicate and prolong the effect with oral analogues of local anaesthetics or antiepileptics have failed.

Sedatives like diazepam are often helpful, but they are highly addictive and therefore rarely used. Thiazide diuretics are specifically indicated for Ménière's disease and can help Ménière's-related tinnitus.

Depression and tinnitus can feed off each other. Antidepressant medication can be very beneficial for tinnitus sufferers if there is an associated depression. Low dose amitriptyline (Endep, Tryptanol) has long been used in pain management and is being investigated for likely tinnitus benefit. Furthermore, selective serotonin reuptake inhibitors may initially worsen tinnitus.

Many nonprescription remedies are

widely used in the community but such use might not be admitted to. These include ginkgo biloba, zinc supplements, herbal 'tinnitus pills', ginseng, valerian, melatonin, St John's wort and echinacea. Acupuncture, massage and chiropractic treatments have been evaluated scientifically; none has been found to be better than placebo.

Behavioural treatments

When the practitioner takes the patient's complaint seriously and investigates it appropriately but finds nothing of medical concern, most patients are greatly relieved and responsive to the reassurance that they can expect relief in time. Some patients might need further support with, say, relaxation therapy. This is a method by which the patient can have a positive influence on the tinnitus and play an active role, rather than a passive one, and so feel less a victim of the condition. It also lowers the expectation of relief by medication alone.

For patients with major tinnitus distress, further support is available with tinnitus retraining therapy or specific cognitive therapy. As with all behavioural treatments, the trick is to find the one that suits each person. Tinnitus retraining therapy is a structured approach that is usually supervised by an audiologist

and involves five elements:

- identifying the effect of tinnitus
- demystifying the nature of tinnitus
- using sound enrichment to disguise the tinnitus among information-rich environmental sounds
- using instrumentation (a white noise generator) to camouflage the noise in an emotionally neutral, broad band sound
- treating emotional distress.

If instrumentation is needed, treatment may be required for up to two years, but success rates of 80% are achieved.

Referral

Referral to an ENT surgeon should be considered for a patient who has tinnitus that is unilateral or of recent or abrupt onset, or tinnitus that has accompanying balance or hearing difficulties. It should also be considered if there is no clear diagnosis and further investigation is needed, or if a patient requests a specialist assessment.

Managing associated noise sensitivity

Noise sensitivity is a frequent accompaniment to tinnitus. It can be in one of three forms: hyperacusis, phonophobia or recruitment.

Hyperacusis can occur without tinnitus

and may often be a precursor to it. The ear is usually normal, but there seems to be a central signal amplification so that sounds are too loud. Treatment requires the avoidance of silence and the maintenance of a low level of ambient noise. This can be achieved by using background music or environmental sounds, or by wearing a sound generator that produces a wide-band ('white') noise to encourage sensory adaptation to a louder background. Treatment is very successful.

Phonophobia is an irrational fear of loud sounds. The treatment for phonophobia is like that of any other phobia.

Recruitment is a manifestation of cochlear disease. If outer hair cells (which are the shock absorbers of the basilar membrane) are damaged, the basilar membrane vibrates excessively and loud sounds are indeed heard louder and are often distorted or off-key. Treatment for recruitment is the same as treatment for Ménière's disease – that is, dietary sodium restriction (a low salt diet) and a thiazide diuretic.

Further information and support groups

Tinnitus clinics are found in most States. Support groups provide very practical help for the distressed tinnitus sufferer.

The Australian Tinnitus Association (NSW) has produced a kit that includes a CD of tinnitus noises (as reconstructed by patient descriptions), information for GPs and handouts for patients. The kits are modestly priced and full of useful information.

Contact details for a list of support groups in each State are given in the box on page 35, and patients can also check their telephone directories to see if other organisations exist in their local area. A list of useful websites is given in the box on page 36.

Concluding comments

Less than one year after the Sydney Paralympics, the message is that life can continue and be enjoyed with a handicap. Tinnitus should be viewed as a temporary hurdle that will be overcome. Old, negative, throw-away lines like 'well, you'll just have to live with it' are the cause of so much of our patients' anguish and must be discarded. MT

Reference

1. Daniels RL, Swallow C, Shelton C, et al. Causes of unilateral sensorineural hearing loss screened by high-resolution fast spin echo magnetic resonance imaging: review of 1,070 consecutive cases. *Am J Otol* 2000; 21(2): 173-180.